

IDIMT-2018**Strategic Modeling in Management,
Economy and Society****26th Interdisciplinary Information Management
Talks**

The 26th 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, Technology and Economy is increasing. It is a challenge to our innovative capacity.

Based on a blind review process 43 submitted papers were accepted together with 10 invited papers. The authors come from 10 different countries: Austria, Croatia, Czech Republic, Denmark, Germany, Kazakhstan, Russia, Slovakia, Slovenia and Ukraine.

The papers have been grouped according to the following themes:

- Opening: Brave New World of ICT
- Innovation, New Business Models and Strategies
- Digital Economy and Industry 4.0
- Leadership development, innovation behavior and creativity
- Performance Management
- Digital Single Market Innovation
- Social Media
- Cyber Security
- Crisis Management
- e-Health
- Smart Systems Everywhere – Intelligence, Autonomy, Technology and Society



9 783990 623398

ISBN 978-3-99062-339-8

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OŠKRDAL VÁCLAV (EDITORS)**IDIMT-2018****Strategic Modeling in Management,
Economy and Society**

26th Interdisciplinary
Information Management Talks,
Sept. 5–7, 2018
Kutná Hora, Czech Republic

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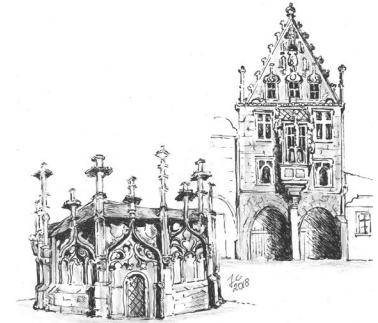
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Impressum

Schriftenreihe Informatik

Doucek Petr ■ Chroust Gerhard ■ Oškrdal Václav
(Editors)

IDIMT-2018

Strategic Modeling in Management, Economy and Society

26th Interdisciplinary Information Management Talks

This publication was partially supported by the Česká
spořitelna, a.s. and University of Economics, Prague –
project IGA 409017

The Conference IDIMT-2018
took place September 5–7, 2018
in Kutná Hora, Czech Republic

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

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

ISBN 978-3-99062-339-8
www.trauner.at

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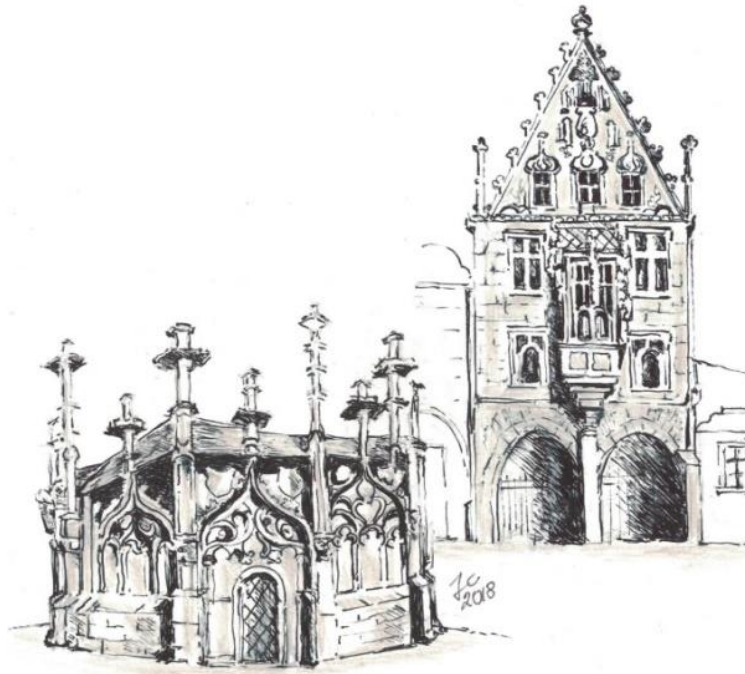
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Kutná Hora: Stone House and Stone Fontaine

A hearty welcome to the 26th IDIMT Conference!

Through the years, the IDIMT Conferences have taken to the tradition of rotating between different historically relevant villages/cities of Southern Bohemia. Kutná Hora is the 7th location hosting an IDIMT Conference. We can learn about Czech history and culture, in addition to the scientific issues of information management at the conference.

Kutná Hora, as its name suggests, was originally a thriving miners' town (kutání in Czech means mining) of silver. In 1142 the first Cistercian monastery in the Czech lands was established in the nearby village of Sedlec and at the end of the 13th century the original mining settlement of Cuthna antiqua – Old Kutna was founded. The city lay on high deposits of silver ore and was a successful mining town. It therefore became Bohemia's political and economic center between the 14th and 15th century and once was one of the richest cities of Bohemia. The Barbara's Cathedral was founded ('privately'!) by Kutná Hora's rich mine owners (!) in 1388. Today the silver mines are depleted, but still can be visited.

It is quite remarkable to follow how the IDIMT Conferences have developed from a small conference in 1993 in Kubova Hut¹. Since then we have made continuous improvements and our conferences have consequently grown. In 1993 we began with 13 speakers and participants. In 2018 we can welcome 62 submitted papers with a total of 117 co-authors, approximately 90 participants, and a program in two parallel streams.

¹Chroust, 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

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 taken as a good regional indicator for the future. When you look at the program, well organized by Antonin Pavlíček and Lea Nedomová, you will notice only minor changes to 2017 and you will find the names of many people who loyally return year after year. We are a big family!

The topics of 2018 are:

- Opening: Brave New World of ICT
- Innovation, New Business Models and Strategies
- Digital Economy and Industry 4.0
- Leadership development, innovation behavior and creativity
- Performance Management
- Digital Single Market Innovation
- Social Media
- Cyber Security
- Crisis Management
- e-Health

In comparison to 2017 we see a newcomer ‘Leadership development, innovation behavior and creativity.’ Not surprisingly Innovation, New Business, and Digital Economy have kept their place. It has come as a surprise that Social Media has not drawn more attention this year.

The title ‘Strategic Modeling in Management, Economy, and Society’ also stresses the current trend in Information Systems.

Employing a two-step submission procedure and a blind review process we have accepted 43 of the submitted papers plus 10 invited papers. The authors have come from 10 different countries: Austria, Croatia, Czech Republic, Denmark, Germany, Kazakhstan, Russia, Slovakia, Slovenia 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. This extensive interdisciplinary exchange of thoughts seems to be one of the unique features of the IDIMT-Conferences.

Since 2000 Christian Loesch has always offered a special contribution: an overview of global technical, economic and/or business developments. This year he will describe how the ICT industry has reached never imaged heights, with a growing demand for more and more complex chips. He will also show some implications of these trends and devote part of his paper to the implications of Artificial Intelligence (AI) on business and production.

On the occasion of IDIMT's 25th anniversary the details of IDIMT's impressive history have been separately published as hard copy and e-book ². Additionally, we have collected Christian Loesch's 18 presentations (2000 - 2017!) and republished them in a separate book³ (see below).



Books on Demand, Norderstedt, Germany, 2017
60 pages
hard-copy 14 €, e-book 4,50 €
ISBN 978-3-74480-9573

244 pages,
hard-copy 15 €, e-book 8 €
ISBN 978-3-74489-4265

Order information:
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Another traditional highlight is the afternoon/evening excursion, excellently organized by Petr Doucek and his team. It has always offered the visit to various culturally impressive vicinities followed by a hearty and very plentiful dinner in a typical Czech inn. This year Kutná Hora itself provides the cultural background and gives the participants the chance to appreciate the historical importance of this city.

The preparation and realization of IDIMT 2018 would not have been possible without the support of many organizations and persons. Therefore, we would like to express our thanks to:

- the University of Economics Prague for the project IGA 409017,
- the Faculty of Informatics and Statistics of the 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, and reminding forgetful authors,
- Václav Oškrdal who is responsible for arranging and assembling the selected papers for the proceedings,

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).

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).

- 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 program,
- 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 2018

Petr Doucek

Previous locations of IDIMT Conferences:

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

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We want to express our special thanks to the reviewers of the IDIMT 2018 Conference:

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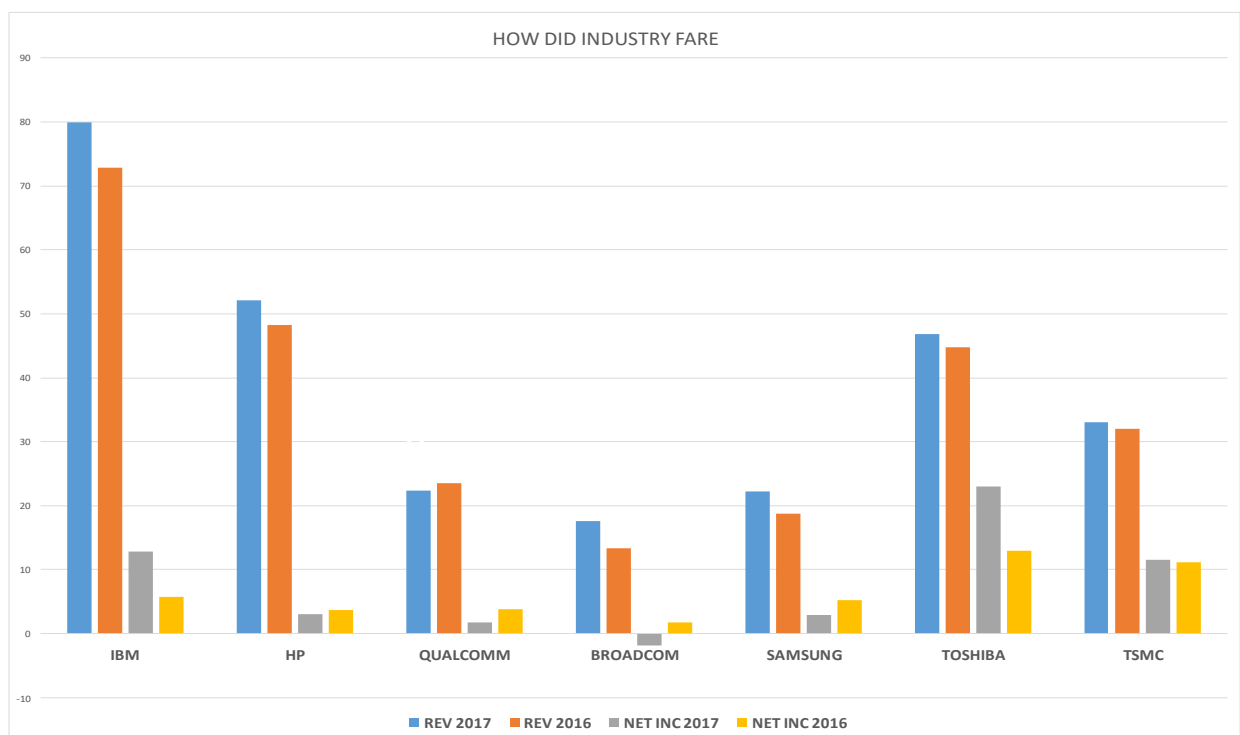
BRAVE NEW WORLD OF ICT

Christian W. Loesch

cw10001@gmail.com

1. State of the ICT Industry

The ICT Industry is reaching never imaged heights, the demand for more and more complex chips in more and more newly created products with never before needed chips, led by an explosion of data, processing power requirement and further on to a server and storage explosion.



Differing reporting periods by country and exchange rate fluctuations are distorting the picture.

1.1. How did ICT Industry fare

Industry has found new ways to pack more power onto tinier chips but unfortunately it is not possible to cut costs on the same exponential curve, due to the increasingly complex and expensive manufacturing tools and processes. Its successful growth and the emphasis on R&D are shown below.

2017 Rank	2016 Rank	Vendor	2017 Revenue	2017 Market Share (%)	2016 Revenue	2016-2017 Growth (%)
1	2	Samsung Electronics	59,875	14.2	40,104	49.3
2	1	Intel	58,725	14.0	54,091	8.6
3	4	SK hynix	26,370	6.3	14,681	79.6
4	5	Micron Technology	22,895	5.4	13,381	71.1
5	3	Qualcomm	16,099	3.8	15,415	4.4
6	6	Broadcom	15,405	3.7	13,223	16.4
7	7	Texas Instruments	13,506	3.2	11,899	13.5
8	8	Toshiba	12,408	3.0	9,918	25.1
9	17	Western Digital	9,159	2.2	4,170	119.6
10	9	NXP	8,750	2.1	9,314	-6.1
		Others	177,201	42.2	159,655	11.0
		Total Market	420,393	100.0	345,851	21.6

Source: Gartner (April 2018)

Semiconductor Vendors 2016 - 2017 (by revenue in Mio US\$)

2017 Rank	Company	R&D Exp (\$M)	R&D/Sales (%)	17/16 % Chg in R&D
1	Intel	13,098	21.2%	3%
2	Qualcomm	3,450	20.2%	-4%
3	Broadcom*	3,423	19.2%	4%
4	Samsung	3,415	5.2%	19%
5	Toshiba	2,670	20.0%	-7%
6	TSMC	2,656	8.3%	20%
7	MediaTek*	1,881	24.0%	9%
8	Micron	1,802	7.5%	8%
9	Nvidia	1,797	19.1%	23%
10	SK Hynix	1,729	6.5%	14%
Top 10 Total		35,921	13.0%	6%

Source: Company reports, IC Insights' *Strategic Reviews* database

*Sales and R&D spending of acquired semiconductor supplier are included.

R&D TOP 10 Semiconductor Companies

ICT became multidimensional and not constrained to computing and storage, this means equally impressive growth rates in fields as optoelectronics, sensors or discretetes.

ICT industry is not only restructuring itself but also restructures other industries as the automotive industry i.e. profit shifts to electronics. Nvidia "Drive Xavier" and automotive firms want a piece of the cake or share of the market (producing SW) themselves.

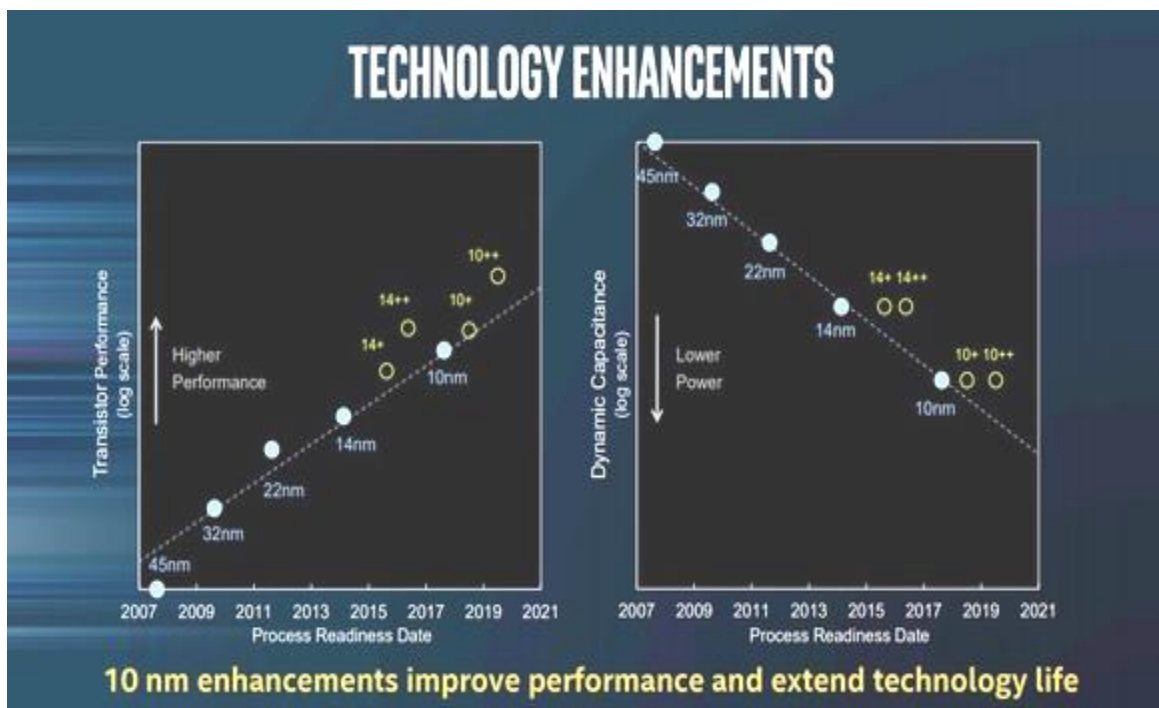
The current assumption is that ICT industries R&D will run out of money before it runs out of physics.

Innovation will continue but it will be more nuanced and complex. The rise of Asian companies has continued and led to surpassing famous US companies. An example is the loss of density lead by INTEL. It's a six-transistor SRAM bit cell implemented in its 10-nanometer technology measures 0.0312 μm^2 . Competing TSMCs (Taiwan Semiconductor Manufacturing Company) and

GlobalFoundries 7-nanometer technologies measure only $0.026 \mu\text{m}^2$, $0.0272 \mu\text{m}^2$, and $0.0269 \mu\text{m}^2$, respectively.

2. Technology

We all know exponential growth cannot go on forever but the end may be much farther away in the future than many think.



The master rule of the game is: the more we shrink it, the more it costs.

Every time the scale is halved, ICT manufacturers need a whole new generation of ever more precise photolithography machines. Building a new fab line today requires an investment typically measured in billions of dollars, something only a handful of companies can afford. Rising costs over the past decade have forced a massive consolidation and concentration process of the semiconductor industry; most of the world's production lines now belong to a handful of multinationals.

Additionally the fragmentation of the market triggered by mobile devices is making it harder to recuperate that money. When the cost per transistor at the next node exceeds the existing cost, scaling will stop.

This leads to multipronged R&D efforts and the search for new avenues and technologies.

3. Emerging technologies

3.1. Innovations that could shape the future of computing

- In-memory computing
- Super flat and 2D materials (TMDCs)
- Ultra-miniature computers
- Carbon Nano technology

- The 5nm transistor
- Advanced Memory Technology (as STT RAM)
- AI and Neuromorphic computing
- IoT
- QC

4. Architecture

4.1. In-Memory computing

As computation becomes increasingly data centric and the scalability limits are reached, alternative computing paradigms are sought. An approach is that of computational memory. The physics of nanoscale memory devices is used to perform certain computational tasks within the memory unit in a non-von Neumann manner. Computation and storage at the nanometer scale could enable ultra-dense, low-power, and massively-parallel computing systems.

IBM Research announced in Oct, 2017 it's first "computational memory" computer system architecture, which is expected to yield a 200x improvements in computer speed and energy efficiency, enabling ultra-dense, low-power, massively parallel computing systems, 'in-memory' computing architecture.

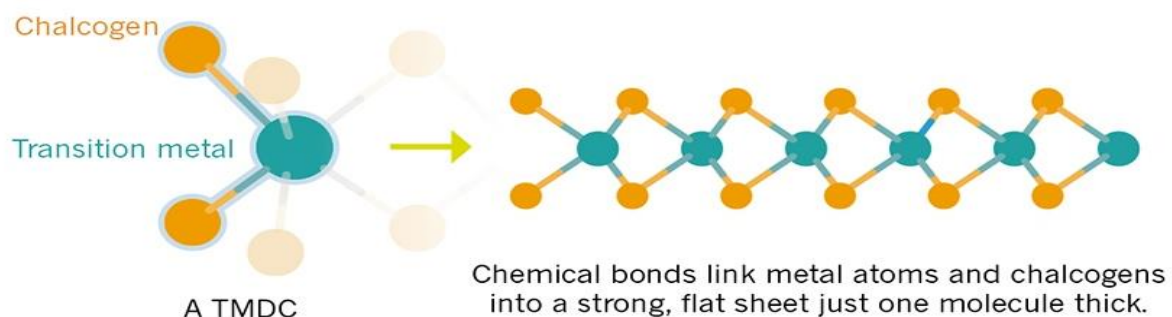
Their concept is to use one device (such as phase change memory or PCM) for both storing and processing information. That design would replace the conventional "von Neumann" computer architecture, used in standard desktop computers, laptops, and cellphones, which splits computation and memory into two different devices. That requires moving data back and forth between memory and the computing unit, making them slower and less energy-efficient. (IBM, 2017)

5. Materials

5.1. New Super-flat materials TMDCs

Super-flat materials have been languishing in graphene's shadow. These materials named transition-metal dichalcogenides (TMDCs).

A single sheet of transition-metal atoms such as molybdenum or tungsten is sandwiched between equally thin layers of chalcogens: elements, such as sulfur and selenium that lie below oxygen in the periodic system of elements table. (KIS, 2018)



TMDCs (transition metal dichalcogenides) are made up of one transition metal atom for every two chalcogen atoms and can be split into 2D layers that are flexible, transparent and have high conductivity. One of the exciting possibilities of 2D materials is stacking them into structures that are very thin. Taking advantage of the vastly different properties of various super-flat materials, it should be possible to build entire digital circuits out of atomically thick components, creating previously unimagined devices. Building conventional silicon transistors involves high temperatures i.e. over 1,000°C. Putting a second layer of silicon circuits on top, at that high temperature will damage the bottom layer of circuits. Carbon nanotube circuits and RRAM memory can be fabricated at much lower temperatures: This means they can be built up in layers without harming the circuits beneath. More than 40 such TMDCs are under development and some are additionally semiconductors. (Shulake, 2017)

5.2. More Alternative Approaches in Computing

Ultraminiature Computer

Thin film surface structure of mono-layer iron (Fe) deposited on boron, gallium, aluminum or indium nitride substrate (non-magnetic) could be the basis of another significant downsizing to a new dimension of computers and memories and having the advantage of being MRAM type. (Yu, 2018)

Hybrid architecture

At Stanford Univ. Cal. S. Mitra and colleagues have developed a hybrid architecture that stacks memory units together with transistors made from carbon nanotubes. This could reduce energy consumption to less than one-thousandth of standard chips.

Probabilistic Computing

Another interesting avenue is Probabilistic Computing. Turning from deterministic to probabilistic calculation allows for attractive trade-offs. For example, based on contemporary chip technology, a fourfold reduction in power can result in less than a 1% chance that a computational step will be incorrect.

5.3. Carbon Nano Technology

Carbon nanotubes is ready to take torch from Si according to Qing Cao of IBM Research. A future graphene-based transistor using spintronics could lead to tinier computers a thousand times faster and using a hundredth of the power of silicon-based computers. Especially Carbon-Nanosheets with their three-dimensional integration may lead to an intimate interweaving of memory and logic, featuring:

- Logic circuits made from carbon nanotubes an order of magnitude more energy-efficient compared to today's logic made from silicon.
- RRAM memory is denser, faster, and more energy-efficient than conventional DRAM devices. (Shulake, 2017)
- Dense through-chip vias (wires) that can enable vertical connectivity 1,000 times more dense than conventional packaging and chip-stacking solutions, dramatically improving the communication bandwidth between vertically stacked functional layers. Each sensor in the top layer can connect directly to its underlying memory cell. This enables the sensors to write at high speed their data in parallel directly into memory.

5.4. STT-MRAM

STT-MRAM technology may lead to the next big change in the evolution of computer memory. With this technology, traditional electrical currents can be used to change the magnetic state of the tunnel junction. Flowing electrical currents through the two ferromagnetic layers set the memory element into the parallel or antiparallel relative magnetic orientation without the use of an externally applied magnetic field.

5.5. The 5 nm Transistors

These dimensions mean signals are passing through a switch not larger than the width of two to three DNA strands. This is made especially attractive by the potential 75% power saving at a 40% performance improvement, and all this with standard tools and processes. But caution, may take 10 to 15 years of R&D before a groundbreaking new chip technology will be mature for the market.

The economy, measured in cost per transistor, is the only element of the “law” that’s kept similar pace over the last 50 years. A future 5nm node chip with nanosheet transistors, and its scaled density, is to deliver the expected value of performance, power, and economy. We can potentially scale a CNT transistor further than silicon for the primary reason that they are only 1,2 nm thick. This reduces gate length to 10 nm, provides a better electrostatic control of the gate, and helps to minimize current leakage, and takes advantage of the fact that electrons travel faster in CNTs than in silicon, enhancing thus device performance.

But it needs new ways to connect CNTs to their source and drain, a mix of materials to “bake” these 10nm elements together at a manufacturable temperature. Previously contacts between source-and-drain required processing temperatures high, at around 850°C. Switching to a cobalt-molybdenum alloy for the wiring between the elements lowered the required temperature to an acceptable 650°C.

A new magnetism-control method could lead to ultrafast, energy-efficient computer memory. A cobalt layer on top of a gadolinium-iron alloy allows for switching memory with a single laser pulse in just 7 ps. This may lead to a computing processor with high-speed, non-volatile memory right on the chip. The researchers found a magnetic alloy made up of gadolinium and iron that could accomplish those higher speeds, switching the direction of the magnetism with a series of electrical pulses of about 10 ps, more than 10 times faster than MRAM. Another single femtosecond optical pulse can fully reverse the magnetization within picoseconds. (Gorchon, 2018)

6. Communications

The future dimension of information volume automatically creates the demand for a matching dimension of communication. In our session we will try to shortly peruse the upcoming era of 5G technology and the potential and practicability of the development towards a 6G technology.

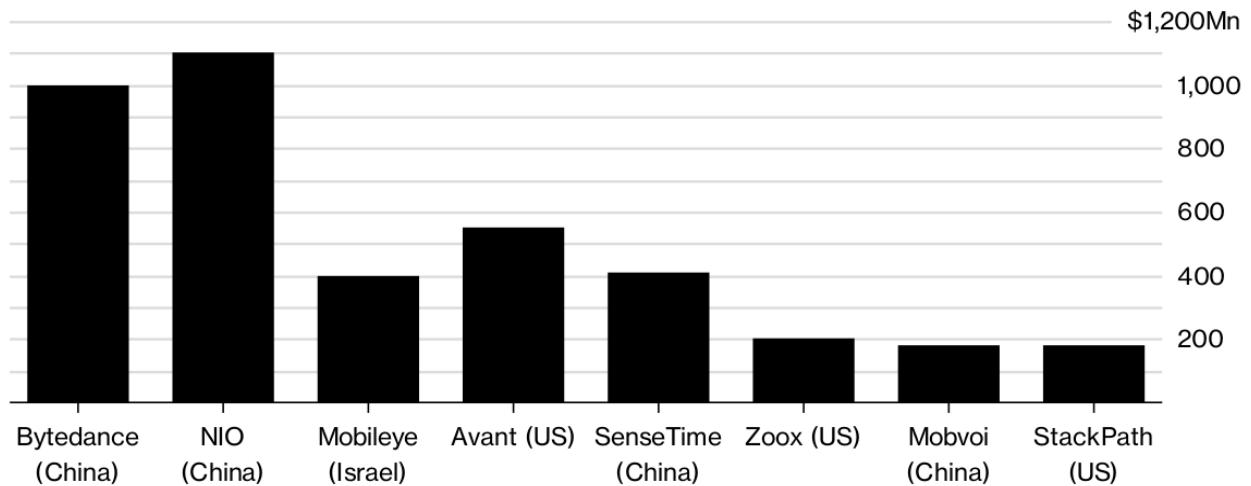
7. AI

7.1. The renaissance of AI

Following a period of exaggerated expectation AI disappeared from the stage for some years. The renaissance of AI, becoming a household word in the last years, is paralleled by attracting worldwide investments and venture capital financed start-ups.

Top AI Investments Since 2013

Chinese startups lead the global pack with software and self-driving cars.



Source: CB Insights

Bloomberg

The first consumer AI offerings share a common trait: they enhance products but don't directly contribute to the bottom line. ? The future centers of application gravity may be

- Governments
- Banks and
- Retail.

Buyers are not interested in AI just because it is an exciting highly publicized technology, they want AI to generate a solid ROI (return on investment) by solving specific problems, saving them money, or increasing sales and profits. From where is it expected to come?

- 40-50% Services solution and user cases
- 40-50% HW
- 0-10% Training

Considering cost of ownership; every use case is having slightly different requirements, each one will need partially customized hardware rather than commodity hardware, such as general-purpose central processing units (CPUs). For instance, accelerators optimized for convolutional neural networks are best for image recognition and thus would be chosen by medical-device manufacturers. But accelerators optimized for memory networks are better suited to speech recognition and language translation and thus would appeal to makers of sophisticated virtual home assistants.

In the past 10 years, the best-performing AI systems, such as the speech recognizers on smartphones or automatic translators have resulted from a technique called "deep learning." Deep learning is a name for an approach to artificial intelligence called neural networks, going in and out of fashion for more than 70 years

The resurgence of neural networks, the deep-learning renaissance, comes courtesy of the computer-game industry. The complex imagery and rapid pace of today's video games require hardware that can keep up, and the result has been the graphics processing unit (GPU), which packs thousands of relatively simple processing cores on a single chip. It didn't take long for researchers to realize that the architecture of a GPU is remarkably like that of a neural net.

How does it work? To each of its incoming connections, a node will assign a number (value) known as a “weight“. When the node receives different values over each of its connections and multiplies it by the associated weight. It then combines the resulting products, yielding a single value. If that value is below a threshold value, the node passes no data to the next layer. If the value exceeds the threshold value, the node “fires,” which in today’s neural nets generally means sending the value, the result of the weighted inputs, along all its outgoing connections.

AI needs big data. A vast quantity of examples is required for training neural networks, representing a valuable asset, e.g. millions of hours of annotated street driving videos are required for the training of basic autonomous driving skills.

Both approaches DL (deep learning) and ML (machine learning) are considered simultaneously because partially they are parallel, partially they are symbiotic. ML is preferred when only small amounts of data are available and the structures behind the data base is known. Neuronal methods need less knowledge and preparation to start with but much more data.

The approaches differ in practice: Deep Learning: first placing, testing afterwards vs. Science: first research and testing, then placement

Another aspect of AI stresses simulations, in which machines teach themselves using synthetic data or in virtual environments. An example has been demonstrated by the program to play Go, by DeepMind, a company acquired and now a unit of Alphabet. Computers were trained using data from actual games; the latest were simply given the rules and started playing Go against itself. Within three days it had surpassed its predecessor, which had itself beaten the best human player. If this approach proves widely applicable, future AI systems can be trained using sparser amounts of data.

The handling of personal data by all-too-human intelligence has turned into a big also ethical challenge of this new world.

Automation has in the long run not led job losses but to more employment. It has done so in every technological revolution since the threshing machine, and will this time too, though it may be now lawyers and medics who may have to readjust rather than farmhands and factory workers. Nothing is proving more egalitarian than the smartphone, and AI should likewise be mostly available to rich and poor alike. (Ridle, 2018)

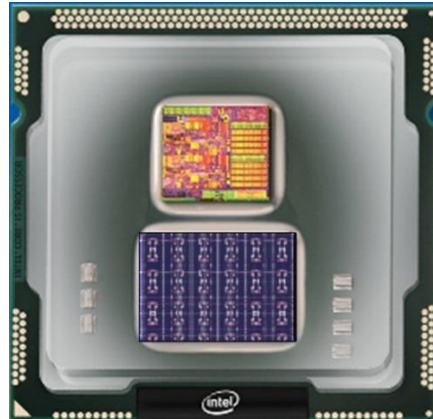
Whereas the previous generation of AI was based on “expert systems” pre-loaded with human expertise, today’s algorithms know almost nothing at the start, but crunch lots of data to learn how to do something. It is the access to deep draughts of data, and the ability to learn from them. In future 1 the decision “make or buy” might change to “teach or buy”? (Batra, 2018)

7.2. AI Technology and Neuromorphic Computing

Traditional workloads we have known for the last 40 years do not more apply. AI requires different capabilities from the machines we build.

There are well known companies to which we deliver our data free or even at our expense, and the volume of data will increase dramatically by IoT, and automation. Think of automated driving or Tesla recording the data of its cars automatically or the upcoming automated emergency call feature which send is also supposed to send selected data to the car manufacturer.

Our brains are much more efficient than computers for classifying unstructured data, like facial recognition and natural language processing, in part due to the reduced precision required for the brain to make a reasonable classification. By exploiting the reduced precision requirements for unstructured data workloads, the innate efficiency advantage of analog computing can be harnessed.



Intel's new 'Loihi' chip mimics neurons and synapses in the human brain and is getting automatically smarter over time.

As result of six years development efforts, the chip uses 130,000 "neurons" and 130 million "synapses" and learns in real time, based on feedback from the environment. Fabricated on Intel's 14 nm process technology, the chip is also up to 1,000 times more energy-efficient than general-purpose computing required for typical training systems.

For comparison, IBM's True North neuromorphic chip currently has 1 million neurons and 256 million synapses. (IBM, 2017)

The new NIST synapse has two unique features that researchers claims to outperform human synapses and other artificial synapses. Operating at 100 GHz, it can fire at a rate that is much faster than the human brain, 1 billion times per second, compared to a brain cell's rate of about 50 times per second, using only about one ten-thousandth as much energy as a human synapse. The spiking energy is less than 1 attojoule, compared to the roughly 10 femtojoules per synaptic event in the human brain... As NISTs M. Schneider stated, we do not know of any other artificial synapse that uses less energy.

Adding the advantages of super-conduction, a superconducting 'synapse' could enable powerful future neuromorphic supercomputers faster, lower-energy-required, compared to human synapses firing 200 million times faster than human brain, using only one ten-thousandth as much energy.

But overall current neuromorphic platforms are still orders of magnitude less efficient than the human brain

Nvidia's "Supercharged law". GPUs today are 25 times faster than five years ago. If they were advancing according to Moore's law, they only would have increased their speed "only" by a factor of 10 considering the increase in power of GPUs. Measured by another benchmark: the time to train AlexNet, a neural network on 15 million images. Five years ago, it took six days to go through the training process; with the latest hardware, it takes only 18 minutes, a factor of 500. Development benefits from simultaneous advances on multiple fronts: architecture, interconnects, memory technology, algorithms, and more. The innovation is not just about chips, it is about the entire stack. (Huank, 2018)

Every year more than nine billion microcontrollers are shipped as part of goods ranging from mobile phones to computers, toasters or refrigerators and we want to connect all of them in the long run.

Technology does not just happen. It is based on deliberate human choices and decisions.

To ensure that these choices are based on general acceptable and ethical principles will be a key problem for the future.

7.2.1. The “Brave new world” of AI, examples and potential issues

Surveillance and spying especially electronically empowered spying by states and governmental agencies has been around and officially tolerated since years. Extending scenario from the well-known stories of Edward Snowden, Facebook, Amazon, Google or project Echelon etc., to some of the more recent AI applications.(Loesch, 2017)

The prognostic use of AI is another two-edged development. Models evaluating the probability of delinquents becoming retrograde based on the record of the parents (weight 50%) or personal interests as membership in a civil rights movement (weight 20%), with wide implications that may determine the future of the person.

At the Zhengzhou railway station (PRC) a test with robots has been successfully implemented. Robot police were rolling through the waiting halls and identified faces and aggressive behavior. Only for arresting people human police is still required.

As Bloomberg reports face recognition is already used to control said to be dangerous groups of people as in the region of the province Xinjiang the computer is alerting the police if certain target objects leave a certain area.

Sometimes the area of free movement is restricted to few blocks (Human Rights Watch criticizes the virtual fencing a serious offence against of human rights). It is called fight against crime and terrorism but is shifting to maintain stabilization and public security and even monitor so called inappropriate behavior. Amnesty International finds that all restraints to use these techniques seem to have vanished.

The new glasses for police officers are more than a gadget, they offer the identification of billion citizens (In many countries a biometric ID card or passport is obligatory and thus the government has already a powerful data base, faces included).

Similar models are available for evaluation and selection of applicants for jobs, or employee performance also.

A study of using automated language analysis, published in the renowned psychiatry journal World Psychiatry, was studying a larger patient cohort, based on a retrospective model of patient speech patterns that would have predicted with 83% accuracy whether a patient subsequently developed psychosis

Deep neural network models have already scored higher than humans in reading and comprehension test. Microsoft achieved 82.650 on the ExactMatch metric, and the Alibaba Group Holding Ltd. scored 82.44.0 The best human score so far is 82.304.(Yampolskiy, 2018)

8. Quantum Computers

The general idea for a quantum computer is often traced to the physicist Richard Feynman in 1981. An alternative starting point could be a paper by Peter Shor in 1994, then of AT&T Bell Laboratories, outlining how a quantum computer could quickly find the prime factors of large numbers, thus defeating commonly used public-key encryption systems.

Many companies work to lead the Quantum Computers out of the laboratories. Technology giants and startups alike want to bring quantum computing into the mainstream and market. The list ranges from D-Wave, IBM, Microsoft, Intel, and Northrop Grumman to Google to many start-ups.

Scientists are cringing at press reports overstating progress. The algorithm Google is running to demonstrate quantum supremacy but does not do anything of practical importance yet. Building

quantum computers that can solve real-world computing problems people actually care about will require many more years of research. Engineers working on quantum computing at both Google and IBM say that a quantum “dream machine” capable of solving computing’s most vexing problems might still be *decades* away.

The picture below of the IBM 50-Qubit Processor may give you an impression of the state of technology of today’s QCs.

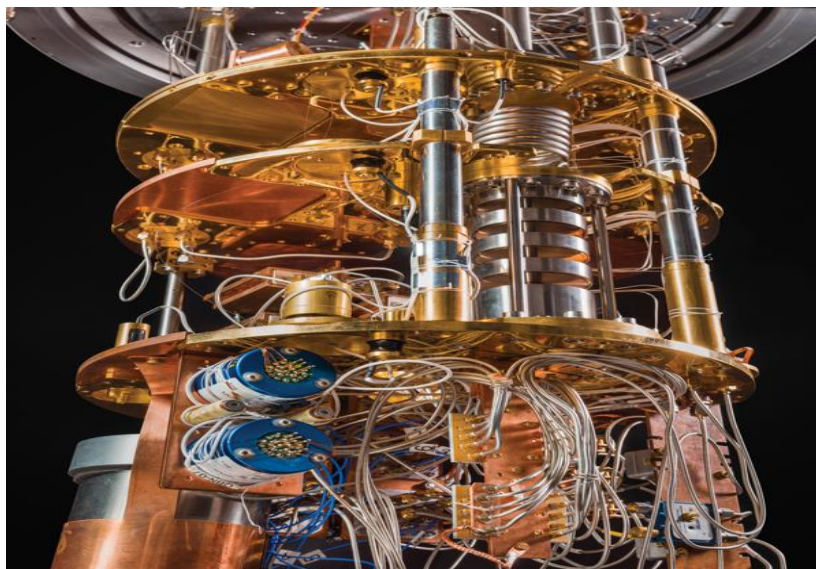


Photo: IBM, Christopher Payne

The idea of a 50-qubit+ (or so) quantum computer outperforming a state-of-the-art supercomputer sounds alluring, but it leaves a lot of questions hanging. Outperforming for which problem? How do you know the quantum computer has got the right answer if you can’t check it with a tried-and-tested classical device? And how can you be sure that the classical machine wouldn’t do better if you could find the right algorithm?

All current designs for quantum computers involve pairing them with classical ones, which carry out myriad pre- and post- processing steps. Many everyday programming tasks that can now be executed quickly on traditional computers might actually run *slower* on a quantum one, given the hardware and software overhead associated with getting a quantum computer to work in the first place. IBM’s new quantum computers, like those of Google, must be chilled to near absolute zero temperature to function.

Qubits must be kept isolated from even the minutest amount of outside interference, at least for as long as it takes for the computation to be completed.

Because of all the noise that surrounds them, qubits tend to be error prone. To deal with this problem, quantum computers need to have extra qubits standing by as backups to enable restoring the errant qubit to its proper state. Such error correction occurs in regular computers too, but the number of required backups is much greater in quantum systems i.e. for a reliable quantum computer, every qubit used might need 1,000 or more backups. Because many advanced algorithms require many qubits to begin with, the total number of qubits necessary for a useful quantum machine, including those involved with error correction, could run into *millions*.

Researchers have suggested to express the power of a quantum computation as “quantum volume,” which bundles all the relevant factors: number and connectivity of qubits, depth of algorithm, and other measures as noisiness. It is this quantum volume that characterizes the power of quantum computation.

The emerging consensus seem to be, surprises are always possible, expect the progress to be gradual. While researchers warn against excessive optimism, also don't rule out the prospect of breakthroughs that will allow the machines to do much more with less.

Some researchers are pointing out that we are essentially at the point that classical computing was at 100 years ago, not even at vacuum tubes yet.(IEEE, 2018)

EU announced a flagship program on Quantum Computing (announced, but not yet agreed by council and parliament), expecting from this program:

- Prim number factoring very large numbers into prime numbers
- Precise sensors for solid state physics new materials
- GPS from meters to millimeters using entanglement
- Contributions to the „Human brain” project
- Secure “Quantum Internet”

But caution against overselling; neither computers nor the Internet will not be entirely quantum

9. IoT

Since it will be addressed in separate sessions, let us restrain ourselves to few selected points.

IoT's value, from the customer's perspective, is in Services and IoT analytics & applications. These two layers are expected by 2020 to have captured 60% of the growth. The rest of the technology are enabling components with lower growth potential.

9.1. IoT's Market potential and Applications

Market potential (B\$ 3 ys)
Discrete manufacturing B\$ 40
Transportation B\$ 40
Utilities B\$ 40
B2C B\$ 25
Health care B\$ 15

Applications
Predictive Maintenance Self-Optimizing Production.
Automated Inventory Management
Remote Patient Monitoring
Smart Meters.
Track and Trace.

10. Summary and Outlook

Summarizing the points covered and guessing how the new scenario may look:

- Industry reaching new heights,
- Shift in constituency and geography
- Concentration and Oligopoly
- A bouquet of fascinating technologies emerging
- Another period of quasi exponential growth ahead
- A plethora of promising competing ideas in the R&D pipeline

But principal questions may arise, since 90% of rare earth metals mines are in China and at current speed will run out in 20 years

Potential areas of impact and basic questions arising:

- Productivity gain (less jobs more profit)
- Which layer of society will benefit?
- Society reduced to statistics (loss of other dimensions)?
- Autopilotation: extended from car to autopiloted enterprise (Industry x.0)
- Transition of knowledge from state to private enterprise?
- AI ethics: Selection of samples and algorithms?
- Society of Prognostic and algorithmic controls ahead

Privacy, a new “quality” additional surveillance, control and user transparency

But there may also be significant social implications ahead:

Automation has led to more employment, not less, in every technological revolution since the threshing machine, and will continue to do so. (Though it may now affect lawyers and medics who may have to readjust rather than farmhands and factory workers.)

Nothing is proving more egalitarian than the smartphone, and AI should likewise be mostly available to rich and poor alike. A new egalitarianism with an invisible hand on the horizon?

The handling of personal data turned into one of the big challenges of this brave new world.

Society must grapple with the dilemma of preserving people’s privacy and ownership of their data, while letting machine-learning algorithms harvest insights of value to everybody. The starry-eyed optimism that greeted, for example, the Obama campaign’s use of Facebook data in 2012 has given way to rage at similar practices used by in the recent US election campaign. Is there a sensible compromise to be found?

The rise of AI will make life richer, better, more interesting, and then be taken for granted, as electricity and cars are. Yet the same old, all-too-human ethical and political dilemmas about how much power to allow the state, or private enterprise, will persist. (Ridle, 2018)

Transgressing the limits of human capabilities and act beyond the scope of proven human behavior and power and traditional ethics is a tricky endeavor, especially without ruling ethical democratic principles?

Technology has always assisted human endeavors but its use is up to us. We still have all the opportunities but should not be late.

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TOPIC A: DIGITAL ECONOMY AND INDUSTRY 4.0

METAMODEL OF INDEXES AND MATURITY MODELS FOR INDUSTRY 4.0 READINESS IN ENTERPRISES

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Keywords

Industry 4.0, maturity model, readiness index, industry 4.0 readiness, cyber security risks

Abstract

The article deals with the analysis of available indexes of digital readiness and maturity models applied for the trends known as industry 4.0. Based on this analysis the metamodel of the industry 4.0 readiness is formulated. The individual models and indexes are positioned in this metamodel and the “gaps” with the potential for further research have been identified.

1. Introduction - Industry 4.0 trends as a part of the digitization of the whole society

The main goal of the trends known as “industry 4.0” is generally the further digitization, robotization and automation of production and products through their whole lifecycle. These IT based trends have not started to be implemented in business practice in this decade. The whole process of digitalization started more than 40 years ago and the good example of that is the concept of the Flexible Manufacturing Systems (FMS) in eighties. This period of the second half of the last century is known today as the 3rd Industrial Revolution and the current stage as the 4th Industrial Revolution.

The main question of companies is already not whether industry 4.0 yes or no and whether to take part in these changes (Basl, Sasiadek, 2017; Basl, 2017). The industry 4.0 trends are already in a fast-paced business today. Their dynamics is in line with today's pace of change, not only for technological reasons, but for example for demographic, resources and climatic reasons as well. The main question today therefore is how fast the industry 4.0 trends will be penetrated the companies, event. the whole society.

The business decisions in what areas to build the industry 4.0 can be speed up by various indexes of digital readiness and industry 4.0 maturity models. These indexes and models show the position of a company on the way towards to industry 4.0. There is a varied palette of more than two dozen different maturity models of industry readiness 4.0 available in literature mostly from the last couple years. The available readiness indexes have been linked to the digitization of the economy and the digitization of the whole society for longer time. They are also mostly built on the collection of a large amount of data from a wide range of rated entities (countries). On the other hand the evaluation of a company based on maturity models evaluates the situation of only this one entity (company), based on a pre-formulated scale and dimensions (Schuch et al., 2017; Schumacher et al., 2016; Industry 4.0, 2016; Koschnick, 2015).

The evaluation of a company's readiness has to be done with the respect to company's expectations related to industry 4.0. Besides higher profits the main expectations could be achieving higher flexibility, increasing the availability of products and services, further reducing costs, lower resource consumption or lower impact on environment, etc. Achieving these goals is often linked to finding out what "maturity level" the business is today and what further steps could be done due to the 4.0 development.

However, all current readiness approaches have one common assumption. They assume that the current digitization trends are identically identifiable as industry 4.0. But it is unfortunately not true. Moreover the approaches are also not uniform and it would also be necessary to assert that there is no final stage of the development of the society, the enterprises and especially the key technologies.

Table 1: Different understanding of important stages and milestones of the society development

Authors	Stages	Top	Milestones
Basl	<ol style="list-style-type: none"> 1. industrial revolution 2. industrial revolution 3. industrial „information“ revolution 	NA	Microprocessor Computer Internet
Keidanren	<ol style="list-style-type: none"> 1. Agrarian society 2. Industrial society 3. Information Society 4. Super Smart Society 	Society 5.0	Computer Distributed information
	<ol style="list-style-type: none"> 1. Mechanization 2. Electrification 3. Automation 4. Globalization 5. Digitalization 6. Personalization 	Revolution 5.0	Man-machine cooperation Collaborative robots Artificial Intelligence

The current state of industry 4.0 affairs will undoubtedly continue to evolve and new forms of development will have to be taken into account. Different authors dealing with it different ways already today. Some introduce the concept of the 5th Industrial Revolution and some speak about the Industry 5.0. Others authors, incl. of the authors of this article, would suffice to describe the current society with the cover topic of the information society.

2. Theoretical Background - overview of available frameworks and maturity models for company's readiness for digitization and industry 4.0

2.1. Industry readiness for industry 4.0 in a wider context - "macro" readiness indexes

The companies always operates in a certain environment. It creates and form the conditions for the digitalization processes, in general, the ability to innovate. Therefore company's industry 4.0 readiness evaluation can be viewed not only from the point of view of "micro", but also from the "macro" point of view. It means it can be seen in the wider environment context. In the context of

the "macro" view is the entire society or a state analyzed and more important indexes of readiness have existed for a long time. There are for example:

- NRI (Networked Readiness Index),
- GCI (Global Competitive Index)

or

- OECD scoreboard.

And especially for „macro“ evaluation of industry 4.0 there is available:

- Industry 4.0 Readiness Index from Roland Berger.

From Industry 4.0's point of view, the last mentioned index - Industry 4.0 Readiness Index by Roland Berger (<https://www.industrie40-readiness.de/?lang=en>) is particularly important. It uses together to assess the readiness of the national economy in combination with the indicator of industry's share of the country's GDP. It should be also mentioned that this index is mentioned in literature by many authors.

Table 2: Main „macro“ readiness indexes

Index	Name of index	Authority	Number of indicators	Number of countries evaluated
NRI	Networked Readiness Index	WEF World Economic Forum	51	139
GII	Global Innovation Index	Cornell University, INSEAD, WIPO	81	127
SITS	Science, industry and technology Scoreboard	OECD	200	31
RBI	RB Industry 4.0 Readiness Index	Roland Berger	2	24

This "macro" assessment of readiness generally indicates the overall assumptions of digitization in an analyzed country. It means its readiness for innovation as necessary condition for the development of industry 4.0. The common factor of these "macro" evaluations is the large number of analyzed countries and also the large number of (assessed) criteria. Another factor is that these indexes do not appear in the context of industry 4.0 but they provide long time series: The NRI index has been available since 2002.

From a methodological point of view, the result provide the country the feedback and information about its location with respect to other countries. This is not an absolute assessment, but a relative placement within a rated set of economies, with the ability to compare its tendencies over time.

2.2. Company's readiness for industry 4.0 from the perspective of maturity models

The "micro" rating of individual companies is different from the "macro" level evaluation. This is not necessarily a comparison of a large number of companies with dozens of indicators. There is rather an evaluation, often self-assessment, of the maturity degree of the company. Therefore, at this "micro" level, readiness models (maturity models) predominate (versus readiness indexes at "macro" level mentioned in the above chapter). These maturity models have arisen in a variety of workplaces - academia, consulting companies, and government levels. More than two dozen of them were

selected to process this article. Through the literature review, the following models were obtained and analysed:

- RAMI 4.0 (The Reference Architectural Model Industry 4.0) from BITCON VDI/VDE, ZVEI (Germany), 2015 (Koschnick, 2015).
- Industry 4.0 Component Model – derived from RAMI 4.0 and oriented on information technology (Koschnick, 2015).
- SIMMI 4.0 (System Integration Maturity Model Industry 4.0) from TU Dresden and TU Heilbronn (Germany), 2016 (Leyh et al., 2016).
- IMPULS (Industry 4.0 Readiness) from VDMA and RWTH (Germany) (<https://www.industrie40-readiness.de/?lang=en>).
- APM Maturity Model (Asset Performance Management Maturity Model from Capgemini (Dennis, 2017).
- Industry 4.0 Readiness Evaluation for Manufacturing Enterprises from Academy of Science Hungary (Hungary), 2017 (Halenár et al., 2016).
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- Stage maturity model in SME towards Industry 4.0.
- Roadmap Industry 4.0 from Uni Caphenberg, 2017.
- Industrie 4.0 MM (Assessment model for Industry 4.0) from Uni Ankara (Turkey), (Gokalp et al., 2017).
- M2DDM (Maturity Model for Data Driven Manufacturing) from Uni Stuttgart (Germany), 2017.
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- The Connected Enterprise Maturity Model from Rockwell Automation, 2014.
- Pathfinder 4.0.
- Industrie 4.0 Maturity Model from Acatech Studie.
- Firma4.cz from the Czech Minister of Industry and Trade (Czech Republic), 2016.

It is clear from this list that these models have been published since the last two years and examples can be found across the whole Europe.

3. Analysis of existing models and proposal of metamodel of enterprise readiness for industry 4.0

3.1. Main evaluation dimensions and scales of analysed models

The following attributes have to be taken into account when evaluating the enterprise Industry 4.0 maturity models:

- Scope of maturity evaluation – there is mostly the scope of the entire enterprise, but the model may also be focusing only on a particular area of enterprise (such as technology or information technology only, resp. enterprise information systems).

- Evaluation dimensions - usually these dimensions are related to the extent of the evaluation, but also depend on the depth of the evaluation, respectively on details of the evaluation. It means if this were to evaluate more IT-specific details that a large number of partial attributes can be taken into account.
- Evaluation scale – this aspect determines the scale, degree and access to maturity of an enterprise in a given dimension.

The main findings from the available maturity models show that the models are very complex but do not usually have a detailed view. They mostly deal with the corporate issues such as:

- strategy,
- leadership,
- enterprise culture,
- human resources,
- technology.

Most models have for example the dimension “Technology”. It can include not only subdimension information technology but assembly, and logistics technology as well. On the other hand the subdimension of information technology can often be spread over more dimensions, such as:

- product digitalization
- process digitalization
- digitalization of control and management

In this context, it is surprising that attributes of cross-sectional dimensions, such as quality or safety, models examined by the models are very rarely emphasized.

The scales used for evaluation are largely based on the mature principles known from the classic Capability Maturity Model (CMM) but some also use digitization scale or evaluates the enterprise as a whole.

From the point of view of specialization, the maturity models are in the range (scale interval) from the focus of the model on the whole enterprise to the focus of the model especially on its digitization or concentrating on its information technology. There is possible to identify in the maturity models an analytical tool evaluating the current state of readiness of the company and its maturity for industry 4.0. Some models already include the follow-up steps in the "roadmap" towards industry 4.0.

Analysis of indexes and models at the macro and then the micro level shows:

- there are not fully developed industry solutions yet (eg. for automotive, food or chemistry industry) and also solution for different types of enterprises and in particular SMEs,
- the individual models does not cover the IT dimension in needed details,
- there are no new risks integrated in the models (such as the safety and security issue for example),
- many dimensions are not disjoint, but on the contrary, they repeat the higher level of enterprise in the spirit of the fractal approach.

The analysis straight away pointed out that the question “of whether there is better access and a view of industry 4.0 over index readiness or maturity model” is not properly formulated. These two approaches these two approaches do not stand against each other. On the contrary, they provide important information, drawing on other data and other ways of processing.

3.2. Proposed metamodel for enterprise evaluation in the context of Society 4.0

The results obtained from the analysis were incorporated into the proposal of a own metamodel for the assessment of the company's readiness in the context of Society 4.0. The individual readiness indexes for 4.0 readiness can be co-edited into one common metamodel with more levels and attributes. The proposed metamodel is based on the following 8 levels gradually increasing the degree of details:

- Level 0 - the vision of further future development of the society (for example like 5th Industrial Revolution or Smart Society).
- Level 1 - the whole society currently (Society 4.0).
- Level 2 - sub-sector of the society (for example industry 4.0, farming 4.0, health 4.0 etc.).
- Level 3 – branch within the sub-sector of the society (for industry 4.0 it can be automotive or food industry or it can be category of small and medium-sized enterprises, etc.).
- Level 4 – the whole enterprise (industry 4.0).
- Level 5 – the area of the enterprise (for example technology, human resources, strategies, processes, data, security, etc.).
- Level 6 – the dimensions for area of the enterprise (for technology it could be information technology, production technologies (3D prints, predictive maintenance etc.) or logistics technology (drones, robotics, etc.).
- Level 7 – the attributes of the dimensions for area of the enterprise (it could detailed views of enterprise information systems and information technology or it could also be areas with great importance for the future (such as safety and associated risks).

The model thus has its "horizontal" line of gradual refinement of the enterprise's readiness. It is currently formulated based on tens of different maturity models that it points to. However, they do not address fully such attributes like information technology, enterprise architecture, security issues and new risks in detail. Therefore the metamodel needs to be expanded in this direction, including requirements for all forms of integration (horizontal, vertical, processes and data). Last but not least, potentially new management requirements have not yet been identified, such as the early deployment of large enterprise system of ERP category. The ERP systems have already been important in the early 1990s, when these implementations triggered a wave of management changes, such as procedural management linked to process mapping and, in particular, re-engineering or outsourcing.

Metamodel also points to previously uncharted locations. This is especially about the small industry specialization of available models. For example, supply chain areas include automotive, food and / or pharmaceutical industries. Another more specialized look certainly deserves models focused on the specifics of small and medium-sized enterprises.

3.3. Increasing importance of cross-sectional security dimensions

Analysed models have little to do with cross-cutting themes. One of the most important attributes of business dimensions is, for example, the issue of security risks associated with the use of information and communication technologies for the future. These cyber risks pose a new challenge, but also new limits with which we have to cope in the future in the business. Cyber-related risks are mainly related to wireless data transfer issues between manufacturing and monitoring devices (sensors) that will meet the Industrial Internet of Things concept (IIoT) and privacy issues. Both major areas have a very different character. While the area of IIoT communication security is the subject of new research and application of new technologies. The area of personal data security is more closely related to

areas of process management and modelling. If we analyze deeper the IIoT communication area, we encounter the following basic areas of cyber risks for communication between devices:

- The interference of one device or sensor is very closely related to the frequency band of the data transfer, which can interfere with the device. What is important, however, is that the device can not easily be interrupted, for example an industrial robot sensor on the production line, following its motion. If this sensor is shielded, it may result in uncontrolled movement of the robot over the production hall, which may have fatal consequences.
- The interruption of the entire communication network is very similar to the previous area, it is only applied to the entire network's IIoT network. This is also a far greater impact on the business and its outputs.
- Ensuring the integrity of transmitted and processed data affects the credibility and completeness of the data provided. The provider's endeavor is to ensure full data integrity so that data integrity can not be compromised in the transmission
- Encryption is a relatively specific area whose importance and importance and associated risk is associated with the specific application of IIoT technology under specific deployment conditions. Not too high security will be required, for example, by sensors that monitor the pulling and pulling of window blinds, but it will be critical, for example, when controlling the assembly line or managing traffic on-line.

The above risks are directly related to IIoT traffic.

4. Conclusion and final recommendations

An enterprise achieving a high degree of maturity in industry 4.0 will be the smart enterprise that will offer smart products and smart services to be delivered in an intelligent manufacturing environment in a smart economy.

Currently, attention is too much concentrated on the concept of 4.0, which corresponds to the topics of the conferences and their frequency. Although the current trends in digitization are very significant and their impact on all areas of human activity undeniably large, a certain "distance" or outlook is important. As part of their exponential growth, it is better than social sciences to evaluate social science. For example, they have used the post-modern society for some of these changes since the 1990s. At the same time, it is also to be expected that the theme of sustainable development and so-called green IT, which at the beginning of this decade dominated as one of the main topics at CeBIT prestigious trade fairs, was also temporarily challenged.

5. Acknowledgement

Paper was processed with contribution of the Czech Science Foundation project GAČR 17-02509S and with support from institutional-support fund for long-term conceptual development of science and research at the Faculty of Informatics and Statistics of the University of Economics, Prague (IP400040).

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E-GOVERNANCE: DIGITAL TRANSPARENCY AND THE MODEL OF INTERACTION WITHIN CZECH MUNICIPALITIES

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Keywords

Digital transparency, Models of interaction, Municipalities, Czech Republic

Abstract

The goal of the paper is to evaluate the level of digital transparency in the Czech municipalities and to examine which model describes the interaction of the government with the citizens the best. Results of the study show that Czech municipalities were heterogeneous in the analysis of digital transparency. Nevertheless there is a lot of room for improvement when it comes to the municipalities' websites the disclosure of information. The comparison results show that the managerial model, and after that the consultative model, best describe the interaction between the Czech municipalities and the citizens.

1. Introduction

Transparency is currently still an issue in the public sector of the modern society, and it has been among the most discussed topics in the past 20 years within good governance. Recently because of the wide spread of internet, more attention has been given to the concept of transparency and the circumstances that trigger transparency and similarly the consequences of transparency are studied more intensively by academics (Sičáková-Beblavá, Kollárik, & Sloboda, 2016). The aim of the paper is to evaluate the transparency of municipalities in the Czech Republic in the following areas:

- Communication of the municipalities with the citizens – how much information is published in the municipal office and the municipal events.
- Municipal management and documentation of their activities – publishing compulsory information and documents about the activities of municipality.
- Web accessibility – how well are the websites? Is the website quality affected by the number of the inhabitants in the municipality?

And also to compare the results of this study with the three models of interaction between states and their citizens that are mentioned in the study conducted by Chadwick & May (2003) in order to analyze and to find out which one of these three models describes the interaction of municipalities in the Czech republic with their citizens, focusing on the next 3 points:

- The direction of the flow of information.
- The major tools for interaction between government and citizens.
- The ability of citizens to interact electronically taken into consideration.

2. Theoretical background

Transparency could be conceptualized in a few different ways, some are normative and others are descriptive. One thing that most of these definitions have in common is that information is a “sine qua non” of transparency, in other words information is essential for transparency (Rawlins, 2008). Transparency is considered as a vital feature of rationality, progress, and good governance (Florini, 2007), and “*as a conduct of public affairs in the open or otherwise subject to public scrutiny*” (Birkinshaw, 2010). Piotrowski & Van Ryzin (2007) point out the important role of transparency to find out about what is happening inside the government, and Strathern (2000) emphasizes on the following proposition: “*if procedures and methods are open to scrutiny, then the organization is open to critique and ultimately to improvement.*” Prat (2006) points out the control features of transparency in organizations by the use of principal-agent model, where principal is using transparency as an instrument in order to ensure that the agent, who is acting instead of the principal by delegation of power, will not substitute the principals interests with their own (Prat, 2006). In the cases that information irregularities exist that are in the favor of the agent, this could possibly lead to governance abuse and/or failures. Such complications could be avoided or fixed by transparency (Bowles, Hamilton, & Levy, 2014) (Bannister & Connolly, 2011). Openness, insights, and clarity are some family resemblance concepts that are related to transparency (Oliver, 2004). However, it is very often that relations between transparency, openness, and information are not clear and hard to explain. Christensen (2015) provided one way to explain such relations; he believes that organizational openness could be considered as a precondition for transparency, and accessibility of information could be considered as a precondition for openness and transparency (Christensen & Cornelissen, 2015). There is a higher demand from society to access public information because of corruption, government’s abuse of power, theft and fraud, favoritism, abuse of discretion, embezzlement, nepotism, and clientelism. In order to respond to this growing demand, governments have to be more transparent conducting their activities. The information transparency index (TI) could be conditioned by local governments economic and political characteristics, in order to affect the information provided (Araujo & Tejedo-Romero, 2016) (Bennis, 2013). Canares (2016) claims that the use of ICT brings more transparent and more liable revenue generating systems that could possibly benefit both government and taxpayers. Other studies show that high usage of Facebook suggests that local governments have a tendency to enable citizens to watch over the government to make more transparent information, data and processes (Guillamón, Ríos, Gesuele, & Metallo, 2016). According to Bachmann (2011), the principle of transparency is synonymous with openness, the ability to communicate, responsibility, transparency management, exposure of services provided, and organization’s activities. The quality of the information provided increases the reliability and openness of public institutions, avoids corruption and improves the comfort of citizens that are in the municipality (Morris & Shin, 2002).

Chadwick & May (2003) introduced the following three models of interaction between states and their citizens in the form of e-government:

- **Managerial Model:** public services are faster and more efficient using ICTs, government gives public information to people anytime and anywhere they want them. Communication is faster between the government and the citizens but it is mostly in the form of “service delivery”

from the government to citizens. This is a kind of “push” model and the government makes the information accessible (for example on forums) but it is on the users to access them.

- Consultative Model: this model is quite the opposite of the managerial model. The consultative model is a “pull” model where ICTs are used to communicate the citizens’ opinion to the government and information is used to improve the administration and to provide better policies. Governments can seek the citizens’ opinion and “consult” on some special issues whenever they need to.
- Participatory Model: despite the other two models this model has a multidirectional interactivity. State is one association of many that is present in the civil society and facilitates political discussion and interaction. Solutions are based on agreements between the state and the citizens and all relevant data must be publically available.

3. Methodology

It is appreciated when municipalities publish information or documents in a manner that allows remote access; most municipalities do this through setting up and operating with their websites. Delivery of mandatory and voluntary information is the subject of transparency research. Article 17 of paragraph 5 of the Charter of Fundamental Rights and Freedoms (Chamber of Deputies, 2002) contains the duty of municipalities’ information in relation to the public, and establishes the constitutional duty of local authorities to provide information on their activities to the public in a sensible manner. The conditions and applications on free access to information are controlled and regulated by Act No. 106/1999 Coll., and Decree No. 416/2008 Coll. describes the structure of which the municipality must publish the information in order to be in a way that allows remote access especially when it comes to mandatory information (O svobodném přístupu k informacím, 1999; Ministerstvo vnitra České republiky, 2008). The meaning of Voluntary information is that municipalities have no obligation to publish such information but they have to be able to provide such information if someone requested; for example municipality's news, and presence of inhabitants in discussions about the administration of the municipality. It is highly suggested that such information would be provided on a voluntary basis in order for the municipalities to gain the citizens trust and strengthen citizens' confidence in them by showing that they have nothing to hide from the public (Mohelska, H. & Sokolova, M., 2017).

The observation focuses on the following core circuits based on what was mentioned previously:

- The communication between municipalities with their citizens; the focus here is the extent of which the information is published about the municipal office and also about the municipal events.
- Municipalities’ management and documents on their activities; this part is focused on how the mandatory information is published as well as the publication of documents on municipality activities.
- Websites accessibility. The focus here is on the evaluation of orientation and manipulation within the municipality's website and how clear is the arrangement of the website, not only for the general public but also for citizens with health disadvantages like people who have poor vision or the elderly.

For finding specific municipality websites the Google search engine was used. Data was collected through the municipalities' websites in January and February 2017.

The sample of this research contains 100 Czech municipalities, which were selected randomly from a list of all municipalities in the Czech Republic that had populations ranging between 2,000 to 10,000

inhabitants. The larger the number of inhabitants indicates larger municipalities and towns and of course they have a larger budget the smaller municipalities and also they host more social and cultural events. Most of the municipalities, which have more than 2,000 inhabitants, have more than 15 representatives and therefore they are able to elect the municipality government. A number has been assigned to each municipality fitting to a defined population according to their position in the alphabetical order of the municipalities. An online pseudo-random number generator that was earlier tested for the randomness of the generated numbers was used in order to create these numbers that represent the municipalities. These assigned numbers were then used to select municipalities randomly, with the pre-condition of selecting at least six municipalities within each region of Czech Republic. The analyzed sample consists of 73% of municipalities that have about 5,000 inhabitants and most of these municipalities have the status of a town. To identify the parameters that impact the transparency analysis a one-factor scattering analysis was used in this study (Mohelska, H. & Sokolova, M., 2017).

According to the Czech Republic Ministry of the Interior (2017) and from 1st of January 2017, some municipalities that have a population ranging from 2,000 to 9,999 inhabitants were also included in the analyzed sample of municipalities. It is important to mention that all of the municipalities in the selected sample have their official website, some of these municipalities have their websites but only accessible from the micro-region portal; nevertheless, such websites were also considered valid.

In addition, methods of analysis and synthesis, induction and deduction, abstraction and concretization were used. The obtained results were compared with generally valid models in order to find out which model best describes the current state of digital transparency in the Czech Republic.

4. Results and Analysis

The goal of the analysis is to evaluate how the principle of transparency is kept on the websites the Czech municipalities. The analyses were divided into three groups:

1. Municipalities' communications with their citizens: investigation of publication of mandatory and voluntary information.
2. The management of municipalities: in terms of public procurement and publication of documents about activities of municipalities. For example resolutions from meetings of municipal councils and boards, and minutes it takes to vote.
3. Websites accessibility: in order to ease the orientation and access of information on websites, and to have more user-friendly websites for visually impaired users and elderly citizens.

The primary analysis about municipalities' communication with citizens showed good results with the overall 81% success rate in publishing information. The criteria of mandatory disclosure of information had very good ratings. Compliance with the discussion forum on websites of municipalities was the least successful criteria. From 100 municipalities that were surveyed, 12 municipalities met all the criteria conditions in the analysis. 27% of the total number of municipalities surveyed has a population ranging between 5,000 and 9,999 inhabitants, and it is worth mentioning that half of the most successful municipalities in analysis of communications with citizens belong to this size category.

Analyses regarding the website accessibility were evaluated and had slightly worse results than the previous analysis, with a success rate of 66%. The font size change criterion was the least fulfilled criterion and visually impaired individuals criterion was the best. 20 municipalities were successful fulfilling all the criteria of website accessibility analysis. 14 of these 20 municipalities had a group

size ranging between 2,000 and 5,000 inhabitants. Approximately 70% of the sample surveyed consists of municipalities ranging between 2,000 and 5,000 inhabitants.

Municipalities' management and documents on their activities had the worst score with the success rate of only 49%. The most successful criteria that was examined is the publication of the resolution from municipal councils meetings with a 96% success rate in this analysis. None of the municipalities accomplished to be successful in all the criteria that was examined. This may be because of the difficulty of the voluntarily provided information.

One-factor analysis of scattering was used in this work to examine the factors that could influence the quality of the municipalities' websites. In order to test both hypotheses, it was essential to verify that random samples had a normal distribution. The combination of the Lilliefors variant of the Kolmogor-Smirnov test and the Shapiro-Wilk test were used to verify that random samples had a normal distribution. Moreover, homogeneity of scatterings (homoscedasticity) was also tested using the Brown-Forsythe test, with the significance level of 5%. For both hypotheses, the normality and homogeneous scattering tests cannot be rejected.

The following hypotheses were identified and tested.

H1: The quality of municipal websites does not change with the size of municipalities by population. (F-test statistic = 1.919, the corresponding p-value = 0.152, with a significance level of 0.050.) The mean values of municipalities are not different in different groups of municipalities and therefore, we do not reject the hypothesis.

H2: The quality of the municipal website does not change depending on the region to which the municipality belongs. (F-test statistic = 0.946, the corresponding p-value = 0.506, with a significance level of 0.050.) So, we do not reject the hypothesis.

Both of the hypotheses tested were not rejected, which means that the quality websites of individual municipalities does not depend on the number of inhabitants in the municipalities and does not depend on the region where the municipalities are located either.

Generally satisfactory results were obtained in the analysis about websites of municipalities in the Czech Republic and their compliance with the principle of transparency. Most of the municipalities that were surveyed provided basic information and also their webpages were accessible to disadvantaged clients. Documents about municipalities' activities are published but not often. Surveyed municipalities have overall a 65% success rate in summary of the research, meaning that 65% of municipalities are concerned when it comes to open disclosure of information. Šolc (2014) believes that the conscious municipalities publish everything that is possible to be published on their websites voluntarily and they don't need the legislation to force them to do so. None of the 100 municipalities surveyed complied with all evaluation criteria that were divided into three logical units. Nevertheless, 32 municipalities that are one third of the sample municipalities succeeded and publish all the information surveyed in at least one partial analysis.

It is clear from the results of the analyses, in the case that the legislation forced the municipalities to publish specific information in such a way that allows remote access, the municipalities will increase their efforts to fulfil these regulations rapidly. This is an open and responsible act from municipalities to help create a corruption-free environment within the municipalities, and this in turn increases the possibility that citizens would be involved as a tool for public control.

- The direction of the flow of information.
- The major tools for interaction between government and citizens.
- The ability of citizens to interact electronically taken into consideration.

A few things were interesting while comparing the results of the study with the models described by Chadwick & May (2003). The flow of information was mostly from the municipalities to the citizen and this direction of flow of information is consistent with the “push” model and consequently with the managerial model. Websites of the municipalities were the main tool for the interaction and necessary measures were taken by a little bit more than a half of the websites in order to facilitate better access for disadvantaged citizens. Results show that some voluntary information has been published through discussion forums. This could be considered as the consultative model but not to the full extend.

5. Discussion and Conclusions

In the analysis of digital transparency, Czech municipalities showed to be heterogeneous. Once the legislation precisely defines the scope and the form of mandatory disclosure of information on municipalities' websites, there is a lot of improvement to be made and requires large efforts from municipalities to achieve this duty. The degree of disclosure of information is declining with the freedom provided to municipalities for publishing information. The openness manifestation of municipalities in general is supported by Legislation, but transparent behavior depends on every individual municipality. It is sensible to define the requirements specification more clearly as a suitable approach in order to allow remote access in Czech legislation. Introducing other legislations that could capture this issue better on the whole could be another approach. Regardless of regular improvements in the quality of the municipality websites, there are still some important issues that need to improve.

Scott (2006) states that the most basic public services are provided by websites and citizens are connected more with the government. Web content and its usage requirements are increasing continually, and municipalities must monitor and improve the quality of their websites on a frequently in order to attract users and to keep them satisfied (Scott, 2006).

Specialized web portals can serve as help counselors to improve the quality of municipalities' web content. They repeatedly proved to be helpful in highlighting issues and coming up with suitable and inspirational solutions.

Comparing the results with the models described by Chadwick & May (2003) we can say that the managerial model best describes the municipalities in the Czech Republic, however there are some results that could imply that there are some connections to the consultative model as well, but mostly the managerial model.

6. Acknowledgement

The paper was written with the support of the specific project 6/2018 grant "Determinants of Cognitive Processes Impacting the Work Performance" granted by the University of Hradec Králové, Czech Republic and thanks to help of student Tomáš Valenta

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DEVELOPMENT OF ICT PROFESSIONAL WAGES IN CZECH REPUBLIC

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Keywords

ICT Professionals, ICT Managers, ICT Specialists, ICT Technicians, Wages in the Czech Economy, wages in ICT

Abstract

This article analyzes the time series of ICT Professionals' wages during the time period of 2000 – 2017 and compares them with wages in the Czech economy without the wages of ICT Professionals. We analyzed both ICT Professionals and the categories of ICT Professionals in compliance with the CZ-ISCO methodology (ICT Managers, ICT Specialists and ICT Technicians). Our analyses are based on quantile characteristics of wages - the median, quartiles, the first decile and the ninth decile. We used Trexima, a.s.'s Information System on Average Earnings as our source of data and performed our analyses in MS Excel. The results of our analyses show that the median wage of ICT Professionals during the time period of 2015 – 2017 kept going up faster than the median wage of the entire Czech economy, except for the median wage of ICT Technicians, the trendline of which is lower than that in the Czech economy.

1. Introduction

The current growth trend in the Czech economy is also reflected in a year-to-year increase in wages and salaries. We can use as an example the negotiations between the trade unions and the management of Škoda auto, a.s. (CTK, 2018), the result of which is a 12% year-to-year wage increase. The economic crisis, the follow-up recession and a relatively successful restart of the Czech economy in 2015 created room for similar increases in wages in the individual sectors and departments of the Czech economy, which made the average wage go up. In IV/Q 2017, the average wage was 31,646 CZK (CN, 2018) and the median wage was 27,320 CZK (CZSO, 2018). Many elaborations of Czech professionals currently analyze wages or salaries from different points of view. The time series of the wages of individuals are analyzed in (Marek, 2013), and those of households in (Malá, 2015). We performed a traditional analysis of professionals working with information and communication technologies (ICT). We distinguished the job description of ICT Professionals regardless of which sector of the economy they work in. We can thus say that we analyzed the wages of ICT Professionals regardless of where they work.

Information and communication technologies and their impact on the economy have been analyzed for a long time by economists who mostly agree that the implementation of ICT has a positive impact on the economy (Chen et al, 2010, Dedrick et al, 2003, Bloom et al, 2010). Some authors were able to identify a different impact of ICT on the economy in different countries (Dewan, Kraemer, 2000, Delina, Tkáč, 2010). The implementation of ICT seems to have a much bigger positive impact in

developed economies (Baumol, 2004) where it generates not only economic growth (Schumpeter, 1934) but also more competition (Ion, 2011). On the other hand, ICT may have a less positive, or even negative, impact in developing economies or underdeveloped regions (Devol et. al, 1999).

The Czech economy is growing and so are the wages of professionals, who are one of the motors of economic growth. The main goal of this article is to analyze the wage trend in ICT Professionals in the Czech economy during the time period of 2000 – 2017 and to show the wage trends in different years.

2. Data Collection and Methodology

We work with a data set in the form of a time series for the period 2000-2017. The source of the data is the corporation Trexima, s.r.o. (Trexima, 2018), which conducts statistical surveys on wages for the Ministry of Labour and Social Affairs and the Czech Statistical Office – see ‘Sample Set ISPV’ (ISPV, 2018) – Information System on Average Earnings. We performed the entire analysis in MS Excel. The basic comparison was done in the form of tables and figures. We used an annual time series for II/Q of each calendar year. Therefore, the values of individual characteristics do not represent data for the given year but only data for II/Q of the given year. As a result, these values may differ from official annual statistics. We chose the second quarter because it has very stable working hours in the long run, which ensures the best comparability of data over time. This quarter also has considerably less vacations and less special bonuses for employees. The data were converted to EUR based on the CNB’s current exchange rate and adjusted for inflation (inflation values were taken from the website of the Czech Statistical Office).

Based on generally used methodologies, such as KZAM (used in the Czech Republic since 2011) or CZ-NACE, ICT human resources are divided into three basic profession groups: CZ-ISCO 133 – ICT Managers, CZ-ISCO 25 – ICT Specialists, CZ-ISCO 35 – ICT Technicians. **ICT Managers, also called managers in information and communication technologies**, plan, manage and coordinate the purchases, development, maintenance and use of computer and telecommunication systems. Their work description usually includes: consultations with users, management, sellers and technicians in order to evaluate ICT requirements and to define technological specifications to meet such requirements; the formulation and management of ICT strategies, policies and plans (ICT). **ICT Specialists** research, plan, design, write, test, provide consultations and improve IT systems, hardware, software and related concepts for specific applications; process related documentation, including policies, principles and methods; design, develop, supervise, maintain and support databases and other information systems to ensure optimal performance and data integrity and security. Most occupations in this class require a university education. **ICT Technicians** support the regular operation of computer and communication systems and networks and perform technical tasks related to telecommunications and to transmission of image, sound and other types of telecommunications signals on land, on the sea or in the air. Most occupations in this class usually require a high school education (CZSO, 2010).

3. Results

The analysis results are provided below. First, for ICT Professionals as a whole and then by category, i.e. for ICT Managers, ICT Specialists and ICT Technicians. In the end, we performed an analysis always for the first and ninth decile of income groups by category of ICT Professionals.

3.1. ICT Professionals

First, we compared the average wage of ICT Professionals (ICT Managers, ICT Specialists and ICT Technicians) with the average wage in the CR without the wages of ICT Professionals. Their trend is shown in Fig. 1.

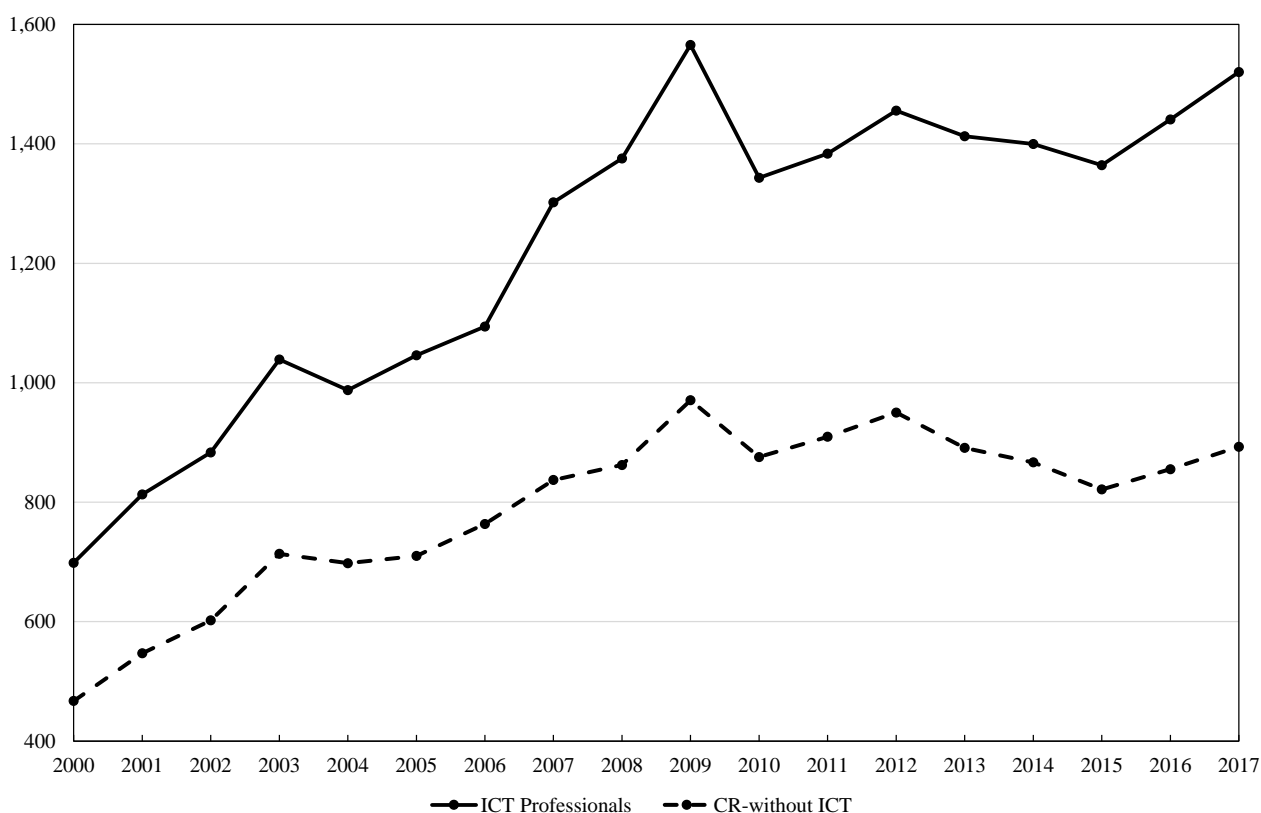


Fig. 1 Trend in the average wage of ICT Professionals and the average wage in the Czech economy

The analysis of the time series presented in Fig. 1 shows that the wage trend in ICT Professionals copied the wage trend in the Czech economy. Therefore, as the average wage in the Czech Republic grows, so does the average wage in ICT, and as the average wage in the entire economy diminishes, so does the average wage of ICT Professionals. The recovery after the year 2015, when the average wage stopped dropping, is very interesting. We can see that after 2015 the average wage of ICT Professionals grew faster than the average wage in the Czech Republic. The value of the trendline for the wages of ICT Professionals is 78 (the determination index is 0.99, which indicates a very close correlation), while the value of the trendline for the average wage in the Czech Republic is only 35.7 (the determination index is again 0.99). However, this trend started already in 2012. The difference in the values of the trendlines during the economic crisis was minimal. A more significant gap in these values started in 2013 and continued until 2017.

3.2. Analysis of the wages of ICT Professionals by category

We also examined in detail the trend in the median wage for the analyzed categories. Fig 2. provides a closer look at this situation.

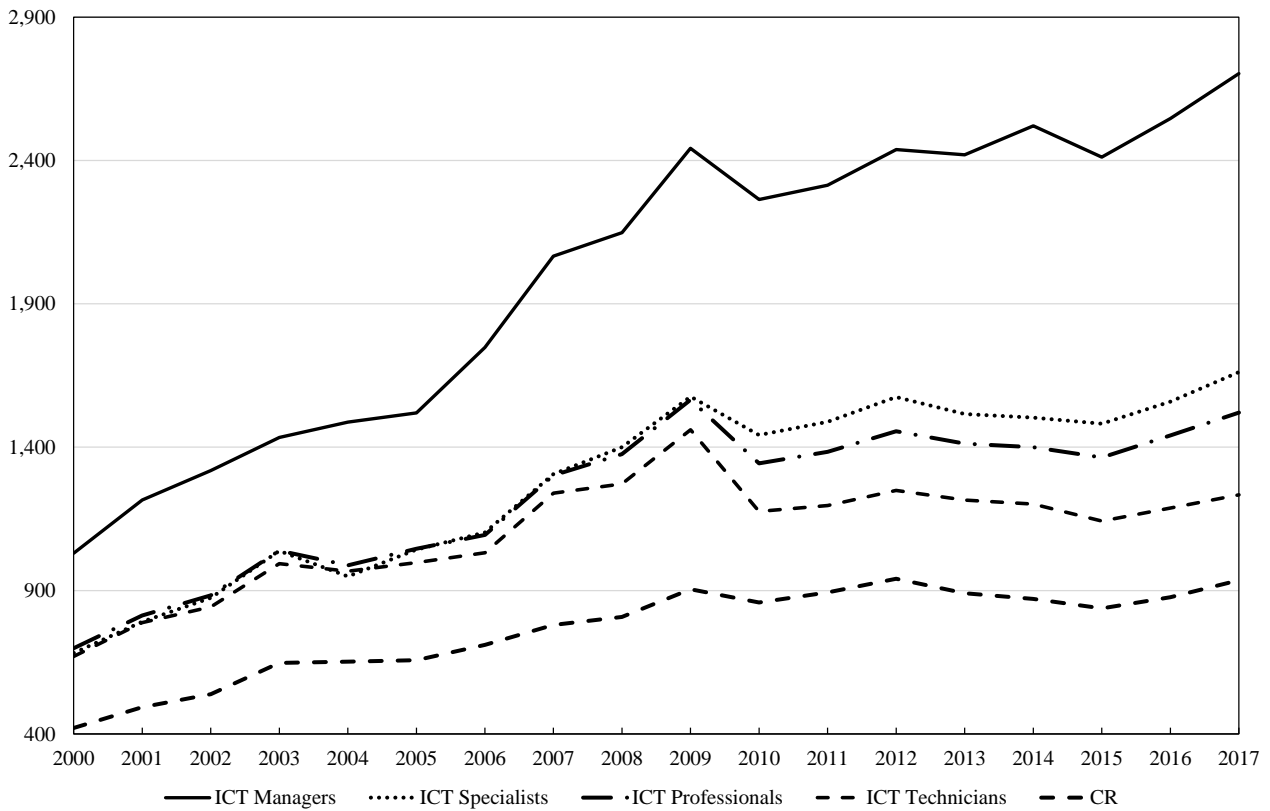


Fig. 2 The median wage of ICT Professionals during the years of 2000 – 2017

Fig. 2 shows two basic trends in the wages of ICT Professionals. The first one is the situation in 2009 when the wages of ICT Specialists were separated out from the wages of ICT Professionals. It is because the methodological framework for defining the category of ICT Specialists has changed. The trends since 2015 are shown in Tab. 1.

Tab. 1 The value of the trendline by ICT Professionals category during the years of 2000 – 2017 – based on the median

Profession category	Trendline
ICT Managers	145,02
ICT Specialists	89,91
ICT Technicians	45,92
ICT Professionals	78,01
Czech economy	49,27

As we can see, the gap between the wages of ICT Professionals and the wages in the rest of the Czech economy keeps growing, and this trend is also confirmed for the median wage. It is apparent that it is ICT Managers and ICT Specialists who drive this trend. We can see that the wages of ICT Technicians are growing even slower than the wages in the Czech Republic.

Another interesting piece of information is that the median wage of ICT Professionals is very close to the median wage of ICT Specialists. This is because in 2017, 61% of the analyzed sample represented ICT Specialists, 5% ICT Managers and 34% ICT Technicians in 2017.

The median wage of all ICT categories (and as a whole as well) was higher than the median wage in the entire CR. This confirms the situation shown in Fig. 1, where the average wage of ICT Professionals is considerably higher.

3.2.1. The first decile

Let's see what the wage trend looks like in the lowest 10% income group. Fig. 3 shows the trend of the first decile. It is obvious that even the worst paid 10% of all ICT categories were better off than other employees in the entire CR (even though the category ICT 35 shows a drop in the past years and there is almost no gap in 2017 as compared to the values for the entire CR).

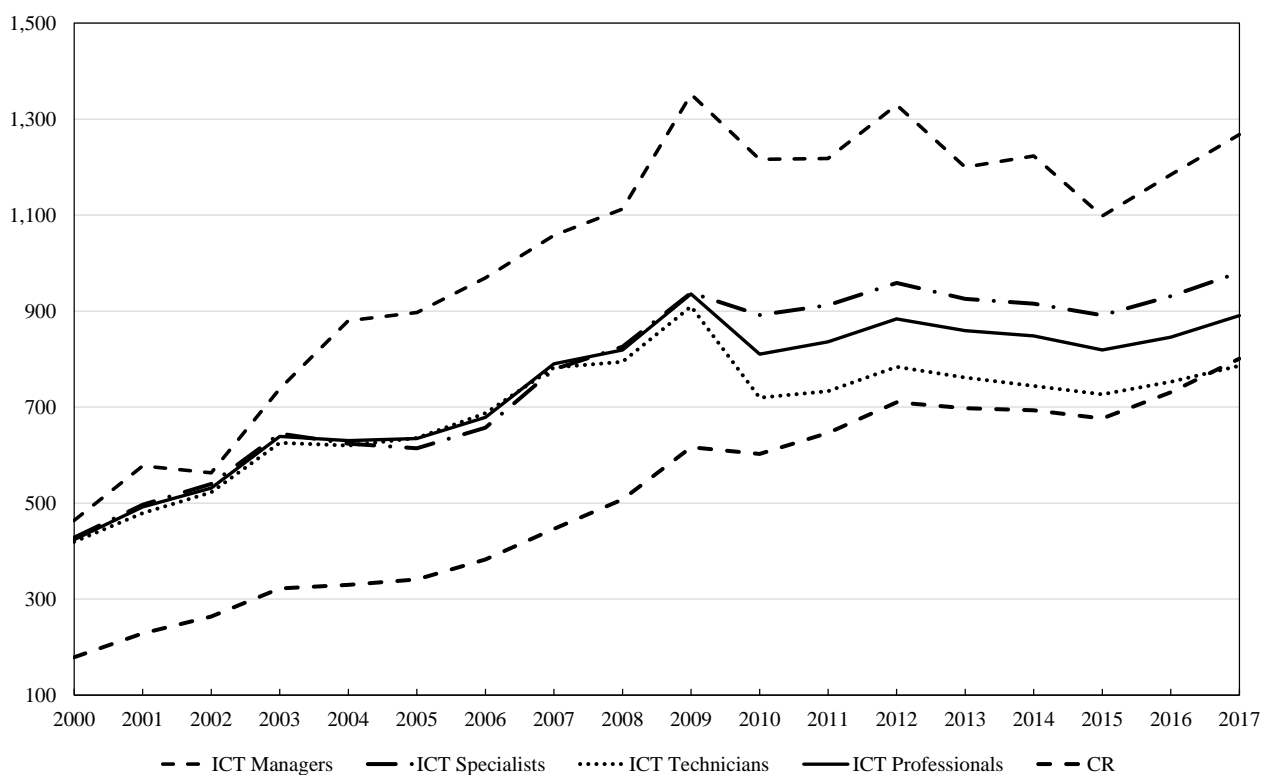


Fig. 3 Trend in the wages of ICT Professionals during the years of 2000 – 2017 – the first decile

The trend during the past three years in the first decile of the analyzed sample is shown in Tab. 2.

Tab. 2 The value of the trendline by ICT Professionals category during the years of 2000 – 2017 – the first decile

Profession category	Trendline
ICT Managers	84,79
ICT Specialists	44,53
ICT Technicians	29,60
ICT Professionals	35,92
Czech economy	62,30

Fig. 2 and especially Tab. 2 show that in the lowest income groups, the growth trend in the first decile of wages is the highest in ICT Managers, who are surprisingly followed by the growth trend in the entire economy and not by the growth trend in another ICT profession. This is mainly due to the very

low starting level of the first decile of wages in the Czech Republic (179 EUR) as compared to that of the wages of ICT Professionals (424 EUR).

3.2.2. The ninth decile

The situation at the other end of the analyzed sample, i.e. the ninth decile of the analyzed sample, is shown in Fig. 4.

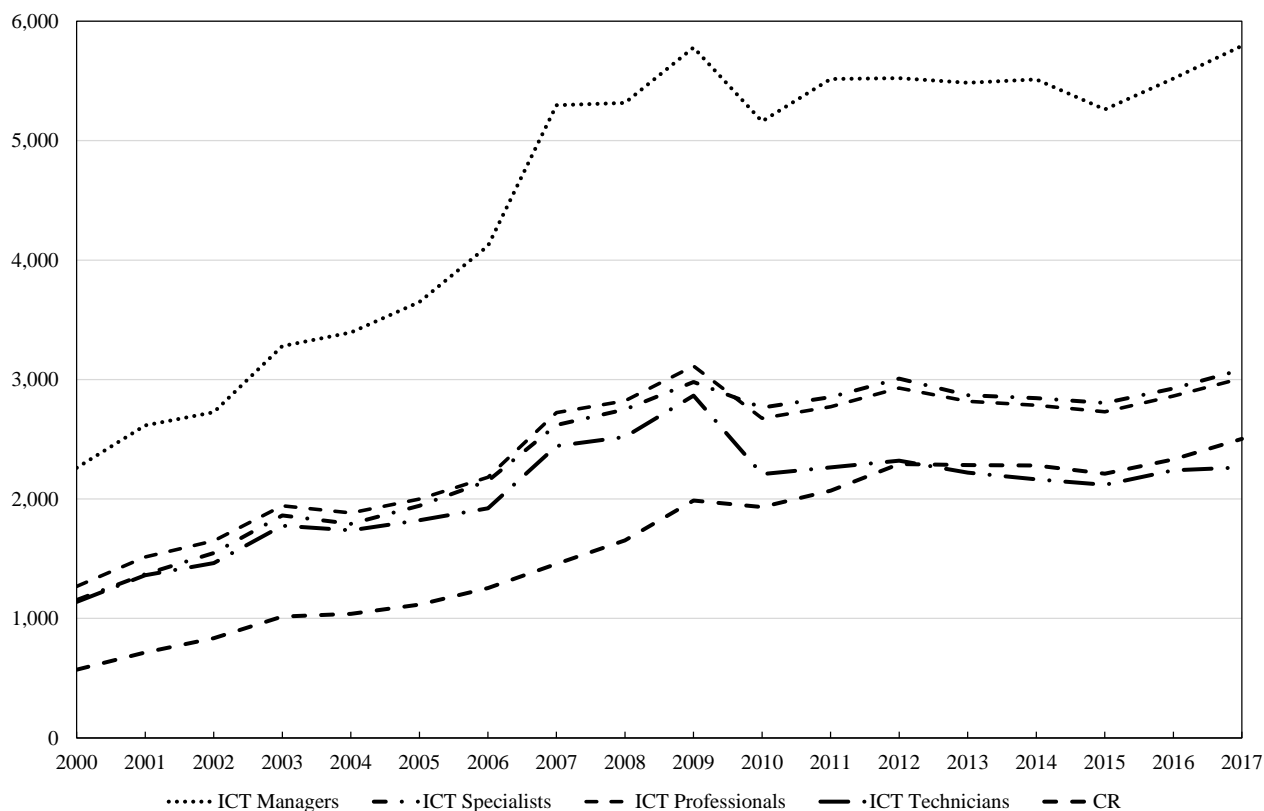


Fig. 4 Trend in the wages of ICT Professionals during the years of 2000 – 2017 – the ninth decile

The trend of the ninth decile of wages in the highest income group shows that the wages of the best paid 10% of employees did not drop from year to year, except in 2010 and 2015. This is explained at the end of this article.

Tab. 3 The value of the trendline by ICT Professionals category during the years of 2000 – 2017 – the ninth decile

Profession category	Trendline
ICT Managers	265.66
ICT Specialists	139.57
ICT Technicians	73.33
ICT Professionals	140.57
Czech economy	145.32

4. Conclusions

The analysis of wages in ICT based on the average and quantile characteristics (the median, quartiles, the first decile and the ninth decile) for different categories of ICT Professionals and their comparison with each other and with the average and/or median wages in the entire Czech economy provided the following conclusions:

- The median wage of ICT Professionals as well as in the entire economy dropped during the years of 2010 – 2015. In both cases, it was because the Czech Crown devaluated compared to world currencies and thus also compared to EUR. However, there were different reasons during these years. In 2009, the Czech Crown appreciated from year to year by 13.9% compared to EUR only to depreciate the next year by 6.9%. This was a result of stakeholders' extreme interest in buying Czech Crowns in 2009. Another factor at play was the lack of professionals, including ICT Professionals, on the Czech market. Their number did not go up in 2010, but the economic crisis curtailed the demand for them (there were less ICT projects). Wages (converted to EUR) dropped in 2015 because the Czech National Bank devaluated the Czech Crown at the end of 2014 by 5.9%.
- The wages of ICT Professionals went up in 2015 – 2017 also because there was a lack of professionals in the Czech economy and because the Czech Crown appreciated by approximately 1.5%.
- The analyzed quantile characteristics of wages show that:
 - The gap between the median wage of ICT Professionals and the median wage in the Czech Republic keeps growing.
 - The wages of ICT Managers show the fastest growth in both the first decile and the ninth decile.
 - The wages of ICT Technicians in the past three years show the slowest growth.
 - The lowest wages (in the first decile) in the Czech economy grew and keep growing during the analyzed time period faster than the wages of ICT Professionals, except for the wages of ICT Managers.

5. Acknowledgement

This paper was written with the support of the Czech Science Foundation project No. P402/12/G097 „DYME – Dynamic Models in Economics“ and with contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague IP400040.

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THE BUSINESS POTENTIAL OF EMERGING TECHNOLOGIES IN THE ENERGY INDUSTRY DOMAIN

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Keywords

Emerging technology, Artificial Intelligence, Machine Learning, Internet of Things, Digital Twin, Energy, Decentralized Industry

Abstract

This paper deals with the business potential of emerging technologies in the decentralized energy industry domain. Organizations must choose which progressive technology to implement in order to reap business benefits. New technologies like artificial intelligence, machine learning, digital twin or Internet of Things should bring new capabilities that have significant business value. Energy industry goes through major transformation from the old centralized model to a new kind of energy network integrating technologies like renewable energy sources, energy accumulation or e-mobility. This transformation brings new challenges that create opportunities for new technical solutions.

1. Introduction

Emerging technologies often struggle with providing enough value that will justify their adoption into business environment. Characteristic of the emerging technologies is that they are generally new but include older technologies. Emerging technologies are characterized by radical novelty, relatively fast growth, coherence, prominent impact, and uncertainty and ambiguity (Rotolo, Hicks, & Martin, 2015).

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 expects, that new technology has better performance, is easy to use, necessary conditions exists and that the new technology makes sense to use (Venkatesh, Morris, Davis, & Davis, 2003).

Organizations are faced with rapidly accelerating technology innovation that impact the way they deal with their workforces, customers and partners. To survive and thrive in the digital economy, enterprise architecture and technology innovation leaders must continue to work with their CIOs and business leaders to look for emerging technologies that can help create competitive advantage, generate value, overcome legal and regulatory hurdles, reduce operating costs, and enable transformational business models (Walker, 2017). Three outstanding technologies are:

- Artificial intelligence everywhere
- Transparently immersive experiences
- Digital platforms

Artificial intelligence (AI) delivers value to every industry, enabling new business models. It does so by supporting key initiatives such as customer engagement, digital production, huge data processing (big data / Internet of Things), smart cities, self-driving cars, computer vision and speech recognition.

The way we interact with technology will undergo a radical transformation over the next five to ten years. Conversational platforms, augmented reality, virtual reality and mixed reality will provide more natural and immersive interactions with the digital world. As people, places, processes and "things" become increasingly digitalized they will be represented by digital twins. A digital business is event-centric, which means it must be continuously sensing and adapting (Cearley, Burke, Searle, & Walker, 2017).

Energy sector changes from the traditional model to new approach. Changes in the provision and consumption of electricity services are now underway, driven by many factors affecting the distribution side of power systems. A variety of emerging distributed technologies are creating new options for the provision and consumption of electricity services. At the same time, information and communications technologies are rapidly decreasing in cost and becoming ubiquitous, enabling more flexible and efficient consumption of electricity, improved visibility of network use, and enhanced control of power systems (Perez-Arriaga, Knittel, Miller, & Tabors, 2016).

Traditional energy utility model is based on large remote power stations with central dispatch, long transmission lines, and a distribution system primarily designed to deliver power from transmission substations to load centers with established load profiles. New approach accommodates greater level of demand side management, generation and storage resources on the distribution system, generation closer to the loads, flexibility for islanding and micro-grids and considerably higher levels of intermittent generation (Ipakchi & Albuyeh, 2009).

Transformation of energy sector is a key contribution to transition towards a low carbon economy. Energy sector evolution is based on improving energy efficiency, integrating and development of renewable energy, new design of the electricity market and ensuring security of supply ("Clean Energy For All Europeans," 2016). Technologies that are perceived as a key to success in utility industry were identified by (Harrison, 2017) and are BI and analytics, cloud services and Internet of things.

2. Problem Formulation

Energy utility companies have problems how to respond to new challenges that are created by shift to decentralized energy network model. Problems need to be solved on organizational, business, processes, technical and operational side.

Problem of energy companies is, that they don't know what new technology can help them to get the job done, how it can help them, what to expect from new technology etc. Companies don't know as well which areas could provide quick wins (often called low hanging fruits) and how to prioritize use cases.

Energy companies are involved in many activities like operating valuable assets, provisioning of 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 mapping of emerging technologies to energy industry potential use cases and to identify most important ones which should be solved with top priority from business benefit point of view.

3. Methodology

Methodology for the research comprises of execution of steps that are compliant with case study execution described by (Yin, 2008).

Research was performed in December 2017 and in the first quarter of 2018 among specialist from Energy Industry. There were 12 participants in our research which answer our questions and 16 participants in total. The respondents are working in energy industry in average for 9 years. Research was composed from two phases, identification and consolidation. Identification phase was about identification of all use cases enabled or related to defined progressive technologies. We specified list of technologies and respondents had to specify, which use cases they see in defined areas. Technologies in the scope were defined based on multiple sources. The most precise and the most important for us in this context were Gartner's Top 10 Strategic Technology Trends for 2017 and 2018 (Cearley et al., 2017; Panetta, 2016). Technologies, which we review, were:

- Data and advanced analytics
- Artificial intelligence and machine learning
- Cloud and progressive infrastructure
- Internet of things
- Robots, drones and autonomic systems
- Augmented and virtual reality, digital twin
- Conversational systems, digital worker
- Blockchain
- 3D printing

Use cases identification was done across four business streams. Business streams selection was based on high level processes and organizational structures in organization where case study was performed:

- Distribution system operation (DSO) that deals mainly with operation and maintenance of energy distribution network
- B2C sales, retail sales of energy commodities and other services to customers and small businesses
- B2B sales, wholesale of energy commodities and provisioning of energy services mainly to large businesses and organizations
- Renewable energy sources (RES), construction and operation of solar, wind and other types of renewable energy sources

After primary use case identification, consolidation and aggregation was done in order to identify coherent business opportunities that can combine multiple progressive technologies.

4. Results and discussion

During the analysis, 87 use cases in total in 9 technology areas were identified. During discussion with respondents topics of digitalization and digital transformation were discussed. Situation differed in each business streams since only one of them is currently running digital strategy activity.

Respondents were confident that also in other business streams similar activities will be started. Main tasks for technology that must be addressed are improving efficiency, ability to provide new services and keeping competitive advantage.

The most promising technology is Data and advanced analytics with 22 identified possible use cases, see Figure 1. This one was mentioned by 11 respondents from 12 (91%). Common usage for advanced analytics was complex analysis, simulation and event detection over large data sets. Reason for this can be that energy industry is going through digitalization and number of uses with the need for strong data analytics is rising.

Behind it artificial intelligence and machine learning with 13 use cases and conversational systems and digitalization of worker tasks with 12 use cases. AI and machine learning was mostly mentioned in context of input processing automation, both text based and image based. Conversational systems were not only mentioned in customer service context but they have also large potential as a tool for data acquisition from field workers. Field work digitalization can further drive savings with digital tools to boost worker productivity.

It is very interesting that the current technology trend "Cloud technologies" is only on the fourth position. We expected, that cloud technology will be one of the most important nevertheless we see that in case of energy industry the importance of Cloud and progressive infrastructure is not so high. One of the reasons for this can be strong competence for on premise operation of IT with cloud services serving pretty much a complementary role.

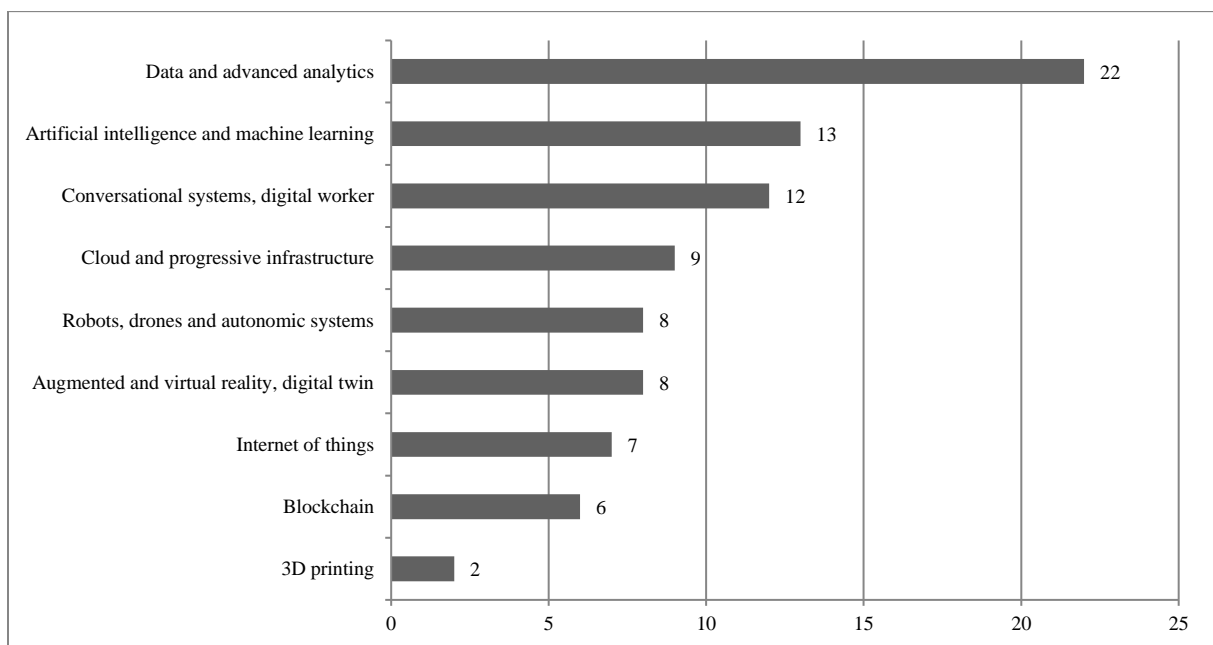


Figure 1 - Number of identified use cases per technology, source: Authors

Possible usage of robots and drones for asset inspection is limited by current legislature prohibiting fully autonomic system operation out of operator sight. However drones are perspective tool for inspection and maintenance of cooling towers and high voltage power lines.

Augmented reality and digital twin were mentioned mainly in the context of engineering tasks and complex visualizations. Internet of things technology is interesting as a complementary technology to current SCADA systems and other operational technology commonly used in energy industry.

Blockchain and distributed ledger in general can provide some benefits for logistics and digital information distribution. There is large potential in blockchain enabled new market models based on peer-to-peer trading and communication but market model design must be made first.

3D printing use cases identified were on-site spare part manufacturing that can shorten outage or even be used as a full time replacement of failing component.

Security concerns were mentioned multiple times during the analysis even though we did not consider security as a deployable technology but we treat it like a system quality that must be met, Topic of security new threats that are related to new technology deployment is very wide and is outside of scope of this paper.

Different look on technology use cases was obtained with analyzing number of opportunities in every defined business stream, see Figure 2

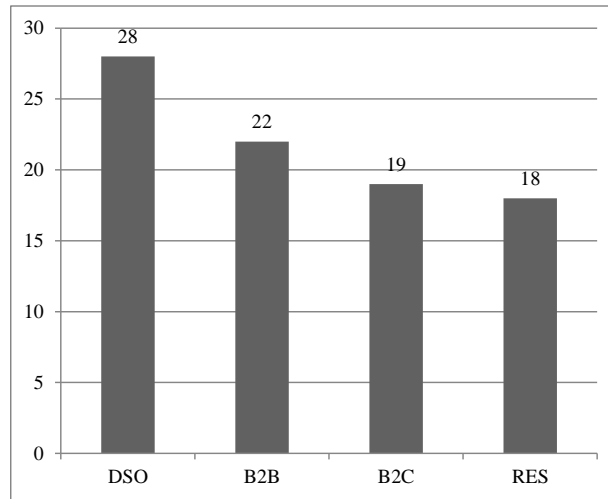


Figure 2 - Number of uses cases across business streams, source: authors

Most uses cases (28) were identified in distribution system operation. B2B Sales was on second place and B2C and renewables were lagging behind.

Based on the methodology part we integrated all identified uses to consistent areas. These areas were based on application of one or more technology and had common business benefits associated with them. As the final result our larger business areas were mapped to four defined business streams (Distribution system operation, B2C sales, B2B sales, Renewables), see Figure 3.

Name	Technologies	DSO	B2B	B2C	RES
Operations and asset management	Data and advanced analytics for predictive maintenance and maintenance optimization Internet of things for data acquisition	X			X
Remote imaging with automatic processing	Robots, drones and autonomic systems for asset inspection and surveillance Artificial intelligence and machine learning for automatic image and data processing	X			X
Customer interaction, automation (chatbots)	Artificial intelligence and machine learning for automatization of customer request acquisition and processing	X		X	

Name	Technologies	DSO	B2B	B2C	RES
3D engineering	Augmented and virtual reality, digital twin for engineering task simulation and advanced visualization Data and advanced analytics simulation including system target attributes validation	X	X		
Procurement and logistics	Blockchain for distributed procurement ledger including smart contracts Internet of Things for asset tracking and condition monitoring	X			
B2C Data models	Artificial intelligence and machine learning for customer behavior simulation Data and advanced analytics for customer and product portfolio modeling and different scenarios validation			X	

Figure 3 - Business areas with supporting technology, source: Authors

Operational excellence can be improved in quite a few areas:

- Smart asset maintenance and equipment renewal, data based predictive maintenance
- Acquisition of data relevant for operations like frost and weather condition metering with the Internet of Things means
- Demand side management, ability to manage load on distribution network and remote power management of renewable energy sources with Internet of Things technology

Remote imaging with automatic image processing is based on image acquisition through installed cameras or drones. Further processing is done with image recognition and automatic processing based on AI and machine learning with identification of possible signs of deteriorating equipment state.

Customer interaction and automation uses AI and new human interface technology to automate as much of customer request as possible since cost of human work is major component of customer interaction costs.

New way to deal with 3D engineering uses immersive technology like augmented reality with combination of digital twin to streamline design and engineering processes. Ability to simulate actions and identify problems as soon as possible can prevent much of costly engineering redesigns.

Procurement and logistics can use new technologies to keep track of every item during its whole lifecycle from acquisition through installation to maintenance.

B2C Data models use current data to create model to simulate customer behavior and preferences in order to optimize product portfolio, increase cross/upsell and decrease churn rate.

5. Conclusions

Energy companies are facing new challenges in today market environment. New technologies can help them to solve these challenges and to improve their operations. Topics like digitalization or

digital transformation are resonating in energy companies and strategic digital activities are ramping up across business areas.

We identified 87 use cases in 9 technology areas.

By the research we showed that there is substantial opportunity for emerging technologies in energy industry. Data and advanced analytics is by far the most promising technology to be deployed. We identified 22 possible use cases and data and advanced analytics were mentioned by 11 respondents from 12 (91%). On next places artificial intelligence (13 use cases), machine learning, conversational systems and digital workplace are technologies with the widest business benefits. Current technology trend “Cloud technologies” is on the fourth position, which is interesting.

Most opportunities were found in distribution system operation. This can be attributed to wide range of activities that are done on distribution network from asset management, work management, engineering and customer service.

We expect that implementation of emerging technologies 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

Paper was processed with contribution of long term support of scientific work on Faculty of Informatics and Statistics, University of Economics, Prague (IP 400040).

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LOW POWER WIDE AREA NETWORKS, COMPARISON IN THE CONTEXT OF THE CZECH REPUBLIC

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Keywords

IoT, LPWAN, LoRaWAN, SigFox, NB-IoT, Czech Republic

Abstract

The present paper aims to summarize the most widespread solutions available in the area of LPWAN technologies and to propose a set of criteria for choosing the most suitable technology from the perspective of the Czech market. Attention is paid to NB-IoT (Narrowband Internet of Things), LoRaWAN (Long Range Wide Area Network) and Sigfox. The above-mentioned technologies are first described, then a set of criteria is defined and in the end, the suitability of technologies in the context of the Czech Republic is discussed.

1. Introduction

Internet of Things (IoT) is a notion that has been resonating with growing tendency not only throughout the business area, but also in the commercial sector. IEEE defines (Minerva, 2015) IoT as *a network of objects with embedded sensors connected to the Internet*. Connectivity is one of the basic pillars of IoT and it is just thanks to growing coverage of the Internet network, wireless technologies and new protocols with low energetic requirements that the new space for innovation in all areas has been opening up.

The company Cisco (Bradley, 2013) estimates the number of connected devices in the year 2020 to 50 billion, while it is expected that during the year 2013 and 2020 there will be a generation of volume of opportunities in the amount of 14.4 trillions of dollars. Areas which are according to the study expected to grow up fast are those with prevailing communication of the type M2M (machine-to-machine), it concerns concretely production, health care, smart buildings, smart supplier networks and education. The company Gartner (Hung, 2017) supposes that the number of IoT devices will reach 20 billions of dollars in the year 2020 and that there will be on average 4 IoT devices per one person. Even though the values, denominations and segmentations of individual areas may differ from study to a study, they all predict a continuous growth of the IoT phenomenon. The heterogeneity of areas in which the IoT boosts is considerable while each of them claims increasing requirements on different criteria (Al-Fuqaha, 2015). In case of critical applications for example from Smart Grid area the focus will be most probably on a permanent connectivity, an acceptable data rate and a guaranteed quality of services (Khan, 2016). Another solutions for example from area of Smart Metering build on a wide geographical coverage, mobility and a long-term duration of the source of energy, however they can be satisfied with a low data rate. (Yang, 2017). They are just the different requirements of different solutions which have caused the creation of different technical solutions already at the data transmission and basic protocols level. It is necessary to take into consideration

the requirements and to choose a convenient technology during implementation of a concrete IoT solution, while one of the crucial criteria is the distance and geographical range which is supposed to be covered by the solution. In general, we distinguish two types of networks, local (LAN) and wide (WAN), and there exist more convenient communication technologies for each of them. Data transmission through Bluetooth or Zigbee suit absolutely solutions belonging to the Smart Home and Smart Wearables areas because the data transmission will not be longer than dozens of meters. However the mentioned technologies are completely inconvenient for implementation of an application which shall ensure communication within the scope of kilometers. There was rather a limited choice for solutions of such a kind, the only thing coming into consideration were services provided by mobile operators. However they demand higher energetic requirements on end devices, as the device is forced to a continuous listening to network communication. Nevertheless, many applications need only regular collection of small data in larger time intervals and low data rate is sufficient for that. For the end device it is also useless to be in an active mode for the whole time and to waste the capacity of energetic source. New technologies have appeared right for solutions of this kind. In sum, we can call them *Low Power Wide Area* (LPWA) technologies.

2. Problem Formulation

It is due to mentioned significant heterogeneity of the IoT areas that the implementation of a concrete solution claims higher requirements when choosing suitable technologies and protocols. The choice has to be based on a set of key criteria and their evaluation contributes to the most appropriate choice of given alternatives.

The aim of this contribution is to describe chosen technologies and to offer evaluation criteria to select the most suitable variant considering all relevant key factors.

3. Methodology

In this paper we present a critical analysis of parameters that can be identified in examined LPWA technologies which are suitable for implementation of IoT solutions within the Czech Republic. Selected technologies are first described sufficiently in the fourth chapter, which serves as a theoretical background. The characterization of technologies is based on both the official documentation published by the producers themselves and useful information acquired from already elaborated works dealing with similar topic. The following is the identification of key aspects which are present in the technologies under review, the outcome of this part is the list of most relevant attributes. For each attribute, the reasons why it was listed as an important parameter are clearly stated. The sixth chapter recommends the pairwise method with the use of the so-called Fuller's triangle for the evaluation and explains the importance of assigning different weights to individual criteria. LPWA technologies. In the final part we discuss the pros and contras of the individual technologies.

4. Low Power Wide Area Network

The Low Power Wide Area Network (LPWAN) refers to networks with high communication range and low energy requirements demanded from the end devices, for which they use transmission in both licensed and unlicensed bands. LPWAN is not represented by a single technology but several approaches built on proprietary protocols and different infrastructure transmission systems. However, there are common factors that led to their development and further enhancements, primarily the

suitability for simple devices with limited capabilities that handle communication on the ideally maximum second layer (line) of the ISO OSI model. Low power consumption allows devices to communicate for up to several years without the need to replace a power source, typically a battery. The network's ability to serve tens to thousands of devices at low economic costs, here the employment of unlicensed bands is playing an important role. Typically, these networks do not require low latency and wide bandwidth, as they usually handle data from several bytes to maximum of kilobytes. The fact that the above characteristics appear to be crucial is demonstrated by ETSI's effort to standardize them by the definition of the Low Throughput Networks (LTN) (Margelis, 2015).

4.1. SigFox

The SigFox network is the result of a joint project carried by SimpleCell and T-Mobile. This is a very understandable cooperation because mobile operators have transmission infrastructure and it is easier to modify the existing system than to create a whole new one. In the EU Sigfox uses a non-licensed ISM 868 MHz (Sigfox, 2017) which is not charged, however there is no guarantee of free-interference. Only a narrow modulation band of 192 KHz is used from the mentioned spectrum. The communication itself is of the Ultra Narrow Band type, and it is being used by messages that occupy only 100 Hz at the moment of transmission. This approach, when the transmit power is concentrated to a very narrow frequency range, allows transmission at considerable distances with low transmit power and low noise. The data is transmitted by a short pulse with a transmitting power of max. 25 mW and the message is transmitted at a rate of 100 or 600 bits per second depending on the region (Sigfox, 2017). It means that it has to be a small scale data transfer, the documentation specifies a size range from 0 to a maximum of 12 bytes (Sigfox, 2017). In order to save the energy source of the end devices, they are activated only at uplink time and repeat the transmission three times for a greater chance of capture. This is followed by the opening of a 10-second listening window on a predetermined channel for downlink. Due to the absence of a collision and confirmation mechanism (Sigfox uses unslotted ALOHA) on successful reception, and for maximizing the likelihood of processing the message, the network operates on a cooperative principle. It means that all base stations are listening in the whole spectrum and captured messages are forwarded to the SigFox Cloud gateway. Due to the shared band, there are clear limits for the use set by the so-called duty cycle, which is set at 1% for the EU. This measure is reflected in the maximum amount of messages that can be transferred within one day.

4.2. LoRaWAN

It is the abbreviation of the full name Long Range Wide Area Networks and denotes the name of the MAC Layer Protocol that determines how the data is transferred through Semtech's proprietary physical layer LoRa. Protocol LoRaWAN is developed under the auspices of a non-profit association of several companies, the so-called LoRa Alliance. LoRa also uses the non-licensed ISM bands which are free of charge, in the EU uses 868 MHz and 433 MHz (Lora Alliance, 2015). Regarding modulation, either FSK (Frequency Shift Keying) or proprietary LoRa modulation based on Chirp Spread Spectrum (CSS) is used. Depending on the modulation used, data bandwidth values range from 290 bps to a maximum of 50 Kbps, with maximum values being reached using FSK modulation (Lora Alliance, 2015). Unlike SigFox, the width of the channel is not fixed, but is determined by the capabilities of the device, which maximizes the lifetime of the power source and optimizes transmission capacities. Only the minimum width is set for the channel and the threshold is 125 kHz. Messages can vary in size from 2 to 255 bytes. LoRaWAN supports three classes of end devices- A, B and C. (Lora Alliance, 2015). Group A is characterized by the fact that the communication is initiated by the end device, after the end of transmission there are two short windows intended for receiving messages. Devices from the group B have dedicated periodic time windows, during which

they are ready to receive messages. For that there is a need of network synchronization which is done by using so-called beacon packets (Lora Alliance, 2015). Group C devices are ready to receive and broadcast continuously. All devices must be able to operate in group A mode (Sinha, 2017), which is also the default mode for the first login to the network using the so-called join procedure. The end nodes are not tied to a particular master node and messages are typically captured by multiple stations. The messages are further forwarded to the server by the stations equipped with standard IP connectivity and using traditional connection methods such as Ethernet, mobile, satellite, etc. (Sinha, 2017). Like Sigfox LoRaWAN also has limited maximum transmission time (1 %) set by the so-called duty cycle.

4.3. NB-IoT

Narrow Band Internet of Things (NB- IoT) is another representative of LPWA networks. Technology is being developed by the 3rd Generation Partnership Project (3GPP), which has been dedicated to the development of mobile technologies suitable for the implementation of Machine-Type Services since 2005. NB-IoT is the latest release and is part of the release of marked by the number 13, released in 2016. The company Huawei (Chen, 2017) may be named China's leading developer. NB-IoT uses the licensed ISM band (GSM, LTE) for the uplink and downlink bandwidth of 180 KHz, which corresponds to one LTE block. The modulation used can be BPSK or QPSK type, SC-FDMA is used for uplink, which is suitable for QoS guarantee. Downlink is done using OFDMA. As in the case of LTE, the core of the network is the so-called Evolved Packet Core (EPC) suitable for both voice and data transmission. The protocols themselves share the basics with the LTE suite, however, they are lightweight versions (Sinha, 2017) and have been optimized in the so-called user plan and control plan. The control plan has been building up the route and providing signaling between the components. Now, thanks to the service capability exposure function (SCEF), it is capable of transmitting small data volumes that do not require encapsulation in IP datagrams. The end devices are capable of maximizing the power source's output by entering in the power saving mode (PSM) and using expanded discontinuous reception (eDRX).

5. Design of Criteria in the context of the Czech Republic

The Czech Republic is aware of the impacts brought by the IoT phenomenon, we can consider working out so-called Initiative 4.0 processed by Ministry of Industry and Trade and approved by government on August the 24th 2016 (department 31300, 2016) as a proof of this. The support of investments aiming at IoT through subsidy programs and grants is expressed in the document mentioned above (Mařík, 2016).

Therefore, new possibilities for development of specific services based on introduced technologies have been opening. In the Czech Republic there are all the three mentioned technologies available by the date of April the 10th 2018. The SigFox network is implemented in cooperation with company T-Mobile, LoRaWAN is operated by the company Czech Radio-Communications and NB-IoT figures in the offer of company Vodafone. According to official pages of mentioned subjects more than 90 % of the area of the Czech Republic is estimated to be covered by today. As far as price conditions are concerned we can conclude from official web pages that all the three providers are aiming at clients from the range of businessman (B2B) and that the final offer will differ from client to client.

From the above, it is obvious that LPWA technology needs to be seen through their strengths and weaknesses. Due to the fact that we expect to implement a solution within the Czech Republic, the criteria are being viewed from this aspect. The key attributes for the evaluation whether the

technology is suited to thoughtful solutions appear on the basis of individual technology studies, available literature and discussions with experts:

1. Geographic coverage - implementation of the solution should not be geographically limited. The service should be available on the whole territory.
2. Range - given the previous requirement, the requirement for range is very understandable. Densely populated areas will most likely be covered completely. Different situation could be detected in sparsely populated areas where lower demand for services will lead to lower infrastructure spending and thus the coverage could not be perfect. Technology should be able to cope with this issue.
3. The lifetime of the energy source - the replacement of the energy source can be very problematic in many cases, often impossible. It is highly desirable for the end devices to be maximally energy efficient and capable of operating mode for several years. This allows creating new products and to offer new services.
4. Direction of the communication - for ultimate energy savings, end devices should be able to switch between active and sleeping mode. In sleeping mode, the device wakes up only at data transmission times. This behavior predisposes the type of communication which tends to be unidirectional, from the end device to the network. It is therefore necessary to consider whether one-way communication is sufficient or bi-directional support is indispensable.
5. Quality of Service (QoS) - if the implemented solution requires guaranteed data transmission parameters and best effort approach is not enough, the QoS should be considered. If QoS support is required, increased costs are to be expected, as this type of service is provided on a dedicated bandwidth in the licensed spectrum.
6. Encryption - when choosing a technology, it is also necessary to take into account the demands on the security of the transmitted data, which is ensured by encryption. This can be handled at the level of the transfer layer, or it is left to the client side.
7. Mobility - due to LPWA extensive geographic coverage, wireless communication and compact dimensions of end devices, it is very easy to move them from one place to another. Therefore, it is not unexpected the requirement for supporting the mobility, which means that the communication enables roaming.
8. Data transfer rate - the data transmission via UNB modulation allows to achieve an excellent ratio between the range and the energy power needed, but at the cost of a very limited data transmission that is given by using narrowband spectrum. The intended solution must take into account the volume of data to be transmitted.
9. Costs - the solution must also cost effective. Costs can be divided into fixed costs that represent payments to the operator of the technology and variable costs, which are operating.

The comparison of selected IoT technologies available in the Czech Republic is presented in the following table:

Table 1- Authors (based on (Chen, 2017), (Margelis, 2015), (Sinha, 2017))

Criteria	SigFox	LoRaWan	NB-IoT
Geographic coverage	> 90 % of the territory	> 90 % of the territory	> 90 % of the territory
Range	10 Km (city), 50 Km (country)	5 Km (city), 15 Km (country)	5 Km (city) , 15 Km (country)
Lifetime of the energy source	>10 years	>10 years	>10 years
Direction of the communication	Downlink possible only after uplink	Downlink, uplink	Downlink, uplink
Quality of Service	ISM unlicensed spectrum, QoS not guaranteed	ISM unlicensed spectrum, QoS not guaranteed	Licensed spectrum, time slotted protocol
Encryption	Not available	AES 128	Same as LTE
Mobility	Yes	Yes	Yes
Data transfer (payload)	Max 12 bytes	Max 255 bytes	Max 125 bytes
Costs	Pricelist available	Not available	Not available

We would like to underline the fact that above mentioned criteria were selected for the context of Czech Republic, however are also applicable for neighboring countries, except the Costs category.

6. Discussion and Comparison of Selected Technologies

Since each solution is unique because of the specific context in which will be implemented, it cannot be unequivocally declared that one of the presented technologies is most suitable for all projects. We propose to select the technology using the pairwise comparison method using the so-called Fuller's triangle for choosing the most adequate technology. Its advantage is relatively simple application and a mechanism of mutual comparison of the criteria between each other, which guarantees that none of the possible combinations will be omitted (Agarski, 2012). Additionally, it allows the selected criteria to assign different weights to influence the impact of the criterion on the overall result.

Regarding the context of the Czech Republic, we dare to say that all three presented technologies will most likely be suitable for the majority of the intended solutions because of similar values of all examined parameters. Sigfox could acquire a comparative advantage thanks to range where it achieves appreciably higher values, but due to the geographical scope of the Czech Republic (CR), this parameter is not likely to be the key one. In addition, all operators declare coverage of the CR over 90% of the territory. Therefore, we assume that in the context of the Czech Republic the encryption, quality of service, bi-directional communication and costs will prove to be the decisive attributes. As far as encryption is concerned, Sigfox is not the best choice because it does not support any kind of encryption. The security issues must be handled at the application level, which may be inappropriate for some services. LoRaWan and NB-IoT support encryption at the MAC layer. For services requiring QoS, the only option is NB-IoT that uses time slotted protocol and operates at the licensed spectrum. And although Sigfox and LoRaWan have mechanisms to maximize the success of data transfer, it cannot be expected that there will be no drops of messages. It is also necessary to

take into account the fact that the interference factor will increase in unlicensed bands with the growing number of IoT implementations. For services requiring bidirectional communication, Sigfox may be inappropriate, but regarding the lifetime of the energy source it will be probably the most efficient. Without a doubt, one of the key attributes will be the costs which can be separate into two categories. The costs of the devices and costs related to the operations. While the first category can already be fairly accurately calculated on the basis of the price of the components, the second category within the Czech Republic is not yet clearly defined. While SimpleCell, the operator of the Sigfox network, provides a pricelist on its web presentation, the remaining two operators do not, therefore cost are unclear. Neither Vodafone (NB-IoT) nor Czech Radiocommunications (LoRaWan) provide specific amounts. The authors contacted representatives of these companies asking for a clearly structured pricelist. These are not yet available and the price is set individually depending on demand.

7. Conclusions

In the present article, we introduced the most widely used LPWAN technologies. These were briefly described and a set of key attributes, which should be evaluated during the selection of the most suitable technology, was identified. The selection of each attribute was justified and the current situation in the Czech Republic was outlined.

Regarding the context of the Czech Republic, we dare to say that presented technologies will most likely be suitable for the majority of the intended solutions because of similar values of all examined parameters which were mentioned above.

Although it is really difficult to make unambiguous recommendation, we have reached the conclusion that SigFox is currently the most suitable choice for LPWAN projects.

8. Acknowledgement

This paper was supported with internal grant project IP400040 provided by the Faculty of Informatics and Statistics, University of Economics, Prague.

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PERSONAL DATA PROTECTION IN CYBER SPACE

Cybercriminal activity is one of the biggest challenges that humanity will face in the next two decades (2017,CCR)

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Keywords

Cyber security, personal data protection, GDPR, security auditing, Cyber risk management

Abstract

The protection of personal data is one of the most important rights of entities working in cyberspace. This article analyzes the results of 167 information systems security audits conducted in Czech and Slovak companies during the years of 2008 – 2017. The authors of the article were interested in the part of company information security focused on the protection of personal data. The first part of the results section of the article presents the main types of procedures, based on which personal data can be audited. It presents audit methods based on the criteria of the ISACA Group and the ISO/IEC 27000 family of international standards. The second part of this section of the article sums up the most frequent problems with implementing Regulation (EU) 2016/679 of the European Parliament and of the Council (General Data Protection Regulation) into current Czech and Slovak practice.

1. Introduction

The penetration of information and communication technologies (ICT) into the economy and people's everyday life brings not only positive effects but also certain risks (Novák, Doucek, 2017). For the sake of faster communication and better availability of data sources of the organization, the organization is willing to run a greater risk of damaging or totally losing its data files. Such risk is referred to as the risk of using information and communication technologies (181/2014); the risk of working in cyberspace is called cyber risk. In general, we can say that personal data are the most valuable data in cyberspace (Tiganoaia et al, 2017). These data can be used to reach potential customers, to promote products, services or political ideas and, in the worst case, to manipulate the entire public opinion. Criminal activities in cyberspace are a separate issue. They represent a serious threat to the entire economic system. (2017, CCR) presents that: Cybercrime is the greatest threat to every company in the world, and one of the biggest problems with mankind. The impact on society is reflected in the numbers. Last year, Cybersecurity Ventures predicted that cybercrime will cost the world \$6 trillion annually by 2021, up from \$3 trillion in 2015. This represents the greatest transfer of economic wealth in history, risks the incentives for innovation and investment, and will be more profitable than the global trade of all major illegal drugs combined. "Cybercrime damages are not only pecuniary; they also concern an unauthorized data acquisition. (CCR, 2017) also says: „Cybercrime costs include damage and destruction of data, stolen money, **lost productivity, theft of intellectual property, theft of personal and financial data**, embezzlement, fraud, post-attack

disruption to the normal course of business, forensic investigation, restoration and deletion of hacked data and systems, and reputational harm.“ In this respect, a leak of personal data is especially dangerous (SDM, 2017).. Good protection of personal data in the CR and a well-functioning Office for the Protection of Personal Data (Aserkar et al, 2017), both in compliance with Act No. 101/2000 of Coll., on the protection of personal data, were the exception rather than the rule in Europe (Steinfeld, 2016). This fact, as well as the new requirements for regulating the protection of personal data, became the reason for harmonizing this matter in Europe. This harmonization resulted in Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data General Data Protection Regulation (**GDPR**) (Dabrowska-Klosinska, P, 2017, Hujnák, 2017). This regulation will come into force on 25 May 2018 and will be followed up with an amendment to Czech Act No. 101/2000 of Coll., on the protection of personal data, to make sure that the Czech law is in compliance with the EU’s law.

The goal of the article is to present the most frequent problems concerning the protection of personal data in Czech and Slovak companies with respect to GDPR projects, based on results of the analysis of company information systems audits.

2. Data Collection and Methodology

The data used for our conclusions come from the analysis of information systems security audits performed in the different sectors of the Czech and Slovak economy. The analyzed companies had a different number of employees, which was probably a limiting factor for some of our conclusions. Tab. 1 shows individual performed audits by year and company size.

Tab. 1 Audits by year and company size

Year	Total number of audits	Number of employees		
		Under 50	50-250	Over 250
2008	7	4	0	3
2009	14	3	2	9
2010	14	3	3	8
2011	14	3	4	7
2012	14	3	4	7
2013	15	2	5	8
2014	19	4	6	9
2015	20	6	8	6
2016	22	8	7	7
2017	28	9	8	11
Total	167	45	47	75

The data sample shows that large companies in the CR and the SR are mainly interested in security audits because 45% of the audits were conducted in the companies having over 250 employees. Both remaining categories, i.e. small and medium-sized companies, represent 27% and 28% of the data sample. Therefore, our results rather correspond to the needs of large companies or public or state

administration organizations. For our assessment, we used the method of frequency of occurrence of a certain matter. Our article presents personal data protection problems with the highest occurrence.

An audit is a systematic, independent and documented process to obtain and objectively evaluate evidence and to determine the extent of satisfaction of audit criteria (ISO19011). Audit criteria mean a set of policies, procedures or requirements used as a basis against which evidence obtained from the audit is compared (ISO19011).

Within the meaning of these definitions, the audit of personal data is very specific because it requires supporting audit criteria. With some exceptions, the legislative definition (e.g. the GDPR or Act No. 101/2000 of Coll., on the protection of personal data) is not detailed enough to be used as a rationally applicable audit criterion containing all necessary details.

For the purposes of this article, **personal data** mean any information concerning a determined or determinable data subject. A data subject is considered determined or determinable if he/she can be directly or indirectly identified mainly based on a number, a code or one or several elements specific for his/her physical, physiological, psychological, economic, cultural or social identity (101/2000).

3. Results

The audit of the state and extent of fulfillment of personal data protection requirements has become an integral part of audits since Act No. 101/2000 of Coll., on the protection of personal data, came into effect. Lately, good-quality information security audits also examine the state of projects that review organizational and technical measures protecting personal data in compliance with the GDPR's requirements that shall come into force in May 2018.

3.1. How to audit personal data

The Data Privacy Audit/Assurance Program, (ISACA) which is a part of the large audit criteria library kept by the international organization ISACA, should be used as an audit criterion (Bélanger ,Crossler, 2011). This Data Privacy Audit/Assurance Program covers the following areas. Included are examples of the topics addressed in each of the areas:

1. Privacy Management — Governance and privacy impact assessments.
2. Data Management and Collection — Data use and retention; electronic and physical records management.
3. Data Security — Access management to electronic data; data transfer.
4. Third-Party Compliance and Contractual Agreements — Third-party interaction with data.
5. Incident Management and Escalation — External party notification; cyber insurance.

Some authorities regulating personal data protection published detailed guidelines specifying the essential elements of personal data protection. For instance, the Slovak Office for the Protection of Personal Data that specifies the extent of personal data protection measures in Decree No. 164/2013 of Coll., on the extent and documentation of security measures. These regulations can be used as an audit criterion, which is usually done also in connection with ISO/IEC 27001 and ISO/IEC 27002 standards.

3.2. Experience from GDPR implementation audits

Lately, GDPR implementation projects have a special position. When evaluating the state of implemented projects, we can generalize the following facts.

The majority of these projects are handled by lawyers, and experience and procedures established outside the legal area, e.g. the procedures of ICT departments or departments responsible for entire management, are not used very often.

Current approaches to risk management consider a risk as an impact of uncertainty on goal fulfillment. Regulation does not really work with the GDPR and does not tackle the completely different personal data protection interests or goals of the data subject and the data controller. The fact that the goals of different interest groups are not distinguished calls into question any results since it is not clear whether the risks were assessed from the point of view of the data subject or the data controller. Interpretations of the different concept of information security goals (based on the data controller) and data protection goals already exist, but they are not used in practice (Figure. 1).

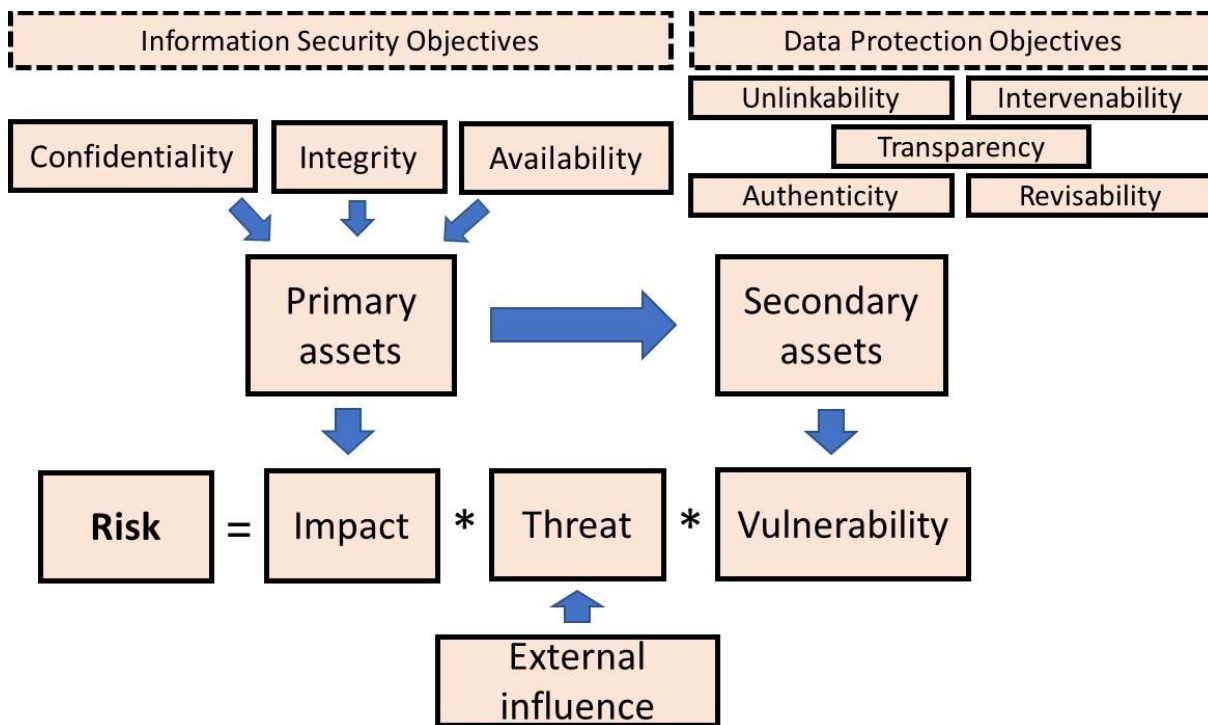


Figure 1. Risk scenario model for Personal Data Protection

The projects mostly review contracts and regulate the formal text of the consent of persons in question as well as the contractual terms of the data processor’s activity. Technical security measures are changed only exceptionally, and some organizations do not have them at all. This situation is also facilitated by supervising authorities and other state organizations that have not yet rationally interpreted adequate technical measures, just like the Cyber Security Act did (Act No. 141/2008 of Coll.).

Different professional terminology is a separate issue that problematizes the implementation of the GDPR. In other words, what the ISO 27001 standard (ISO_27001, 2013) or the Cyber Security Act calls “the evaluation and handling of risks (cyber security),” the GDPR calls “the evaluation of an impact on the protection of personal data” or the term “records of (information) assets” means in the GDPR “records of processing activities.” This inconsistency in terminology often means that organizations are not able to use already existing tools.

Existing processes and tools are rarely shared, and most outputs are not naturally integrated into practice. In other words, separate records of activities, based on which personal data are processed, are created as part of projects instead of expanding the existing records of primary and support assets for data necessary to satisfy the GDPR. Multiplication of records leads to a considerable

fragmentation of operating sources and to a situation where all existing records become “outdated” over time because there are not enough sources to update them due to regular operating activities.

4. Conclusions

The presented experience clearly shows that an effective implementation of GDPR requirements is obviously hindered by a highly isolated approach that is not usually effectively linked to the organization’s existing good practice. This then reduces the effectiveness of adopted solutions, mainly in the case of technical measures.

Another visible problem is a relatively low awareness about what is really needed and what effective techniques to satisfy GDPR requirements are. This situation is also a result of the attitude of many authorities in the CR that are not able to interpret the rules in a timely manner.

The non-existence of a generally recognized audit criterion to evaluate the purposefulness of the protection of personal data is also a major shortcoming. The absence of a respected criterion is not just a problem for auditing but also for the actual implementation of personal data protection measures because it does not specify a generally acceptable extent of reasonable controls. A totally free interpretation of legal requirements does harm rather than improve the level of personal data protection.

5. Acknowledgement

This paper was written with the support of the Czech Science Foundation project GAČR 17-02509S and with contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague IP400040.

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TOPIC B: INNOVATION, NEW BUSINESS MODELS AND STRATEGIES

HOW TO MAKE ACADEMIC-INDUSTRIAL COLLABORATION MORE EFFECTIVE?

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Keywords

Science and technology park, academic-industrial collaboration, firms, satisfaction

Abstract

Science and technology parks (STPs) allow gathering companies together and try to create space for knowledge transfer. They are constantly evolving so it is necessary to define the desirable objectives in terms of collaboration with a university to achieve. In this paper, the key areas are described to help better understanding of academic-industrial collaboration and make it more effective. The study primarily focuses on the CERIT Science Park. Each STP is unique and therefore the defined areas can serve as a basis for creating specific areas for a specific park. Next possible research can be focused on defining general quantitative questions for key areas and explore their use and effect in multiple STPs.

1. Academic-industrial collaboration

Based on International Association of Science Parks (IASP) definition, Science and technology park (STP) is an organization, managed by specialized professionals. The organization provides space for transferring knowledge and technology through university, laboratories, companies, and markets. Space is intended to increase quality, innovation and provides also other value-added services. The main aim is to increase the wealth of its community. These parks provide a real sense of community, allowing companies in the same or relevant fields to cluster, network and even collaborate, which helps to create a unique environment.

Collaboration with the university is closely related to the success of STP because the university can provide many benefits such as researchers, laboratories, technologies, students as potential employees and knowledge transfer. However, it is necessary to create the conditions in which knowledge can be created (Choo & de Alvarenga Neto, 2010). Therefore, it is important to find out if a park creates such conditions, but because data related to knowledge generation cannot be sufficiently described by statistics (Hansson, 2007), it is better to focus on case studies. According to

a study by Cook (2001) at Sophia Antipolis Park, it has been found that innovation networks exist within the park only rarely. If there are any links, they always have a vertical rather than a horizontal position. The problem may also be isolation from other companies and organizations in the region and limited connection to the local industry (Asheim & Cooke, 1998).

In this paper, we focus on CERIT Science Park which Masaryk University established as own instrument for fostering long-term cooperation in applied research as well as entrepreneurship mainly in ICT and related fields (Pitner & Ministr, 2014).

As mentioned before, STP is an organization which gathers companies together and is trying to create space for knowledge transfer, so it is important to involve workers in different activities that can help them as well as universities. The problem is that employees often do not see a real benefit of being part of STP or transferring knowledge. In result, they may have a problem to realize that they actually have something to share what can help others, or sometimes they do not want to provide their knowledge because they are struggling to lose know-how (Chaplyha & Nyemkova, 2017). The aim of this paper is to identify the key areas based on previous studies focused mainly on the CERIT SP, but also on other STPs, that are associated with questions about the satisfaction of STP members with cooperation and improve the cooperation at all.

In order to identify the key areas, we use the AIC Framework defined by Pitner & Ministr (2016). This study has helped to analyze key areas, among other things, by being designed and verified directly on CERIT SP. Next, we relied on the study by Bakotić (2016) which discuss the relationship between job satisfaction and organizational performance. It claims that job satisfaction determines organizational performance and thus efficiency, therefore it is important to find out level of the satisfaction in STP.

2. Motivation for research of STP and innovation

- Based on the study by Bakotić (2016) the connection between job satisfaction and organisational performance is stronger than the connection between organisational performance and job satisfaction. The possible explanation is that job satisfaction determines organisational performance, rather than organisational performance determining job satisfaction. This research was carried out in 40 companies that decided to participate in the empirical research. However, in comparison to other studies in this field (Santhapparaj & Alam (2005), Bendre & Heywood (2006) or Latif et al. (2015)), it should be noted that this study is very valuable since it included the examination of 5806 employees, which is very respectable.
- Therefore, it is necessary to focus on the satisfaction of companies in the STP to increase the overall efficiency and competitiveness of the entire park. In addition to the strategic location close to the university, companies in the STP have the opportunity to use a variety of services including, for example, the use of technical equipment offered by the faculty to collaborate on research to save resources and time.
- Universities are an important source of new scientific knowledge. Industry can gain access to this knowledge or resources by developing formal and informal links with higher education institutes (Gursel, 2014). The structure and location of the STPs are playing an important role in their growth and on regional development economical expectations. The collaboration of STPs to university, industry and other stakeholders can affect the whole economy.
- If there is a happy atmosphere in the company, the formation of new cooperation and agreement with either other companies in the park or with laboratories at the faculty are more likely. Therefore, it is necessary to determine what companies and their employees are

missing, whether the space of the park is sufficient and whether the cooperation between the companies and the university is productive.

- Since there are a number of different companies in the park, some of which are more focused on development, others for the recruitment of new employees, it is necessary to adapt the analysis of satisfaction to individual types of companies and their cooperation with the university. We wanted to create a unified solution, but also not to lead to misleading information. For this reason, we have decided that it is necessary to set out the key areas of the issues that need to be addressed in determining the satisfaction of companies in the STP. The extent to which these areas will be dismantled may be individual depending on the type of the company and the selected survey method.
- The collection of data on the satisfaction of companies based on the key areas thanks to large enough sample is thus becoming for STP a tool for increasing the efficiency of companies and their cooperation. This information is also useful for routing and merging expectations for cooperation within the park. The consistency of these ideas increases the interest in cooperation, which can generate many new effective projects.

3. Identification of key research areas

We used the *Framework for service-oriented academic-industrial cooperation* defined by Pitner & Ministr (2016) to identify the key areas. The framework is designed for identification of crucial strategic values, performance indicators, and important innovation factors for service-oriented ICT businesses. The framework consists of three dimensions representing:

- *Driving forces*: motivations and benefits, as well as their opposites obstacles, controversies, and other distractors.
- *Values*: shared values of the academic-industrial cooperation and conflicted values.
- *State*: reflects presence or absence of formal structures.

Based on the study (Pitner & Ministr, 2017), where the AIC Framework was extended, we know that this framework has helped the CERIT SP to identify positive and negative factors affecting cooperation. Therefore, this framework has been chosen as a basis, and its dimensions have helped us in the key division of questions into four areas that we can consider to be relevant in determining company satisfaction.

3.1. Collaboration with the university

The area is focused on the advantages and disadvantages of collaborating with the university. This is a cooperation that is a prerequisite for innovation (Carasca, Lundwall, & S., 2009) (Carasco et al., 2009). This area is affected by the two factors of the AIC framework, namely driving forces and values.

Motivation and benefit for companies that result from cooperation with the university, in addition to accessibility to students, is the possibility to use the various spaces offered by the park. Characteristics of common values with a positive impact on firms and the university have projects and research that the company runs along with the university. Such cooperation is often made possible by a membership of the Association of Industrial Partners (AIP), which also determines the way in which the company is involved. The Faculty of Informatics of Masaryk University established the AIP in 2007. It is focused on long-term collaboration with companies that have been involved in joint projects. In addition to collaborating on research and conducting bachelor's, master's or doctoral

theses, it is also a key part of engaging in teaching. Students are thus in contact with real professionals and firms have the opportunity to establish contact with potential employees, students.

3.2. Technical cooperation

The pleasant work environment, the cooperation between the companies in the park and the possibility of using the latest technologies increase the efficiency of the companies. Companies in the STP have the opportunity to engage in projects in laboratories, use techniques and spaces in a cyber polygon, or organize their own professional seminar at the faculty, thereby also transferring knowledge.

This area focuses on the benefits of technical equipment, the use of laboratories and the space that the park and faculty offer to companies. From AIC Framework's perspective, there are motivating and discouraging driving forces, in the form of the benefits of using devices or, on the other, the drawbacks of missing space. It is also about shared values in the case of cooperation with a variety of research. In the STP, there are mainly small and medium-sized enterprises (SMEs) and it is necessary to find out whether this cooperation is effective for them. In any case, it is necessary to focus on the shortcomings that companies see and identify the reasons why they are not involved in joint projects.

3.3. Events

For business collaboration to be as effective as possible, it is necessary for individual firms in the park to know about themselves as much as possible. Many events are often organized to make companies visible. These can be focused on the presentation of solved projects, training of potential employees, sharing knowledge gained, etc.

This area focuses on making it possible to create different events for employees of companies, academics, university students or even the general public, whether in the park, university or other places. Because of the AIC Framework, the area concerns shared and conflicting values. In particular, it is the identification of the areas that companies are interested in, and the benefits and disadvantages of these. Based on this knowledge, it is then possible to create events that will provide benefit to the largest group of companies in the park.

3.4. Administration

The last area deals with the administrative activity of the park. It is important for companies to be satisfied with communicating and solving potential problems that may arise. The park is responsible for the management of the building as well as for the organization as a whole.

The area is related to the AIC framework regarding the present and absent structures of the park, companies and university. This is a small part of the whole, but it is very complicated to change, and it is necessary to collect the largest and most comprehensive possible number of information that can be related to improving communication and administration.

4. Specifying issues to find out how to increase efficiency of collaboration

Using AIC Framework, we identified four key areas that define the issues (Table 1) that need to be focused on increasing the effectiveness of academic-industrial collaboration. Answers to these questions can be obtained by various methods, such as a questionnaire or a personal meeting. Depending on the size of the STPs and the time options.

Table 1: Issues to find out how to increase the efficiency of academic-industrial collaboration. Source: Authors.

AIC dimensions	Key area	Issues
Driving forces, Values	Collaboration with the university	How many Bachelor/Master thesis are supervised?
		What are the experiences with supervising?
		Do students have the opportunity to work after the defence of the thesis?
		Are there many theses that no one has signed up for?
		How are companies satisfied with students working on theses?
		...
	Technical cooperation	Is the company working with other companies at STP?
		Is the cooperation between companies affected by membership in the park?
		Does the company collaborate on joint projects with the university?
		What laboratories does the company use for research?
		How does the company see the closeness of the university and the park?
		How is the company satisfied with the equipment of the STP?
Values	Events	Does the company organize events at the university?
		Is the company organizing events aimed at training or recruiting new employees?
		Is the company involved in events organized by STP?
		Is the company involved in events organized by the university?
		...
State	Administration	How are company employees satisfied with the administrative structure of STP?
		How often do companies need to contact STP?
		How often does park management need to contact companies?
		How are companies satisfied with administrative cooperation with the university?
		...

5. Discussion and conclusion

AIC Framework is the framework for identification of crucial strategic values, performance indicators, and important innovation factors for service-oriented ICT businesses (Ministr & Pitner, 2016). Four key areas have been identified based on AIC Framework dimensions: Collaboration with the university, Technology cooperation, Events, and Administration. The first one is focused on the quality of collaboration and the evaluation of benefits for the company and for the university. The second focuses on the possibilities of technological cooperation between companies in STP. Event marketing, as the third area, aims to find out how sharing information works through various events and the last one focuses on the satisfaction of companies with the administration in STP. Defined areas can help to find out the satisfaction of firms in the STP. Satisfaction of individual employees leads to increased efficiency of companies and, ultimately, the entire STP. The following steps can

lead to verifying the usability of questions structured in these areas. Collecting data can then generate a satisfaction analysis and define further steps to improve the effectiveness of collaboration between companies and the university.

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ETHICS PERCEPTION BY UNIVERSITY STUDENTS

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Keywords

Ethics, ethical and unethical behavior, code of conduct, prevention of safe cyberspace, generation Y and Z, ethical maturity

Abstract

The purpose of this research is to examine the University of Economics, Prague students (the Faculty of Informatics and Statistics) perception of ethics, using four factors: (1) Knowledge of the University/ faculty code of conduct and its adherence, (2) The perception of ethical maturity in society, (3) The influence of ethical theories on ethical behavior, (4) Perceptions of the future in terms of technology development and cyber security. Comparison of perceptions and attitudes is realized on representatives of two generations - generation Y (master's study) and generation Z (bachelor's study). A survey questionnaire was distributed via internet, e-mail and paper form in the period September 2015 to May 2017. Data was collected from 587 respondents. Four hypotheses were developed and tested. Research has shown that it is not true that vast majority of students know the Code of Conduct (1). Students consider the ethical maturity of society to be important (2). Student's views did not confirm or disprove the question of the influence of ethical theories on ethical behavior (3). Students have expressed concerns about the future in terms of technology development and cyber security. (4).

1. Introduction

Today's society faces a number of problems beyond the bounds of ethically responsible social behavior. Unethical practices include, for example, alienation of information, interception of information in telecommunication networks (emails, wiretapping - microphones, cameras, telephone lines, internet disk groups, forums, intercepts of Internet traffic on international communication routes, unethical communications, etc.). In the last few years, information about cyber-attacks on banks, political parties, etc. has been revealed almost every week. People are tracked and information is being collected about them. "Every purchase we make with our cards, every search we type into Google, every movement we make when our mobile phone is in our pocket, every "like" is stored. Digital footprints suddenly become real people with fears, needs, interests, and residential addresses" (Grassegger and Krogerus, 2017). We encounter patterns of thought-based thinking - spin doctoring and prefabricated media opinion, viral marketing, false information and misinformation.

According to Jirovsky, infoware leads "to virtualize the collision and, at the same time, to the failure of basic ethical, moral and emotional barriers" (Jirovsky 2007). It is related to massive media campaigns of various causes, military operations in the world, and their transfer to politics, economics, business and people. Is ethical behavior linked to low awareness of ethics? Are ethical issues related to the development of techniques and technologies? Is cyberspace the most democratic

grouping in society? Jirovsky responds, "rather, it might be talked about extensive anarchy in the behavior of the population in cyberspace." (Jirovsky, 2007. p. 34).

The aim of the research was to find out in the student population belonging to generation Y and Z, how ethics and ethical challenges are perceived, evaluated and acted on, to enhance their understanding of ethics in real life and in broader consequences. Research was attended by Faculty of Informatics and statistics (University of Economics Prague) 373 students in bachelor's degree in Applied Science and 214 master's degree students, mostly in the field of Information Management. Students are assigned according Schroer (2015) to two types of generations: Generation Y - born 1977 – 1994 and Generation Z - born 1995 - 2012. Bachelor's students are born after 1995 and are part of the Generation Z (Google or Internet generation), students of the Master's degree are born before 1995 and belong to the generation Y, sometimes referred to as the Millennials. For both generations, the same sign is the strong use of ICT and social networks as a natural part of life. The data were collected from September 2015 to May 2017.

2. Theoretical basis - overview

In this study is used the following definition of ethics: “the discipline dealing what is good and bad and with moral duty and obligation” (Meriam-webster Dictionary, 2011). „Ethics are the inner guiding moral principles, values and beliefs that people use to analyze or interpret a situation and then decide what is the right or appropriate way to behave“. „Different people or groups may dispute which actions are ethical or unethical on their personal self-interest and specific attitudes, beliefs, and values“(Gareth and Jenifer, 2016). "Morality evaluates human behaviour in terms of good and evil, in comparison to the human conscience” (Jankovský, 2003, p. 24). Morality particular person is then based on an assessment of his conscience.

„Unethical behavior that goes unpunished creates incentives for people to put their unbridled self-interests above the rights of others“ (Gareth and Jenifer, 2016). Therefore it is necessary to follow, whether existing laws are still appropriate. The basis for ethical decision making is a detailed introduction to the code of ethics. The Code of conduct (Jankovsky 2003) promotes self-perception and stimulates self-reflection. Everyone needs to be aware of the necessity of ethical responsibility for their own existence and actions, on the basis of their upbringing, their surroundings, but also of ethical standards, and reinforce the risk that a person (or group of people) becomes an instrument of others. Codes of conduct are standard communication features, even if, in the practice they manifest primary concern to behaviors which are mandated by law. In reality, however, solved problems are often complex and the ethical standard is not sufficient for the decision. It is only possible to observe it if the rules and boundaries are clearly defined within it.

In practice everybody meets situations, when he/she or other people violent professional codes and legal regulations, or find that they resist to practice. These problems are clearly evident in the political scene, in the media, in the use of IT, in life, in education, but also in the great differences in the characteristics of the generations. Its understanding is fundamental in building a culture based on ethical values.

Perception of ethics is solved in the Journal of Academic and business Ethics “College students’ perception of ethics (Lau, L., Caracciolo, B., Roddenberry, S., Scroggins, A. 2010) with the main purpose – to analyse impact of education and faculty on Ethics, attitude towards cheating, impact of technology in cheating, importance of ethics and ethical environment on campus. This research is inspirative mainly in the conclusions and for further research. We agree, that “the excessive use of technology may erode the ethical nature of participants”.

Ten Ways to Encourage Ethical Values in Beginning College Students, solved by Dalton, J.C. and Crosby, P. C. in *Journal of College and Character*. This paper is focused on out of class activities. We agree, that a lot of transmission of ethical values to new students occur “when new students are already overload and not in a receptive mood for moral lessons pronounced from on high by college officials”.

Another conceptual research is focused to “Behavioral Ethics and Teaching Ethical Decision Making” (Drumwright, M., Prentice, R., Biasucci, C. 2015). Very important conclusion are, that behavioural ethics focuses on understanding cognitive errors (as loss aversion, framing, or overconfidence), social and organizational pressures (to gain pleasure from being obedient to authority, peer pressure, etc.) and situational factors (time pressure, not being watched) – they all make people act less ethically.

As research respondents - students were born mainly between 1989 and 1997, follows the characteristic of Generation Y and Generation Z.

Generation Y – Millennials – Digital natives - „are tech-savvy, appreciative of diversity and skilled in multitasking“, „integrate technology into workplace, are not loyal to organization, have very short attention spans, etc.“ but „keeping copies of confidential documents, taking a copy of work SW home for personal use, buying personal items using a company credit card, blogging or tweeting negatively about a company“ (Verschoor, 2013). According Schroer (2015) this generation is “one of the best educated generation, incredibly sophisticated, technology wise, immune to most traditional marketing and sales pitches“. This is the first generation, which have grown up with the Internet. The role of technology had in teenage influence on their moral development (attitudes towards music or movie piracy, accessing sites with pornography, plagiarism), (Subrahmanyam and Šmahel, 2011). Digital natives „have an inclination to trust peer opinion and public consensus rather than established data sources“ (Hershatter and Epstein, 2010). Key features of generation Y according Bohoňková (2017), Trézová (2015) and Brončeková (2010) are: self-confidence - a high opinion of one's own abilities; expectations of valuation and evaluation, regardless of the need to "work out" - a successful career right now; flexibility, diversity and creativity, talent development (want everything and offer everything); the possibility of free working hours and the organization of a working day; open communication, but great sensitivity to criticism; they expect a quick feedback and five quick feedback to leaders/managers; become accustomed to a high standard of living and technical equipment; hates the directive style of leadership; they want the support of recognized professionals, but without orders; image preference before the text; the ethics of "duty" is replaced by the ethics of "the right to happiness"; ambition, desire for money and power (want to manage, not to exercise); quality education and technical skills, but lacking working ethics.

Generation Z also referred to as a „Google Generation“ , „Internet Generation“ , „Screenagers“, „Post IT Generation“, „The Tweennials“. Its members were born to digital world, live by the screen – are all the time online, are visually stimulated. This generation “is dissolving boundaries between social and cultural norms and the compression of time and technology“(Sparks&Honey report, 2016). Resources for study are online courses, book, articles, video, etc. They are less responsible, sometimes with negligent attitude to work, impatient at achieving their targets. They „are not persistent enough at achieving long-term results“, for motivation they need „untraditional working conditions – creative environment, not typical working week, horizontal management style“ , „they are team-oriented individuals – they prefer individual work in projects – no hierarchy – everyone wants to be leader“ (Primako, 2015). They are „less concerned than other generations about their privacy when using technologies native to them“, „they expect everything to be mobile first, from communication and collaboration to training, retention and engagement strategies“ (Dorsey, 2016). Key features of generation Z (Bawden, D. 2009): must be "always on"; quickly adapt to new situations; attention deficit - unable to concentrate long; do not worry about privacy and no problem

sharing the details of life in the virtual environment; the information is to be delivered in quick, short doses; they want everything immediately - time is gone to think, and this generation does not make its own judgment; priority on how fast you can find the right information instead of whether or not you know the right information; believes primarily in its ability to solve every problem in its own right, so it is expected that “Z” will completely circumvent traditional social solutions; intellectually mature, mature very fast, do not understand terms as a status quo or tradition.

3. Research

For research chosen factors and hypothesis highlight the four most commonly parts of ethics perceiving by university students oriented in their study mostly to Information Technology and Information Management.

Knowledge of the school / faculty code of conduct and its adherence.
Hypothesis 1: All students know the code of conduct of the university / faculty and adhere to the rules - behave accordingly.

Perception of ethical maturity in society.
Hypothesis 2: Ethics is not only necessary, but is also well developed and exploiting inventions, technical achievements including ICT and discoveries correspond to it.

The influence of ethical theory and codes of conduct on ethical behavior.
Hypothesis 3: Behavior is influenced by ethical conduct and ethical theories.

The future is from the point of development of technology and exploitation of cyberspace threatened.
Hypothesis 4: We are not to be worry about the future.

As a research method was used a questionnaire survey conducted in selected fields of study groups. Students were given the opportunity to answer questions electronically or by hand filling the questionnaire.

HYPOTHESIS 1: All students know the code of ethics of the university / faculty and adhere to the rules - behave accordingly

Questions of part 1 Knowledge of the University/ faculty Code of Conduct and its adherence				
Question: 1a) With a code of conduct he/she was acquainted				
	obligatory upon enrolment in the study	of own interest	during study	not yet familiar
GEN Z	tot 253, perc 67,8%	tot 42, perc 11,3%	tot 31, perc 8,3%	tot 47, perc 12,6%
GEN Y	tot 57, perc 26,6%	tot 22, perc 10,3%	tot 86, perc 40,2%	tot 49, perc 22,9%
Question: 1b) He/she respects the Code of Conduct				
Answers	never violates	some points sometimes violates	ordinarily violates	no answer
GEN Z	tot 201, perc 53,9%	tot 166, perc 44,5%	tot 6, perc 1,6%	tot 0, perc 0,0%
GEN Y	tot 62, perc 29,0%	tot 149, perc 69,6%	tot 0, perc 0,0%	tot 3, perc 1,4%

Table 1: Results of questionnaire part 1 in absolute (tot) and relative frequency (perc)

Slightly more than one fifth (gen Y) and one tenth (gen Z) was surprisingly not yet familiar with the University Code of conduct, even if they should know Code of conduct at least from the time, when they were enrolled in study, and because it is a part of several subjects. More disturbing is, that more than 69% students of gen Y and 44,6% students of gen Z answered, that they some points of Code Conduct sometimes violate. (Table 1) This corresponds to the characteristic of Y generation that students have quality education and technical skills, but lacking working ethics. And to one of the characteristics of gen Z, that they are less responsible.

This hypothesis was rejected.

HYPOTHESIS 2: Ethics is not only necessary, but is also well developed and exploiting inventions, technical achievements, including ICT and discoveries correspond to it.

Questions of part 2 The perception of ethical maturity in society					
Question: 2a) Ethics is necessary and sufficiently developed in contemporary society					
Answer	Yes	Partially	Limited	Very limited	Not
GEN Z	Tot 118,perc31,6%	tot 175, perc 46,9%	tot 63,perc 16,9%	tot 7,perc 1,9%	tot 10, perc 2,7%
GEN Y	tot 72,perc 33,6%	tot 104,perc 48,6%	tot 29,perc 13,6%	tot 6,perc 2,8%	tot 3,perc 1,4%
Question: 2b) Mankind can be proud of inventions and technical achievements and discoveries (including ICT)					
Answer	Yes	Partially	Limited	Very limited	Not
GEN Z	tot 267,perc 71,6%	tot 88,perc 23,6%	tot 12,perc 3,2%	tot 0,perc 0,0%	tot 6,perc 1,6%
GEN Y	tot 170,perc 79,4%	tot 41,perc 19,2%	tot 3,perc 1,4%	tot 0,perc 0,0%	tot 0,perc 0,0%
Question: 2c) We can be proud of how mankind applies inventions and ICT					
Answer	Yes	Partially	Limited	Very limited	Not
Gen Z	tot 62,perc 16,6%	tot 162, perc 43,4%	tot 110,perc 29,5%	tot 22,perc 5,9%	tot 17,perc 4,6%
Gen Y	tot 45,perc 21,0%	tot 114, perc 53,3%	tot 42,perc 19,6%	tot 13,perc 6,1%	tot 0,perc 0,0%

Table 2: Results of questionnaire part 2 in absolute (tot) and relative frequency (perc)

Students, in the vast majority, perceive ethics as necessary and mature enough. The answer was “yes and partly” reported near up to 80% of all respondents. About 90% student is basically proud to inventions and technical achievements and discoveries, including ICT (answers yes and partially). The prevalence of respondents (about 65% - answers yes and partially) is satisfied with how mankind applies invention and ICT. (Table2)

This view corresponds to the respondent's study focus and the characteristics of the generation Y - they are digital natives and have an inclination to trust a public consensus. Very similarly we find the results of generation Z, which “lives by the screen” and “expect everything to be mobile first”.

This hypothesis was confirmed.

HYPOTHESIS 3: Behavior is influenced by ethical theories and codes of conduct.

Questions of Part 3 The influence of ethical theories on ethical behaviour					
Question 3a): Ethical theory helps to mankind in practice					
Answer	Yes	Partially	Limited	Very limited	Not
GEN Z	tot 113, perc 30,3%	tot 201, perc 53,9%	tot 40, perc 10,7%	tot 9, perc 2,4%	tot 10, perc 2,7%
GEN Y	tot 40, perc 18,7%	tot 127, perc 59,3%	tot 34, perc 15,9%	tot 10, perc 4,7%	tot 3, perc 1,4%
Question 3b): People really have an idea what is ethical and what is unethical					
Answer	Yes	Partially	Limited	Very limited	Not
GEN Z	tot 13, perc 3,5%	tot 144, perc 38,6%	tot 150, perc 40,2%	tot 47, perc 12,6%	tot 19, perc 5,1%
GEN Y	tot 13, perc 6,1%	tot 77, perc 36,0%	tot 92, perc 43,0%	tot 24, perc 11,2%	tot 8, perc 3,7%
Question 3c): Autonomy and freedom are enough (sufficient) for ethical behaviour					
Answer	Yes	Partially	Limited	Very limited	Not
GEN Z	tot 20, perc 5,4%	tot 92, perc 24,7%	tot 111, perc 29,8%	tot 40, perc 10,7%	tot 110, perc 29,5%
GEN Y	tot 1, perc 0,5%	tot 71, perc 33,2%	tot 68, perc 31,8%	tot 27, perc 12,6%	tot 47, perc 22,0%
Question 3d): People behave according to the theory of ethics and codes of conduct by					
Answer	Yes	Partially	Limited	Very limited	Not
GEN Z	tot 0, perc 0,0%	tot 100, perc 26,8%	tot 170, perc 45,6%	tot 81, perc 21,7%	tot 22, perc 5,9%
GEN Y	tot 3, perc 1,4%	tot 65, perc 30,4%	tot 78, perc 36,4%	tot 47, perc 22,0%	tot 21, perc 9,8%
Question 3e): Social boundaries are pushed towards indifference, tolerance of violence and aggression					
Answer	Yes	Partially	Limited	Very limited	Not
GEN Z	tot 117, perc 31,4%	tot 141, perc 37,8%	tot 67, perc 18,0%	tot 26, perc 7,0%	tot 22, perc 5,9%
GEN Y	tot 72, perc 33,6%	tot 78, perc 36,4%	tot 23, perc 10,7%	tot 10, perc 4,7%	tot 31, perc 14,5%

Table 3: Results of questionnaire part 3 in absolute (tot) and relative frequency (perc)

Students in nearly 80% confirmed the importance of ethical theories for practice (answers yes and partially). This is inconsistent with the answer to the question, if people really have an idea what is ethical and what is unethical. Here they clone to the negative view (about 50%). Possible reasons are the ethical issues that students encountered in society. Even worse is the question of whether people behave according to the theory of ethics and codes of conduct by. More than 60% of students

responded negatively. Students feel insufficient attention to ethical codes and ethical issues in society and in companies and the media. About 67% of students do not consider autonomy and freedom as sufficient for ethical behavior. They take the view that permanent education and delineation of boundaries of desirable behavior are necessary. Thus, the result is not surprising at the question of whether indifference, tolerance of violence and aggression is growing in society, where almost 70% of respondents have expressed their consent. Students perceive social tensions in the world, military interventions, terrorist actions, exploitation of technologies (including ICT), etc. (Table 3)

This hypothesis was rejected.

HYPOTHESIS 4: We are not to be worry about the future.

Questions of part 4 Perceptions of the future in terms of technology development and cyber security					
Question 4a): We should fear the future, which man and technology will be able to do					
Answer	Yes	Partially	Limited	Very limited	Not
GEN Z	tot 129,perc 34,6%	tot 143, perc 38,3%	tot 59, perc 15,8%	tot 20, perc 5,4%	tot 22, perc 5,9%
GEN Y	tot 58, perc 27,1%	tot 113, perc 52,8%	tot 19, perc 8,9%	tot 11, perc 5,1%	tot 13, perc 6,1%
Question 4b): It is difficult to prevent and establish ethical norms in cyberspace and require compliance with them (ICT tools are produced faster than generally known rules)					
Answer	Yes	Partially	Limited	Very limited	Not
GEN Z	tot 175, perc 46,9%	tot 124, perc 33,2%	tot 55, perc 14,7%	tot 7, perc 1,9%	tot 12, perc 3,2%
GEN Y	tot 125, perc 58,4%	tot 61, perc 28,5%	tot 18, perc 8,4%	tot 7, perc 3,3%	tot 3, perc 1,1%
Question 4c): Society (governments, organizations, staff, parents) can ensure a sufficient prevention of safe cyberspace use and information about risk					
Answer	Yes	Partially	Limited	Very limited	Not
GEN Z	tot 21, perc 5,6%	tot 103, perc 27,6%	tot 89, perc 23,9%	tot 88, perc 23,6%	tot 72, perc 19,3%
GEN Y	tot 6, perc 2,8%	tot 56, perc 26,2%	tot 82, perc 38,3%	tot 43, perc 20,1%	tot 27, perc 12,6%

Table 4: Results of questionnaire part 4

Concerns about the future, human and technology are capable of creating, have expressed 79% of students. Students are aware of hectic development of new technical inventions and technological changes that society can use not only for the development of itself (e.g. robotics, drone, information abuse, cyber-attacks, etc.). Therefore, almost 82% of the students responded positively to the question whether it is difficult to prevent and establish ethical norms in cyberspace and require compliance with them (ICT tools are produced faster than generally known rules). The final question of this part was aimed at the society (governments, organizations, staff, parents) - "It is possible to ensure a sufficient prevention of safe cyberspace usage and information about risk." 77% of the student responded to the negative answer. (Table 4)

This hypothesis was rejected.

4. Conclusion

With ethical problems, we still encounter ordinary, at school and working life. Ethical behaviour can be supported by ethical theories and ethical codes, as well as by the ethical culture of the society environment. ICT simplifies violations of ethical standards. But it also creates the need to engage with ethical issues in their own attitude. The society must also create and update active elements to enforce ethical behaviour. Ethical barriers or rules are not strong enough to prevent harmful activities in life and in cyberspace. Cybersecurity will continually evolve over time because the threats are forever changing. Mankind in confrontation with forms of enforcement of ethical behaviour can lead to discussions about ethics and freedom, and to correction of errors.

The advantage of our respondents was their study program. It gives them broader information and knowledge not only from the field of information technology, but in communication skills, leading teams, working on projects. It brings them broader view to the society, organization and its functioning from various kinds of view. As they integrate technology into their life, school and practice, they sometimes have no problem using it – fly in the face of ethics or the Code of Conduct.

The cooperation with both generations brings new challenges to universities and employers. This generation pays attention on the one hand to the possibility of permanently developing their education and, on the other hand, to work-life balance - work and education at a time of their choice (flexible study/working conditions). These generations are self-confident (they may appear arrogant to older generations) and want to have power, money and to manage. They expect awards for tasks filled from anywhere, not for time spent at school or at work. Students (and workers) may want to work less (in comparison with older generations), but more, they want to work another way.

This article is among the first to emphasize how a particular perception of ethics can contribute for improving not only education, but the overall environment. For universities it means to discover - a new approach to the educational process and the leadership of students - not a directive but rather a coaching one. This approach can lead to transform the theory to living practice.

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UNIVERSITY'S SUPPORT FOR INNOVATION AND ENTREPRENEURIAL STUDENT'S ACTIVITIES

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Keywords

Innovation climate, Innovative centers, Creativity, Entrepreneurship, University support

Abstract

The article brings the inspiration of different ways how to teach and develop creativity in university surroundings and how these activities could be improved. Universities have an important role in the knowledge economy era and are also vital for contribution of innovation systems through their activities such as developing skilled human capital, transferring knowledge and skills to the society. Therefore it is necessary to support student's activities connected with the entrepreneurship. All bigger towns in the Czech Republic have some forms of coworking support for the starting entrepreneurs cooperating with universities and research centers. Some of them are actually start-ups, some of them are support by the European Union or private companies, regions and universities. The realized research demonstrates dependency between the student's entrepreneurial activities and the universities surroundings encouraging these activities.

1. Introduction

Development in the global economy has changed the traditional balance between customer and supplier. New communications and computing technology, and the establishment of reasonably open global trading regimes, mean that customers have more choices, variegated customer needs can find expression, and supply alternatives are more transparent. Businesses, therefore, need to be more customer-centric, especially since technology has evolved to allow the lower cost provision of information and customer solutions. These developments, in turn, require businesses to re-evaluate the value propositions they present to customers in many sectors. The supply side driven logic of the industrial era has become no longer viable. This new environment has also amplified the need to consider not only how to address customer needs, but also how to capture value from providing new products and services. Without a well-developed business model, innovators will fail to either deliver or to capture value from their innovations and many inventions emerge from academic surroundings (universities). Despite the proclaimed third role of universities in the area of transferring R & D results to the business environment, the academic environment has its own specificities. Therefore, university's support for entrepreneurial activities is a key factor affecting its academic innovation performance (Clarysse et al., 2011). Developing an innovative climate in universities is a management practice that facilitates enterprise and benefits both entrepreneurs and universities. On the other hand, successful innovation within a setting the university requires the creation of a supportive culture. The aim of this article is to find the answer to the research question as to whether the university environment affects student business activities.

2. Literature review

Creativity is the first step in innovation, which is the successful implementation of those novel and appropriate ideas. Creative skills provide “something extra” for creative performance. Person's social environment can have a significant effect on that person's level of intrinsic motivation; which in turn, have a significant effect on that person's creativity (Hang, 2017). The theory includes three major components of an individual's (or small team's) creativity, each of which is necessary for creativity in any given domain (Fig. 1). The proposed model puts knowledge reuse as a predictor of individual creativity outcome, the dependent variable of interest. Knowledge reuse, or in a broader sense, knowledge management has been conceived by numerous practitioners as well as academics as a booster to organizational performance; especially in the areas associated with organizational innovation, such as new product development, innovation diffusion, and technology transfer (Bures, 2017).

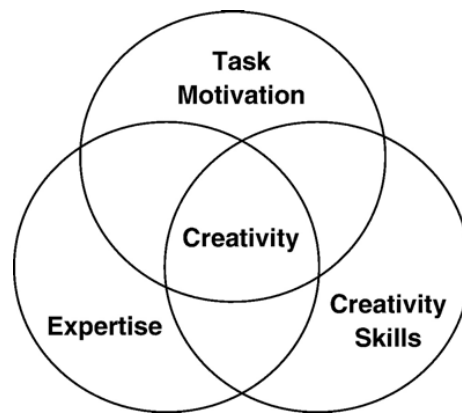


Fig. 1. The three-component model of creativity (adapted from Amabile, 1997).

Currently, universities are implementing various mechanisms for encouraging research teams of the faculties and students to engage in entrepreneurial activities (Tornatzky et al., 2002). Plenty of different student's hubs or student's incubators are almost in all the Czech universities (startuphelp.org) and bigger towns (Pitner and Ministr, 2017). In the universities, we can find all very important factors from the above mentioned creativity model which helps the innovation spirit. These factors are:

- Team integrity of students
- Effective teamwork
- Friendly atmosphere
- Personal relationship
- Different background available
- Group-task closeness
- Idea generation
- Team decision making
- Specialization of students
- Coordination understanding and collaboration
- Techniques

- Concept development

3. Methodology and Data

The following steps were taken to answer the question of the influence of the university environment on the students' decisions to take business. The source of data was the database of international research project GUESSSS 2016.

The Faculty of Economics Technical University of Liberec has become a guarantor since 2016 and has taken part in the world survey about the student's attitude towards their future career and entrepreneurship. The project is called GUESSSS "Global University Entrepreneurial Spirit Students' Survey" (more about the project on web, see GUESSSS, 2016). It is one of the largest entrepreneurship research projects (on student business activities) in the world. The main research focus is students' entrepreneurial intentions and an activity, including also the topic of family firm. The research GUESSSS is organized every second year in spring time.

The questionnaire GUESSSS 2016 is organized in more than 50 countries, in more than 1000 universities, and there were 117,371 students who completed responses in 2016. 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 (see GUESSSS, 2016).

1. Step: We analyzed data of all the participating countries from the structured questionnaire by data mining methods. Data analysis is performed in the program IBM SPSS Modeler and IBM SPSS Statistics. In this study we suggest that the correlation between students' intention of own business and university surroundings exists (hypothesis H1). Null hypothesis considers these two variables as independent. Variable „At my university, students are encouraged to engage in entrepreneurial activities“ is between 0-6 (on Lickert scale), "0" means „do not agree at all“ and "6" means „very much agree“. The variable: „Are you currently trying to start your own business?“ is just 0= false or 1= true (see Table 1).

Table 1 Data analysis

		Are you currently trying to start your own business?		Total
		No	Yes	
At my university, students are encouraged to engage in entrepreneurial activities.	do not agree at all	8699	2096	10795
	pretty not agree	10351	2101	12452
	rather not agree	13069	2931	16000
	Equal	17112	4076	21188
	rather agree	16698	4582	21280
	pretty agree	14698	4492	19190
	very much agree	11396	5070	16466
Total		92023	25348	117371

Source: Own processing

The value of statistical significance for the Spearman coefficient is 0.000, the null hypothesis is rejected. The value of the Spearman coefficient is 0.089 (Table 2). There is a correlation between the fact that students want or intend to start a business when they are guided by their University surroundings encouraging them to participate in business activities. This link, however, is weak.

Table 2 Symmetric Measures (SPSS Modeler)

		Value	Asymptotic Standard Error ^a	Approx. Tb	Approx. Significance
Ordinal by Ordinal	Kendall's tau-c	,083	,003	29,767	,000
	Gamma	,145	,005	29,767	,000
	Spearman Correlation	,089	,003	30,503	,000 ^c
Interval by Interval	Pearson's R	,086	,003	29,490	,000 ^c
N of Valid Cases		117371			
a. Not assuming the null hypothesis.					
b. Using the asymptotic standard error assuming the null hypothesis.					
c. Based on normal approximation.					

Source: Own processing

2. Step: The entrepreneurship environment in the Czech Republic is getting better, thus the World Bank has improved the evaluation of the business environment in the Czech Republic. In the prestigious list “Doing Business 2016” (The World Bank Group, 2018), in the global competition, the Czech Republic is on the 27th place. What is the interest in doing business among university students in the Czech Republic?

The questionnaire “GUESSS 2016” was translated from English into the Czech language for students of Czech universities. In 2016 we have altogether the data from 9 universities in the Czech Republic (see table 3). We had 3,040 respondents of which 1,135 sent relevant data.

Table 3 Universities in the Czech Republic

University	Count	%
Charles University	110	10
Masaryk University Brno	15	1
Skoda Auto University, Mlada Boleslav	17	2
Technical University of Liberec	456	40
Technical University of Ostrava	83	7
University of Economics in Prague	23	2
University of Hradec Kralove	134	12
University of Pardubice	39	3
University of West Bohemia	157	14
Other	101	9

Source: Own processing

Enthusiasm to become an entrepreneur is represented by a smaller part of students from our survey – 27% (see Figure 2). 16% of students still do not know whether to be an employee or not. Next figure brings some alternatives after studies. We can see that 28% of students would like to set up their own business.

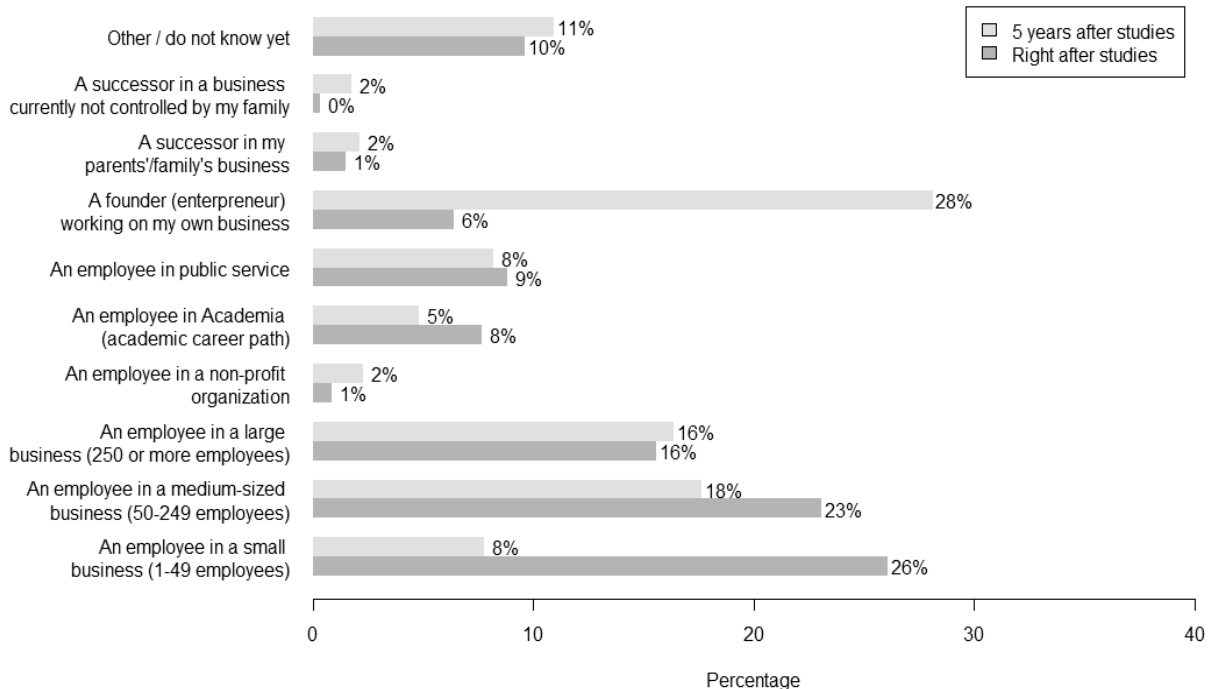


Fig. 2: Career path right after studies and Career path 5 years later (Source: Own processing)

Within the survey, we conclude that the university environment is set up for the benefit of business activities but still not satisfactory. We used Lickert scale (from 1 to 7, where 1 means not at all and

7 means very much). As can be seen from Table 4, up to 40% of the students in the Czech Republic believes that the University is not inspired or led them to business activities. The results show the negatively-rated feedback of educational courses at the universities for the preparation to the business. Another issue suggests that a third of the students involved in the research is affected by the environment that supports business activities. Higher education should reflect the approach that it will support the fact that the business is a combination of ideas, knowledge and skills. Whereas that occurs at a young age to the shaping of the mind, it is necessary to make the business promote already during their studies at the school.

Table 4 University inspiration for entrepreneurship and innovations (Czech Republic)

My university	The atmosphere at my university inspires me to develop ideas for new businesses.	There is a favourable climate for becoming an entrepreneur at my university.	At my university, students are encouraged to engage in entrepreneurial activities.
I do not agree at all	96	101	154
I do not agree partly	154	182	164
I do not almost agree	183	196	167
I almost agree	268	257	211
I agree	238	202	194
I agree partly	120	120	150
I agree very much	71	63	81
Without answer	5	14	14

Source: Own processing

It is quite interesting to find that only 10% of the respondents already run their own business and that 21% of the students is currently trying to start their own business and would like to become self-employed. Table 5 brings the numbers of active entrepreneurs and the numbers of possible future entrepreneurs at different universities in the Czech Republic. However, the results are influenced by the numbers of respondents from different universities. The highest score also means the highest number of respondents.

Table 5 University by nascent entrepreneurs and by active entrepreneurs

University	Nascent entrepreneurs		Active entrepreneurs	
	Count	Percent	Count	Percent
Charles University	5	3	6	5
Masaryk University Brno	1	0,5	1	1
Skoda Auto University	4	3	1	1
Technical University of Liberec	78	51	47	41
Technical University of Ostrava	6	4	9	8
University of Economics in Prague	7	4,5	8	7
University of Hradec Kralove	23	15	17	15
University of Pardubice	5	3	1	1
University of West Bohemia	15	10	21	18
Other	9	6	4	3

Source: Own processing

Applicants for undergraduate studies are influenced by different factors when selecting their study. One of the main factors is the interest in the studying field, and the related idea of future work. However, also the possibility of finding a job linked with the studying field and the amount of the financial appraisal of the profession play an important role. Another interesting factor could also be the place where students want to study (for instance the capital or a big city) or studying costs. Some of the students are from the family businesses, have the family background (see more in Antlova, Rydvalova, 2017) and have the bigger sense of innovation and effort to start their own business.

4. Conclusion

Entrepreneurship is perceived positively, as a way how to increase employment, growth in living standards, promote common interests and objectives. Innovation and creativity are the key factors of success. To teach the entrepreneurship and also the innovation is new mission in all universities. In the Czech Republic we can say that almost all the universities are trying to increase the student's entrepreneurial activities, are establishing different learning hubs (or innovation centers) which are supporting the innovation ideas and have the module of entrepreneurship in their curricula. The big companies also start to support these activities such as some competition for instance "hackathon days". All these activities are very convenient alternatives to classic ways of teaching. Here, the students can realize their start up activities and meet the experienced entrepreneurs and business angels.

It can be deduced from the historical development of human society, the business activities (especially SMEs) are an instrument dealing with crisis situations, e.g. in the transformation of the economy, for the decline in the activities of the selected sector or the collapse of large enterprises. At the same time it presents the transfer of R&D knowledge from academic to business environment. Also in connection with Industry 4.0, an increase in the need for business activities in the area of services can be expected. It means the services requiring human approach and creativity that the robot will not hold. It is therefore necessary to prepare an educational environment for training according to the model of creativity (see Figure 1).

5. Acknowledgement

This study was supported by Technology Agency of the Czech Republic, in the framework of the project “Family business – solutions to social and economic disparities of municipalities”; reg. number TD03000035.

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COMMITMENT MODELING IN DEMO METHODOLOGY

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Keywords

DEMO, commitment, DEMO enterprise ontology (DEO), FAR ontology

Abstract

The notion of commitment is a fundamental term in human communication in social systems. It can be also considered as an elementary contract, in which human beings enter into and comply with to achieve their business aims. DEMO (Design Engineering Methodology for Organization) has its foundation in DEMO Enterprise Ontology (DEO) and provides a strong theoretical foundation for business process modeling with truthful state machine with well-defined states and state transitions. Its generic transaction pattern provides capabilities for unilateral commitment modeling. Commitment is implemented within a transaction pattern (transaction). However, in real world applications, reciprocal commitment models prevail. The paper describes and illustrates all modeling possibilities of the unilateral commitments and then introduces reciprocal commitment model in which one commitment is done in consideration of another commitment. The paper discusses and contemplates possible extension of reciprocal commitments and their utilization.

1. Introduction

The notion of commitment belongs to fundamental notions in the social systems, in which human beings are the core participants. In general, human beings plan and achieve their goals through conversation (coordination). Human beings, who are involved in conversation concerning commitment, are marked as performer (anyone who exposes intention) and addressee (somebody, to which the intention is addressed). We can distinguish a unilateral commitment, in which the performer exposes intention towards the addressee and reciprocal (paired) commitments, in which one commitment is in consideration of another (reciprocal) commitment. Unilateral commitments are easier elaborated and structured because there is only one commitment over which human beings have their roles. Reciprocal principle of commitments has its origin in accountancy systems, in which one transfer is in consideration of another transfer. Introducing the commitment notion means not only processing current or past activities (as classical accountancy) but also capturing future activities as well and thus extending the modelling scale. In short, reciprocal commitments are represented by two commitments in which one commitment is in consideration of the other and form inseparable unit. In general, it may be represented by two groups of commitments in which one group of commitments is in consideration of the other group of commitments.

Commitments can be a part of contract or may stay alone, in which case they are often regarded as uncontracted commitment. Commitments are also regarded as atomic contracts, according to (Korczak 2013; Pitner, 2015). In the simplest form of commitment (contract) two contract parties

(human beings) commits to an exchange of resources such as goods for money or service for money, i.e. to a pair of transactions of resources from one party to other party. The important thing about it is just the reciprocal character. The commitment performs as a part of transaction which is thoroughly described in the transaction pattern.

Commitments are describe in many papers (Dietz 2006; Hruby, 2006; Hunka, 2016; Ministr, 2009). However, in the majority of these articles commitment is described as a static entity having relationships with two different kinds of actors (sometimes also called agents) and possibly relationships with exchanged resources or services. Some of these descriptions have also relationships with real event when transfer or reciprocal transfer occurs. However, only one methodology introduces rigorous formalization of the human's conversation in the form of state and state transitions. It is done in the DEMO methodology and its transaction pattern which is a general pattern around which not only human's conversation occurs, but it can be used as a pattern for workflows.

The reminder of the paper is organized as follows. Section 2 deals with the DEMO Transaction Pattern. Unilateral commitment and its example is depicted in Section 3. Requirements of reciprocal commitments and the DEMO FAR ontology are uttered in Section 4. Section 5 depicts an example of reciprocal commitment in the form of corresponding DEMO models. Section 6 contains discussion, and conclusion and future research are depicted in Section 7.

2. The DEMO Transaction Pattern

DEMO is an engineering methodology to derive conceptual models of enterprises, based on an ontological theory, DEMO enterprise ontology (DEO) (Dietz, 2006). According to DEMO (Design & Engineering Methodology for Organizations) methodology (Dietz, 2006), an organization is composed of people (social individuals) that perform two kinds of acts, *production* acts and *coordination* acts. The result of successfully performing a production act is a *production fact*. An example of a production fact may be that the payment has been paid *and accepted*, or the offered service has been accepted. All realization-specific details are fully abstracted out. Only the acts and facts as such are relevant, not how they are achieved. The result of successfully performing a *communication act* is a *communication fact*. Examples of coordination acts are *requesting* and *promising* a production fact, which essentially constitutes a mutually binding contract. The subsequent communication acts and facts *state* and *accept* of the production constitute the fulfilment of that contract, agreed by both actors.

A *fact* is a proposition that can be either false or true, to be validated by empirical observation. A fact may encompass a single object, or may encompass more objects. Depending on the number of objects that are involved in a fact, we speak of unary, binary, ternary, etc., facts. An example of unary fact is that *Vendor is a Person*. Another example of binary fact is that a *Customer receives a Pizza*.

In DEMO modeling enterprises are represented by discrete deterministic systems that may exist in a set of precisely defined allowed states. For each state there is a set of allowed transitions to another state, so-called the state transition space. All other state transitions are forbidden and cannot occur. In general, a state is determined by the set of facts that exist at that moment. A state change or state transition consists of one or more facts starting or ending to exist. The occurrence of a transition at some moment is called an event.

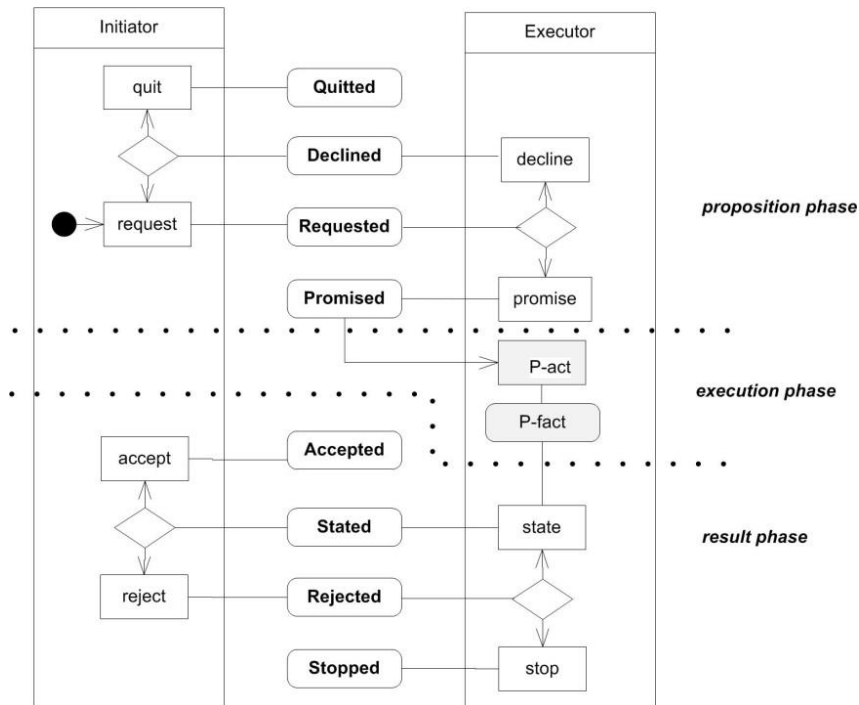


Fig. 1 The Transition axiom, the standard pattern. Source: (Dietz, 2006)

The diagram in Fig.1 shows the standard pattern of the DEMO transaction axiom, which is a hypothesis about phenomena in the real world. It assumes that any transaction in the real world follows this pattern. It contains interrelated acts and facts and the transaction is in one of the allowed discrete states. The partition of the *Initiator* contains the coordination acts and the decisions, represented by diamonds in the diagram. The partition of the *Executor* contains the corresponding coordination acts, the decisions and the production act and production fact. The production act and the production fact, depicted in grey color, are performed by the *Executor*. The coordination facts are situated in the middle of the figure as states in bold format. The complete transaction pattern can be extended by communication acts that revoke communication facts and thus capture more precisely modeling reality.

Events are widely defined as "things that happen in the real world", and that cause some effects. In DEMO there exist only i) *communication facts*, that are brought about by actor's communication, following the transaction pattern; ii) *production facts* that describe the production of a specific actor; and iii) *facts*, that are caused by acts in the real world that may become true or false. Example i): the pizza has been requested by the customer and promised by the pizza baker, a contract has come into existence. Example ii): the production *fact* of the pizza baker is a pizza margarita. Example iii): the exchange rate between the US dollar and the EURO is 1.234. By empirical observation of the real world this fact is either true or false.

The DEMO pattern contains not only commitment itself represented by the *promise* transaction step, but also the *production* step and the *state* and *accept* transaction steps. It means that the transaction pattern comprises commitment as well as event in which scope the commitment is fulfilled.

3. Unilateral Commitment and its Utilization

Utilization of unilateral commitment can be illustrated in a pizza example. This example comprises only two transactions, T-1 purchase transaction and T-2 payment transaction. The other transactions such as preparation or delivery of pizza are omitted to make the example simple and straightforward.

The construction model and the Process model are illustrated in Fig. 2. The Construction Model is placed on the left hand side.

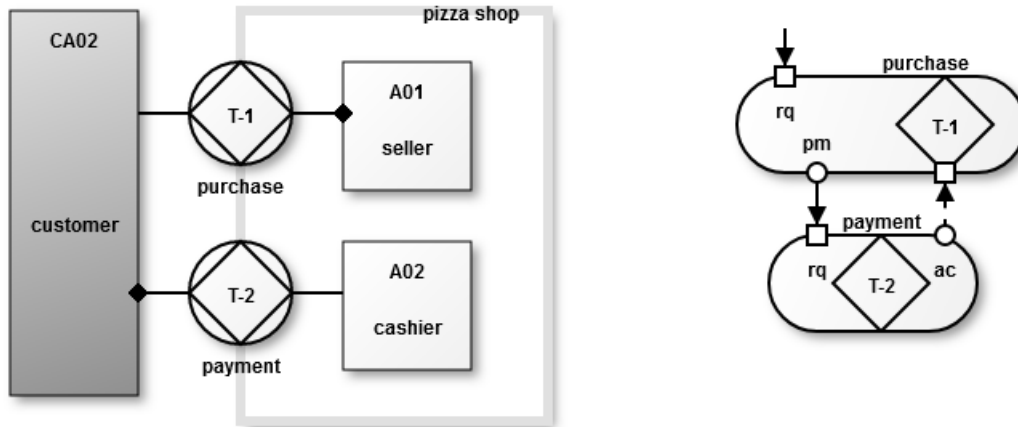


Fig. 2 The Construction Model and the Process model of pizza purchase

The whole construction model represents one system of a “pizza shop”. The environment is represented by the customer – CA02 (composite actor role). The executor of T-1 transaction is the seller and the executor of T-2 transaction is the customer (execution is indicated by the black dot at the actor role box). The construction model summarizes actor roles and corresponding transactions but says nothing about the internal arrangement (structure) between individual transactions. This feature is depicted in the Process model which is placed on the right hand side of Fig. 2. From this part of the figure follows that T-1 transaction is a parent transaction and T-2 transaction is a child transaction. In other words, T-2 transaction is enclosed within T-1 transaction.

The detailed description says that the customer requests purchase (pizza). The purchase is promised and the customer is requested (T-1 transaction) to make a payment for the purchase. Accepted payment (T-2 transaction) starts production fact in T-1 transaction. Next, T-1 goes on till accepting the purchase.

Of course, there can be some more scenarios of mutual possible relations between T-1 and T-2 transactions but all these scenarios are limited by the tree structure of DEMO transaction and coordination steps of the transaction pattern. Despite the fact that these scenarios of transaction arrangement are correct and functional they do not completely reflect the needs of reciprocal commitments, in which one commitment is in consideration of the other commitment.

4. Requirements of Reciprocal Commitments

In general, DEMO transactions are arranged in a tree structure with a parent-child relationship between them (utilizing the Composition axiom). The parent-child relationship is very effective and natural, but in some cases it doesn’t enable to capture all real world phenomena. By this we mean “the same level” transaction relationship, which is an inseparable part of reciprocal commitments in which the commitments have to be at first promised and after that consequently fulfilled. The tree structure of transactions does not provide adequate means to model this issue effectively. The model of reciprocal commitments implicitly covers different kinds of commitments (transactions) that are placed a parallel way.

In order to truly capture the relation between two reciprocal commitments, the DEO was extended by the FAR (Fact, Agenda, Rule) ontology (Skotnica, 2016; van Kervel 2012A). The FAR ontology

specifies that a fact is a proposition that may have a logic relation with other facts in a recursive way. Next, a fact is a proposition that may have three values; true | false | undefined. The value of “undefined” reflects the situation that for some unknown reason factual information is not available. In the FAR ontology (van Kervel, 2012B) there exist four kinds of facts:

1. Communicative facts; as defined by the DEMO transaction axiom.
2. Infologic and datalogic production facts. These facts are at lower abstract level and standard DEO does not enable to access these facts.
3. Facts about the world of phenomena not captured by the DEMO ontology, the kinds 1 and 2. Example: the exchange rate dollar – euro = 0.85. The value of this proposition can be true | false | undefined.
4. Any logic aggregated facts, or dependent facts, composed of logic relations (AND | OR | NOT relations) of other facts. Evaluation laws for the three-state logic.

The FAR ontology is rather focused on implementation level of the DEMO methodology. According to this ontology, it is possible to explicitly capture communication facts such as requested or promised. The other important feature of the FAR ontology is the ability to capture any logic aggregated facts. This is used when it is necessary to express that reciprocal commitments were promised or when reciprocal commitments were fulfilled.

5. Reciprocal Commitments and their Application

This section will describe and illustrate reciprocal commitments which are applied on a simple example of purchase and payment. The reciprocal commitments, as was mentioned earlier, mean that one commitment is in consideration of the other commitment (Korczak, 2017). Each commitment is implemented within a corresponding transaction. The Construction Model of the reciprocal commitments is mentioned in Fig. 3. The actor roles are composed of elementary actor’s roles. It means that somebody who makes a purchase is in the roles of a customer and a payer. Somebody, who sells the goods, is in the role of a seller and a cashier. In real life, a human being usually plays more roles. In this case, there is not only one system but there are two systems indicated by boxes labeled pizza shop and customers. Each system has the following properties: composition, environment, production and structure. For the pizza shop system, the customer forms environment. For the customers system, the cashier forms environment. Contemplating this simple application as two systems the following mechanism for systems “synchronization” has to be proposed. The specific features of the FAR ontology are utilized (Hunka, 2017).



Fig. 3 The Construction Model of reciprocal commitments

To synchronize reciprocal commitments it must be possible to explicitly express the promise transaction steps in both commitments. Further, this condition requires aggregated communication

fact which would represent that both commitments are in the promise transaction step. This approach also needs to explicitly express the accept transaction step in both commitments and the aggregated fact that both transaction steps were accepted.

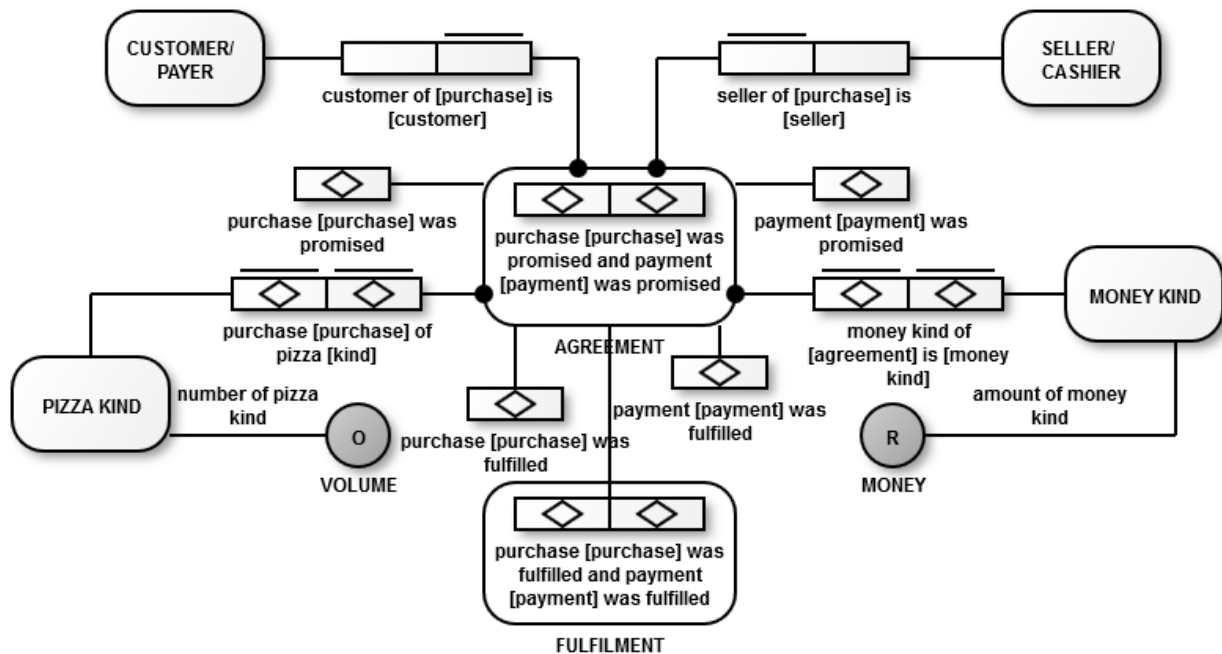


Fig. 4 The Fact Model of reciprocal commitments

The DEMO Fact Model of this application is illustrated in Fig. 4. The object class AGREEMENT is the core object class in the Fact Model. The line between AGREEMENT and CUSTOMER/ PAYER labeled “customer of [purchase] is [customer]” represents property type. The same holds for the relationship between AGREEMENT and SELLER/ CASHIER object classes. Mandatory and uniqueness constraints indicate that an agreement must have actor roles of a customer and a payer and other actor roles of a seller and a cashier.

The result kind “purchase [purchase] was promised” is an existentially independent unary communication (coordination) fact kind which represents the promise transaction step of T-1 transaction. Similarly, the result kind “payment [payment] was promised” is an existentially independent unary fact kind, which stands for the promise transaction step of T-2 transaction.

The object class AGREEMENT is an extension of the result kinds “purchase [purchase] was promised and payment [payment] was promised”. This actually expresses reciprocal commitments. The property type between the object classes AGREEMENT and PIZZA_KIND reflects the fact that one agreement can include only one pizza_kind. The pizza_kind is further specified by a value type, which represents the actual number of pizzas within the purchase.

The property type between the object class AGREEMENT and MONEY_KIND indicates that one agreement can contain only one money_kind (partial payments are not assumed). The money_kind is further specified by a value type, which represents the actual price of the pizza_kind. The result kind “purchase [purchase] was fulfilled” is an existentially independent unary fact kind, which is the result of T-1 transaction. Similarly, the result kind “payment [payment] was fulfilled” is an existentially independent unary fact kind, which is the result of T-2 transaction.

The result kind FULFILMENT is a subclass of the object class AGREEMENT. The object class FULFILMENT becomes existent when the result types “purchase [purchase] was fulfilled and

payment [payment] was fulfilled” comes into being. In short, it stands for completing the purchase and completing the payment.

6. Discussion

The DEMO commitment is enclosed in a transaction pattern and forms the state machine that captures all real model requirements. It integrates current (past) and future events (production transaction steps) in one unique pattern. It happens that there is a time lag between a promise transaction step and the production transaction step. All this is in accordance with the modeling reality.

However, the DEMO commitment is only unilateral commitment. It means that any expression of the reciprocal commitment such as purchase and payment has to be modelled by the parent-child relationship. The proposed solution, which is described in the paper utilizes the FAR ontology which extends the “implementation” of the DEO and enables to capture reciprocal commitment in its real shape. It also means to model two different systems and place emphasis on the promise and accept transaction steps. The presented proposal may serve as a basis for more elaborated structures such as contracts.

7. Conclusion and Future Research

The paper describes and explains the commitment modeling in DEMO methodology utilizing the FAR ontology. It extends the possibilities of the DEMO methodology towards applications which are based on reciprocal commitment models or paired transactions models. The origin of these models is in accountancy systems. Utilizing the DEMO methodology enables to keep track of all business and production events which provides more detailed and precise view on the modeling reality. The model of reciprocal commitment creates a core for future research aimed at contract modeling.

8. Acknowledgement

This paper was supported by the grant provided by Ministry of Education, Youth and Sports Czech Republic, reference number SGS05/PRF/2018.

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SYSTEM PROBLEMS OF ENTREPRENEURSHIP DEVELOPMENT IN KAZAKHSTAN REGIONS IN CONDITIONS OF GLOBALIZATION

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Keywords

Entrepreneurship, Kazakhstan, regional institutions of supporting entrepreneurship

Abstract

In present day conditions of Kazakhstan, the issues of entrepreneurship development are resolved through forming special conditions of institutional support and development regarding strengthening the globalization tendencies in the Eurasian space. Modern theories of entrepreneurship development and organizing state and public institutions for supporting entrepreneurship in the conditions of globalization have acted as theoretical-and-methodological base of the research. On the basis of using statistical methods of qualitative and quantitative indices analysis of entrepreneurship development in the regions of Kazakhstan, as well as by the results of a sociological poll of entrepreneurs in the regions the main hypothesis of the research has been formulated as follows: entrepreneurship in Kazakhstan is characterized by rather high activity despite availability of system problems of its development that requires developing special measures for solving the revealed problems.

1. Introduction

In present day conditions of Kazakhstan, entrepreneurship development taking into account the strengthening of globalization trends in the Eurasian space is being addressed through forming special conditions for institutional support and development. Among the main resources of present day Kazakhstan that allow accelerating the formation of the market economy and to embark on the path of stable development, it is necessary to note entrepreneurship, which is the most important internal strategic factor for sustainable self-development of the economy. In this connection, there is growing the importance of scientific understanding of the economic essence of entrepreneurship, studying the ways of its formation. Such analysis allows the state forming favorable economic, organizational, social and political conditions for entrepreneurship development in present day Kazakhstan.

2. Methodology

As a theoretical-and-methodological basis for the research, there are taken modern theories of entrepreneurship development and organizing state and public institutions for supporting entrepreneurship in the context of globalization. Analyzing the definitions of the concept of "entrepreneur" of various authors, you come to the conclusion that the main characteristics of its

content are innovation, freedom of the entrepreneur's choice who appears to be an owner and a manager in one person. Therefore, entrepreneurship can exist in the scale of small and less often medium businesses. And in a large business corporate thinking and activities, where the functions of the owner and managers are divided and individual freedom is limited within the organization, there cannot be entrepreneurship.

Thus, the essence of entrepreneurship expresses economic relations of individual reproduction in the scale of small and medium businesses implementing innovative activities, predetermined by a free choice of a business entity, which is in one person the owner and the manager operating in a competitive environment, providing the market with new goods, services for obtaining profit.

Next, it should be noted that entrepreneurship has forms of manifestation: mediation and innovation. In general, entrepreneurship of small and medium firms operating in the areas of commodity circulation and services is represented as intermediation between producers and end users. Innovation is referred to new use of combinations of factors and use of modern technology in producing, managing and marketing new goods and services in the market conditions to meet the needs of the population (Kudratov, 2015), (Bagiyev, 2001)

On the basis of using statistical methods of qualitative and quantitative indices analysis of entrepreneurship development in the regions of Kazakhstan, as well as by the results of a sociological poll of entrepreneurs in the regions the main hypothesis of the research has been formulated as follows: entrepreneurship in Kazakhstan is characterized by rather high activity despite availability of system problems of its development that requires developing special measures for solving the revealed problems.

3. Results

Despite ongoing reforms in Kazakhstan, a lot of policy initiatives, experts emphasize, do not achieve results because of a number of serious problems:

- Administrative barriers in Kazakhstan are at a high level, including high costs of the licensing system for business.
- Despite a relative openness of the domestic market, the extremely low efficiency of import and export procedures is one of the main limitations of the RK involvement in international trade.
- Low effectiveness of customs administration is also a significant factor in restricting international trade.
- Despite the existence of special measures, in a significant part of state programs there are not defined the target values of the effectiveness indicators.
- When implementing a significant number of government programs, budgetary funds are used inefficiently (Kangalakova, 2017).

In the conditions of the transformed economy, identifying and studying the entrepreneurial potential available in the regions is of particular importance, since it is in the regions that the center of gravity of the economic reform moves. The study of the regional aspect of entrepreneurship development makes it possible to determine the role and significance of the latter in raising productive forces of the regions of the Republic of Kazakhstan and to formulate an effective state policy of supporting entrepreneurship. All this predetermines relevance of the research subject.

The key objective of the study is to answer the question in which sectors of the economy it is possible and appropriate to develop entrepreneurship in each region and what conditions are necessary for the

today's business. It is necessary to understand clearly the current needs of entrepreneurs from a small trading enterprise to a large, system-forming entity. Understanding the restrictions and ways to overcome barriers is possible only through direct interaction with entrepreneurs, therefore, there is needed the maximum coverage of the existing entrepreneurs through questionnaires and direct interviews.

Small and medium business (SMB) of Kazakhstan is 26.2% of the GDP, 17% of exports, 33% of employed and more than 99% of economic entities. Among these, 83.4% of the country's business are subjects without forming legal entities: individual entrepreneurs and peasant farms. Small business specializes in trade, other service sectors and agriculture. Medium and large enterprises are mainly employed in the industrial sector. The size of the assets of the quasi-public sector of the country is about 60% of the GDP. 26.4% of entrepreneurs of the country are entrepreneurs "on demand", i.e. self-employed. A potential entrepreneur is a man at the age of 25-34 (Committee, 2018), (Damu, 2018), (Business portal, 2018).

As of the beginning of 2016, there were 1,332,762 active entrepreneurs in Kazakhstan. The dominant part of the entities is represented, as we have already noted by individual entrepreneurs (IPs) and peasant farms (PFs).

At the same time, the number of large enterprises is only 0.2% of operating entities, and 99.8% of subjects belong to small and medium business. A similar ratio of large enterprises and SMB subjects is typical for the developed countries of the world. Thus, the share of enterprises with more than 250 employees (the equivalent of large enterprises in Kazakhstan) in Germany is 0.49%, in Canada 0.26%, in the UK 0.28%, in Spain 0.12%. On average for the OECD countries, this indicator is at the 0.2% level.

At the same time, the feature of Kazakhstan large enterprises is that a large proportion of state and quasi-public enterprises are among them. Thus, of 2419 large enterprises operating in the republic, 627 are state-owned, and more than 500 are affiliated with the state. According to experts, the amount of assets of the quasi-public sector in the country has reached 60% of the GDP.

As a result, in 2014 only a group of NWF Samruk-Kazyna JSC paid 20% of the tax revenues of the state budget (KZT 1,048 billion).

In the sectoral context, the largest number (70%) of the subjects are concentrated in agriculture, trade and other services. There is a clear specialization of small business in trade and agriculture, and subjects of large and medium business in industry.

In addition, large and medium enterprises are largely represented in the sphere of public administration, education and health, which is a consequence of state enterprises prevalence in their structure.

In the regional context, most of the subjects are concentrated in the territory of Almaty and the Almaty region, as well as in South Kazakhstan and East Kazakhstan regions and Astana. These regions specialize mainly in providing services and agriculture.

Unlike the characteristics of the number of subjects, the contribution of small and medium business to the economy of Kazakhstan is much lower. In 2016 the share of the added value of small and medium business in the GDP was 26.8%.

Within 2011-2013, the contribution of SMB into the economy was estimated at 17%, a sharp increase in the contribution of SMB in 2014 is due to changing methods of statistical accounting.

In value terms, the contribution of SMB into the country's GDP was about 16.8 trillion tenge, of which 7.1 trillion tenge was made by medium enterprises and 9.7 trillion tenge by the subjects of small business (2016).

At the same time in the developed countries of the world, SMB contributes significantly to the economy. In the OECD countries the average share of SMB in the GDP is about 60%, including this in Denmark 61%, in Germany 55%, in Italy 68%.

In the regional aspect SMB produce a significant portion of the GRP of Astana and Almaty, as well as the West Kazakhstan and Almaty regions.

An important factor of the entrepreneurship characteristics is providing jobs in the country. According to the results of 2015, SMB of Kazakhstan provides employment for about 38% of employed (33% in 2014). In the developed countries a significant part of the population is engaged in SMB. In Denmark this figure reaches 65%, in Spain 74%, in Italy 80%, in Germany 63%.

At the end of 2015, the SMB sector employed 3.1 million people. On average, one SMB subject employs 2.5 people. And for certain categories of SMB, the values of the indicator are even more insignificant. So, at individual entrepreneurs and in peasant farms, that is, in more than 80% of subjects there work 1-2 people. In each small enterprise (still more 16% of subjects), on average there are employed about 6 people. At the same time, one legal entity of medium business employs more than 120 people. This fact confirms the thesis that under a large army of SMB enterprises of Kazakhstan, there are mainly hidden microenterprises: small in size and output and with a minimum number of employees.

The nature of doing business is particularly influenced by various barriers of the objective and subjective nature.

The infrastructure availability and quality is one of the key criteria for developing the business environment. In this regard, it is very important to assess the infrastructure support of the regions.

As part of the survey performed and based on the results of the online survey of current entrepreneurs, interviews with large and medium enterprises, a survey of entrepreneurs and the results of the rating "Business Climate", the following main barriers faced by entrepreneurs have been identified:

1. The quality of highways;
2. Wear and shortage of the railway trains and wagons fleet;
3. Deficit and high tariffs for electricity;
4. A high percentage of thermal network wear;
5. High rates of water supply and sewerage networks deterioration;
6. Low qualification of human resources;
7. Absence of information of the European countries markets;
8. Barriers related to the financial resources access (high rates of short-term loans, high requirements for collateral property, etc.).

The conditions of doing business are defined in the framework of the Business Climate study. The basis of the ranking is the respondents' assessment of 5 key factors of business development: administrative regulation, real estate and infrastructure, human resources, financial resources and state support. According to the 4-point scale, in 2015 the most vulnerable factor of the country's business environment was administrative regulation. Human resources received 3 points out of 4 possible, which is the best estimate among the five ranking factors.

According to entrepreneurs, the most favorable conditions for entrepreneurship development are in Astana (2.7 points). Compared to the last year, the capital increased its position by 4 points. The business climate was also improved in Karaganda (+6), Atyrau (+6) and Almaty (+5) regions.

According to the Business Climate ranking, the Aktobe region and Almaty are among the three leaders together with Astana. The Akmola, North Kazakhstan and Kostanay regions that significantly reduced their positions in 2015 in comparison with the last year are at the end of the ranking.

4. Discussion

Within the years of independence Kazakhstan has become part of the world economy closely integrated into international monetary-commodity relations (Abakumova, 2015). All the crisis phenomena occurring in the world, of course, have a negative impact on the economy of the country. The situation is aggravated by the fact that the structure of our economy has low diversification: the commodity sector is predominant. There are new challenges for domestic business: Kazakhstan joining the WTO and the EAEU. This circumstance entails the opening of the domestic market for foreign players and a sharp increase in competition. At the same time, our state, like all other members of the WTO and the EAEU will be limited in measures to support business. Developing a platform for increasing financial independence and competitiveness of enterprises, gradual transition from manual control to systemic measures of self-regulation is the only true formula for successful competition in current complicated conditions.

Realizing the full value and scope of the decisions made by the state, it should be noted that great responsibility lies on the entrepreneurs themselves. The state is able to form conditions but if the entrepreneurs themselves do not begin being care for long-term development, even joint and synchronous actions will be ineffective. It is important that domestic business begins to acquire skills of effective survival in constantly changing conditions, to increase its productivity, to introduce innovations and modern approaches, to improve the management and production processes, and to learn competing at the international level.

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INNOVATIONS IN WASTE MANAGEMENT

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Keywords

waste management; information technology; innovation; smart; circular economy; risks; economic benefits; waste collection

Abstract

The article focuses on the innovation of the waste management processes by introducing new information technologies. The article also presents selected areas where the implementation of information technologies seems to be the most effective. The aim of this article is to name the means of introducing the information technologies into the process of waste management and highlighting the arising economic benefits. The purpose of upgrading individual waste operations can be seen in meeting the requirements of the European Commission's 2015 Circular Economy Package. The main reason of implementing this strategy is reducing waste and increasing the recycling rate. The article is an outcome of cooperation between the members of the academic community VŠB-TUO, HGF and employees of the joint-stock company EKO-KOM, which is the only authorized packaging company in the Czech Republic.

1. Introduction

The aim of the research team is to propose optimization of waste management processes based on analysing the current situation and to define what benefits can arise from this process. The method of analysis, synthesis and deduction will be used to optimize the process. The selected information technologies defined in this article will be used to implement the optimization measures.

At present, the subject of circular economy or circulatory economy, which mainly focuses on lowering the amount of waste, has become a recurrent topic of public discussion. In 2018, the European Union even adopted the so-called Circular Economy Package (CEP), which sets out the following key objectives:

- by 2035, limit the landfill of mixed municipal waste to a maximum of 10%;
- by the same year, the Member States should prepare for an increased rate of reuse and recycling of municipal waste of 65% (and 60% by 2030 then 55% by 2025),
- in 2030, the recycling rate of packaging waste should be increased to 70% in the EU (Vosecký, 2018).

In January 2018, the European Commission published a Europe-wide strategy on plastics, which states that by 2030 all plastic products must be reusable or recyclable (Ministry of Industry and Trade of the Czech Republic, 2018). All EU countries must meet these targets. There is a risk that the Czech Republic will not be able to fulfil some of the conditions set by the package, as the currently achieved

values in the selected areas are absolutely different from the required ones. And it is therefore essential to think about possible innovations that should be made in the field of waste management. The waste management process under Act No. 185/2001 Coll. On Waste includes waste prevention, preparation for reuse, waste recycling, other waste recovery and waste disposal. The authors of the article find significant potential in implementing new information technologies into the waste management system, which according to them, will lead to improvement and acceleration of individual activities as well as the whole process.

2. Optimization and Information Technology

We believe that the most suitable areas for implementing information technology innovations are waste collection, collection of waste and final sorting of waste. In the field of waste collection, this concerns innovations relating mainly to collecting waste containers. That is followed by the actual waste collection applying the communication systems between the containers and the waste collection vehicles, which shall make the collection more transparent for both the waste collection companies and the waste producer. Regarding the final sorting of waste the information technology can be useful in improving the speed of the process. The ways in which to implement the information technology into waste management processes are researched by, for example, Wu (2016). He has been focusing on a specific field of demolition waste collection. Das (2015) was also involved in the optimization of waste collection. His research is mainly based on mathematical calculations on the basis of which the ideal waste collection routes are set, basically similarly to Kozel (2014), who used linear programming to do so.

Information technology has an irreplaceable place in the economic recovery of waste from processing technology (Danel, 2017). Janovská (2012) or Klézl (2017) deal with the optimization of all the important processes that the energy recovery of waste is associated with. Klézl emphasize the importance of information technology in the implementation of e-auction trading of energy commodities. Baránková (2013) based on the analysis of two similar cities verified that using information technology for energy recovery of mixed municipal waste brings along greater economic progress than landfilling.

At present, introducing process innovations is also an important element of competitiveness and success, both in private and public sectors (Dujčák, 2014). This is confirmed by Ministr (2009) who describes increasing dependency of companies on information technologies, which represent optimal tools for achieving the quality of production in accordance with customer requirements. One of the goals of innovations is to design an innovation process, which would represent a way of software development as a service (Hunka, 2013). As Danel (2016) emphasizes, the optimization of production processes using greater proportion of automation and computerized management can, for example, shorten the production operations times, improve machine utilization, and so on.

Innovation of the waste management process through information technology is one part of the smart cities concept. The use of information technology within this concept is made possible by reducing the cost of deploying the technology and a fast increase of its capabilities (Helfert, 2017). The deployment of intelligent systems is now a driving force for innovation in all the industrial and social areas. These systems take control of tasks and services and may take control of our lives once (Schoitsch, 2017). Hand in hand with the development of Smart cities is involving the large amount of service providers into the service chain. The most important in this area seems to be the understanding of value creation for stakeholders (Caputo, 2017).

3. Authorized packaging company EKO-KOM

The only authorized packaging company EKO-KOM, established in 1997, provides the whole system of collection, sorting, recycling and reusing of waste in the Czech Republic. The company has set up and efficiently operates a nationwide system that ensures the sorting, recycling and recovery of packaging waste at a European quality level. The main mission of EKO-KOM is to fulfil the obligations the company has towards its clients for the collection and recovery of packaging waste. Given the spectrum of the activities specified above, the company will also be affected by the implementation of the Circular Economy Package. So the EKO-KOM Company is obligated to implement new projects and innovate individual processes in order to meet the requirements of the package. One of the key areas is the implementation of information technologies. After the implementation, the company can optimize all of its processes (EKO-KOM, 2018). Vítamová (2017) also highlights the need for adequate communication to achieve the Corporate Social Responsibility objectives, which is why EKO-KOM uses information technology, for example, when communicating these goals to the main target groups on-line.

The sorting system the EKO-KOM Company uses is mostly prepared for future requests arising from CEP. However, the system needs to be further developed to meet the recycling targets set for 2035, especially with regard to the measure point. That can be achieved by further development of sorting infrastructure. Moreover it should implement the eco-modulation tools, which means, that the system should influence the industry on the basis of a tariff policy so that one-way packaging placed on the market is easily recyclable.

4. Key areas of implementing innovations with the help of information technologies

4.1. Waste collection

Basically it can be said that the collection is a system of placing waste containers in a particular area for the purpose of collecting waste from waste producers and creating special waste collection points that will collect and purchase waste. We will also focus on innovation via information technology within the system of collection containers. All these trends are in the spotlight of EKO-KOM. These technologies find use in the sorting system for sorted waste, especially in low-density areas, or in places subject to the seasonal occurrence of a large number of people - typically in recreational or tourist areas.

One of the technologies that are being upgraded within the process of collection is the so-called RFID chips or tags. RFID (radio-frequency identification) is the method of automatic identification based on radio communication between the reader and the identification element (so-called RFID tag). These chips can then be placed in the collection containers. These collection containers are commonly known as smart bins (Herštus, 2014).

The main advantage of these bins is the use of RFID chips that by the means of GPRS or other IoT (Internet of Things) tool inform the collection company's headquarters or the collection vehicle about how full the bin is. This way the company may monitor the bins and prevent their overfilling that may result in polluting the surrounding area. Especially in the field of waste sorting in cities, overfilled collection containers may have a negative influence on the willingness of the citizens to sort waste. Smart bins are very often completed with a compression unit that can push the waste into the container, increasing its volume up to four times. As soon as the bin is full, the content is pushed down into it, and a new free space is created. In open spaces, the compressor unit is powered by a

solar panel located on the top of the bin. By using the press, the frequency of waste collection prolongs, which is particularly advantageous in the distant regions, as there would be a reduction in:

- the driving distances,
- the fuel consumption,
- release of carbon dioxide in the air,
- and overall collection costs.

Furthermore the individual collection bins may be upgraded with another devices, such as Wi-Fi Hotspot or smoke detector, which would alert the fire brigade in case of fire (Bárta, 2016). Another indisputable advantage of RFID chips and tags is the ability to carry information about the GPS coordinates of a particular collection bin, about its last emptying, when it was last cleaned or repaired. The use of smart bin appears really effective on places with increased concentration of people, such as historic centres where it is problematic to create a system of collection points which would correspond with the aesthetics of the place, and yet their residents would be able to dump their garbage or even sort it. As an ideal places for these bins seem to be city centres and parks, busy traffic hubs and railway stations, motorway stops, production halls and cottage areas. On the contrary, it turns out, that the widespread placement of these bins in large cities is not economically effective. There are precisely planned collection routes in the cities and the collection network is very dense and the costs of the smart bin are high as well as the cost of its operation or possible repairs.

4.2. Collection of waste

Another significant area of innovation by the use of information technologies is the actual collection of waste. This area most commonly uses the Global Positioning System (GPS) and Geographic Information Systems (GIS). GPS is a passive telemetry system for determining the position and time on Earth and in the adjacent space. GIS is a computer system that allows you to store, manage and analyse spatial data (Bagárová Grzywa, 2003). The innovation of collection by their means leads to optimization of collection routes and thus to reduction of the total collection costs. EKO-KOM uses the GIS systems as an analytical tool for the development of uniform sorting systems. The resulting analyses then serve as an important decision-making tool.

The collection routes may not only be optimized in terms of driving distances but also in terms of how full the individual collection containers are. And the RFID chips can inform the collection company about that. These chips may also send information to tablets that are placed in the cabin of the collection vehicle so the crew may adjust the collection route based on the received data. This may ensure the prevention of overfilling the containers. The whole system of RFID chips and tags works in the following way. The technical unit consists of a chip with a built-in antenna (transponder), a reader and a data bank. The entire RFID system has these three characteristics:

- unique electronic label,
- contactless data transmission,
- broadcast on call.

Within the system, the so-called passive chips are used, which are placed on individual containers in order to identify them. These chips, which do not have their own power source, transmit at a wavelength of 134.2 kHz. There are also readers used to transmit electromagnetic fields. The antenna placed on the chip converts electromagnetic waves into electrical energy, thereby being able to specifically modulate the electromagnetic field of the reader. In this way, the numerical series stored in the chip is transferred and the object is uniquely identified (Třídíme.cz, 2011).

The innovation may also be implemented by using the linear bar codes. These are part of the ProBaze ODPADY software that allows monitoring and evaluating the process of waste collection. The software can be used for both collection of mixed waste as well as sorted waste.

In case of waste collection from individuals the collection vehicle will arrive at the container and by using the mobile terminal with the appropriate SW application it will retrieve the unique barcode on the container and fill the data on how full the container is. Subsequently, the data will be sent for further processing within the information system. On the basis of thus obtained data, the collecting company may set an individual fee for that person. Regarding the sorted waste each individual (household) will receive a unique barcode that would be printed on containers with a specific type of sorted waste.

There is another type of waste collection and that is waste collection provided by citizens themselves. Anyone interested shall register at a given location to receive a unique barcode and containers (most commonly bags) for waste. The citizen then can bring the waste to a collection point where it gets weighed and registered in the system. At the end of the agreed period the citizen will receive a statement declaring how much of which waste he brought in. Such citizen may then be granted a discount on the waste collection fee. On the part of the collecting company, there is a significant saving in fuel. The whole system is shown in Figure 1 (ProBaze, 2018).

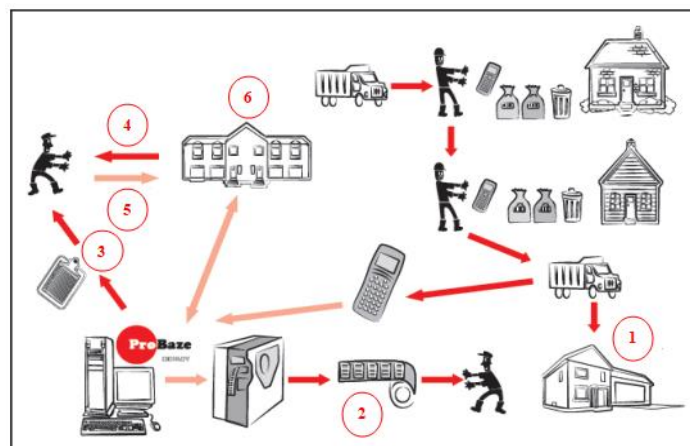


Figure 1 Illustration of the ProBaze ODPADY system operation: 1 - processor; 2 - printing of codes; 3 - output assembly; 4 - discount; 5 - registration; 6 - city office (Source: ProBaze, 2018)

Another way to upgrade the collection via information technologies is the use of QR codes (Quick Response). The matrix code symbol consists of square cells and allows omnidirectional and very fast retrieval of large volumes of data. When deploying this system, individual collectors would be labelled with a special QR code, which can be captured and sent by the mobile company via mobile phone application when the container is full. The collection company can then, based on such information, adjust the collection routes. This system is a part of the Zero Waste City project and has currently been implemented in some parts of the city of Ostrava and Krnov (Fajtová, 2018).

4.3. Final sorting of waste

The importance of final waste sorting increases with regards to the impacts of future legislation (e.g. CEP). The interest of not only the European Commission in increasing and improving the outputs of sorting lines will continue to grow, so that the objectives of CEP are effectively met. In the field of waste sorting, innovation together with information technology is gradually replacing human work. E.g. sorting lines recognize objects on the belt based on NIR (Near InfraRed) spectroscopy (Dvořák, 2016). This device enables, 90-93% sometimes even up to 98% purity of final sorting. Sorting

capacity is up to 10 tons per hour. The sorting line is equipped with NIR sensors, which are based on infrared detection. The whole system works on the principle that each material reflects infrared radiation in the light. Based on reflection, it is possible to distinguish individual materials from one another. Then:

1. NIR sensor transmits the captured reflection to the software.
2. Based on the reflection the SW creates a two-dimensional image of the object.
3. Then the SW determines what type of material it is, determines its size, shape and position.
4. The SW is connected to air nozzles that point to a particular object and blow it out of the belt.

In addition to NIR sensors, VIS sensors serving to detect transparent objects can also be used on sorting lines. VIS sensors are especially suitable for sorting bottles of polyethylene terephthalate and polyethylene. Basically, this is an improved RGB (Red-Green-Blue) camera technology that is capable of capturing a stronger signal from all colours, resulting in better sorting (Šťastná, 2007).

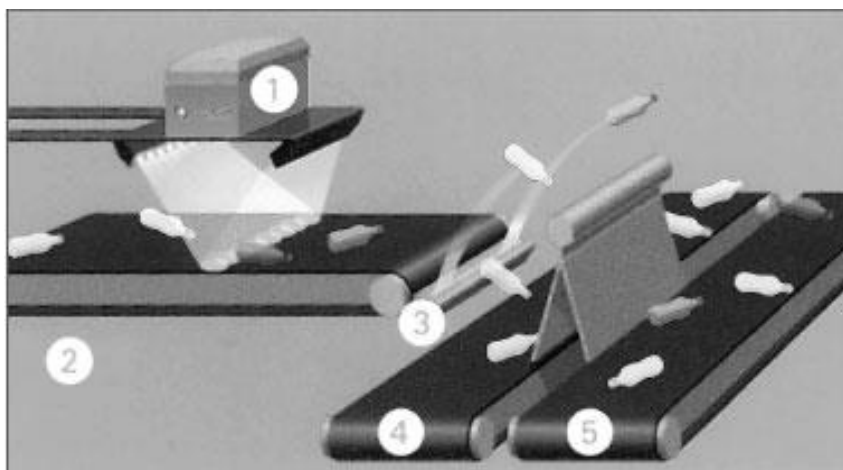


Figure 2 Schematic illustrations of a sorting line with NIR sensors: 1 - scanner; 2 - conveyor with input material; 3 - air nozzles; 4 - secondary transport system with sorted material; 5 – residual fraction (Source: Šťastná, 2007)

5. Conclusion

In order to meet the requirements of new legislation on waste management, in particular CEP, individual countries must proceed to a more active use of information technology throughout the whole waste management process. Innovation, especially in the field of waste collection, collecting and recycling, is an appropriate solution for optimizing not only municipal waste. This article specializes in precisely the examples of the appropriate use of information technology in the mentioned areas and their economic impacts.

Furthermore the article introduces the EKO-KOM Company that is in charge of overseeing the entire packaging handling process and its role in the waste collection and sorting of waste in the Czech Republic. The authors of the article are from the EKO-KOM Company and from the academic sphere. They have been working together on analysing the consequences of implementing the current legislation in waste management. Implementation of CEP will affect the whole waste management and the approach to environmental issues in general. It is true that at present there is information about the amount of waste, but ways of handling waste will definitely change under the influence of long-term effects of CEP. In order to correctly set up the waste management system, it will be necessary to focus on a more detailed analysis of the waste structure so as to set the recycling capacities in a better way. And these capacities will surely increase and change.

6. Acknowledgement

The article was supported by a specific university research by Ministry of Education, Youth and Sports of the Czech Republic No. SP2018/22 Risk Management Study of Industrial Enterprises in the Czech Republic.

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INNOVATION OF THE INFORMATION SYSTEM IN THE FIELD OF DATA ARCHIVING

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Keywords

OAIS – Open Archival Information System), memory institutions, digital libraries, Ingest, ARCLib, SOA (Service oriented Architecture)

Abstract

Innovation of the information system in the field of data archiving in memory institutions partially solves the problem of the rapidly growing amount of digital data. Digital content of electronic archives has to be stored in a secure way respecting guidelines for storing of archival information. The OAIS (Open Archival Information System) reference model is a well-accepted standard that serves as a starting point when building such an archive. The article describes the basic structure, functional model and data model of OAIS. The module Ingest for accepting the information packages from Producers and preparing them for storing to Archival storage is illustrated by a specific case study.

1. Introduction

Internet makes easier the previously difficult to access to information available to people today. However, there are some exceptions and one of it is information stored deep inside archives that preserve the data in its physical form (Maryska et al, 2015). Memory institutions as libraries, museums, archives and etc. understand that in order to keep up with the digitized world must be made

their custodies available for a wider area of people not only for the people physically visiting their archives. The final destination of the digitized content are electronic archives in which the data is securely preserved and available to next generations (Moravec et al. 2017).

Designing of an archival system is not an easy and straightforward process. Organizations responsible for building of an archive need to guarantee two kinds of securities, the physical security and the logical security (Kozel et al, 2012). Ensuring the physical security means making the information securely saved and protected from external threads (Chaplyha, & Nyemkova, 2017). The logical security is a more abstract term and it consists of measures and activities that ensure that the information is usable and understandable over a long period of time (Danel et al, 2013). The OAIS standard provides a model of an archive that manages to ensure both of these securities by defining a functional and a data model (Hanclova & Ministr, 2013). The OAIS stands for ‘Open Archival Information System’ and it is the name of a reference model (CCSDS, 2012) that currently serves as a well-accepted starting point for organizations interested in building long term preservation systems (Lavoie, 2000). It was created as a reflection of the need for standardization when in the process of digitization many archives appeared to have shared interests. The OAIS is a conceptual framework with the goal to achieve a high degree of flexibility and level of abstraction, it does not define any specific implementation. The first edition approved by International Organization for Standardization (ISO) dates back to January 2002 as ISO Standard 14721; in 2012 it underwent revisions and updates and was released as ISO Standard 14721:2012 (ISO, 2012). This second edition rather revised what has been introduced in the first version than brought any major updates (Lavoie, 2014). The term open in OAIS means that the negotiation during the development process was open to any interested parties. The act of long term preservation of data is not as simple as storing the data to a secure place. Without knowing the information about how the data should be interpreted, the data can become impossible to understand when retrieved after a long period of time. The context of the data is as important as the data itself. Because of that, not only the data itself needs to be stored, but also the respective metadata, with all the information necessary for making the original information useful. A major purpose of the OAIS model is delimiting what exactly is necessary to store. If an archive wants to be declared as OAIS compliant, it must meet the six responsibilities defined in the OAIS standard (CCSDS, 2012, p. 38). There is not a strict definition of what is and what is or not an OAIS archive because of the high level of abstraction given by the flexibility of the model. Most archives that declare themselves as OAIS archives do that without any external audit. If not anything more, the reference model establishes a common language that is used by the people cooperating on building archives for a long term preservation.

2. OAIS characteristic of archive

OAIS reference model elaborates archive from three perspectives:

- the first one is the OAIS environment describing the surrounding of the archive and the external entities operating with the system;
- the second one is the OAIS functional model specifying the elementary functional components of the OAIS archive and how they cooperate;
- the last one is the OAIS data model that elaborates the topic of data packages stored in the archive. It describes their structure, contents and meaning of all the necessary metadata information.

2.1. OAIS environment perspectives

OAIS archive operates in the environment consisting of three types of external entities: Producers, Consumers and Management (CCSDS, 2012, p. 28):

- *Producers* are the originators of the data that is transferred to the archive. This transfer is restricted by a Submission Agreement that specifies the conditions the data needs to fulfill before saving to the archive.
- *Consumers* are the entities accessing the information materials stored in the archive. The reference model defines a special type of consumers that is the *Designated Community (DC)*. They are the primary users intended to read the information. The concept of the DC is one of the most important parts of the OAIS model. Making the information available and understandable for the DC is the major responsibility of an OAIS archive. The scope of the DC is determining the contents of the archive, the larger is the scope, the more metadata needs to be stored with the data to make the data understandable (Ministr & Pitner, (2015).
- *Management entity* is responsible for establishing and revising the policy of the OAIS activities. This are usually the beholders of the archive. Something else are the administrators responsible for daily routine management of the archive who operate from the inside of an OAIS system.

2.2. OAIS functional perspectives

The functional model of OAIS (CCSDS, 2012, p. 44) shows the internal components of an OAIS system and the relationships between them.

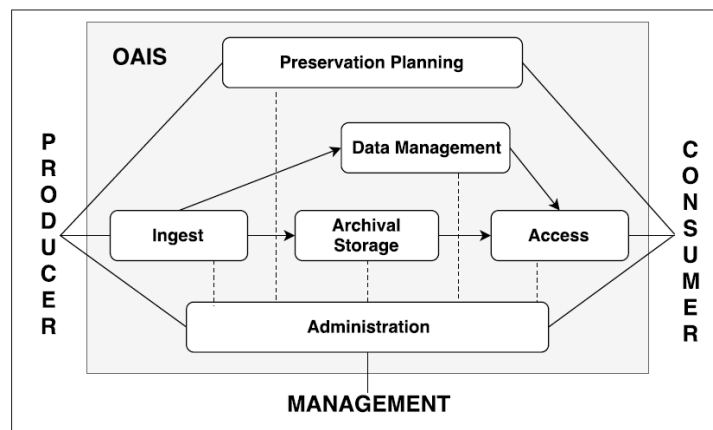


Figure 1: OAIS functional model, adapted from (Lavoie, 2014)

- *Ingest* - serves for accepting the information packages from Producers and preparing them for storing to Archival storage. This includes package transformations, validations, quality checks and adding new necessary information.
- *Data management* - provides access and control over the metadata stored in a database that are used in the lookup process of information packages (Kozel & Chuchrová, (2015). Moreover, it manages the internal OAIS's administrative data such as performance data or access statistics.
- *Administration* - is responsible for the daily management of an OAIS archive. This includes the interactions with Producers, Consumers and Management.

- *Access* - enables locating and delivering of the archived content in a suitable format to the Consumer. It provides interfaces for the lookup and access to the data as well as access control mechanisms.
- *Archival Storage* - is responsible for transferring of information packages to a persistent storage. More specifically it provides functions for storage, maintenance and retrieval of information. Besides that it supports error checking mechanism and disaster recovery.
- *Preservation planning* - monitors the environment of an OAIS archive checking for changes of expectations of the Designated Community and evolvement of access and storage technologies to ensure that the data stored in the archive remains accessible to and understandable by the Designated Community.

2.3. OAIS data model perspectives

OAIS defines a concept of information packages that are the basic archival units used by the storage and access functions. The data model specifies the types and structure of these information packages. An information package consists of the object that is the focus of the preservation and all the metadata helping the object to become securely stored, accessible, searchable, understandable and representable in the right way (Hunka & Matula, 2017). There are three types of the information packages from the point of a lifecycle of a package:

- *SIP* (Submission Information Package) is the package in the state when it is ingested by Producer to the OAIS archive. This is the initial state and the package contains only a minimum of metadata information. The exact structure of the SIP must be negotiated beforehand between the Producer and the Management of the OAIS archive.
- *AIP* (Archival Information Package) is the version of the package that is stored in the OAIS archive. In comparison with the SIP, it has a complete set of metadata associated with the stored object. The new metadata are generated during the Ingest process. From the logical point of view the object and its respective metadata operate in the system as a single object, in reality they can be stored separately and later bound logically.
- *DIP* (Dissemination Package) is the version delivered to the Consumer as a result of the access functions. It can consist of one or more AIP packages transformed to the form acceptable to the Consumer. DIP does not have to include all the metadata information preserved in an AIP package.

3. Ingest functional entity

Masaryk University in collaboration with the Czech Academy of Sciences has been involved in development of the Ingest module which is a part of the open-source system for a preservation of structured documents and its metadata for the needs of the Czech memory institutions (Lhoták, 2017).

Ingest functional entity provides the following functions (CCSDS, 2012, p. 48):

- *Receive Submission* function represents the infrastructure for a transfer of SIP from Producer to the archival system. The function returns a confirmation to the Producer after a successful SIP receipt or a request for resubmission in case of failure.
- *Quality Assurance* function validates that the SIP and all its associated files have been successfully transferred to the temporary storage area. For the digital objects this can include integrity checks.

- *Generate AIP* function transforms one or more SIPs into one or more AIPs according to the rules given by the archival system so that the resulting AIP was meeting the archives standards. The transformation consists of file format conversions, addition of new Representation Information or changing the structure of the Content Information of the SIPs.
- *Generate Descriptive Information* function supplements the generated AIP with the Descriptive Information. The Descriptive Information is extracted from the contents of SIP and complemented with information collected from other sources.
- *Coordinate Updates* function performs the transfer of the AIP to Archival Storage and the Descriptive Information to Data Management. A successful transfer of AIP to Archival Storage is followed by adding the respective storage identification to the Descriptive Information (Hunka, 2015). In case of an update of just the Descriptive Information the communication with Archival Storage can be omitted.

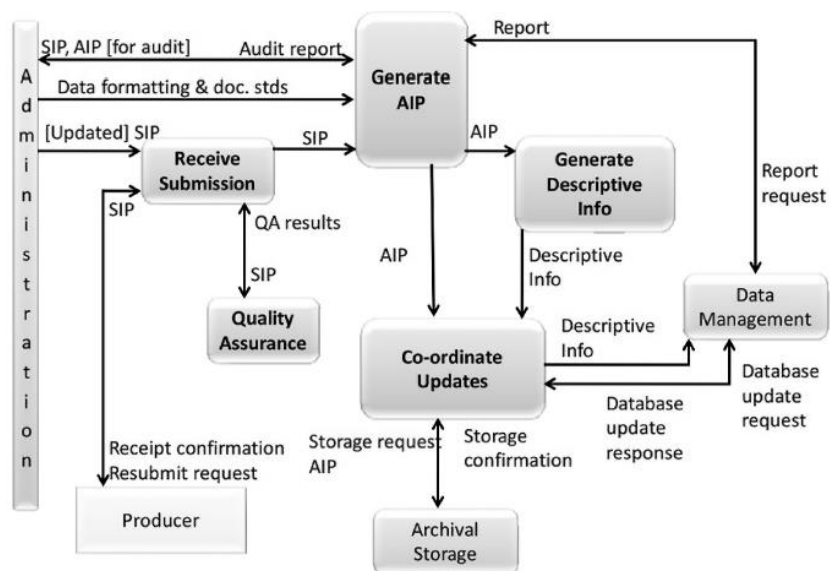


Figure 2. Functions of Ingest entity, reproduced from (Melichar, 2016)

3.1. Functional requirements for Ingest module

The project analysis consists of a list of system requirements. For a better comprehension the requirements were grouped according to the functions of the Ingest entity:

- *Receive Submission* that receives SIP packages, saves them to the temporary storage and scans their contents for viruses by an antivirus check. The input packages are created by an external application like Archivematica or ProArc. Conversion of unprocessed input data to the format SIP is not supported. If the producer owns only the scanned data and metadata it is necessary to use an external application for the SIP package creation. Prior to the SIP ingestion, the producer needs to provide the system with a corresponding Validation profile and Ingest workflow profile in case they have not already been defined previously (Rozeňal & Novak, 2017).
- *Quality assurance* consists of two phases. The first one is performed in the production systems as ProArc or Archivematica and involves a complex identification of all formats and extractions of metadata. ARCLib is receiving the SIP packages in an already pre-prepared state. The second part complements the first one and is performed by ARCLib. It consists of:
 - validation of the SIP contents and structure according to the agreement saved;

- validation of the SIP completeness by checking the fixity;
 - checks of the existence and fulfillment of all descriptive and preservation metadata;
 - control of the technical metadata extracted in the first phase for individual objects.
- *Generate AIP package* is generated as two objects, the original SIP package and an associated a metadata structure specific for ARCLib. The part generated by the system includes information about the Producer, the used Ingest workflow profile and Validation profile, audit information and result of the file format, see fig.3.

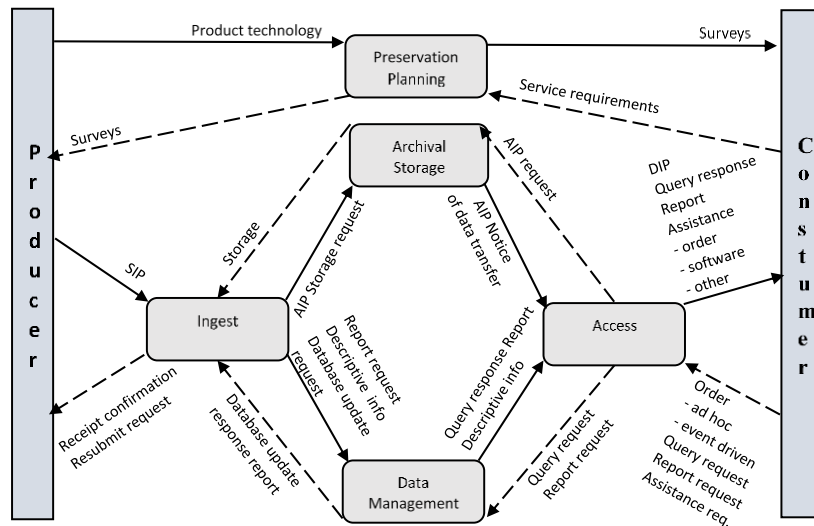


Figure 3. Data Flow Diagram of Common Services, reproduced from (Lhoták, 2017)

4. Architecture of the archive system

On base of the customer requirements the architecture has been created with high degree of modularity. Because of that it was necessary to make the architecture as modular as possible so that it was easy to replace any module without affecting the rest of the system.

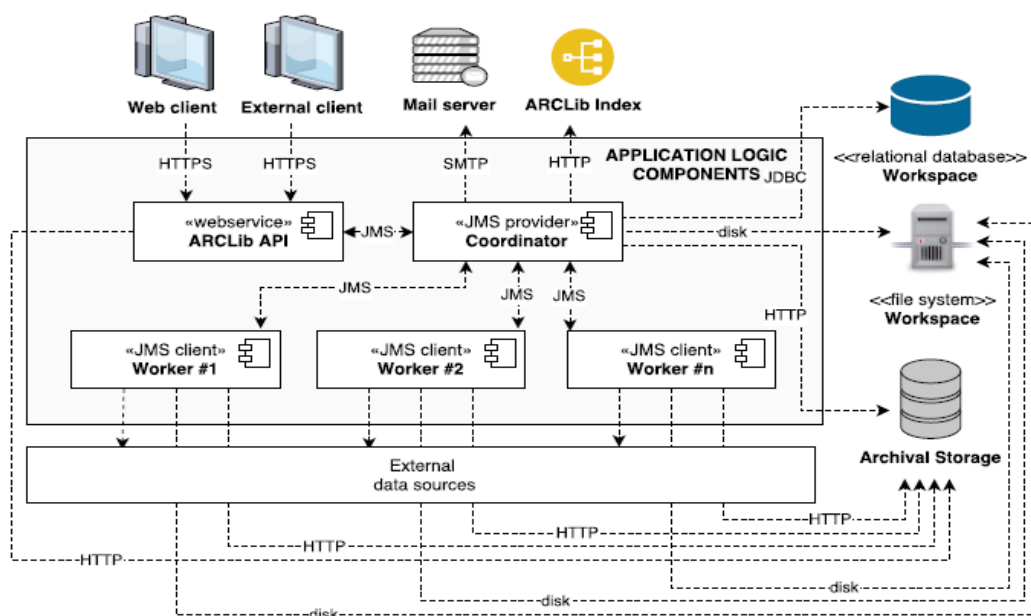


Figure 4. Architecture of the ARCLib system, reproduced from (Library of the Czech Academy of Sciences, 2017)

The design of the archive system implements the SOA (Service oriented Architecture) that is most popular design concepts to achieve module interchangeability in large systems as is shown in fig. 4.

5. Conclusion

ARCLib project is a project of the Library of the Czech Academy of Sciences whose aim is to create an open-source system for a preservation of structured documents and its metadata for the needs of Czech memory institutions. The project was initiated by the current situation in the Czech Republic where there are no complete archival solutions available except of the custom tailored commercial solutions for the big institutions like National Library of the Czech Republic.

The target users of ARCLib are regional libraries, scientific institutions, museums, galleries and archives. The system is designed in correspondence with ČSN ISO 14721 (OAIS) and will implement all the function modules of OAIS. The project is estimated to be deployed in the year 2020 in a pilot plant in the Czech Academy of Science.

Masaryk University in collaboration with producers of ARCLib system was involved in to analysis and design the Ingest module of the archive system. The performance bottleneck of an OAIS system, especially of its functional entity Ingest, is the transformation of a SIP package to an AIP package. Processing of multiple simultaneous requests for a SIP ingestion imposes high demands on the system resources. That was the reason why it was created a separate SOA service for the process of the SIP to API transformation. This enables a parallel run of several SIP ingestions. Consequently, there must be another SOA service in the system for the coordination of messages sent to perform the particular SIP ingestions.

6. Acknowledgement

This paper was supported within Operational Programme Education for Competitiveness – Project No. CZ.1.07/2.3.00/20.0296. Innovation was implemented in the following stages. The project

ARCLib solved in cooperation with Masaryk University, National Library of the Czech Republic and Moravian Library in Brno.

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INNOVATIVE METHOD OF THE CORRECTION IN HEAT DISTRIBUTION DIGITIZED DOCUMENTATION AGAINST THE ACTUAL STATUS USING THERMOVISION

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Keywords

Aviation thermovision imaging, information system, heat distribution, georeferencing, implementation of GIS

Abstract

The article describes the requirements for the GIS system implemented in the HTS heating company. During the implementation of the project, a problem with the digitization of the heat distribution documentation was identified in the form of detected deviations from the actual state. To resolve the problem, an innovative correction method was used consisting in comparing digital maps with the results of aviation thermal imaging.

1. Introduction

The company HTS, a.s. (Havířovská teplárenská společnost – Havířov Heating Company) provides heat supply for central heating and hot water preparation in the locality of the town of Havířov. Havířov is located in the Moravian-Silesian region, about 20 km east of Ostrava and has about 75,000 inhabitants. Emphasis is placed on supplying heat to all customers with minimal impact on the environment. Investments are primarily focused on increasing the reliability and quality of heat supply and reducing losses in deliveries to the population and other customers (Mikoláš et al, 2015).

The supplies are covered from the central heat production source in Karviná, owned by the company Veolia Energie ČR, a.s.

The central heat supply system in Havířov is based on a hot-water distribution system with planned hot water parameters of 160 °C/60 °C at the source, which respects the geographical situation of the town and the nature of the consumption with the prevailing housing development. This system realizes heat supply through water-water transfer stations connected to large-scale secondary distribution systems with central temperature control. Heat energy is then distributed through 76 transfer stations, 201 pressure-independent residential stations, and about 39 km of secondary thermal networks to over 20,000 households and 335,000 m² of non-residential premises in the territory of the town. In addition to heat distribution, HTS also ensures production and delivery of thermal energy from 9 local gas boilers with an installed capacity of 0.798 MWt. The heat energy consumption is measured by 1,029 ultrasonic heat meters, mostly with electronic transmission of the recorded data. HTS, a.s. has a central dispatching centre for continuous monitoring and control of the heat energy distribution grid. The control system is mainly based on the SCADA technologies of the companies Siemens, Landis+Gyr and Johnson Controls.

2. Requirements for the system and its implementation

A significant impetus for the implementation of GIS for public utility network administrators was the approval of the amendment to Act No. 183/2006 Coll. on Territorial Planning and Building Regulations. This Act imposes an obligation on the owners of the technical infrastructure to provide the town planning office with the layout of the technical infrastructure in the coordinate system of the Uniform Cadastral Trigonometric Network in the graphical version (Hunka & Ministr, 2013). For energy companies this meant, among other things, the obligation to digitize their analogue documents.

2.1. Requirements for GIS

The direct users of the proposed GIS in HTS a.s. are the employees of the Information Technology Department, whose main job function is to administer the project documentation of the technical infrastructure. The most important tasks that the GIS should cover are:

- viewing HTS, a.s. installations above map data,
- transfer of data of the Town Hall of Havířov,
- provision of infrastructure information to third parties,
- preparing documentation for planning repairs and investment
- making the location of central heat supply underground elements more accurate

The primary task being resolved by GIS is to display installations administered by the company HTS, a.s. above the reference map data. The aim is to make a clear plot indicating the crossing of the distribution lines and to easily detect their Z coordinates (depth of the underground placement).

The system is required to plot the symbol of the piping according to the way its route is detected, i.e. the visual differentiation of the thermal network, which is determined by geodetic measurements, from the pipelines whose route is derived from the design documents or is estimated, for example, due to missing drawing documents.

The following items have also been included among the following GIS features:

- display of labels - basic information on the HTS a.s. technical infrastructure, such as piping dimensions (whether it is a two- or four-pipe line, etc.);
- finding information about displayed installations;
- measuring distances and areas;
- searching for installations;
- printing of general layouts or individual cut-outs even in formats larger than A3.
- finding out the volume of excavation work - this information is necessary for planning investments and addressing possible thermal network failures (Kozel & Chuchrová, 2015). It is sufficient to know the depth of the piping placement and the information in which construction part of the design documents the technician will find additional data: excavation width, piping material, method of distribution storage (in a collector, heating channel or pre-insulated in the ground)
- spatial analysis - in particular, the creation of protective zones around the thermal conduction and the identification of the owners of the plots of land through which the distribution network passes
- editing data to make information about technical infrastructure installations more accurate
- operational failure correction - providing basics for troubleshooting
- processing data located by means of a GPS receiver - locating technical infrastructure installations is performed by a GPS receiver up to the accuracy of 0.5 m; locating and defining the routes of the distribution lines using installations visible on the surface, such as shafts, entrances, entrances of piping to buildings, etc. The frequency of the measurement is 2 to 3 hours per week.

For the implementation of the GIS, ArcGIS software of the company ESRI has been selected in HTS.

2.2. Stages of implementation

- Data preparation - at this stage, the Land Cadastre data and the reference data of address points, access roads and street networks were prepared and passed on.
- Processing the data of HTS installations - within this stage, the data of HTS installations was processed from available documents, in accordance with the elaborated data model and identified user requirements.
- Processing the orthophotomap of the HTS secondary heat distribution - during this stage, the concerned data was obtained using the aviation data acquisition system and adapted for the needs of the GIS. For aviation data acquisition it was necessary to have special conditions (suitable vegetation period and weather conditions).
- Implementation of the data into the GIS - during the implementation, the data was modified for the application layer, legends were created, queries were defined, and special print assemblies were made.
- Purchasing ESRI products - in order to maximize efficiency in the field of product guarantees and financial management, the purchase of ESRI products was matched with the stage of implementing data into the GIS.
- GIS implementation in HTS - this stage included the actual implementation of the GIS in the company, installation, setting of specific users and setting of access rights.

- Training on ESRI products and application software - within this stage, the users were trained and certified in using ESRI products in the company ARCDATA Praha (Prague) and they also completed application software training, led by the representatives of the implementer. The company ORACLE trained by the GIS administrator for database work.
- The GIS test run - the stage included the system test run at the customer, output printing, identifying problems, comments, and removing them.
- Launch of routine operation - this stage included the launch of the GIS in HTS, a.s. in routine operation across all departments of the company's organizational structure.

3. Definition of the problem

During the implementation of the project a problem was identified - the differences between the original design documents of the heat distribution infrastructure and the actual state were identified.

4. Method and solution used

To solve the problem of the differences between the documentation and the actual state, a method of correcting the digital documentation was designed by performing aeronautical imaging of the space with infrastructure and subsequent imaging of this space by means of thermovision. Due to the nature of the infrastructure (heat distribution), it was possible to make the correction under suitable climatic conditions by comparing the GIS documents, orthophotomaps from the imaging and the thermograms of distribution in the case of significant deviations.

4.1. Aerial imaging

By converting the images from central to orthogonal projection and by placing them in the coordinate system, so-called orthophotos are created. The photos must be taken in certain weather. Orthophotos carry a large amount of information, the advantage is also the ability to repeat imaging after a certain amount of time and to monitor changes in the area under consideration (Peňáz, 2012).



Figure 1 Digital UltraCamX large format camera [Photo: Moravec]

The imaging took place in the early vegetation period with good visibility and favourable weather using a UCX Combi digital photogrammetric camera (Figure 1) and a Cessna 206 aircraft. Two levels of the resolution were acquired for GIS purposes, the more accurate one copying the route of

secondary heat distribution. Due to the imaging scale, the aircraft flew 690 m above the site terrain with the required resolution of 1 pixel - 5 cm. In photos with a 10 cm pixel, the flight height was 1380 m above the terrain surface. The acquired data was processed into a map according to the sheet line system and digitization of the above-ground elements and georeferencing was carried out.



Figure 2 Orthophotomap of a part of the town of Havířov - transfer station PS 58 [Author: Moravec]

Figure 2 shows an example of an orthophotomap of a part of the town of Havířov. The underground heat pipe drawn as a separate layer above the orthophotomap can be seen in more detail.

4.2. Thermovision



Figure 3 Demonstration of monitoring of underground elements of the central heat supply system distribution, PS 58 area [Author: Moravec]

During the night hours, in suitable weather (freezing without snow), the aerial thermal imaging of a part of Havířov was carried out to monitor the underground elements of the central heat supply system distribution (Figure 3). Infrared images are visualized using RAIN or IRON colour models, possibly greyscale (Neustupa et al, 2015).

More than 6000 aerial photographs were acquired by a thermal imaging camera in a total of 47 flight axes. The images were evaluated and subsequently processed into a complete thermovision map after georeferencing of the orthophotomap.

4.3. Georeferencing

Georeferencing is the expression of spatial references - the process of determining the relationship between the data position in the instrument coordinate system and the geographic (map) position on the raster image.

For the successful identification of the above-ground elements and the subsequent georeferencing, it was necessary to provide the visible above-ground elements with unambiguous signalling (Peňáz & Lazecký, 2015). The HTS project team implemented the signalling of the distribution above-ground elements by its own employees. More than 900 above-ground elements were identified in the terrain, especially collector entrances, covers and shaft lids. The HTS project team then elaborated an overview that locates individual elements in the reference map for easier traceability when processing the orthophotomap by the contractor.

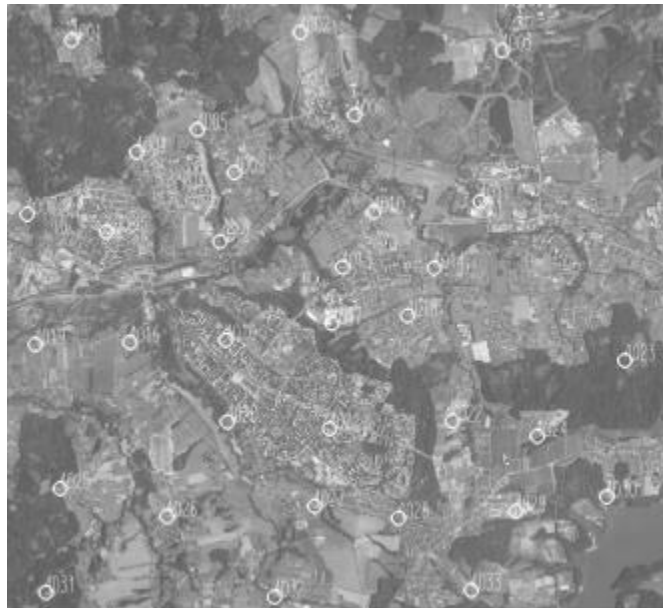


Figure 4 Locating the ground control points

Subsequently, ground control points were acquired geodetically over the town of Havířov. A sample of the acquired ground control points is shown in Figure 4. These points were used for the georeferencing of aerial images. Based on the thermal imaging of the site, the GIS documentation was then corrected. An example of the correction of the documentation by thermal imaging is shown in Figure 5. The white colour marks the original state of the heat conducting piping route according to the paper documentation, the grey colour indicates the actual state, which is located by aviation thermal imaging.



Figure 5 Correction of the documentation in the GIS system using thermal imaging [Author: Moravec]

5. Discussion of the results

Before the GIS implementation, the technical infrastructure was plotted based on the drawings which HTS, a.s. had at its disposal. This drawing documentation was created in the period from 1950 to 1980. It was not in digital form and was characterized by spatial deviations of 1 - 2 m or more. Moreover, the drawings did not always capture the actual situation of heat distribution placement. With the help of the implemented GIS, which offers incomparable capabilities compared to traditional paperwork, different types of selections and outputs that are based on spatial properties or corresponding attributes can be performed. The GIS has replaced work with conventional drawings with all the data taken over and provided dynamic map work.

When requesting a statement about the existence of networks, where the output is a plot of the layout according to the localization performed, it took an average of 50 to 100 minutes to process an application without the GIS system. After the system was deployed, the response time for requesting a statement about the existence of networks decreased to 25-35 minutes.

Havířovská teplárenská společnost, a.s. fulfils its statutory obligations at regular time intervals. In accordance with the provisions of Section 161 and Section 185 Subsection 2 of the Building Act, which requires data providers to transmit this data in digital form (vector data installed in the Uniform Trigonometric Cadastral Network system in the cadastral map scale), HTS, a.s. started to pass data sets in the ESRI format. This format is the most widely used format for administering and maintaining a database of technical infrastructure data today (Pitner & Ministr, 2015). The Department of Spatial Development, which further processes the data submitted, stated that the data sets handed over by the company HTS, a.s. is of high information value, it is topologically clean and meets all the required standards with respect to quality and descriptive information. Compared to the data of another heating company, which also has its networks in the administrative area of the statutory town of Havířov, the descriptive information of HTS, a.s. is much more detailed and comprehensible.

6. Conclusion

The implementation of the GIS system, as well as its outcomes described in the article indicate that even projects that do not generate direct financial returns can be highly significant due to their impact on the organization. Account must be taken of their contribution to key services within the company and the support of the organization's strategy. Thanks to the implementation of the GIS system, Havířovská teplárenská společnost, a.s. is ready to participate in a reciprocal exchange of data in the area of interest with other utility administrators.

Thanks to the innovative use of thermal imaging, the digitized heat distribution documents have been made more accurate and corrected according to the actual state. This has contributed to a higher quality of the data provided.

Significant speeding up of the process of data transfer to territorial analytical documents, as well as the implementation of statements about network impact or expert opinions on changes in the heating system, such as disconnection requests, contribute notably to the increase of labour productivity. The processes of day-to-day operations, including emergency services and leakage searches, have been greatly speeded up compared to paper work; in addition, preparation in the area of investment planning and administration of estates is more accurate. The Geographic Information System is currently being used as a support tool for all professions whose work involves the use of technical documentation. Thus, the GIS is already used routinely by a wide range of technical professions across the organizational structure of Havířovská teplárenská společnost, a.s.

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BUSINESS MODEL INNOVATION IN SMES IN SLOVENIA

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Keywords

Business model, business model innovation, micro, small and medium sized enterprises

Abstract

Business model innovation is becoming one of key activities that have to be performed by every enterprise, to remain competitive in rapidly changing business and technology environment. This paper presents result from research conducted in 2016 and 2017 among Slovene micro, small and medium enterprises, which already have experiences with business model innovation. In our study, we have analyzed areas of business model innovation, level of support for business model experimentation in enterprises, role of business model innovation, source of ideas for business model changes, and internal and external drivers for changes in business models. Results of the study revealed low level of systematic and continuous business model innovation among Slovene micro, small and medium enterprises.

1. Introduction

Rapid, continuous technological development and innovation, as far as disruptive environmental changes determine nowadays digital economy. In digital economy, business is run predominantly in digital way. Digital business exceeds digitization of data and business documents. Digital business can be defined as new business design, where boundaries between physical and digital world are more and more blurred (Raskino & Waller, 2015).

Digital technologies (such as internet of things, mobile technologies, social media, HPC, cloud computing, artificial intelligence, virtual reality, machine learning, big data and analytics, intelligent systems and applications, digital platforms, 3d printers, robotics etc.) have significant impact to the way how business is conducted, they impact on our lives and are reflected in overall society.

The exploitation of digital technologies lead enterprises to digital transformation, which is defined by ability to redesign business activities, processes, competences and business models. Results are reflected in improved efficiency, digitization and automation of business processes, new products and services and improved customers experiences. In addition, digital technologies bring numerous potentials for business model design and innovation, including of digital business models (Raskino & Waller, 2015).

In digital economy, business model innovation is one of key activities, that has to be continuously undertaken in every enterprise, either to survive or to achieve growth (Hanelt, Hildebrandt, & Polier, 2015). In practice, there are evidences of numerous successful business models (e.g. Google, Apple, IBM, production enterprises with digitalized products and services and implementations of internet of things, etc.) and even new, disruptive digital business models as for example Uber, Airbnb, Etsy, ... However, there are also examples of unsuccessful business models (e.g. Kodak, Nokia, etc.). Therefore, it is of huge importance for every enterprise to continuously evaluate, re-think, re-design and innovate the way how value is created, captured and delivered (Amit & Zott, 2012; Florén & Agostini, 2015; Teece, 2010).

Business models have raised interest of researchers in 1990 (Morris, Schindehutte, Richardson, & Allen, 2006). Since then, many researches have been done in the field of business model design and innovation. However, many researchers claim that there is still lack of research in this field (Carayannis, Sindakis, & Walter, 2014). Many enterprises still struggle on how to systematically and continuously approach to business model innovation (Barjak, Niedermann, & Perrett, 2014; Florén & Agostini, 2015). However, rapid technological and environmental changes demands continuous flexibility and innovativeness of enterprises.

The European Commission report “The Need for Innovations in Business Model – Final Policy Brief” (Barjak et al., 2014) has shown that many enterprises in Europe still lack of awareness and knowledge of proper methods and tools for systematical approach towards business model design and innovation. Especially the situation is alarming in SMEs (Envision, 2015), which represent 99% of European marketplace and are key potential for economic growth, innovation and employment (European Commission, 2014). Recent report of OECD (OECD, 2015) has revealed that SMEs often lag behind when it comes to adoption of digital technologies and less likely innovate their business model (Barjak et al., 2014). The report points out that business model innovation is a complex phenomenon that requires in-depth research of best practices and drivers that promote the innovation of business models. It also draws attention to the importance of education and training, the presentation of good practices and the provision of support to SMEs to boost business model innovation (Barjak et al., 2014).

These problems were addressed in the European project »ENVISION – Empowering SME business model innovation«. The ENVISION project aimed at activating SMEs to innovate their business models. In the current economic environment, business model innovation could accelerate the revenue growth of the European SMEs. During the duration of the project, which has ended in February 2018, the partners also carried out a survey on the situation in the field of business model innovation among SMEs. The paper presents the results of the research, which was carried out in 2016 and 2017 in micro, small and medium sized enterprises in Slovenia. The purpose of the paper is to present the current situation in the field of business model innovation in SMEs in Slovenia. First, we present characteristics of enterprises that participated in the survey, which is followed by detail presentation of areas of business model innovation, level of support for business model experimentation in enterprises, role of business model innovation, source of ideas for business model changes, and internal and external drivers for changes in business models. The paper proceeds with literature review, followed by research methodology. After that we present research results and provide discussion and conclusions.

2. Literature review

There are many definitions of business models. Osterwalder & Pigneur (2010, p 14) define business model as a way in which enterprises create, provide and capture value. Broader meaning of business models implies that other organizations connected to observed enterprise through value chains, need

to be considered (Pucihar, Lenart, Borštnar, Kljajić, & Marolt, 2015). Bouwman, Vos, & Haaker (2008) present wider definition of business model. Business model is the foundation for design and production of product or service, for planning value proposition for different types of customers, types of income, enterprise architecture for ensuring products or services, including processes, resources, financial deals between stakeholders, and description of roles and divide of revenues and costs amongst them (Bouwman et al., 2008).

Based on previous research, there are various definitions of business model innovation. Florén & Agostini (2015) define business model innovation as a process of implementing changes into existing business model, which often result in lower costs and increased value for customers (Teece, 2010).

In our research, we define business model innovation as changes in business logic that are new to the studied enterprise (but not necessarily new to the world). These changes of business logic are visible in various elements of business model (Pucihar, Kljajić Borštnar, Heikkilä, Bouwman, & De Reuver, 2015).

Many researchers tried to establish models for classification of business model innovation practices (Giesen, Berman, Bell, & Blitz, 2007; Lindgardt, Reeves, Stalk, & Deimler, 2009). Many of them offered frameworks for analysis of business model innovation (Harry Bouwman, Macinnes, & Reuver, 2010; Bucherer, Eisert, & Gassmann, 2012; Florén & Agostini, 2015). Mentioned frameworks focus primarily on: drivers for business model innovation (Bucherer et al., 2012; Carayannis et al., 2014), key elements of business models that enterprises decide to change (Florén & Agostini, 2015; Mahadevan, 2004) and approaches to business model innovation (Bucherer et al., 2012; Florén & Agostini, 2015).

Main drivers for business model innovation in enterprises are often linked to lowering costs and to increase flexibility (Pohle & Chapman, 2006). Other drivers for business model innovation are new technology, competition, legislation, etc. Many authors differentiate between internal and external drivers for business model innovation (Bucherer et al., 2012; Sorescu, Frambach, Singh, Rangaswamy, & Bridges, 2011) and between internal and external opportunities and threats (Bucherer et al., 2012; Carayannis et al., 2014).

These drivers influence on changes of key elements of business models, that are defined in business model ontologies (Harry Bouwman et al., 2010; Johnson & Christensen, C. M. Kagermann, 2008; Skarzynski & Gibson, 2008). Level of changes key business model elements leads to various forms of business model innovation. Some authors differentiate between incremental and disruptive business model innovation (Comes & Berniker, 2008; Markides, 2006), others advocate that business model innovation consists of gradual phases, that are more frequent than radical changes (Bucherer et al., 2012; Florén & Agostini, 2015; Schaltegger, Lüdeke-Freund, & Hansen, 2012).

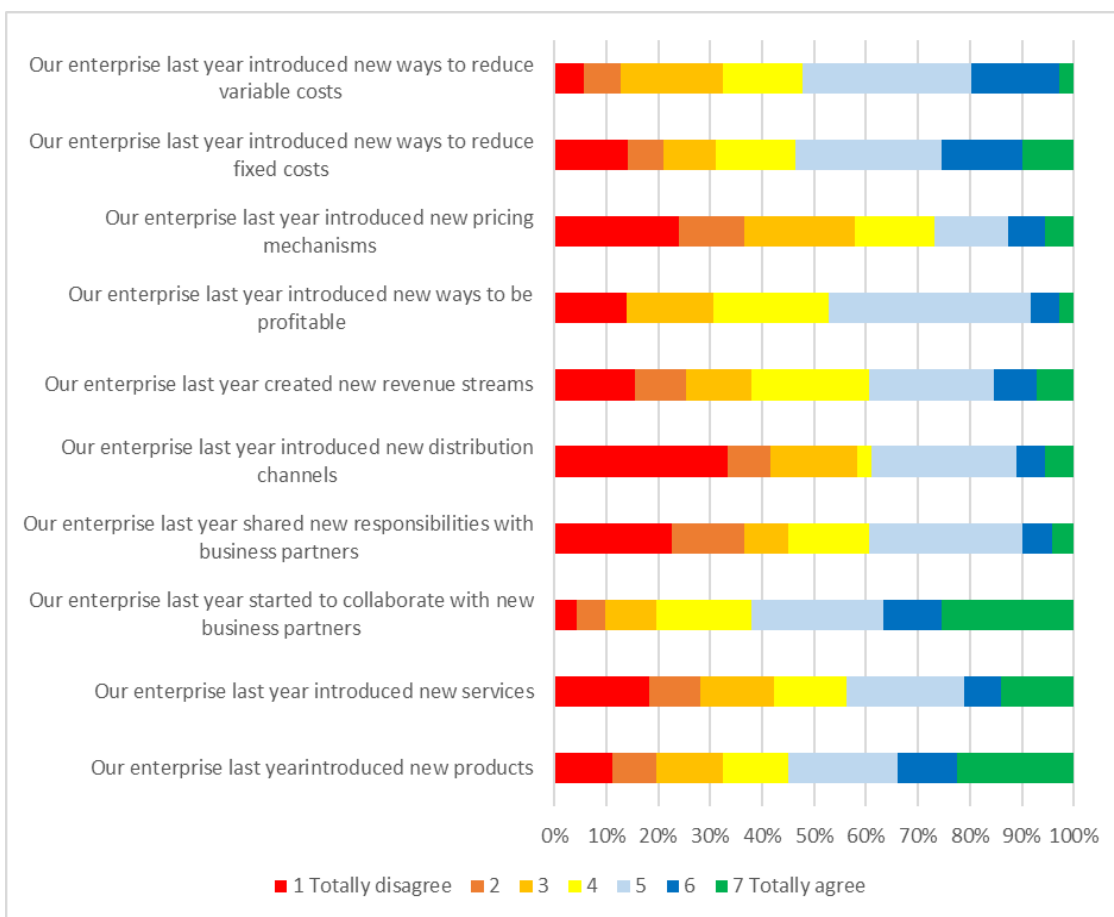
3. Research methodology

The survey was conducted among SMEs in Slovenia in 2016 and 2017. This paper presents the results of those companies that already have experiences in business model innovation. In this study, there were 88 enterprises identified with prior experiences with business model innovation, however 71 completed the whole questionnaire. Out of 71 enterprises, 37.2 are micro enterprises (1-9 employees), 38.5% are small businesses (from 10-49 employees) and 24, 4% are medium-sized enterprises (from 50-249 employees). Mostly represented industry was building and construction (17.6% of enterprises), followed by manufacturing (14.9% of enterprises), trade (13.5% of enterprises) and enterprises from tourism (accommodation and food providers) (9.5% of enterprises). Other industries are less presented.

In micro and small enterprises, the respondents were the owners or managers. In the case of medium-sized enterprises, the respondents were managers, which are responsible for business model innovation. The respondents evaluated each question in the questionnaire with 7 point Likert scale, from 1 meaning totally disagree to 7 meaning totally agree.

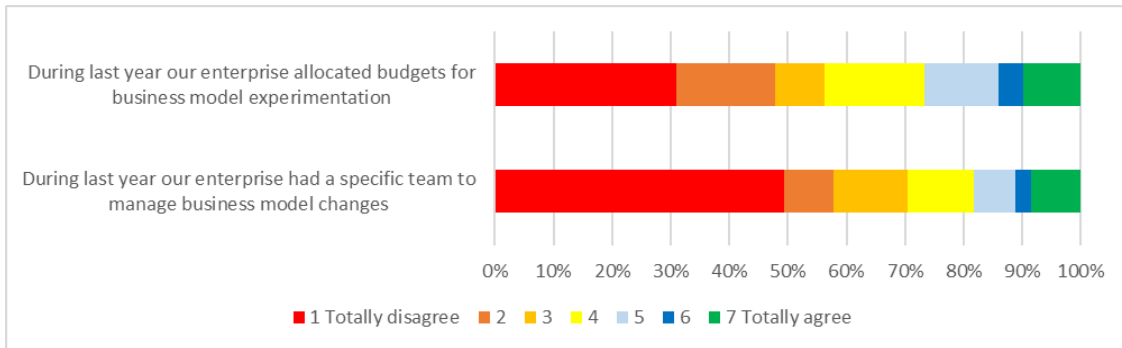
4. Results

25% of enterprises have innovated their business models in the last two years. Graph 1 shows the areas of business models innovation in surveyed enterprises. The data indicate that enterprises mainly started to cooperate with new business partners, developed new products and services, introduced new distribution channels, reduced fixed and variable costs, and provided new ways of profitability.



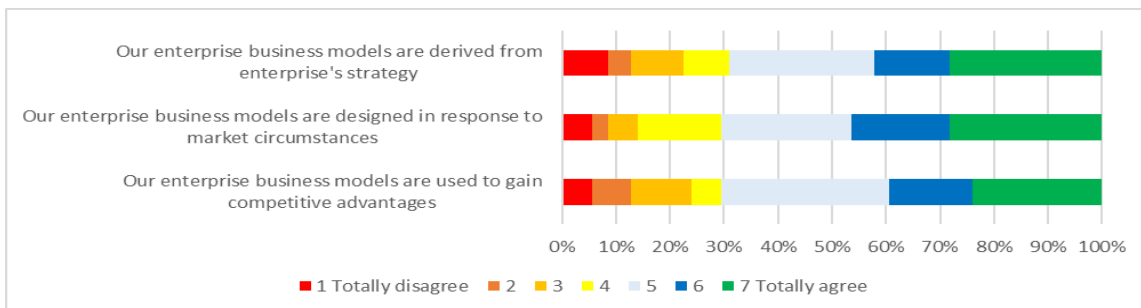
Graph 1: Areas of business model innovation in the last 2 years

Enterprises have supported business model experimentation in different ways. However, data show that most of the enterprises did not allocate special budgets for that purposes and not either had specific team to manage business model changes. Detail data are presented in Graph 2.



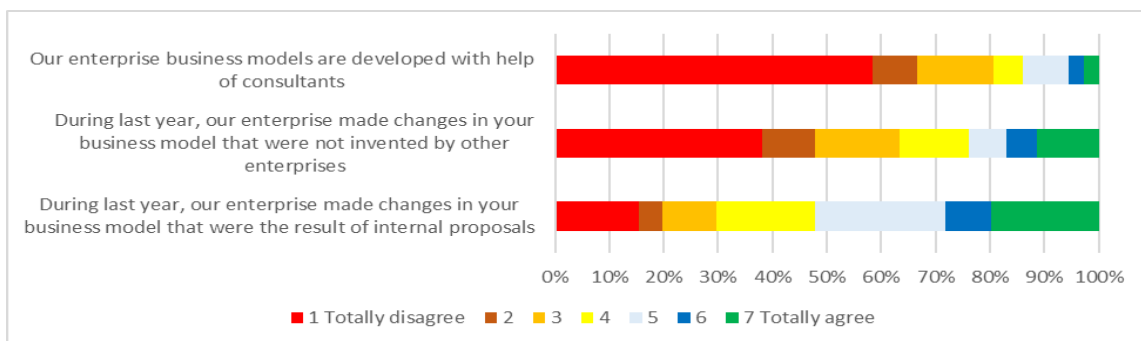
Graph 2: Support for business model experimentation

Enterprises in general consider that business models derive from the enterprise’s strategy. They develop business models as a response to market conditions to gain competitive advantage. Detail results are presented in graph 3.



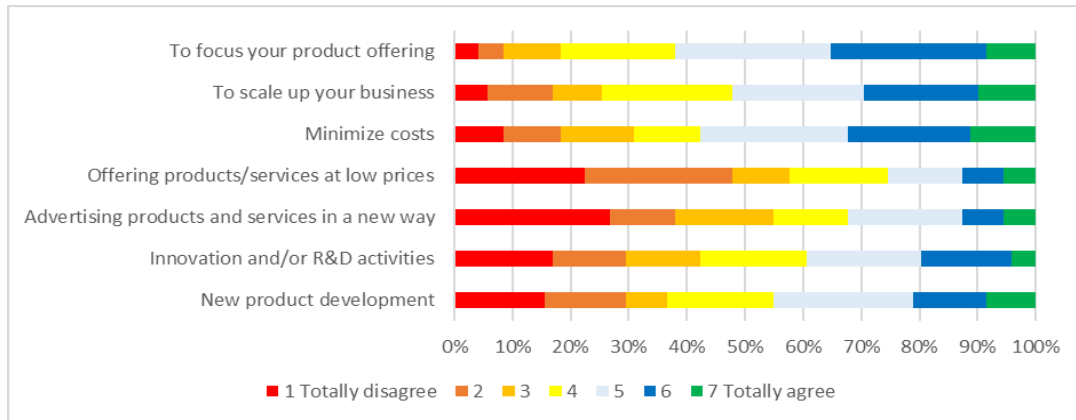
Graph 3: Role of business model innovation

Enterprises mostly innovate their business models based on their own ideas and less likely use the external expertise for that purposes. Detail results are presented in Graph 4.



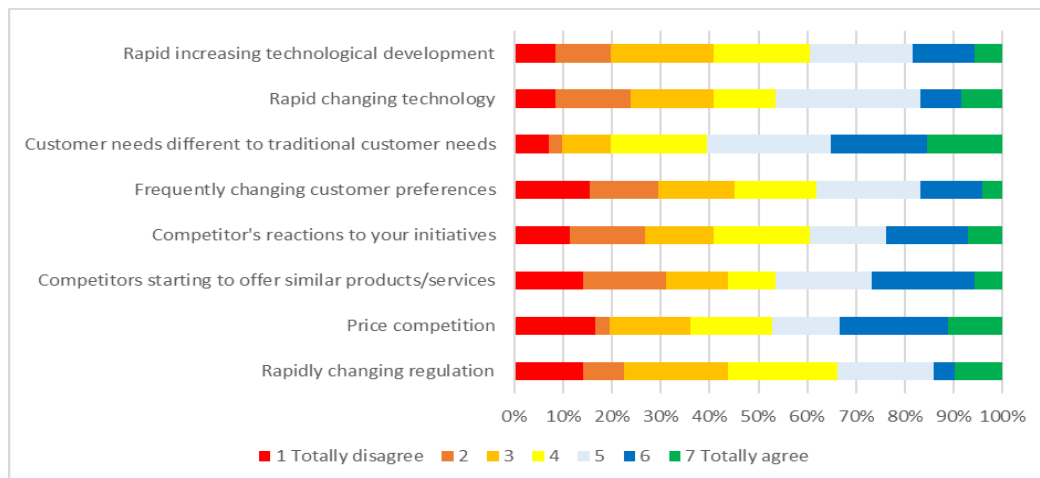
Graph 4: The source of ideas for business model changes

The opinions of the enterprises on internal drivers that motivated the change in their business models differ. Enterprises agree to the highest extent that these factors were especially: focusing the product / service offering, minimizing costs, new product development and to scale up their business. The details are shown in Graph 5.



Graph 5: Internal drivers for changes in business models

Among the external drivers, the following factors prevailed: customer needs different from traditional customer needs, similar products and services provided by competitors, price competition, rapid changes in technology and technological development (Graph 6).



Graph 6: External drivers for changes in business models

5. Discussion and conclusions

Paper presents results of survey conducted on a sample of 71 micro, small and medium enterprises in Slovenia, that already have experiences in business model innovation. Results have shown that only 25% of enterprises innovated their business models in the past 2 years. Interestingly, most enterprises did not assign specific team or budget for business model experimentation. Despite that, most enterprises are innovating and developing their business models through ideas, suggested by their own employees. Enterprises mostly understand that business models result from strategy and are developed as a response to market demands to gain competitive advantage.

Most enterprises agree that internal drivers for changing of business models were predominantly: focusing the products/services offering, minimizing the costs, development of new products and scaling up business. Most prevalent external factors were related to the needs of customers that differ from needs of traditional customers, similar products and services offered by competition, price competition, fast changes in technology and technological development.

Results of our survey imply lower degree of systematic and continuous approach to business model innovation amongst micro, small and medium enterprises. Finding the enterprises with experiences

in business model innovation for our survey was challenging and time consuming. This confirmed our expectations that many SMEs still do not perform business model innovation and have little or no knowledge and awareness of its needs. Furthermore, the results of our study have shown that majority of surveyed SMEs are not aware of approaches and tools that are available and suitable for business model innovation. This finding confirms that business model innovation is still a complex area (Barjak et al., 2014) and that many managers find business model innovation as a challenging area (Giesen et al., 2007). In addition, as already exposed by Florén & Agostini (2015), many enterprises have difficulties in finding proper approaches, methods and tools for systematic business model innovation.

To overcome these challenges, better understanding of drivers that encourage SMEs for business model innovation is needed. It is also important to have an in-depth understanding of good practices and approaches implemented by successful enterprises. Special attention should be paid to the education and training of micro, small and medium-sized enterprises. There is also a need to create a supportive environment for SMEs to boost their innovation potential. This environment should link various stakeholders from universities and institutes to regional development agencies, chambers of craft and commerce and other potential partners.

Presented survey has also limitations, which implies opportunities for future research. First, relatively small number of enterprises with previous experiences in business model innovation were identified and included in the survey. In the future, sample size should be increased and possibly extended to enterprises in other countries. As the business model innovation is still a relatively new and fast developing phenomenon, in depth case studies could support to gain deeper understanding of drivers, approaches, tools, methods and practices of business model innovation in SMEs.

6. Acknowledgement

The work leading to these results has received funding from European Community's Horizon 2020 Program (2014-2020) under grant agreement 645791. The content herein reflects only the authors' view. The European Commission is not responsible for any use that may be made of the information it contains.

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SMART SYSTEMS EVERYWHERE – INTELLIGENCE, AUTONOMY, TECHNOLOGY AND SOCIETY

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Keywords

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 Anything Everywhere – that’s 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 integrated into every day devices. Comfort, health, services of all kinds, safety, security and privacy of people depend increasingly on these. The challenges have been e.g. taken up by AIOTI, the Alliance for Internet of Things Innovation, or ARTEMIS, EPoSS and AENEAS, the three industrial associations in the ECSEL Joint Undertaking, with an industry-oriented European Research Program, and many national programs, e.g. by BMVIT (Austrian Ministry of Transport, Innovation and Technology). Highly automated or autonomous smart interacting systems are becoming the main drivers for innovations and efficient services. The impact on society and economy is tremendous and will change our way of living and economy in a disruptive manner, and we will face not only benefits but also new hazards and risks. Dependability (safety, reliability, availability, security, maintainability, resilience, etc.) in a holistic sense becomes an important issue. Artificial Intelligence, Machine Learning, Big Data and open, adaptive systems in a rather unpredictable environment are key challenges for systems of systems.

The paper will try to provide an overview not primarily on technological but also on some economic, societal and ethical aspects of highly automated and autonomous system in a changing world, hopefully better than the “Brave New World” of Aldous Huxley or “1984”.

1. Introduction – Smart Systems as Key Elements of Digital Transformation

Smart Anything Everywhere – that is the new hype on IoT, Internet of Things, combined with Intelligence, Autonomy and Connectivity. Smart Systems are digitalized – and part of the progressing trend towards a digitalized world, the so-called “Digital Transformation”. This covers all aspects of economy, industry and living, examples are (without prioritization):

- Smart Production/Manufacturing,
- Smart Health,
- Smart Mobility,
- Smart Farming,

- Smart Energy,
- Smart Critical Infrastructures
- Smart Cities/Homes/Buildings,
- Smart Construction (of buildings by smart machines and robots)
- Smart Living for Ageing Well,
- Smart Wearables,
- Smart Water Management, or even so curious ideas like
- Smart Food Production (e.g. by 3D-Printing!)
- Etc.

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”. On European level, organizations like AIOTI, the Alliance for Internet of Things Innovation, which takes care of the IoT aspects in 13 Working Groups, or the industrial associations ARTEMIS (Advanced Research and Technology on Embedded Intelligent Systems), EPoSS (European Technology Platform for Smart systems Integration) and AENEAS (Association for European Nano-Electronics Activities), which are the private partners in the ECSEL Joint Undertaking, a European PPP within Horizon 2020 (Public-Private Partnership) with an industry-oriented Research and tri-partite Funding Programme, take care of further development of research, standardization and promotion of these topics, together with the European Commission and national funding authorities (therefore “tri-partite”).

The digital transformation of European business and society is a major goal of the EC. EC Growth, the DG (Directorate General) for Internal Market, Industry, Entrepreneurship and SMEs, considers digital transformation as a key element for European growth, because Europe can build on its strength in traditional sectors and can take up the potential and challenges of advanced digital technologies. Technologies considered in this context are IoT, big data, advanced manufacturing, robotics, 3D printing, blockchain technologies and artificial intelligence (see (EU, 2016), European Commission, “Digitising European Industry – Two years after the launch of the initiative”). Additionally, DG Growth delivers an annual report on standardization, e.g. the “Rolling Plan on ICT Standardization”, which includes most of the relevant areas in this paper’s context and is a key pillar in Digitalization, and have started a Joint Initiative on Standardization (JIS) http://ec.europa.eu/growth/single-market/europeanstandards/notification-system_en, although they do primarily consider the European SDOs (Standardization Organizations, ESOs) CEN, CENELEC and ETSI, comprising

- Awareness, Education and Understanding about the European Standardization System i.e. increasing the use of standards and participation in the process at all levels
- Coordination, Cooperation, Transparency, Inclusiveness, i.e. ensuring adequate, high-quality, user-friendly and timely European standards
- Competitiveness and International dimension, i.e. standards supporting European competitiveness in the global markets.

DG CONNECT, DG for Communications Networks, Content and Technology, has a strong focus on “Digitalization of European Industry”, with the pillars IoT (physical meets digital), Big Data (value from knowledge) and AI and Autonomous Systems (which is somehow a revival of AI in a new

context and now considered as the “next digital revolution”). The links between technologies are shown in Figure 1 (Source: (EU, 2017) European Commission, “Digitising European Industry – Digital Industrial Platforms”, Final Version, Aug. 2017).

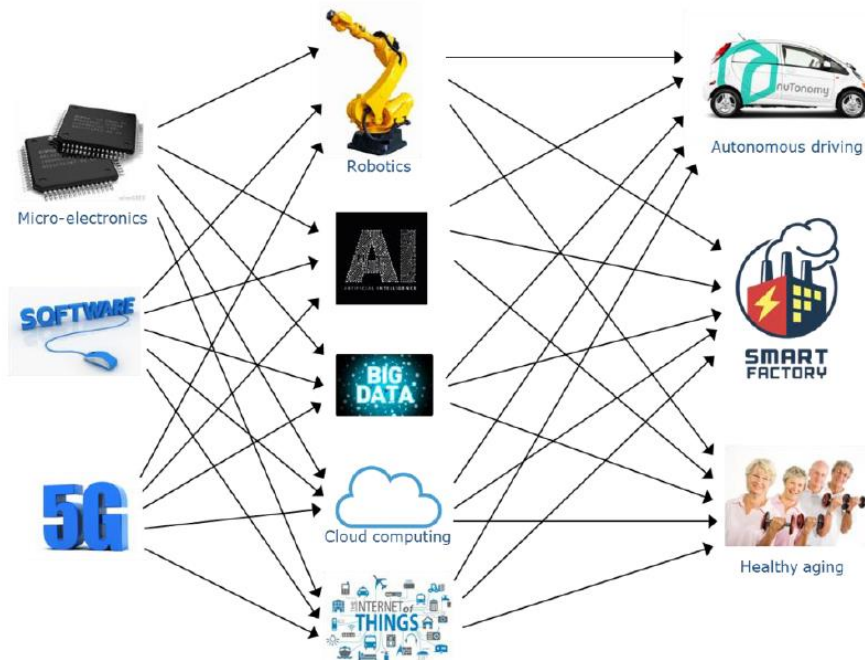


Figure 1: Links between technologies (source: European Commission, “Digitising European Industry – Digital Industrial Platforms”, Final Version, Aug. 2017)

In many European countries, many related initiatives have been started (see Figure 2)



Figure 2: National initiatives for Digitizing European Industry in EU (Source: EC, “Digitising European Industry – Two years after the launch of the initiative”, Brochure March 2018)

2. Highly Automated/Autonomous Systems – Challenge for our Future

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", which is not per se "knowledge", but nevertheless 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. Movies from YouTube are often informative or funny, but on the other hand anybody can upload nonsense, lies and conspiracy theories, which already without the seemingly plausibility of a movie were dangerous in the past (see Wikipedia https://en.wikipedia.org/wiki/Conspiracy_theory). There are studies (Brian, 2017), 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, and countermeasures are often impossible – "the net never forgets", as Facebook has proven, although it was illegal according to European Privacy Laws not to delete completely contents everywhere if the generator wants to have deleted it. And anyway, you cannot delete illegal or fake contents that has been downloaded.

Autonomous systems have a property that is new to ICT systems – they have to decide on basis of data provided to them based on algorithms (particularly neural networks, big data, and AI methods), where predictability of dependability properties (safety, security, resilience) is not possible today or difficult to prove. The dependability of results of such decisions is a major obstacle to implementation of fully autonomous systems without human control – and liability issues are difficult to handle in a fair manner. This raises severe ethical questions as well, additionally to all technical questions, – how to decide in a no-win situation? Several models have been discussed, some ideas are:

- Model the average human behavior (whatever this means)
- Define priorities whom to protect (e.g. the people in the autonomous vehicle, or the VRUs (vulnerable road users) like cyclists or pedestrians)
- To put liability on the designer of the rules or software (the "programmer")

Each of these proposed solutions has drawbacks. A few principles and recommendations will be discussed later under "Ethical considerations". Anyway, there are challenges beyond the purely technical questions – they have severe societal and legal impact, and a joint international approach would be appreciated to serve people with products and solutions that can be well accepted all over the world.

A critical part of the AI game is "Machine Learning". ISO/IEC JTC1 SC42 ("Artificial Intelligence") has recently started a New Standardization Work Item (NP AWI 23053) "Framework for Artificial Intelligence (AI) Systems Using Machine Learning (ML)". This is a first approach to provide some

structure to such systems; the resulting Specification or Standard should be the starting point for further work towards safety and security considerations of such systems, and include later on ethical considerations as well. The framework provides in the first draft some process model for ML which particularly looks at the “training” perspective of such systems. I want to emphasize that these are initial considerations and not a final document, but at least for the discussion at this conference it seems to be a worthwhile input. It is important to notice that the semiconductor industry has already taken up some ideas, the most important one being the idea that a well training neural network as AI component should be validated and then put into silicon – a module representing some behavior like a “basic instinct” in nature (“reflex”) (see Figure 3).

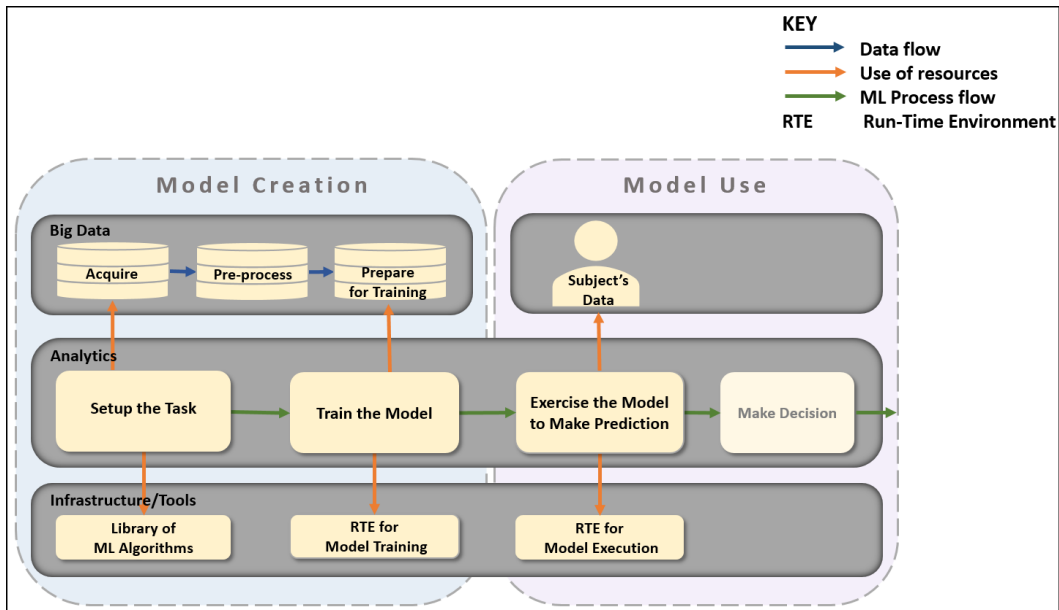


Figure 3: Typical Process for a ML Subsystem (from ISO/IEC JTC 42, Artificial Intelligence, AWI 25053)

Here again we have to take into account that existing standards and certification procedures do not fit. We have to “re-think” standardization and certification, and recent research projects in ECSEL JU (see acknowledgements) like the “lighthouse” projects Industry4.E Productive 4.0 and Mobility.E AutoDrive have set the goal to promote work in that direction. Related projects like SECREDAS, AMASS, AQUAS, Semi40, IoSENSE and now iDev40 or even AfarCloud in the Smart farming sector, will be invited to participate in the “lighthouse initiatives” to provide synergies in a larger context to promote digitalization/digital transformation in a rather joint effort in the end. There are arising risks and challenges for the public, particularly in the area of cybersecurity, safety and privacy, impacting also liability, legal issues and insurance issues as well.

3. Internet of Things – Driver for Digital Transformation

Originally, communication and connectivity included 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).

AIOTI (2018), the Alliance for Internet of Things Innovation, 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 its 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 (Verizon, 2017). 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 several reports and is very active because of the importance of standardization for huge IoT systems with many interfaces and “things”:

- 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, ETSI, CP-SETIS (Schoitsch, 2017))
- Semantic Interoperability (key issue, led to many co-operations with other standardization organizations and industrial or international working groups)
- 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 “IoT Trust” based on 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. (see Figure 4).



Figure 4: The IoT Standardization Landscape (Organizations (SDOs) and Alliances) (source: AIOTI, ETSI)

ETSI, AIOTI and associated groups like ARTEMIS Standardization WG, but also IEC and ISO (ISO/IEC JTC1 SC41, Internet of Things and related standards) try to cooperate and coordinate efforts to achieve a joint view and make the “landscape” more usable (hopefully).

IoT has to be seen on European level as one important component to driving the “Digital Transformation”, as depicted in Figure.

4. Autonomous Systems – Challenges and Ethical Questions

4.1. 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.

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. This is e.g. discussed at the annual conference “Connected Car Insurance Europe” (April, London), so it is taken for earnest by business.

A major issue is public (user) acceptance. AutoDrive (see acknowledgements) is the first research project including this question in its work programme, together with standardization/certification issues and disruptive business issues.

One business issue for OEMs will be that car ownership may no longer be the primary reason to use cars, it is becoming more a mobility service, one out of several options. Studies have shown that this may be a question of generation change; for the young generation in cities car ownership is no longer such a prevailing prestigious issue as in the past, the number of driver license applicants and car ownership are reducing.

That’s of large societal impact and may change our behavior in transport considerably, even the role of public transport. Particularly **intermodal transport** could 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 Hamburg 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 public bus services, which very often have only a small degree of utilization. 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!

A European Coordination and Support Action Mobility4EU, Action Plan for the Future Mobility in Europe (2016-2018) (Mobility4U, 2016), states on major trends and emerging societal factors:

- Enabling an inclusive society, personalization and accessibility
- Safety & Security in Transport, Novel business models and innovation in Transport
- Environmental Protection benefits, Benefits for increased Urbanization and Smart Cities
- Digital society and IoT as benefit for sustainable growth: New products and services
- Changes in the legislative framework

‘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 and most demanding one being urban traffic.

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, (Roadmap see (ECSEL, 2016)) 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.

4.2. Autonomous Systems in general

But “autonomous vehicles” covers not only automotive, although this is the largest market besides “Industry 4.0”. It covers

- Robotics (industrial, health, ageing well applications),
- Heavy machines (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, 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
- Sensors and actuators

- Software development, life cycle issues
- System integration
- Connected vehicles, V2X connectivity
- Cooperative driving and transport systems,
- 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.

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, industrial trucks) and others where the general public and public spaces set the requirements (road transport, smart cities/buildings/homes and care).

4.3. (End-) User/Public Acceptance and Ethical issues

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 projects AutoDrive and Productive4.0 (see Acknowledgements).

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.
- How should a “perfect” autonomous car behave in case of reckless driver behavior around him? How should it give warning signs or allowance signs to others (he can’t “wave hands”?)
- 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 (Greenberg, 2017)). 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 (Heindl, 2016)

Ethical concerns have already been taken for earnest by international and European authorities and organizations for automated driving as well as robotics and autonomous machinery.

As a famous example and first idea on how to manage the influence of robots on our daily life and protect humans were Isaac Asimov's "Three Laws of Robotics":

- A robot may not injure a human being or, through inaction, allow a human being to come to harm
- A robot must obey the orders given it by human beings except where such orders would conflict with the First Law
- A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws

The laws seem to reasonable and complete, but soon it was shown (even by Asimov himself) that realistic situations may result in unresolvable conflicts for a robot just adhering to this law. Soon, Asimov himself introduced a “Zeroth Law” (zero being of a higher level to obey than Law 1) for a broader context (e.g. one human endangering mankind, a situation similarly to the “tyrants murder” ethics (is it allowed to kill a dictator who endangers millions of lives?)).

- Law zero: A robot may not harm humanity, or through inaction allow humanity to come to harm.

It seems that the question “Is it possible to create practical laws of robotics which can guarantee a safe, conflict free and peaceful co-existence between robots and humans?” has no positive answer valid in all foreseeable situations. Even in Asimov’s stories, robots had to decide which type of risk of harm is acceptable (e.g. autonomous robotic surgeon). Other authors assumed, that robots may have as logical result a mental collapse after detecting that an activity which seemed to follow Law 1 had a disastrous result, e.g. in “The Robots of Dawn” the whole plot of the story revolves around a robot which apparently was destroyed by such a mental collapse (like a “short circuit” in his computer brain).

These robotic laws were written in 1942, when robots were androids and just relatively simple “slaves” for humans, not taking into account the much more complex robots imaginable today. And what about a robot developed for an army? And who or how is defined as “human being” (from history we know that sometimes a certain group of people is not considered as equally human and killed, e.g. genocide?). This, we have to look at the humans behind the AI and robots as well.

Nevertheless, the issue was taken up by IEEE, the European Parliament, the German Ethical Commission for Automated and Connected Driving, UNO and some standardization organizations. Some general autonomous machines (robots) ethics recommendations are:

- The IEEE Global Initiative for Ethical Considerations in Artificial Intelligence and Autonomous Systems (AI/AS) (April 2016)
 - Ethically Aligned Design: A Vision for Prioritizing Human Wellbeing with Artificial Intelligence and Autonomous Systems (EAD V1 released)
 - Identification and recommendation of ideas for Standards Projects focused on prioritizing ethical considerations in AI/AS.

- Petition to the UN to rule against „Drone Wars“, „Robots at War“ (Iraq War: A far remote US UAV controller received a „Bravery Medal“)
- European Parliament took first actions to study „Robots Ethics“:
 - Resolution on automation ethics calling for robot “kill switches” (Jan 12, 2017)
 - Delvaux tabled a resolution at the European Parliament that stressed the need for an EU agency that is dedicated to dealing with A.I.
- IEC/SMB Ad Hoc Group on autonomous systems and ethics (AHG 79) (ISO/TC299, June 20, 2018!!), scope commitment: SMB (Standardization Management Board) agreed to setup AHG 79, Autonomous Systems – Ethics, with the task of assessing the role of IEC and standards in addressing ethics, trust and values particularly in autonomous systems, and making recommendations. The review should consider the work of JTC 1/SC 42 (Artificial Intelligence), ACART (Advisory Committee on Applications of Robot Technology), ACOS (Advisory Committee on Safety), TC 59 (Performance of household and similar electrical appliances), TC 100 (Audio, video and multimedia systems and equipment), SyC AAL (Systems Committee on Active Assisted Living), SyC Smart Cities, IEEE, ISO and others.
- ISO/IEC JTC1/SC41 (IoT and related technologies), June 2018, Swiss proposal for establishment of a Subgroup on “Societal and human factors in IoT based services”.

For Automated Driving, the relevant organizations set up already some recommendations and rules how this should be implemented in societal context, setting requirements on automated driving vehicles:

- UN, UNECE WP29 Report from Intelligent Transport Systems and Automated Driving (ITS/AD), setting rules in extension of the existing “Vienna Convention” for
 - **Type Approval for automated and connected vehicles**, testing of automated systems, real world and simulated
 - How to approve serial produced automated vehicle for usage on public streets
 - The original Vienna Convention defined in §5, that “Every driver shall at all times be able to **control his vehicle** or to guide his animals”, which of course is no longer true. The functional safety standard ISO 26262 has “controllability” as one of the perimeters to derive the ASIL safety integrity level, which is no longer meaningful for automated vehicles. Thus, the amendments state: “When these vehicles are fitted with systems, parts and equipment that are *in conformity with the conditions of construction, fitting and utilization* according to technical provisions of international legal instruments referred to ... they shall be *deemed to be in conformity with Annex 5*” (Unece, 2014).
- DE, Ethics commission Automated and Connected Driving (Report June 2017, Federal Ministry of Transport and Digital Infrastructure):
 - 20 high level guidelines: “The **protection of individuals** takes precedence over all other utilitarian considerations. The objective is to reduce the level of harm until it is completely prevented. The licensing of **automated systems** is not justifiable unless it promises to produce at least a diminution in harm compared with human driving, in other words a **positive balance of risks**.”
- US National Highway Traffic Safety Administration, Federal Automated Vehicles Policy, September 2016

- The **fall back minimal risk condition** portion of the framework is also specific to each HAV system. Defining, testing, and validating a fall back minimal risk condition ensures that **the vehicle can be put in a minimal risk condition in cases of HAV system failure** or a failure in a human driver's response when transitioning from automated to manual control.

SAFETRANS (Germany, WG “Highly Automated Systems: Test, Safety, and Development Processes“), has published a **Roadmap Highly Automated Systems** with recommendations on Actions and Research Challenges, in German, but the Management Summary is available in English.

5. Conclusions

The technologically oriented funding organizations and the EC have a very positive approach and high expectations concerning the benefits of digitisation of economy, industry and society. They highlight the fascinating opportunities for a better life for all, better and sustainable usage of resources, reduced environmental footprint, and of course economic competitiveness for European industry. 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 that many of the achievements could be used against us as well (and some research projects consider this fact already) – drones help with precision farming, and building inspection and maintenance, but also as war drones. Robots can help in health (exoskeletons), ageing well, rescue and maintenance actions, etc. by saving peoples life or keeping people to live longer independently, but also serve as a robot army or control our live in an undue manner. This requires careful European and international legislation and control of the automation impact on our lives to avoid the worst outcomes of these new technologies, and requires high public awareness. Politics sometimes tend to use safety and security threats as argument for more surveillance and control of people, endangering freedom and democracy. A first approach is taken by several authorities and international or governmental organisations to provide guidelines and recommendations for an ethical approach to highly autonomous systems.

6. Acknowledgements

Part of the work received funding from the EC under grant agreement n° 645149 (CP-SETIS), from the EU ARTEMIS/ECSEL Joint Undertaking under grant agreement n° 692474 (AMASS), and from both, the EC ECSEL JU and the partners' national funding authorities (in Austria FFG (Austrian Research Promotion Agency) on behalf of BMVIT, The Federal Ministry of Transport, Innovation and Technology) - (Grant agreements n° 692466 (SemI40), n° 692480 (IoSENSE), n° 692455-2 (ENABLE-S3), n° 737475-2 (AQUAS), n° 737459-2 (Productive4.0) and n° 737469-2 (AutoDrive) and recently started projects SECREDAS (783119), iDev40 (783163) and AfarCloud (783221)).

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TOPIC C: CRISIS MANAGEMENT

TOWARDS A COMMON UNDERSTANDING – RELEVANCE AND EXEMPLARY METHODOLOGY OF CREATING A JOINT TERMINOLOGY FOR CRISIS AND DISASTER MANAGEMENT

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Keywords

Terminology, methodology, crisis management, interoperability, mass involvement, enhancement of the operational picture, ethical and societal challenges, information exchange

Abstract

In emergencies, crises and disasters, precise and distinct communication is a critical factor for successful management. Experiences of managing large scale events show, that not only language barriers, but also differences in the and between organizations, practices, tools, technical terms, and resources of disaster management create potential for friction, misunderstanding and consequently inadequate decisions. The use of different terms for identical items such as actors, objects, and processes also hampers effective communication between involved stakeholders. Moreover, the use of the same term in different contexts or domains is potentially leading to a lack of understanding and consequently, reduced efficiency. This is due to the fact, that different organizations often use implicitly or explicitly different definitions for the same term or more coarser or finer differentiations and subdivisions.

Despite this crucial importance and critical potential of clear and concise communication, crisis management organizations scarcely pro-actively address the topic of the terminology of their

domain. Although there are several national and international organizations as well as research projects providing sets of terminologies and even taxonomies, their common application and use in practice often does not sufficiently take place and insulated approaches are standing practice.

In order to enhance semantic interoperability in future crisis and disaster management, the path towards a basic methodology for creating a thesaurus by cross-referencing internationally acknowledged and accepted terminologies is presented in this paper. In addition to the compilation of a thesaurus in the area of crisis and disaster management, an evolving process to quantify similarities of different definitions of the same terms was identified as necessary and developed in the course of the projects EPISECC and DRIVER+. In a subsequent paper, a proof of the generated methodology will be presented by taking test terms from relevant selected sources. Such sources are represented by terminologies such as the standard “ISO 22300: 2018(en), Security and resilience” or the “UNISDR Terminology on Disaster Risk Reduction (Sendai Framework)” from 2009.

By providing a contextually enriched overview on terms and definitions, this thesaurus and the underlying methodology support fostering a future common understanding and frictionless communication and information exchange in crisis and disaster management. This process and the evolving outputs are apt to be enriched, transferred, and used in other projects, standardization initiatives, but above all in the practical application of crisis and disaster management.

1. Communication and Information Flows in Crisis and Disaster management

In a disaster situation three things contribute to an operational success: having the right resource available in the shortest time, with the highest relevance and at the right location. Access to necessary information, communication with other relief units/organizations and stakeholders as well as the availability of resources are key factors in minimizing damage and loss of life (Wex et al. 2014 and Fiedrich et al. 2000).

Large scale, complex disasters and crisis situations increase the requirements on personnel and material exponentially. Additional challenges, in particular in cross border events, include language barriers, knowhow and organizational as well as technical barriers regarding above others communication and data exchange. Thus, a clear and efficient communication in crisis and disaster management (CDM) is one of the crucial factors for the overall outcome of the response and recovery phase (see Kapucu et al. 2011 and Howes et al. 2014). The outcomes and results of leading projects like the Austrian security research initiatives QuOIMA (Mak 2014 or Rainer et al. 2015) and WatchDog (Rainer et al. 2016) – both funded by the programme KIRAS of the Federal Ministry for Transport, Innovation and Technology (bmvit) – point towards the relevance of an enhanced, frictionless data gathering and information transfer.

In order to classify different types of communication according to involved actors, ETSI (European Telecommunications Standards Institute) has been defining the user requirements for the four main areas of emergency communications:

1. communication from citizens to authorities/organizations (emergency calls),
2. communication between authorities/organizations (public safety communications),
3. communication from authorities/organizations to citizens (warning systems),
4. communication amongst citizens during emergencies.

Within this paper, we focus on the second type of communication, although the relevance of mutual understanding is evident for all four communication areas.

2. Gaps and Challenges regarding Communication in CDM

Although the importance of information and communication flows is obvious for CDM (see e.g. Palttala et al., 2011), approaches of optimization and tackling of detected weaknesses mainly concentrated on insulated areas. Questions of process interoperability (see project QuOIMA), technology interaction, source and data integration (see projects WatchDog and EBeCa: Rainer et al. in publication) are main areas of research and application. The basic, underlying aspects of communication and data sharing friction are yet neglected.

In regards of the importance and the role as major factor for efficient, timely, and effective CMD, three major challenges were identified in an exemplary study assessing the coordination between representatives of an emergency department and emergency medical service teams. They include ineffectiveness of current information and communication technologies, a lack of common ground, and breakdowns in information flow (Reddy et al. 2009). These three challenges highlight the importance of designing systems from socio-technical perspective. In particular, inter-organization coordination systems must take into account human factors, technological issues, a general awareness and workflow aspects of the context and language specifics between interacting organizations. In addition to that it has to be taken into account, that communication and information flows can also be broken, distorted, or heavily influenced by the disaster itself and other relevant factors.

To address these challenges among others, the FP7 projects EPISECC (Establish Pan-European Information Space to Enhance seCurity of Citizens <https://www.episecc.eu/>) and Driver+ (Driving Innovation in Crisis Management for European Resilience <http://www.driver-project.eu/>) works on analyzing three core factors:

1. past responses to critical events and disasters in terms of time and cost,
2. the data and data management tool used by crisis managers and first responders, and
3. the organizational structures of the crisis managers and first responders.

These aspects enable the definition of a concept for a shared, common information space and can lead to an enhanced understanding and efficiency. A core requirement for a successful pan European information space is the definition of a common taxonomy and a stable methodology backing the development of a model thesaurus. On this basis, further harmonization efforts can evolve.

As presented in the generalized graphics below, data flows and information processing are highly complex systems that are influenced and vice versa have high impact on the management and decision making processes in disaster management. A relevant part of the project QuOIMA focused mainly on the inclusion of open source media data for quality improvement of an overall operational picture.

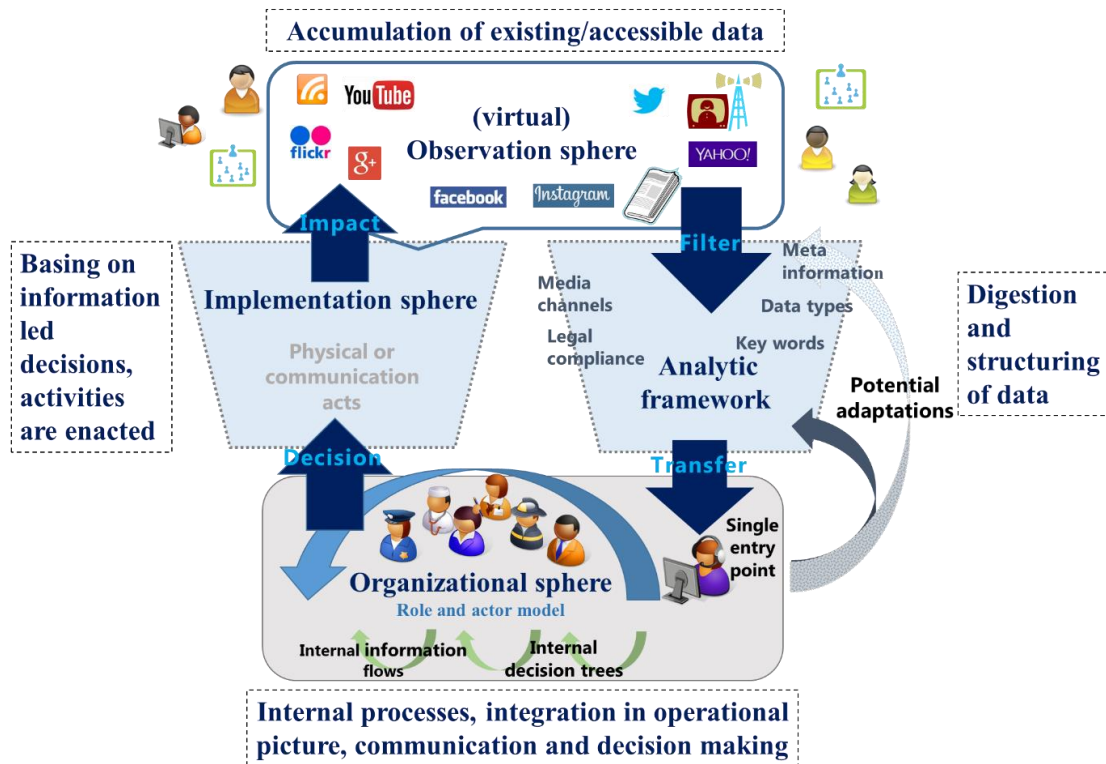


Figure 1: Information, analysis and decision making model of QuOIMA (modified Rainer et al. 2015)

Legal aspects and the potential use of crowd sourcing and crowd tasking were relevant issues handled there as well as the complexity of detecting, verifying, and implementing data and messages regarding an escalating scenario. Taking the open source data in connection of the flooding in middle Europe in 2014 as case study, the creation and development of a list of termini made the challenges of a common understanding between “the crowd” and their language/understanding and the official wording evident (Rainer et al. 2015).

The example of WatchDog highlights another aspect of information sharing and the challenges of a common understanding: the inclusion of multiple and partially not yet broadly used sensor data in scenarios with mass involvement.

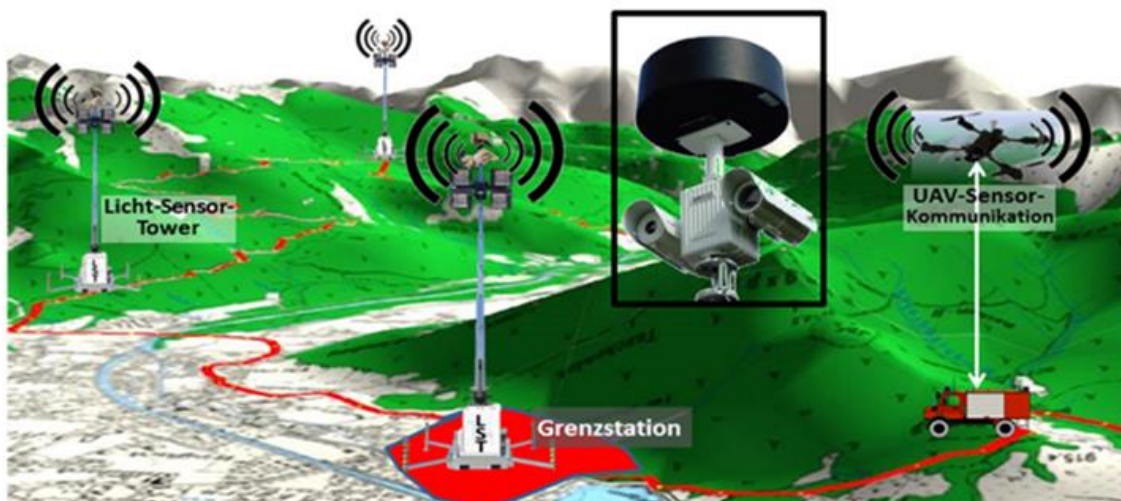


Figure 2: Schematics of the WatchDog multi sensor solution (internal project description, <http://www.kiras.at/gefoerderte-projekte/detail/d/watchdog/>)

This also includes the handling and above all the understandable and standardized transfer and use of sensor data. A common information space, which implies an EU-wide standardization activity, will widen the EU wide market for organization developing solutions and tools for crisis management.

3. Approaches towards a Common Understanding

Considering these prerequisites and frame requirements, different ways and approaches towards a common understanding will be described in the following. Besides the already outlined standardization activities, that represent the final stage of a joint terminology and the resulting communication and information sharing benefits, specific project parts and initiatives subsequently described, will lead to an enhanced shared picture and the necessary clarifications for cooperating in emergency and disaster management. Several projects made attempts to improve common understanding, such as the FP7 projects EPISECC, SecInCore (<http://www.secincore.eu/>), SECTOR (<http://www.fp7-sector.eu/>), Redirnet (https://cordis.europa.eu/project/rcn/185497_en.html), and DRIVER+. In the following sections the approaches of two of them are described.

3.1. The EPISECC project – Approaches towards Semantic Interoperability

The overarching goal of the FP7 project EPISECC was the development of an integrated pan-European crisis and disaster response capacity. In order to achieve this goal, a Common Information Space (CIS) concept was developed and validated in a border crossing proof of concept scenario. Moreover, EPISECC targeted to level its outcomes up to European standardisation. In this section we give first an overview on the project. Subsequently, the outcomes of EPISECC suitable for standardisation are presented and at the end relevant initiatives of the project team towards international standardisation bodies are presented.

A statement of the International Federation of the Red Cross reflects the core philosophy of EPISECC:

“Disaster affected people need information as much as water, food, medicine or shelter: accurate, timely information can save lives. The right information helps aid organizations to understand better the needs of affected communities and ways to meet those needs. Today's information technology presents new possibilities, but has not been fully exploited by humanitarian organization. Lack of information can make people victims of disaster.” (International Federation of Red Cross, 2005)

According to the final report of EPISECC, “Efficient communication and access to critical information are key requirements for the operations of public safety and security services in emergencies as well as disasters.” It is pointed out that “Inter-connectedness and cooperation between different rescue teams are imperative requirements in order to save lives and protect assets.” Challenges arise due to the fact that the communication capabilities are often compromised or destroyed, either by the catastrophe itself or its aftermath. It is imperative that in such cases, new communication systems must be deployed to re-establish communication.

The results of the EPISECC project encompass among others two major outcomes:

1. The **Common Information Space (CIS)**, which represents the central result of the project. Its concept encompass so called **Software Adaptors** allowing participating organisations, using their own, different legacy systems, **to connect to the CIS**, in order to receive and send information while maintaining the same data formats on their systems and thereby ensuring syntactical interoperability.

2. A **Semantic Repository**, including a selection of **common terms and concepts relevant in the disaster management domain**, including, apart from the EPISECC taxonomy, other proprietary semantic structures from cooperating organisations, as well as terms and concepts from the TSO/EMSI. Moreover, it includes a mapping process between existing semantic structures and the EPISECC ones. It allows **conversions between emergency related terms and concepts** that are not the same among different organisations, even of the same count

While examining the potential for exploitation of the different EPISECC outcomes, it turned out that specific aspects of the EPISECC Taxonomy apart from the concept of the common information space have best potential for standardisation activities. EPISECC got in touch with relevant European standardisation organisations. As most promising organisations CEN TC391 “Societal and Citizen Security”, ETSI, 3GPP and OASIS were identified. It turned out that CEN TC 391 provided the best possibilities to bring outcomes related to interoperability on syntactical and semantic level into standardisation. Out of the multitude of tools provided by CEN, the CEN Workshop Agreement turned out to be a very promising approach. It offers a variety of degrees of freedom compared to other approaches such as a New Work Item Proposal for standards. It is open to the participation for anyone, has no geographical limit on participation and is comparatively fast and flexible. The report arising from a CEN Workshop Agreement does not have the status of a standard and involves no obligations on national level. Considering the time limitations of a European research project, the EPISECC team launched together with external partners, the majority of them belonging to other FP7 projects, namely SecInCore, SECTOR, Concorde (<http://www.concorde-project.eu/>) and DRIVER, a CWA on terminologies in crisis and disaster management. The action was supported by CEN TC 391.

The central idea of the CEN Workshop is to develop and provide a thesaurus on international terminologies applied in crisis and disaster management. It is the intention to provide to practitioners and other stakeholders the possibility to see at a glance different definitions from the same terms taken from international relevant terminologies which are applied currently. Having such an opportunity available, it is expected that the degree of mutual misunderstanding in cross-border disaster management will decrease in long terms. It is neither intended to develop an own terminology nor to judge the quality of any applied terminology. Actually, the initiative aims at establishing a common understanding of concepts by providing their terms and specific definitions from different sources and thereby considering different characteristics from various countries or types of organisations (see section 3.3).

3.2. Progress in the Driver+ project

DRIVER+ (Driving Innovation in Crisis Management for European Resilience) is a FP7 demonstration project aiming to improve the way capability development and innovation management is tackled in European Crisis Management. DRIVER+ focuses on three main objectives (see also public reports on <http://www.driver-project.eu/library/project-public-reports/> for more details):

1. To develop a pan-European Test-bed for Crisis Management capability development:
 - a. Develop a common guidance methodology and tool (supporting Trials and the gathering of lessons learned).
 - b. Develop an infrastructure to create relevant environments, for enabling the trialing of new solutions and to explore and share Crisis Management capabilities.
 - c. Run Trials in order to assess the value of solutions addressing specific needs using guidance and infrastructure.

- d. Ensure the sustainability of the pan-European Test-bed.
2. Develop a well-balanced comprehensive Portfolio of Crisis Management Solutions:
 - a. Facilitate the usage of the Portfolio of Solutions.
 - b. Ensure the sustainability of the Portfolio of Tools.
3. Facilitate a shared understanding of Crisis Management across Europe:
 - a. Establish a common background.
 - b. Cooperate with external partners in joint Trials.
 - c. Disseminate project results.

In order to achieve the above described objectives it is necessary to ensure mutual understanding of all DRIVER+ partners and to use one consistent terminology within all five subjects of DRIVER+ as well as the more than 100 deliverables and other publications of this large scale initiative. It was therefore decided to take profit from the involvement of several members of the project in the CEN Workshop Agreement on terminologies in Crisis and Disaster Management and base a new adapted DRIVER+ terminology on the work and methodologies made available within the mentioned CWA. A current version of the DRIVER+ terminology and the methodology for their development are going to be presented at the 2018 IDIMT by Neubauer et al. (2018).

3.3. Evolving Methodology to create a Model Joint Terminology – the CEN Workshop on joint Terminologies

Due to these requirements, a CEN Workshop Agreement on terminologies in crisis and disaster management was jointly launched by EPISECC and the FP7 projects SECTOR and SecInCore. The initiative is supported by CEN TC 391. This section gives general information on the concept of CEN Workshop Agreements, on the structure of this specific CEN Workshop initiative on terminologies in crisis and disaster management, on the focus of the initiative and finally on further activities beyond the time horizon of the EPISECC project.

3.3.1. The CEN Workshop Agreement approach

CEN provided different types of products:

- European standards,
- technical Specifications,
- technical Reports,
- guides,
- CEN Workshop Agreements (CWAs).

It turned out that the CWA was the most suitable product for EPISECC's purposes. From a formal point of view, it was an agreement developed and approved in a CEN Workshop. It was open to the participation of anyone with interest in developing such an agreement. It is important to notice that a CWA does not have the status of a European standard; therefore, it leads to no obligations on national level. A CEN Workshop Agreement (CWA) results in a document published by CEN.

The procedure of developing a CWA starts with the submission of a request to the CEN-CENELEC Management Centre or a CEN-CENELEC national member. The requests include among others a draft project plan and an analysis of the degree of interest in the subject. In case of a positive decision by the CEN Technical Board, the proposal is announced on the CEN website. During the kick-off

meeting the proposed project plan is accepted by a common agreement and a chairperson is appointed. Then, the CWA members draft the CWA report according to the project plan. After agreement of the CWA members on the draft CWA report, CEN starts an open commenting phase of at least 60 days. Subsequent to the consideration of potential comments by the CWA participants, the final report is provided to the CEN-CENELEC management centre and becomes valid for at least three years. For further details, see:

<https://boss.cen.eu/developingdeliverables/CWA/Pages/default.aspx>.

3.3.2. The CWA Initiative on Terminologies in Crisis and Disaster Management

On the 1st of March 2017 the kick-off meeting of the CEN Workshop on Terminologies in Crisis and Disaster Management took place in Brussels. The FP7 projects EPISECC, SecInCoRe (Secure Dynamic Cloud for Information, Communication and Resource Interoperability) and SECTOR (Secure European Common Information Space for the Interoperability of First Responders and Police Authorities) developed concepts and prototypes of common information spaces including taxonomy concepts in order to improve and facilitate information exchange between first responders and other stakeholders. Additional is provided by partners from the FP7 project ConCorde as well as the FP7 project DRIVER. According to the Project Plan for this CEN Workshop (<ftp://ftp.cenelec.eu/CEN/News/2017/WS/TER-CDM/ProjectPlan.pdf>) the following main objectives were defined:

- Support of the mutual understanding of users applying various standards (and multiple semantic structures such as thesauri, terminologies, dictionaries) to enhance mutual understanding;
- Support the use of most commonly used terms and definitions arising from multiple sources to enhance communication effectiveness.

The project plan identifies among others the following stakeholders as main target groups:

- civil protection authorities,
- Local Emergency Management Authorities (LEMA),
- fire brigades,
- police authorities,
- first responders (e.g. Red Cross, Knights of St. John),
- cross border operating initiatives,
- military forces involved in crisis and disaster management,
- critical infrastructure operators,
- industry involved in disaster management and civil protection.

The scope of the workshop was defined as follows:

“This CEN Workshop Agreement analyses scopes of terminologies as well as definitions of terms of such terminologies used predominantly in crisis and disaster management. Both scopes and definitions from different sources are compiled and compared regarding several aspects such as their context and envisaged audience. The focus is set in responses to large scale critical events. Small scale incidents managed by daily routine processes of stakeholders are also covered but are not the main focus of this work. Selected terminologies predominantly from the domains crisis and disaster

management are used for the analysis and are included in the document. The CEN Workshop Agreement includes terminologies and taxonomies, but no ontologies.”

It is pointed out that it is not possible to analyse all existing terms and definitions applied in national and international crisis management. The participating projects presented in this paper selected specific domains of crisis management such as the response phase of crisis management on strategic and tactical levels to demonstrate the feasibility of the CWA approach. The following framing was set:

- a focus on the response phase in crisis and disaster management,
- a focus on large scale catastrophes,
- no special focus (but not a priori exclusion) on critical infrastructure protection, resilience, CBRNe and emergency management,
- no focus on security aspects such as cyber security, border control as well as physical security.

To reach this systemic output, the following activities for the correlation and comparison of the terminologies visualised in Figure 3 were conducted in the course of the CWA.

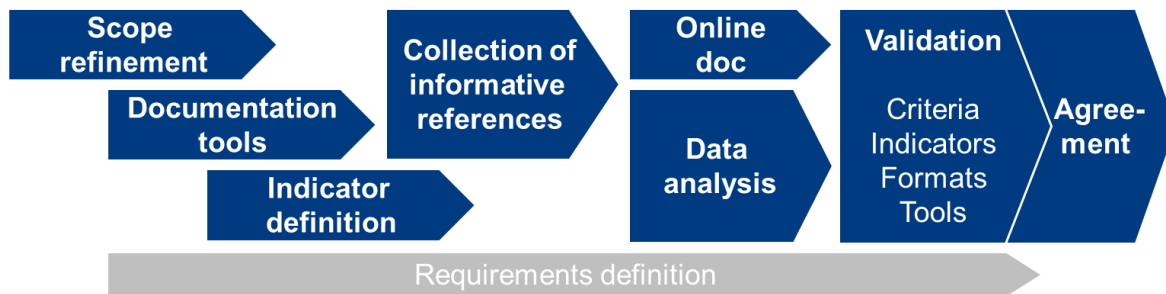


Figure 3: Overall approach for the generation of the methodology

The initiative was terminated by the end of October 2017. At this stage, a report with the outcomes will be provided to CEN.

4. Conclusion and Outlook

The creation of a common understanding via a common terminology is as complex as relevant for the field of CDM. As shown in this paper, the set-up of initiatives and first steps towards a common information space and a harmonization or even a standardization between organizations and in a much later stage among European and Third countries is challenging. It has to be started by gathering already existing knowledge and given practice examples in a strategic and commonly acceptable, scientifically supported way.

The main target of the first stage of the outlined initiative is thus the development of an overall methodological framework for analysis of a high quality vocabulary in the field of disaster and crisis management. The methodology aims at a scientifically sound but at the same time practically applicable system to facilitate the comparison, focusing on similarities, overlaps, and differences of vocabularies applied predominantly in the domain of crisis and disaster management as well as of definitions of concepts included in such vocabularies. It is based on selected vocabularies from this domain taken from international organisations and their defining documents such as standards. At the same time, the area of this first steps towards a common understanding has to be strictly focused to stay manageable and to allow feedback loops with a community of users. Thus, the CEN Workshop initiative does not address cyber-security, counter-terrorism, border control, critical infrastructure

protection directly: some of the results of evaluations can eventually be applied to those domains, but not as a primary application area.

These sources of concepts and terms are mainly organised as terminologies containing definitions of various depth and detail. For the purpose of the methodology, the terminology is defined as technical vocabulary. It aims at establishing a common understanding of concepts by providing their terms and specifying definitions. Thus, the provision of coherent terms, belonging to a particular universe of discourse or a subject area, which are intended to be consistently used by practitioners of various organisations, different nationalities, and working areas in practice.

Common word search engines can perform the identification and first processing of homograph words in existing terminologies automatically if terminologies are adequately retrieved, gathered, and organized.

As presented in a subsequent paper Neubauer et al. (2018) at the IDIMT 2018, an iterative process basing on an evolving methodology is the consequence resulting from the initiatives presented here. Initialized by the strategic and practice oriented steps towards a common understanding, this growing thesaurus of relevant terms and definitions will support the interoperability and reduction of frictions in the cooperation of relief units, NGOs and public disaster management organizations alike when tackling their growing challenges in response, recovery, mitigation and preparation regarding complex events and disaster.

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MEASURING PROCESS MANAGEMENT CAPABILITY IN DISASTER MANAGEMENT

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Keywords

Process modeling, assessment, process view, process capability, maturity, ISO 33000

Abstract

The increase of natural and man-made disasters calls for further improvements of Disaster Management. An important leverage is the adoption of a process view and as a consequence to measure the capability (ability) of organizations to better cope with the challenges of Disaster Management. Starting with the classical process view of production management and its application to software production (ISO 12207), we discuss the applicability and in parallel the necessary adaptations of the process view to disaster management.

1. Motivation

The actual and felt increase in natural and man-made disasters world wide underlines the need for further efficient improvement of Disaster Management in terms of preparation, prevention, actual response, and assessment. Global disasters require global cooperation and interventions.

For fast and efficient international response a harmonization of procedures, terminology, and tools is necessary. Disasters themselves, however, vary with respect to type and impact which makes flexibility and adaptability of disaster responses a necessity.

2. The concept of Process Modelling

A Process Model defines and documents the activities, their contents, their meaning, and their interaction (input and output) with other activities. Forerunner was the production industry (assembly line), soon followed by Software Engineering ISO/IEC 12207 (ISO/IEC, 2016), ISO/IEC 15288 (ISO/IEC, 2006), and later ISO 33000 (ISO/IEC, 2015).

A Process Model abstracts from idiosyncrasies of a single process and describes the process 'in general', independent of the enacting person or the specific usage (project). It describes all necessary activities (e.g., 'assess damage' or 'evacuate people') and their logical dependencies (e.g., 'ensure (temporary) security' before 'search for trapped persons') and the necessary work products (e.g. 'alarm messages', 'ambulances transports', 'bulldozers usage', 'telephone connections') to be used by these activities. When modelling a process, all semantically equivalent activities are abstracted into one "activity type", e.g., 'search building A', 'search building B' etc. are abstracted to one activity type 'search buildings for victims' (fig. 1). Similarly, the work products are abstracted into "work product types", e.g., 'ambulance A1', 'ambulance A2', etc. into "ambulance". For every

activity type and product type in the model the necessary number of 'instances' are created, i.e. the real activities/work products (fig. 1).

The logical dependencies between activities are also expressed in the model on the 'type'-level and have to be obeyed by the individual activities (instances). This leaves still considerable freedom to "navigate", i.e. to apply different strategies or to choose the next task (Chroust, 2000).

A Process Model contains in abstracted form the experiences of many preceding processes combined with theoretical considerations and desirable improvements (fig. 1). By updating the Process Model, newer experiences and best practices can be added.

A complete process model usually contains further important components and elements like tools, roles, input/output relationships, structural information, etc.

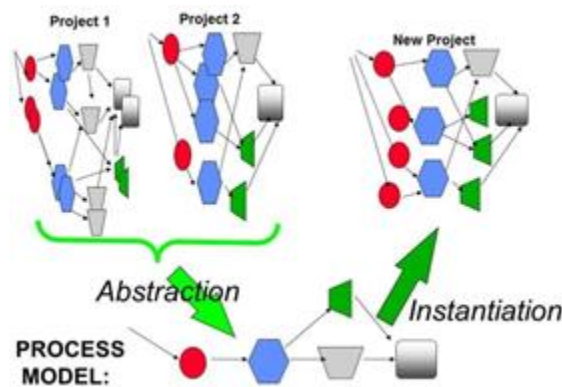


Fig. 1: Process Abstraction and Instantiation (Chroust et al., 2011)

Fig. 2 shows the four essential stages of process modelling: Initially the processes are just kept and remembered by individual specialists, then they are written down, initially in natural language. Later a formal notation ('process modelling language') was used for their description. The formal description lends itself to enactment via computers, supporting humans and automate certain tasks (fig. 3).

Key advantages of a formal process model are (Chroust, 2000):

- It is independent of individual actors, of a specific application (project), and acts as a guidance for users to ensure performance and adherence to the sequencing of activities ('navigation').
- A formally described process model can be recorded, standardized, transmitted to others, stored and taught, thus converting implicit knowledge into explicit knowledge (Nonaka and Takeuchi, 1995).
- It also acts as a repository for new best practices, thus preserving experience. It also allows audits and recording of inadequacies. It provides standardization across different persons, projects and applications. This is of special value for the cooperation of heterogeneous teams, especially international interventions.
- The process can be evaluated ex-post, improved, and its capability and maturity assessed (see section 4).
- A formally described process model can be supported by a Process Interpreter (Kuhrmann et al., 2010; Aumayr et al., 2015) allowing support of selecting and sequencing of activities (fig. 3), automatic recording of enacted activities and accounting of used resource (personnel, volunteers, operational material, etc. (Aumayr et al., 2015)).

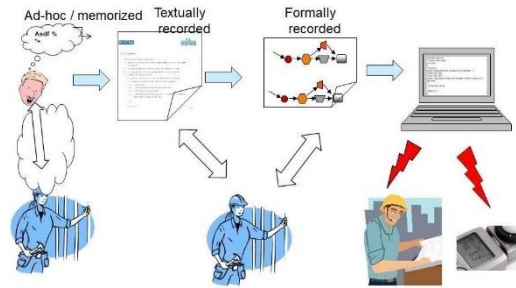


Fig. 2: 4 representations of process models

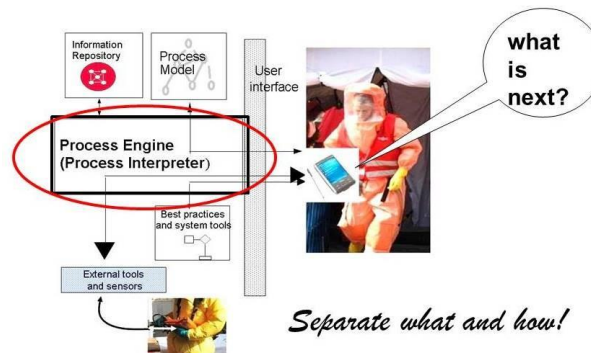


Fig. 3: Supporting Disaster Management by automated Process Management

3. Expanding the application scope of process models

3.1. Evolution of process Management

The introduction of process models describing the necessary best practices and their interdependencies has been very successful in the production industry (Humphrey, 1989; Schoitsch, 2012; Dorling, 1993; ISO/IEC, 2006). They soon were applied to other domains.

Disaster Management is no exception. Fig. 4 show the evolution of process management over time with respect to the different application areas. At each level additional requirements for flexibility beyond the rather fixed, predefined task structure of production, especially in the sequencing of tasks ("navigation") are introduced. In the factory only completely strict processes with no exception etc. was allowed, software, typically, needed more freedom and flexibility in the sequencing and repetition of tasks (Chroust, 2000), financial services requiring more parallelism and speed, Disaster Management more ad-hoc event-driven flexibility and e-health taking into account the frailness and unreliability of elderly people.

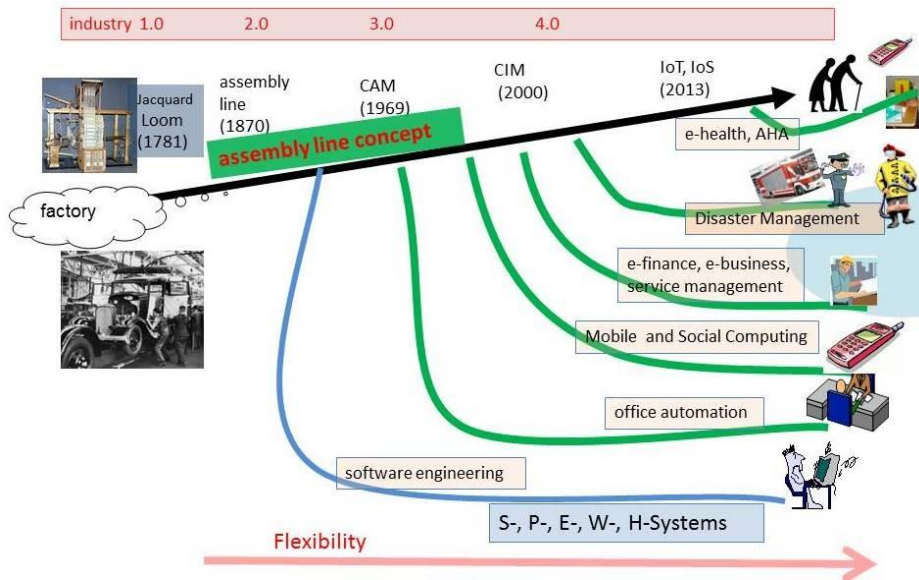
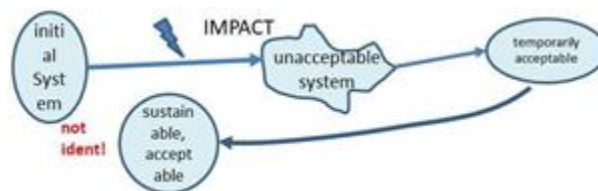


Fig. 4: Evolution of process view

Parallel to the evolution of the classical industry to what is called industry 4.0 many other disciplines adopted the concept of process management, but in the course of the adoption introduced more flexibility of execution in comparison to the assembly line paradigm: In software development the concept of the rigid sequence of steps had to be sacrificed (by recognizing iteration ('spiral model' (Boehm, 1986) and rework during the process, office automation introduced document driven operation and flexible routing of many parallel tasks (CTR-90), mobile and social computing added inclusion of individual, independently interacting actors (Maiden, 2007), e-banking and e-finance demanded security and auditability (Sonntag, 2014, Disaster Management finally brought along the need of considering damage/destruction and unavailability of needed resources plus a strong concern for human victims (Chroust, 2017b), E-health will be characterized by extreme personalization of medical support (Aumayr, 2015). Each of the previously introduced flexibilities has also improved each of the 'earlier' extensions.

3.2. Disaster Management

International Standards Organizations have started to provide frameworks for describing and analyzing disaster management processes, e.g. ISO ((Lazarte, 2013; ISO, 2011)), the International Search and Rescue Advisory Group (INSARAG (ed.), 2012), IFRC (International Federation of Red Cross and Red Crescent) (IFRC (ed.), 2007b) and (IFRC (ed.), 2007a), CEN Comité Européen de Normalisation, (CEN, 2017), etc.



.Fig. 5: State transition: unacceptable/acceptable

Major differences to the classical process management applications are:

- The objective of Disaster Management is not a well-defined product but the change of a current undesirable/unbearable situation into a (temporarily or final) improved one (fig. 5).

- In industry the primary interest is in producing a product, a physical object via a quality process, hence standards like ISO/IEC 25000 and ISO33000 (ISO/IEC, 2015) were created. In contrast, the 'objects' of Disaster Management are not inane objects (software, cars, ...) but to a large (and critical extent) human beings!
- All activities must be designed with strong consideration of human factors with respect to all involved persons (McEntire, 2007; ISO, 2011). This includes observation of cultural differences between ethnic groups (McEntire, 2007) with respect to contents, form and differences as far as belief in an interpretation of warnings and instructions and the willingness to obey them is concerned.
- Many teams of First Responders participate with different methods from different locations and organizations with different (and unknown) knowledge, experience, and background.
- Usually urgent, often contradicting actions have to be performed, depending on the type, the extent of the disaster and the affected environment. Therefore the process model must provide sufficient alternatives, being both highly flexible and adaptable. Especially navigation must be extremely flexible and allow for ad-hoc changes to the process (computer support can be very helpful here, see fig. 3!)
- Due to considerable amounts of stress, anxiety, and uncertainty on the scene of a disaster the process model must be expressed in understandable terms and must be largely intuitive and self-explanatory. One must also consider that many of the stakeholders will not be accustomed to the use of process models, especially those without professional training (typically volunteers).
- Disasters damage the infrastructure and the environment, i.e. the needed personnel, material goods and communication means may often not be available. Substitute materials and replacement personnel are necessary. Gaps in communication must be bridged by involving different communication channels (voice, signaling, graphic, etc.).
- A considerable part of the total process must be accomplished in the 'Preparation Phase', i.e. before disaster actually strikes. All conceivable alternatives must be prepared for (Tierney et al., 2001).
- The intervention is successful, if the change of the status of the affected area/society is a long-term acceptable one. The interventions, however, also offer the chance for future improvement (fig. 5).

All of these considerations show that the process quality must be re-defined and also - what was not yet said - a definition of what the 'quality of the result' of the process(es) is.

4. The Capability of Disaster Management processes

It is reasonable to ask "How good are the processes applied in an intervention?", "How much can they achieve?"

The standards define and measure the so-called capability of a process respectively the maturity of the organization using this standard (Humphrey, 1989). These assessment methods assess a specific process (consisting of many subprocesses!) with respect to a pre-defined so-called reference model based upon a so-called assessment model, which is derived from the reference model. It contains specific questions concerning the enactment of the process (e.g. "are the results of individual steps recorded?", "Who is responsible for the coordination of various groups?", "How can interoperability on different levels to be ensured?" etc.). CMM, Bootstrap, CMMI, and ISO/IEC 15504 are examples.

The ISO-family 33000 (ISO/IEC, 2015) is the latest one in that list. An essential idea is the provision of a framework for the assessment which can be applied to different reference and assessment models, and provides the basic comparability properties as shown in fig. 6 and fig. 7.

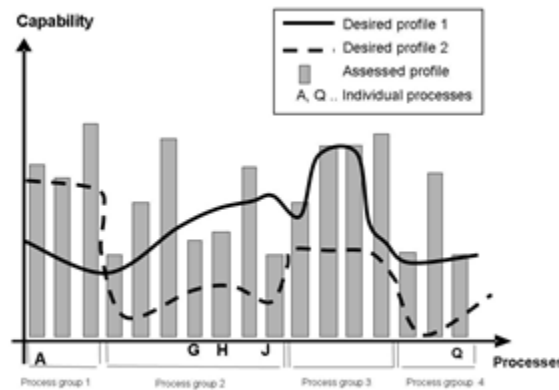


Fig. 6: Comparing different profiles

It separates the formal assessment framework from a specific reference/assessment model. Thus different process models (as long as they conform to certain formal criteria) can be assessed. Examples of conformant process reference models are ISO/IEC 12207, ISO/IEC 15288 (ISO/IEC, 2006), Automotive SPICE, Medical SPICE etc. For ISO 33000 the result of an assessment is (see fig. 6) a diagram which lists horizontally the subprocesses (or rather groups of subprocesses), e.g. requirement analysis, quality assurance, documentation, etc. The vertical bars show the 'level' reached by the assessed process group with respect to the 5 level scale (from 'incomplete' = not achieved), 'performed', 'managed', 'established', 'predictable', 'optimizing'), see fig. 7). The diagram can also be used to describe the level of capability necessary for a given situation (intervention) and thus allows to compare different methods or can warn of deficits in the performance. Averages of similar organizations can be shown. The overall objective of this approach is to gradually improve the capability of an organization and its processes by moving up on the 'ladder of capability' (see fig. 7).

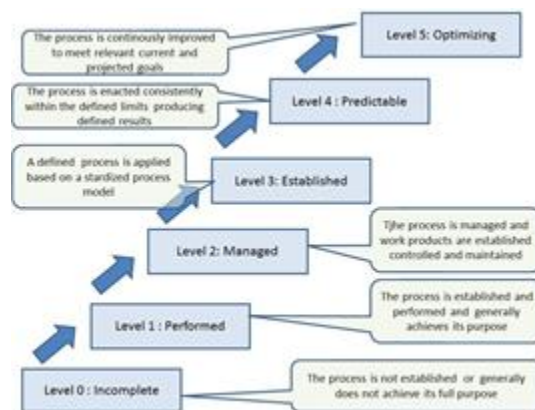


Fig. 7: Levels of Process Capability (ISO/IEC 33000 (ISO/IEC, 2015))

5. Summary

The concept of process view as introduced in the 90'ies in the manufacturing industry offers considerable advantage also when applied to Disaster Management. There is, however, a strong need to modify some basic tenets of the original ideas (Aumayr et al., 2015; Chroust and Aumayr, 2017):

- additional flexibility and adaptability for ad-hoc changes and replanning,
- understandable and usable despite stress, uncertainty, adverse environment, and not adequately trained personnel (volunteers!),
- intuitively understandable and self-explanatory routines even for untrained volunteers,
- processes applicable despite damaged/inadequate infrastructure (communication, material, food) or communication hampered or not reliable,
- strong consideration of human and cultural/ethnic/national aspects,
- usually no 'preparation' time due to unexpected disasters!

Examples have shown that the application of process approaches eases Disaster Management, but is only part of the complex challenge posed by disasters (Aumayr et al., 2015).

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APPROACHES ON HOW TO ANALYSE TERMS AND DEFINITIONS APPLIED IN THE DOMAIN OF CRISIS AND DISASTER MANAGEMENT

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Keywords

Terminology, semantic interoperability, crisis and disaster management, CEN Workshop Agreement

Abstract

In international crisis and disaster management seamless exchange of information between involved stakeholders is considered as one of the most important requirements. For this purpose, interoperability at different levels needs to be achieved, encompassing semantic interoperability. Mutual understanding of actors is imperative for successful operations. In order to support enhancement of such developments, a CEN Workshop Agreement on Terminologies in Crisis and Disaster Management was started in 2017. This paper presents a methodology developed by this initiative on how to analyse and compare terms and definitions from different terminologies.

1. Introduction

In emergencies, crises and disasters, precise and distinct communication is a critical factor for successful management. Past experiences of managing large scale events show, that not only language barriers, but also differences in the organization, practices, tools and resources of disaster management create potential for friction, misunderstanding and consequently inadequate decisions. The use of different terms for identical items such as actors, objects, and processes also hampers effective communication between involved stakeholders. Moreover, the use of the same term in different contexts or domains is potentially leading to a lack of understanding and consequently, efficiency. This is due to the fact, that different organizations often use implicitly or explicitly different definitions for the same term.

Despite this crucial importance and critical potential of clear and concise communication, crisis management organizations scarcely deal with the topic of the terminology of their domain. Although there are several national and international organizations as well as research projects providing sets of terminologies and even taxonomies, their common application and use in practice often does not sufficiently take place.

In order to enhance semantic interoperability in future crisis and disaster management, we present in this paper a basic methodology for creating a thesaurus by cross-referencing internationally acknowledged and accepted terminologies. In addition to the compilation of the thesaurus in the area of crisis and disaster management, an evolving process to quantify similarities of different definitions of the same terms is developed in the course of the projects EPISECC and DRIVER+. A proof of the generated methodology was conducted by taking test terms from relevant selected sources. Such sources are represented by terminologies such as the ISO standard “Security and Resilience-Vocabulary” (ISO, 2018) or the “UNISDR Terminology on Disaster Risk Reduction” (UNISDR, 2017).

The analytical framework of the methodology encompasses analysis and comparison of several relevant parameters, such as the type of organizations/actors, the category/the scenario of application of the term, geographical regions, addressed objects and described effects. Indicators were created to quantify the differences between definitions.

By providing a contextually enriched overview on terms and definitions, this thesaurus shall support fostering a future common understanding and frictionless communication and information exchange in crisis and disaster management. This process and the evolving outputs can be enriched, transferred, and used in other projects, standardization initiatives, but above all in the practical application of crisis and disaster management.

This work is executed in the frame of a CEN Workshop Agreement (CWA) entitled “Terminologies in Crisis and Disaster Management”. In this paper CWA stands for this specific initiative (CWA (2018), EPISECC (2017), SECINCORE (2017)) as well partially in the frame of DRIVER+. The DRIVER+ project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under Grant Agreement n° 607798. The opinions expressed in this document reflect only the author's view and reflects in no way the European Commission's opinions. The European Commission is not responsible for any use that may be made of the information it contains.

2. A Methodology for Semantic Analysis of Terminologies

The overarching purpose of the CWA initiative is the development of a methodological framework for analysis of a high quality vocabulary in the domain of disaster and crisis management. The approach aims on one hand at a scientifically sound as well as practically applicable system to facilitate comparisons on the other. Specific attention is given to similarities, overlaps, as well as differences of vocabularies applied predominantly in the domain of crisis and disaster management as well as of definitions of concepts included in such vocabularies. The methodology is tested using selected vocabularies taken from international organisations and their related documents such as standards. The CWA initiative does not address security domains such as cyber-security, counter-terrorism, border control or critical infrastructure protection. However, some of the results of evaluations can eventually be applied to those domains.

Sources of concepts and terms (e.g. ISO 20300, 2018, UNISDR, 2017, IFRC, 1991, TSO, 2009) are only or predominantly set up as terminologies including terms and related definitions of various depth and detail. In this context the terminology is defined as technical vocabulary. The intention of the

action is to establish a common understanding of concepts by providing their terms and related definitions. We target to provide coherent terms, belonging to a particular universe of discourse, which are intended to be consistently used by practitioners of various organisations, different nationalities, and working areas in practice.

The CWA methodology limits its scope strategically to those terminologies intended for international/inter-organisational use. For the clarity of the concept, it focuses on sources in English that can generate a better common understanding of practitioners in a first step. Translations of terms and definitions between different languages are not in the scope of this initiative.

The CWA methodology specifically focuses on different definitions of the same terms as well as on different terms that are overlapping or totally covering the same meaning. Arising differences in understanding are deemed highly relevant to clarify communication in disaster and crisis management activities in all phases and among all involved stakeholders. By applying this approach, misunderstandings and errors evolving from different inherent concepts are prone to be minimised and in the best case prevented.

Concepts of interest are to be further examined in detail to assess their semantic similarity. Herein, the methodology proposes indicators to be used for identification of an initial degree of the semantic similarity between concepts, in particular the scope of terminologies and as well as definitions of terms. The first type of indicator is based on the metadata about concepts' source, i.e. terminologies and their context (e.g. scopes). The second type of indicator allows comparison between descriptions of equally terms from different sources. This process needs to be highly end user- and requirements-driven and results in definitions of a type of the relation (mapping) between two concepts. Identification of concepts having exactly the same meaning but different terms or concepts having nearly the same meaning and different terms cannot be easily automated and human involvement in this process is strongly recommended. Once identified, such concepts can be further semantically compared with indicators using the same approach.

To develop a comparable and above all practically feasible system to discriminate definitions and their terms a matrix of categories with multiple-choice options was generated (see table 1). The core relationships between concepts/terms proposed in this methodology were identified to have the following semantic values:

- exact match: concepts have exactly the same meaning;
- non-exact match: concepts are related either hierarchically (broader or narrower) or they have certain semantic overlaps or equivalency - they can also be similar or associated in some way while the degree of those connections can be specified by using an indicator (not shown in this paper);
- no match: concepts have no or no significant semantic connection.

Main steps in the development of the methodology are (for more details see EPISECC, 2017):

1. Methodology specification and preparation encompassing universe of discourse refinement as well as indicator definition
2. Selection and collection of informative references: identification of relevant terminologies
3. Data analysis encompassing selection of adequate candidates of definitions for comparisons (exactly the same terms from different terminologies with different definitions), establishment of relations between different concepts

2.1. Quality frame for generating and selecting definitions

Several quality criteria forming an indicative frame were specified. Such rules and requirements are needed to ensure a good outcome of the analysis of the gathered definitions (see also Macagno & Walton, 2014). They are shortly outlined and extended for the necessities of the CWA in the following steps:

1. The definitions of the terms shall encompass relevant attributes of the objects or concepts defined by following the categories and parameters stated in table 1.
2. Definitions of the applied sources and documents should not be too wide or too narrow to grant practicability without missing out or including non-applicable factors.
3. Definitions must be clear and explain the meaning by the use of other words that are commonly understood. To clarify them, further definitions according to the second rule may be necessary.
4. Definitions should be positive and avoid whenever possible the negation of other terms.
5. The definitions should include, if possible, input in all given categories (see table 1 and table 2) to provide all necessary information for the later use of the intended user groups.
6. A system of peer review or a four-eye-principle is recommended.

The result of this combination of the above shown steps is reflecting on the one side the essence of a term and its meaning for the use in the defined field of emergency and disaster management as well as to listing the objects that a term is used for (see also Lyons, 1977).

2.2. Context and definition analyses

Evolving from the basis of the categories, indicators, and parameters mentioned before, it becomes obvious that the area of the definition has to be elaborated in detail. This is necessary for a straight forward and end user oriented comparability and also for the discrimination of different terms. Besides this precondition for the later applicability in an international, cross-system and cross-organisational context, a thorough test of the above-mentioned methodology and the considered variables became a main objective.

For a solid validation test, selected terms were exemplarily elaborated and analysed regarding their context and definitions. The parameters given in table 1 are applied in addition to the basic information, consisting typically of cited terms and definitions. Starting from the definition of several guiding questions, it became possible to systematically reach the parametrisation of the specific additive definition section. These questions were crystallised by the authors as the following examples show:

- What kind of organizations is addressed in the definition? (Group: organization, geographical area);
- Is there a domain addressed in the definition? (category, scenario of application).

In principle, an analysis of a subject, an object and a predicate was conducted within this definition following the technique of discourse parsing (see EPISECC, 2017 for more details).

The choice of the terms is oriented on covering a high relevance for the field and the concerned practitioners/intended end users. Additionally, the coverage of different initially cited definitions of identically spelled terms and linked with this different sources of the identic terms were identified as important.

The guiding questions and related answers can be easily selected via the multiple choice selection modes as shown in the Table . While the parameters regarding the type of organisation as well as the type of geographical area are following the analogous points of the other categories phase, range of escalation and scenario of application were transferred from other, generally accepted models in the field of emergency management. The phases were extracted from the generic disaster management cycle phases (Vasilescu et al, 2008). The parameters of the range of escalation were deduced from the basic discrimination between large scale disasters – not manageable on local/regional level – and small scale emergencies (WHO, 2002). The scenario of application was extracted from an approach that is as holistic as possible to cover all possible types of events (NIEM, 2017).

The categories referring to the other properties of the discourse parsing as “objects” and “effects” were deduced to the most generic level to make them applicable to the broad range of different aspects. In general, the objects were divided into different groups of persons involved in the definition, equipment and infrastructure used or influenced as well as concepts that are relevant and active in the context. Regarding the effects, it has to be underpinned that the intended and immediate effects in the considered temporal and situational setting have to be evaluated and/or implied. Thus, the parameters can be seen as having positive, negative, neutral or no effects.

Table 1: Definition categories and multiple choice selection parameters

Type of organisation	Phase	Range of escalation	Scenario of application	Objects	Effect	Type of region
Governmental	Prevention (Mitigation, risk management)	Emergency (small scale)	"Geo" - Geophysical (incl. landslide)	groups of persons	positive	Local
Industry / other business	Preparation (resilience)	Disaster (large scale)	"Met" - Meteorological (incl. flood)	Equipment	negative	Regional
Research and Education	Response	Other (to be specified)	"Safety" - General emergency and public safety	Infra-structure	neutral/none	National
Standardisation	Recovery	Not Specified	"Security" - Law enforcement, military, homeland and local/private security	concept		International (EU, continent, cross border)
NGOs			"Rescue" - Rescue and recovery			Other (to be specified)
General Public			"Fire" - Fire suppression and rescue			Not specified
First responders			"Health" - Medical and public health			
Practitioners			"Env" - Pollution and other environmental			
International			"Transport" - Public and private transportation			
Other (to be specified)			"Infra" - Utility, telecommuni-cation, other			

			non-transport infrastructure			
Not specified			“CBRNE” – Chemical, Biological, Radiological, Nuclear			
			Other or not specified			

3. Results – Exemplary Comparison of Selected Definitions

Basically, the general constellations of definitions to each were identified as following:

- One term is defined by different sources and generating organizations → similarities and/or deviations according to the selected categories and contexts;
- One term is included in the definition of another term → they have overlaps and similarities (e.g. item and sub-item);
- Two terms are (more or less) sharing one definition → identification of overlaps and differences; specifically in the context of different organisations this is relevant.

In table 2 we show a comparison of the definitions of the term “Emergency Management” included in two different terminologies, i.e. ISO 22300 (2018) and UNISDR (2015). Relevant differences and partial overlaps are relevant in the categories of Phase, range of escalation and objects. They underpin the potential misunderstandings and thus the importance of a common understanding and language supported by the CWA-outputs.

Table 2: Exemplary exercise of the definitions for the term “Emergency Management”

Source	ISO 22300	UNISDR 2015
Term	Emergency Management	Emergency Management
Definition	Overall approach preventing and managing emergencies that might occur	The organization and management of resources and responsibilities for addressing all aspects of emergencies and effectively respond to hazardous event or disaster
Type of organisation	Not specified	Not specified
Phase	Prevention & response (managing)	Prevention and preparation
Range of escalation	Emergency	Emergency and disaster
Scenario of Application	Not specified (all possible)	Not specified (all possible)
Objects	Concept (assisting)	All categories (resources and responsibilities)
Effect	Positive	Positive
Type of region	Not specified	Not specified

4. Conclusion and Outlook

Within this paper insight is given on the methodology for comparison of definitions developed within the CEN Workshop Agreement on Terminologies in Crisis and Disaster Management. The paper is presenting basic principles of the methodology developed to allow comparisons of definitions of the same or similar terms from different sources. Additional analyses are currently taking place in order

to validate the methodology. Moreover, a first version of an indicator was developed making the numerical quantification of similarities of definitions possible (not presented in this paper). The authors intend to implement this methodology in an electronic thesaurus, not only allowing comparison of different definitions from the same term, but also to quantify and analyse similarities. It is imperative that the context (e.g. purpose and scope of a terminology) are taken into account in such an analysis.

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TOPIC D: SOCIAL MEDIA

SOCIAL MEDIA AND INDUSTRY 4:0 – HUMAN RESOURCES IN THE AGE OF LINKEDIN

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Keywords

Social media, industry 4.0, human resources, LinkedIn

Abstract

LinkedIn is a recruitment tool that has gotten a lot of attention for its growing member base the past few years. In this paper, we will use a quantitative case study to analyze how professional recruiters use LinkedIn by looking at the 10 biggest companies in Norway, France and Germany. The paper's first key finding is that, in general, although companies are registered on LinkedIn, their activity is quite low, as it varies from zero to seven posts a week. Secondly, the investigated companies seem to lack encouraging their employees to update their LinkedIn profile regularly. Instead, the employees are free to join the platform if they appreciate it and regard it as an added value to their professional appearance. Another key finding is that Germany has adopted the usage of LinkedIn to a higher extent than Norway and France, and the number of job ads on LinkedIn is significantly lower than on the corporate website in the two last countries. Explored findings imply that LinkedIn is not as essential to achieve sustainable recruiting as it is stated in the theory. On the other hand, this research is definitely limited to quantitative data, and we are thus not able to investigate if professional recruiters regularly use the LinkedIn platform to observe and contact people directly.

1. Introduction

LinkedIn has revolutionized the recruiting world” (Muse, 2014). This claim of famous Forbes magazine proves how important became this social media tool in the field of recruitment, both for companies and job seekers. LinkedIn is now the world’s largest professional online service, used by more than 460 million professionals worldwide. Its success is based on its key features. First, it provides tools to build and manage professional networks. But it especially gives recruiters a quick and easy access to a large range of resumes from skilled potential employees – looking for a job, or not – all around the world. Professionals tend to agree on the fact that LinkedIn is today essential in the business of recruitment. This is why we chose to focus our research on the companies’ interest. We want to understand how recruiters actually use this service, and to what extent their process changed with the emergence of the #1 social media. We will do this by answering the following research question: “How do companies use LinkedIn as a tool in recruiting?”

We will start our paper presenting why this research is interesting regarding the current professional environment we are experiencing as soon-to-be job seekers. In a second phase, we will describe our theoretical findings, identifying key statements on LinkedIn from a professional point of view. Then

we will explain the method we want to use, which is a quantitative case study focused on three countries (Norway, Germany and France) to look at similarities and differences and discover the impact difference of LinkedIn among different markets. Finally, our paper will end with a discussion based on a comparison between our theoretical and practical findings.

The worldwide leader of social recruitment is LinkedIn. The site officially launched on May 5, 2003. The number of LinkedIn members today is 467 million from over 200 countries. Europe is their biggest market outside the United States, and Norway, France and Germany are some of the countries with the highest adoption rates. This amount of members gives LinkedIn a large opportunity to affect the world of recruitment. When we look at their company popularity, more than 4 million companies have LinkedIn Company Pages. This shows that LinkedIn has become a popular social network for both job seekers and employers, and it is therefore interesting to see how the recruiters use it.

1.1. Industry 4.0

Industry 4.0 is a name for the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, the Internet of things, cloud computing and cognitive computing. Industry 4.0 is commonly referred to as the fourth industrial revolution. Industry 4.0 creates what has been called a "smart factory". Within the modular structured smart factories, cyber-physical systems monitor physical processes, create a virtual copy of the physical world and make decentralized decisions.(Doucek, Fischer, & Novotny, 2017)

To cope with information (Sigmund, 2017), knowledge and competence challenges related to new technologies and processes of Industry 4.0 new strategic approaches for human resource management are needed. Due to the continuous automation of simple manufacturing processes, the number of workspaces with a high level of complexity will increase, which results in the need of high level of education of the staff. The challenge is to qualify employees to shift their capacities to workspaces with more complex processes and ensure the retention of jobs in changing working environments. (Hecklau, Galeitzke, Flachs, & Kohl, 2016) A new approach to human resources is needed because of new needs and challenges of Industry 4.0.

1.2. Theoretical background

Let's identify the key facts about LinkedIn from the point of view of the companies. This reflection started after understanding how company-oriented LinkedIn was becoming. We thought it might be interesting to discover why companies consider LinkedIn as a vital tool for their business.

LinkedIn's business is more and more company-oriented

The "Corporate webpage for recruiters" is the perfect example of this trend in the strategy of LinkedIn: satisfying their corporate customers. This page is a "version of LinkedIn just for recruiters", meaning that it is designed to promote the different tools that will help companies in their human resources management. This communication is a proof that LinkedIn is more and more company-oriented, trying to provide the best service for its best customers: the firms.

Through videos and demonstrations, three main pillars are highlighted: powerful search tool to identify quickly the ideal candidates, efficient 'InMail' messaging environment, easy management of recruitment process with a personal dashboard. LinkedIn is currently trying to attract companies to use the advantages of its network, since an international trend has been easily identified: social media has become key in the human resources management – and especially the recruitment process – for the companies. HR specialists even talk about a revolution in the business of recruitment.

Social Media, and especially LinkedIn, revolutionized the recruitment process

HR were becoming the next function (after sales and marketing (Smutny, Cermak, & Tomanek, 2015)) to explore the potential of social media (Rozeňnal & Novak, 2017). That is to say technology is becoming more and more important for HR management. Companies are always looking for easy and enjoyable tools to use. And as explained by Tazeeb Rajwani, a research fellow at the Cranfield School of Management, these tools “have to be of use or value to the individual employing it if those benefits are going to cascade to the bottom line”. This works also for the HR departments. (Muse, 2014)

In an article of *The Economist*, one corporate recruiter calls LinkedIn a “game changer” (*The Economist*, 2014), because it totally changed the recruitment market (how to find a job & how to find a candidate). LinkedIn is ambitious and aims at revolutionizing the business of recruiting, but also the operation of labor markets and, at the end, the efficiency of economies. So it’s a powerful actor that companies now take into account, since the tool will become more & more important.

“This is the future for our company”, said Accenture’s head of global recruiting (Hempel, 2010). In 2010, he was planning to recruit 40% of new employees through social media. This article also ends explaining how recruiting firms are suffering from LinkedIn disruption in the world of recruitment. They are now adapting their job to this new trend, since the online recruitment process, which already revolutionized the business, has totally been changed by LinkedIn.

A sociological explanation could be found in a *Forbes* article (Smith, 2014). LinkedIn is actually using a sociological statement: the balance between strong and weak ties. Sociologists define strong ties as those people who are in our inner circle — family, best friends from high school or college, longtime co-workers. On the contrary, weak ties correspond to the larger circle, the acquaintances we are not nearly as close to. In 1974, the sociologist Mark Granovetter arrived at the following conclusion: weak ties are almost always more valuable to us than strong ties. This can explain the success of LinkedIn, and why people are using this tool so much.

LinkedIn has become the most popular online platform for recruitment purposes among HR specialists

“Everybody uses LinkedIn”, said Dwight Scott, a recruiter with ExecuSearch in New York (Herships, 2014). This means that a lot of data is available for both companies and jobseekers. Scott says he does not spend much time studying applicants’ resumes, because he prefers searching LinkedIn for potential hires (eg 65% of his placements in 2014 have been done via LinkedIn).

Another concrete example of a company is found in the article of *The Economist* “Workers of the World, log in” (*The Economist*, 2014). Kenandy, a Silicon Valley company, has recruited half of new employees via LinkedIn. The proof of the companies’ interest is obvious: 60% of LinkedIn’s turnover come from them, since they spend money to make the most of LinkedIn using all of the available tools. Now 1 million jobs are available on the platform, and not only high skilled positions. LinkedIn is becoming larger and now gathers all of the different types of offers. These are facts that confirm the interest of HR for LinkedIn.

Social recruiting is now the norm explains the last Jobvite Social Recruiting Survey (Jobvite, 2014). 93% of recruiters use or plan to use social to support their recruiting efforts. And 73% plan to invest more on social networks regarding recruitment purpose. Recruiters really take social media profiles seriously when evaluating candidates. 55% of recruiters have reconsidered a candidate based on their social profile (up 13% from 2013).

Other data is also available. In the Bullhorn Social Recruiting Activity Report (Bullhorn, 2014) we understand that recruiters are connected to 3 main social networks (Facebook, Twitter, LinkedIn), but they use much more LinkedIn. This report is also summarized in an article found on the eMarketer website (eMarketer, 2013). We can read:

- 98% of recruiting professionals made use of social media to find talent in 2012, and 97.3% for LinkedIn.
- 93% of the recruiters surveyed placed a least one candidate using LinkedIn.
- Trend: 82.6% of the recruiters surveyed explain they plan to use LinkedIn even more in the short-term.

Another specialized article (TheUndercoverRecruiter.com, 2012) gives more precise figures. LinkedIn gets almost 9x more job applications than Facebook (3x more than Twitter). Regarding the profile of HR specialists, the average number of connections for a recruiter is 616. And 28% of them have more than 1000. (Boehmova & Malinova, 2013)

LinkedIn is actually the only social site that really matters (more serious than any other, such as Facebook or Twitter), explains the article of Fortune (Hempel, 2010).

So LinkedIn is a very important tool for recruiters. And this is especially true when recruiting skilled employees. As explained in the Fortune article (Hempel, 2010), the average member on LinkedIn is a college-educated 43-year-old making \$107,000 (mainly senior executives). Moreover, recruiters rely on the site to find even the highest skilled executives (ex: Oracle CFO recruited via LinkedIn in 2008).

All of the examples above prove how popular LinkedIn is among companies, because it helps them to improve their recruitment process. And to do so, specialists highlight some key features & advantages of LinkedIn. (Boehmova & Novak, 2015)

Recruiters have different LinkedIn tools they can use to improve their recruitment process

Social media has made it easier for recruiters to build and nurture connections, ultimately increasing the efficiency with which a recruiter can source quality candidates (TheUndercoverRecruiter.com, 2012) . Before LinkedIn, it was actually very difficult to identify passive candidates on regular online job boards. Now it is very easy to reach out directly to a candidate (Hempel, 2010).

The article of the Economist (The Economist, 2014), stating some of the key advantages of LinkedIn, confirms that the main benefit for recruiters is to find the ‘passive’ jobseekers. They correspond to those who could miss the job offer, but who would still be good potential candidates for the company. Second, companies even encourage their employees to get an updated profile on LinkedIn. Two advantages appear from this: it helps getting a good understanding of who your business partners are working with, and it can be useful to find skilled candidates within your own company. Finally, firms also love LinkedIn because they can get data about their own company: number of “followers”, number of employees, new positions of former employees. As for Dwight Scott, still in the Marketplace article (Hershops, 2014), the best thing relies on the search options, which allow using filters, to identify quickly candidates.

Moreover, because of all of the data LinkedIn gathers, it can even help for decision-making process, i.e. to understand where to open new facilities (number of skilled workers potentially available, etc.) (The Economist, 2014).

2. Methodology

This study is based on collection of primary data through observation of activity on social media. To collect the data we observed the 30 companies’ LinkedIn profile over 3 month period. In addition, we compared number of job positions on LinkedIn with their corporate website and job posting websites. We had seven factors we observed and studied. The first factor is total number of employees in the company. We want to use this factor together with a second factor, number of employees on

LinkedIn. By comparing these two factors we believe that we can get a picture of how important the company believes LinkedIn to be. The next factor is number of posts per week. This factor explains the company's use of LinkedIn. In addition, it shows the company's attitude towards sharing information and updating their followers. Hence, this factor also implies how important the company believes LinkedIn to be. Number of followers is another factor we have looked into. This factor explains the company's ability to create interest towards the general public and attract followers. Thus, this factor explains the use of LinkedIn. It is interesting to look at this factor together with job postings on LinkedIn, to see if the number of followers really is influenced by the company's activity level on LinkedIn. The last three factors, which is connected, are job postings on LinkedIn, job postings on the corporate website and a job posting website. We chose to observe these factors to research how the company use LinkedIn compared to other job posting places. This will give us a picture on the companies' focus in their use of LinkedIn. The job posting websites are different between the three countries, but they serve the same purpose. For Norway we used data from Finn.no, for France from Indeed.fr and for Germany Monster.de.

3. Hypotheses

As presented in the introduction the purpose of this study is to answering the following research question: "How do companies use LinkedIn as a tool in recruiting with coming Industry 4.0?"

To answer this research question we prepared some working hypotheses to support our main research question:

The theories presented suggest that it is necessary for all companies to be active on LinkedIn, as it has revolutionized professional recruitment techniques. Therefore, we want to investigate the ten biggest companies by market capitalization in Norway, France and Germany by using the following hypothesis:

Hypothesis #1: Big companies actively use LinkedIn.

We believe, based on the theory about the importance of LinkedIn as a recruitment tool that the number of jobs posted on LinkedIn should correlate with the number of jobs posted on the company's corporate website. Based on these we have formulated the following hypothesis:

Hypothesis #2: The companies have as many job postings on LinkedIn as on their corporate website.

In addition, we believe, based on the theory about the importance of LinkedIn that the number of jobs posted on LinkedIn should correlate with the number of jobs posted on job posting websites. Based on these we have formulated the following hypothesis:

Hypothesis #3: The companies have as many job postings on LinkedIn as on job posting website.

Furthermore, from the theory it seems like a higher level of activity will make the page more interesting and therefore more worth following. Hence, it should be a relationship between the level of activity and the number of followers. This helps us to derive the following hypothesis:

Hypothesis #4: High activity on LinkedIn gives companies more followers.

We believe, based on the importance of LinkedIn, that companies care about having most of their employees on LinkedIn and encourage them to fill in the profile. Based on this we will like to test the following hypothesis:

Hypothesis #5: The companies encourage their own employees to have a LinkedIn profile.

Lastly, we believe that job offers attract people to follow a particular page. According to this idea the number of followers should be correlated with the number of job offer on the company's page. That is why we want to test the following hypothesis.

Hypothesis #6: The number of followers is correlated with job postings on LinkedIn.

4. Evaluation of hypotheses

4.1. Hypothesis #1 – Big companies actively use LinkedIn.

In **Norway**, every one of the top-10 companies has a Company Page on LinkedIn. This supports the first of the hypothesis. On average 2.4 posts are made every week. While taking a more detailed look at the 10 companies, it becomes obvious that only 80% of the companies posted on LinkedIn the particular week. On the one hand, YARA International and Seadrill posted both 5 times during the week, while Royal Caribbean Cruise Lines and Marine Harvest did not post anything. This highlights enormous differences. Hence, we cannot prove an active usage in general. Moreover, the theory stated that corporations have to use LinkedIn as a recruitment tool in order to guarantee sustainable recruiting success. Transferring this theoretical argument to the practical observations, one can on the one hand conclude that at least Royal Caribbean Cruise Lines and Marine Harvest do not take full advantage of LinkedIn as a recruitment tool. On the other hand, both companies could further be convinced of the fact that LinkedIn is essentially important to reach potential job seekers on a weekly basis. In addition, both companies could eventually prefer directly contacting job seekers by writing private messages instead of publishing general information on the platform. By way of conclusion, one can underline that the observed companies do not sufficiently use all features offered by LinkedIn. Nevertheless, at least all the investigated companies are registered on the platform, and seem to appreciate it.

In **France**, every one of the top-10 companies has a Company Page on LinkedIn. This supports the first of the hypothesis. The average of 2.0 posts every week is the lowest of the ones observed. When taking a more detailed look at the 10 companies, it becomes obvious that as much as 90% of the companies posted on LinkedIn the particular week. This is the highest value that was detected. When looking at Groupe Danone, they have a high activity with five posts per week. Meaning that this company supports the argument explored from the theory. However, Vivendi did not generate any post in the investigated week, which again underlines differences among the top-10 companies.

This way France differs from the other countries in a positive way, since they have only one company, which is not considered as active. On the other hand, they have a lower average activity, which implies a lower use. In sum, it is hard to draw a conclusion concerning the highest corporate LinkedIn activity. Therefore, the hypothesis cannot be sufficiently be evaluated in a sufficient and generally transferable way.

In **Germany**, every one of the top-10 companies has a Company Page on LinkedIn. As already shown about, this again supports the first part of the hypothesis. On average 3.4 posts are made every week, which is actually 1.0 percent point above the value measured for Norway. While taking a more detailed look at the 10 companies, it becomes obvious that only 90% of the companies posted on LinkedIn the particular week. On the one hand, Daimler AG and SAP posted 7 times each during the week, while Volkswagen AG did not post anything. This highlights enormous differences. Hence, like in Norway and France, an active usage cannot generally be proven.

In total: When comparing the three investigated countries a common presence of LinkedIn in the corporate world can be outlined, which is further supported by the huge amount of 4 million global company pages on LinkedIn. The overall LinkedIn activity seems to be quite high. Four out of 30

companies, only 13 percent, of the investigated companies did not post at least ones in the particular week. At the same time, the average amount of postings varies between 2.0 and 3.4 for the three different countries, implying the slight differences in LinkedIn activity among the three countries. Finally, we can highlight that the hypothesis is only partially supported, both for the countries individually and in total.

4.2. Hypothesis #2 – The companies have as many job postings on LinkedIn as on their corporate website.

In **Norway** we can see a huge variation between the companies on this factor. Two companies use LinkedIn quite a lot for job posting. They have almost as many jobs posted on LinkedIn as on their corporate website. On the opposite side, eight out of ten companies have only one third of their job postings on LinkedIn. When looking at these findings it has to be taken into consideration that the companies are not that big and they probably do not have continuous recruiting through the whole year. Our findings may vary between the different companies based on this. Still the results are clear and it does not give support for our hypothesis. 80% of the companies does only post one third of their number of job postings on LinkedIn. This highlights that the companies does not use LinkedIn as much as the existing literature say and the importance of LinkedIn for companies in recruiting seem to be lower than expected.

When it comes to **France** the picture is quite similar, but even more extreme. Nine out of ten has under one third of their job postings on LinkedIn. One main difference is the fact that the tenth company has more jobs posted on LinkedIn than on their corporate website. The results will as in Norway probably vary in France as well, but based on the fact that nine out of ten companies does not use LinkedIn actively a trend on low use of LinkedIn can be interpreted. Thus, the hypothesis will not get support in based on the data from France either. Only Groupe Danone seem to actually believe that LinkedIn is an important tool in recruiting by posting more jobs there than on their corporate website.

Last, in **Germany** the picture is different. Only three out of ten companies has under one third of their job postings on LinkedIn. As many as four out of ten has more jobs posted on LinkedIn than on their corporate website. The three last companies have a between 40 and 80% of their job postings on LinkedIn. Based on these results we can conclude that the importance of LinkedIn for the companies is higher, but it is still difficult to give support for the hypothesis when we take the three companies, which have low use of LinkedIn into consideration.

In total, on average Germany see higher importance in the use of LinkedIn as a recruitment tool than Norway and France. Still, the hypothesis does not get support for any of the countries. Based on this we question how important the companies actually believe that LinkedIn is in recruiting. The literature regarding LinkedIn as the most popular online platform for recruitment purposes is challenged by our findings. On the other hand, our findings just look into the visible use of LinkedIn by the companies, it may also be other effective ways to use LinkedIn in recruitment, which is difficult to observe. For example can the presence on LinkedIn result in more activity on the corporate website, which is a factor impossible for us to measure. In addition, the fact that we only look into the activity for a limited time has to be taken into account. The companies may not use continuous recruitment as mentioned above.

4.3. Hypothesis #3 – The companies have as many job postings on LinkedIn as on job posting website.

The literature underlines how important companies believe LinkedIn to be, as mentioned for the last hypothesis. Based on this we believe that our findings should support this hypothesis as well. To

evaluate this we will use the ratio between number of job postings on LinkedIn and number of job postings on job posting websites from the result part. We will evaluate the companies' ratio for each country individually, before we compare the countries and conclude with if the hypothesis gets support.

In **Norway** the job postings varies between LinkedIn and the job posting website. The job posting website is used by nine out of the ten companies and seven out of ten companies post more jobs on this job posting website than on LinkedIn. The other three companies use LinkedIn more than the job posting website, but the use varies. Two companies have 20% more jobs posted on LinkedIn, while Seadrill have eight times more jobs on LinkedIn. We believe that these three companies see LinkedIn as important in recruiting, but still seven companies have low use of LinkedIn and based on these we do not get support for our hypothesis. Hence, the importance companies believe LinkedIn has for recruiting is not reflected in our findings.

The companies in **France** also use LinkedIn and the job posting website in a varied way. Six companies post few jobs on LinkedIn compared to the job posting website. While one company use LinkedIn just as much as the job posting website and another one uses LinkedIn more. The two last companies posts half as many jobs on LinkedIn as the job posting website. Based on these findings the hypothesis does not get support and the importance of LinkedIn in recruiting is not as high as the literature express.

When it comes to **Germany** all the companies use the job posting website, but the activity varies here as well. Generally, LinkedIn is much more used in Germany than in France and Norway, and they see the importance of LinkedIn in a higher degree. Only two companies use LinkedIn less than the job posting website. While six companies have between as many and double as many job postings on LinkedIn compared to the job posting website. The two last companies have a lot more jobs on LinkedIn than one the job posting website. Thus, in this country the hypothesis get support and the companies' activity reflects the importance of LinkedIn

In total, Norway and France has the same trends, while Germany differs completely. For Norway and France we do not get support for our hypothesis, while we got support for Germany. Looking at all cases together this hypothesis is rejected. The interpretation of this is the same as for hypothesis above. The literature that sees LinkedIn as the most popular online platform for recruitment purposes is also here challenged. The weaknesses in our data, as mentioned in the discussion of the hypothesis above, also apply here.

4.4. Hypothesis #4 – High activity on LinkedIn gives companies more followers.

For **Norway**, two companies were not active at all the investigated week. These companies are Royal Marine Harvest and Caribbean Cruise Lines. Marine Harvest is the smallest Norwegian company based on LinkedIn followers, so this seems to support the hypothesis. However, Royal Caribbean Cruise Lines is the third biggest company based on LinkedIn followers. This implies that activity is not perfectly correlated with the number of followers. When comparing Statoil and YARA International, we find that Statoil has ten times as many followers as YARA, 227,211 versus 23,659, while YARA has more posts, 5 versus 3. This definitely proves that there is no correlation of the amount of followers and activity on LinkedIn.

For **France**, Vivendi was the only company that had no activity. They are also the company that has the least followers on the platform. This supports the hypothesis. On the other side, Group Danone is the company that is most active, with five posts per week, and second highest ranked by LinkedIn followers in France. This is in accordance with our hypothesis, and it seems to differ from the Norwegian findings.

In **Germany**, SAP had the most activity, with seven posts. They are also the second biggest company by LinkedIn followers. This seems to support the hypothesis. On the other hand, the second smallest company measured by followers, Daimler AG, also posted seven times in the investigated week. BMW had just one post, while having 248,352 followers on the platform. Regarding the hypothesis, these particular findings for German corporations are not able so sufficiently prove or reject the predefined hypothesis.

In total: an obvious correlation of the amount of LinkedIn followers and the overall platform activity, cannot be uncovered in the end. In order to further clarify this argument, one can use the example of the Norwegian corporation YARA International, which generated 5 posts and 23 thousand followers, and the French corporation Sanofi-Aventis, which generated only 1 post while having 385 thousand followers. This implies that the number of followers depends on more factors than the cooperate activity on LinkedIn. In the end we cannot sufficiently prove or reject the predefined hypothesis, neither for the countries in separately nor total.

4.5. Hypothesis #5 – The companies encourage their own employees to have a LinkedIn profile.

In **Norway**, we observe that on average, 42% of employees have a LinkedIn profile stating that they are working for the company. It means that more than half of the employees in the 10 biggest companies either have not any LinkedIn profile or simply do not update it regularly. However, if we are looking into details, we identify significant differences between companies. For instance, Gjensidige Forsikring's ratio is 98%, while Marine Harvest's one is very low, around 10%. If we look at the activity of each company on the platform, we see that Gjensidige Forsikring regularly feeds its page, while Marine Harvest does not. We can imagine that LinkedIn is much more important in the corporate culture of Gjensidige Forsikring, leading the company to encourage its employees to join their LinkedIn community.

In **France**, the average ratio is lower, accounting for 27% of the employees. There are not very big differences between companies. For instance, the highest percentage, which is the one of Sanofi (58%), is still quite low. This weak average shows that French companies do not really take initiative to encourage their employees to create and update LinkedIn profiles. Employees are free to do it or not. This could mean that firms do not use LinkedIn for internal recruitment purpose, certainly because they use other company-specific tools.

In **Germany**, the average number of employees with a LinkedIn profile is close to the French one: 30%. They are more similar to Norway in the differences between companies though: 98% rate at SAP for example. SAP, as a software corporation focused on new technologies, is very active on LinkedIn and is posting news almost every day. This shows that the use of social media, and especially the professional social network, truly belongs to the corporate culture.

As a conclusion, we first observed that Norwegian companies encourage their employees to fill in their LinkedIn profiles more than in France and Germany. So it seems that LinkedIn is more often part of the companies' corporate culture in Norway. However, regarding our initial hypothesis, the three ratios remain quite low. Then we cannot assess that companies really encourage their employees to get a complete LinkedIn profile. Employees are aware of the tool, but they seem to stay free to create their own page, since corporations do not take strong initiatives on this topic.

It actually tends to depend on the corporate culture of the firm. We observed that when a company is very active on LinkedIn, the ratio is high or very high. So we can identify a correlation between visible activity of the company on its page and the likely initiatives to encourage employees to be part of the company on LinkedIn.

4.6. Hypothesis #6 – The number of followers is correlated with job postings on LinkedIn.

In **Norway**, there are quite a lot of followers per page regarding the total population of the country. However, there are a few job offers available on LinkedIn. So the number of followers does not seem to be linked to the availability of positions. This is also proven when exploring details: Statoil, the company with the highest number of followers, only has 9 open positions on LinkedIn. On the other hand, Telenor has quite a lot of job offers (29), while only 51,094 follow them.

In **France**, there are on average more followers and more job offers per company. The observation is similar to Norway though: the most followed corporations are not the ones offering the highest number of positions. For example, while Total has 632 job offers available for around 430,000 followers, France Telecom shows almost twice as many positions (1125) for “only” 118,000 followers.

In **Germany**, there are on average much more followers and much more positions on the LinkedIn company profiles. Again, we however identified counterexamples regarding our hypothesis. In fact, the company with the most followers – Simens and its 668,223 followers – offers 1,124 open positions on LinkedIn. In the same time, Allianz has more positions (1,134) while its number of followers is much lower, close to 88,000.

In total: it seems that the hypothesis is verified at some point when comparing countries together. We indeed observed that on average a Norwegian company has 9 job offers for 51,576 followers, a French one 97 for 190,245 and a German one 633 for 236,564.

So, at the country level, we can say that the more job offers are available, the more followers. But as seen in each particular case, it’s not true at the company level within countries. A lot of differences can be found. We could guess that a lot of other factors are to take into account when trying to analyze the number of followers for a company. For instance, its reputation and its popularity are very important.

5. Acknowledgment

Paper was processed with contribution of long term support of scientific work on Faculty of Informatics and Statistics, University of Economics, Prague.

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FACEBOOK'S EFFECT ON PERCEPTION OF POPULARITY OF VACATIONS ABROAD

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Keywords

Facebook, tourism, perception

Abstract

This article focuses on the effect of social network Facebook on people's perception of quantity of vacations abroad among their friends and general population. The common prediction based on previous studies and theoretical knowledge about the effect of social media would be that active Facebook users will (because of availability heuristic and correspondence bias) estimate the number of people, who spent vacation abroad as higher than people without Facebook account. This paper based on electronic questioning among 289 respondents (Facebook and non-Facebook users) disapproves this conclusion. Results of this research clearly show that active Facebook users are not influenced by availability heuristics and correspondence bias in a way that would lead them to overestimation of people, who spend vacation abroad. The differences in estimates of Facebook users and non-Facebook users are statistically not significant.

1. Introduction

Facebook provides a platform for people to manage others' impressions of them with an increasing influence on the whole economy. (Naaman, Boase, Lai, 2010; Bakshy, Messing, Adamic, 2015; Doucek, Fischer, Novotny, 2014; Muchnik, Aral, Taylor, 2013) Researchers have examined the impact of using Facebook on people's perceptions in different areas of our' lives. It was found out that those who are more active on Facebook will have different perceptions of others than those, who are less active or do not have a Facebook account at all. This happens because users of computer mediated communication can employ several techniques to optimize their self-presentation and promote desired relationships, such as spending more time with greater cognitive resources to edit messages, carefully selecting photographs, highlighting their positive attributes, presenting an ideal self, having a deeper self-disclosure and managing the styles of their language. Through these actions, users of computer-mediated communication can leave better impressions on others. Also, a majority of users focus on the self when posting information while a significantly smaller set of users are driven more by sharing information. (Tierney, 2013; Naaman, Boase, Lai, 2010) On-line activity can also lead to exclusive and cliquy behavior. (Pavliček, 2013)

Previous studies also found out that comments posted by users' Facebook friends, as well as the number of Facebook friends and the attractiveness of Facebook friends, affect others' impression of users' popularity or social attractiveness. The perception of others is not twisted only by message originator, but also by cognitive distortions like availability heuristic and correspondence bias. (Chou, Edge, 2012)

We know that photos and stories from vacation time is a perfect material for social media as Facebook and the main goal of the following research is to find out if the social network Facebook has an effect on people's perception of vacations abroad, more precisely if because of a load of pictures from vacations on Facebook people who are active users of Facebook will estimate the percentage of people, who has spent a vacation abroad higher than people without a Facebook account.

1.1. Availability heuristic

According to Kahneman's availability heuristic, people have the tendency to judge the number of certain events or risks in the world by the ease with which these events or risks come to their mind. Availability heuristic means that people overestimate the importance of information that is easy to remember. This process has generally been demonstrated by questioning participants about the relative likelihood of two categories in which instances of the first category are more difficult to recall than instances of the second category. (Fox, 2006; Kahneman, 2011) Also Facebook users tend to base judgment on examples easily recalled.

1.2. Correspondence bias

The correspondence bias is the tendency to draw inferences about a person's unique and enduring dispositions from behaviours that can be entirely explained by the situations in which they occur. (Yudkowsky, 2007) Facebook users tend to attribute the positive content presented on Facebook to others' personality, rather than situational factors, especially for those they do not know personally. For example, those Facebook users who have used Facebook longer agreed more that others were happier and had better lives than they did themselves. (Chou, Edge, 2012)

2. Methodology

To find out if active usage of Facebook account influences our perception of popularity of vacations abroad we have decided to run electronic questioning among 289 respondents. 195 respondents have indicated to be active Facebook users, 43 respondents have indicated to have Facebook account, but use it only rarely and 51 respondents have not had a Facebook account. All respondents were asked the same questions: "Have you spent this summer vacation abroad? How many of your friends you think have spent holidays abroad this summer? How many of respondents of this questionnaire you think have spent holidays abroad this summer?" The questionnaire went public from September 2017 to January 2018. More than a third of respondents (140) were aged between 19 and 25 years and more than a quarter of respondents (87) were aged between 26 and 35 years. Only 16 respondents were older than 56 years. 94 respondents have indicated to be full-time or employed students. The age structure of respondents resembles the structure of Facebook users. Men formed only 25 % of respondents. The vast majority of respondents have indicated to have university (136) or high school (133) as their highest education level. Only 20 respondents have indicated to have only primary education. The research was carried out in Czech.

After data collection we decided to compare the proportion of friend's respondents of active Facebook users and Facebook non-users, which were indicated to spend holidays abroad this summer. According to the theory of availability heuristics and corresponding bias we have the theoretical hypothesis that Facebook active users will think that the popularity of vacation abroad is bigger among their friends than non-Facebook users will think about popularity of vacation abroad among their friends.

3. Results

The vacation abroad has been spent by 46, 37 % of our respondents in summer 2017. When asked about the proportion of respondent's friends, who had been abroad during summer 2017, we have got these distributions (rounded to two decimal places):

Table 1. Comparison of perception of friends travelling on vacation abroad during summer 2017

Which proportion of your friends has been for holidays abroad this summer 2017?	Answered by all 289 respondents	Answered by respondents, who do not have Facebook (N=51)	Answered by respondents who are very active on Facebook (N=195)	Answered by respondents who have Facebook account, but are active only rarely (N=43)
0 – 20%	19,15 %	16,33 %	18,95 %	23,26 %
21 – 40%	24,47 %	18,37 %	25,26 %	27,91 %
41 – 60%	29,43 %	36,73 %	27,37 %	30,23 %
61 – 80%	20,92 %	20,41 %	23,16 %	11,63 %
81 – 100%	6,03 %	8,16 %	5,26 %	6,98 %

Source: Author

When using method ANOVA to compare these three groups of respondents (non-Facebook users, very active Facebook users and less active Facebook users) we got the p-value = 0,54742 and therefore the result is not significant at $p < 0,05$. Also, only by observation of data we can see that the hypothesis that active users of Facebook will estimate the number of friends traveling abroad as higher than non-Facebook users, is incorrect.

The possible explanation for the data above can be the fact that social media have the tendency to create social bubbles – for example in case of American election Hillary Clinton's supporters bubble and Donald Trump's supporters bubble making it hard to read an opposing view or life approach. We can check if there are also two bubbles regarding spending vacation – social bubble, which has the tendency to spend holidays abroad and social bubble, which has the tendency to spend holidays in homeland. People in these two bubbles could have different perception not only of their friends' habits, but also of habits of general population. The following part of research tries to find out, if those, who use Facebook and have spent their last summer vacation exclusively abroad, have the tendency to think it is more normal among their friends to spent summer vacation abroad than people without Facebook and if people, who use Facebook and have spent the last summer vacation exclusively in the Czech Republic have bigger tendency to think that it is more normal among their friends to spent summer vacation only in the Czech republic than people without Facebook.

For this part of research, it is important to state that 115 respondents have spent their summer vacation in 2017 only in the Czech Republic, 76 respondents in the Czech Republic and abroad as well, 58 respondents only abroad 40 respondents have indicated not to have a vacation during summer 2017. The percentages of respondents, who have indicated a given category (0 - 20 % or 21 – 40 % etc.) are rounded on two decimal places.

Table 2. Comparison of active Facebook users with people without Facebook account from the perspective of the last summer vacation of their friends

Options of answers	All respondents, who spent their vacation exclusively abroad during summer 2017 asked about the percentage of their friends, who have spent holidays abroad during summer 2017	All respondents, who spent their vacation exclusively abroad during summer 2017 and are also active Facebook users (also asked about the percentage of their friends, who have spent holidays abroad during summer 2017)	All respondents who spent their vacation exclusively in the Czech Republic during summer 2017 asked about the percentage of their friends, who have spent holidays abroad during summer 2017	All respondents who spent their vacation exclusively in the Czech Republic during summer 2017 and are also active Facebook users (also asked about the percentage of their friends, who have spent holidays abroad during summer 2017)
0 – 20 %	13,79 %	15,10 %	27,83 %	27,47 %
21 – 40 %	20,69 %	22,64 %	23,09 %	27,47 %
41 – 60 %	43,10 %	37,74 %	27,82 %	27,47 %
61 – 80 %	18,97 %	20,75 %	13,91 %	12,09 %
81 – 100 %	3,45 %	3,77 %	4,35 %	5,50 %

Source: Author

The data above shows that there is not a significant difference in perception of quantity of vacations abroad between Facebook and non-Facebook users when compared with respondents, who have similar summer vacation standard (have spent their summer vacation in 2017 exclusively in the Czech Republic or exclusively abroad). On the other hand, we can see that the theory of social bubble can be applied in case of holidays abroad and holidays in homeland. Respondents, who have spent summer 2017 in homeland, indicate relatively less friends that have spent the vacation abroad compared to respondents, who have spent summer 2017 abroad. This does not have to be the matter of perception, but also a correct estimation of reality. People often do very similar things as their friends.

Therefore, the next part of this research does not ask the respondents about their friends' vacations, but about their estimate of percentage of all respondents of this questionnaire, which has spent holidays abroad. The first column represents all respondents, who spent their vacation exclusively abroad during summer 2017, when asked about the percentage of respondents of this research, who have spent holidays abroad during summer 2017 as well. To find out the effect of Facebook we have to compare the first column with the second column, which represents all respondents, who spent their vacation only abroad during summer 2017 and are also active Facebook users and responded about the percentage of respondents of this research, who have spent holidays abroad during summer 2017.

The third column represents all respondents who spent their vacation exclusively in the Czech Republic during summer 2017 when asked about the percentage of respondents of this research, who have spent holidays abroad during summer 2017. To find out the effect of Facebook this third column

has to be compared with the forth column, which represents all respondents who spent their vacation also exclusively in the Czech Republic during summer 2017, answered the same question and are active Facebook users.

Table 3. Comparison of active Facebook users with people without Facebook account from the perspective of the last summer vacation of general population

Options of answers	All respondents, who spent their vacation only abroad during summer 2017 asked about the percentage of respondents of this research, who have spent holidays abroad during summer 2017	All respondents, who spent their vacation only abroad during summer 2017 and are also active Facebook user (when asked about the percentage of respondents of this research, who have spent holidays abroad during summer 2017)	All respondents who spent their vacation only in the Czech Republic during summer 2017 asked about the percentage of respondents of this research, who have spent holidays abroad during summer 2017	All respondents who spent their vacation only in the Czech Republic during summer 2017 and are also active Facebook users (when asked about the percentage respondents of this research, who have spent holidays abroad during summer 2017)
0 – 20 %	1,72 %	1,89 %	2,61 %	2,20 %
21 – 40 %	37,93 %	37,74 %	37,40 %	31,87 %
41 – 60 %	48,28 %	47,17 %	44,35 %	48,35 %
61 – 80 %	10,34 %	11,32 %	13,91 %	16,48 %
81 – 100 %	1,72 %	1,89 %	1,74 %	1,10 %

Source: Author

After running ANOVA tests, we can see that estimates of respondents (about how many respondents have spent summer vacation abroad in 2017) do not vary significantly neither between respondents, who have spent summer vacation exclusively abroad and exclusively in homeland nor between respondents, who actively use Facebook and respondents who do not have Facebook account.

4. Discussion

The results of this study can be influenced by the fact that some of the respondents maybe have not spent summer 2017 abroad, but were abroad during winter, spring or fall, making the exclusively homeland group more travel-oriented. In case of repeating this research, I suggest not to ask respondents only about a short period of time (summer 2017), but a long period (one year and more). It is also important to mention that this research was carried out exclusively among Czech population (relatively small country without access to the ocean) and therefore the data could be very different for other regions.

5. Conclusion

This research illustrates that people who have spent summer vacation exclusively abroad state that more of their friends have spent vacation abroad compared to people who have spent vacation exclusively in homeland. But the hypothesis about the effect of Facebook on popularity of vacation abroad cannot be confirmed. Contrary to expectations based on previous studies and theoretical knowledge, active Facebook users are not influenced by availability heuristics and correspondence bias in a way that would lead them to overestimation of people, who spend vacation abroad. The differences in estimates of Facebook users and non-Facebook users are statistically not significant.

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RULE-BASED AND CASE-BASED REASONING: A COMPARISON

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Keywords

Rule-based reasoning, case-based reasoning, inference mechanism, knowledge base, sentiment analysis

Abstract

Knowledge representation and reasoning play key role in automated decision support as many of the problems machines are expected to solve will require extensive knowledge about the world. In the area of AI (artificial intelligence) research two complementary approaches, rule-based reasoning and case-based reasoning are widely used for building knowledge-based “intelligent” decision-support systems. We will describe the basic principles of both approaches, their strengths and limitations and show how these approaches can be used for sentiment analysis.

1. Introduction

Knowledge representation and reasoning play key role in automated decision support as many of the problems machines are expected to solve will require extensive knowledge about the world. The term “knowledge” used here should be understood here as a “piece of expertise” acquired from a domain expert of a respective field and represented in a computer processible form.

In the area of AI (artificial intelligence) research two complementary approaches, rule-based reasoning and case-based reasoning are widely used for building knowledge-based “intelligent” decision-support systems. Rule-based reasoning is related to the so called Expert systems, a prominent research area within AI in the 70th and 80th of the 20th Century. In these times the search for general problem solving algorithm (using the formalism of state space) has encountered its limitations in the domains, which require specialized domain knowledge. Recently, the usefulness of rule-based reasoning has been recognized in the business rules management systems that use the basic principles of rule-based expert systems in a particular domain. Case-based reasoning is based on the idea, that past decisions in similar circumstances can help us to solve a new problem. It seems, that such approach to decision making better reflects the way how humans solve problems in their daily lives.

Both types of knowledge-based systems have two main parts, knowledge base and inference mechanism. Knowledge base stores the domain knowledge, inference mechanism is a domain independent algorithm that uses the knowledge stored in the knowledge base for reasoning. The used knowledge representation form determines the corresponding inference methods.

The rest of the paper is organized as follows: section 2 briefly describes the rule-based (expert) systems, section 3 briefly describes case-based reasoning (CBR) systems, section 4 shows how both approaches can be used for sentiment analysis and section 5 concludes the paper.

2. Rule-based Reasoning

2.1. Basic principles of expert systems

Expert systems are computer programs that emulate the decision-making ability of a human expert. One of earlier definition claims, that expert system is “an intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution” (Feigenbaum, 1979). The power of an expert system (ES) is derived from presence of a knowledge base filled with expert knowledge, mostly in symbolic form. In addition, there is a generic problem-solving mechanism used as inference engine. Some other more-or-less typical features of ES are uncertainty processing, dialogue mode of the consultation, and explanation abilities.

The knowledge represented in expert systems typically has the form of IF-THEN rules. These rules have two basic semantics: procedural (as used in generative systems), i.e.

IF *situation* THEN *action*

or declarative (as used in diagnostic systems), i.e.

IF *condition* THEN *conclusion*

The *situation* or *condition* is a combination (usually conjunction) of statements, the *action* is a list of actions that can be performed if the respective situation occurs and the *conclusion* is a statement that holds if the condition is true. The statements can be simple propositions (e.g. “the car is red”), attribute-value pairs (car_color = red) or object-attribute-value triples (car001: color = red).

The rules represent the knowledge in a “global” form, i.e. they express some generalized knowledge of domain experts. This is illustrated in Fig.1 where the rectangle corresponds to one rule that is applicable to all decision situations mapped onto points within this rectangle.

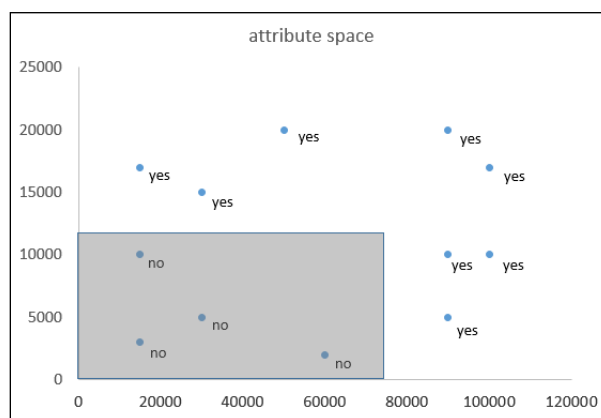


Fig. 1 Expressive power of a rule

The task of rule-based inference is to (1) perform actions that are applicable to the content of working memory (in generative systems), or (2) derive truth values for goals according to the answers to the questions (in diagnostic systems). This task is accomplished by:

- searching the rule base,
- application of a rule,
- uncertainty processing (if applicable).

There are two standard ways how to search for applicable rules, backward chaining and forward chaining. Backward chaining starts from goals of the consultation and looks for rules that have these goals as its conclusions, forward chaining starts with known facts and looks for rules that contain these facts in its conditions.

Once an applicable rule is found, it is used either to perform the respective actions (procedural meaning of the rule) or to infer the respective conclusion (declarative meaning of a rule). In the latter case, the rule is usually applied using deduction, i.e. for true rule and true condition we can infer that also the conclusion is true:

$$\frac{A \Rightarrow B, A}{B}$$

The deductive application of a declarative rule can be further extended by using uncertainty. In this case, both the rule itself and the condition can be true only to some extent and thus the inferred conclusion is true to some extent as well.

An important question to be solved during inference is if we have to apply just a single rule or all applicable rules. In generative systems, as the actions of different rules can have contradicting effect on the working memory, only one rule is used. Both options are possible in diagnostic systems. Typically if working without uncertainty, only one rule will be used while when working with uncertainty, contributions of all applicable rules are considered.

2.2. Strengths and limitations of rule-based reasoning

The IF-THEN formalism of knowledge representation is easy to understand so the knowledge base can be easily interpreted. Also the rule-based reasoning is a well established method. But to obtain the knowledge from domain experts in the form of rules can be very hard as the experts have to formulize general statements based on their experience. The difficulties of this transformation of tacit knowledge into explicit one are known in the AI community as “knowledge acquisition bottleneck”. Moreover, if we try to elicit rules with uncertainties, the numbers given by domain experts need not to be consistent with the uncertainty processing used during the inference. Another limitation of rule-based representation is the fact that the knowledge cannot be automatically updated. Typically, a new knowledge elicitation phase from the domain expert is necessary when modifying the actual knowledge base.

3. Case-based Reasoning

3.1. Basic principles of case-based reasoning systems

The history of case-based reasoning goes back to the Schank's model of dynamic memory in the early 1980th (Schank, 1982). In case-based reasoning systems, the used knowledge has the form of previous successfully solved problems (called cases) and the decision-making process for a new

situation is based on finding the most similar case (cases) that will guide us what to do. The ratio behind this approach is the idea to apply a successful past solution of a similar problem to current situation. So reasoning by analogy is the key principle used here. Such type of reasoning can be found also in clustering; here centroids of clusters play the role of cases.

To represent domain knowledge using “typical” solved problems is more natural for domain experts. A knowledge base consisting of cases can thus be obtained more easier and more faster than knowledge base consisting of rules. The represented knowledge has a “local” form as a case covers only a small subset of similar situations. This can be illustrated in Fig 2.

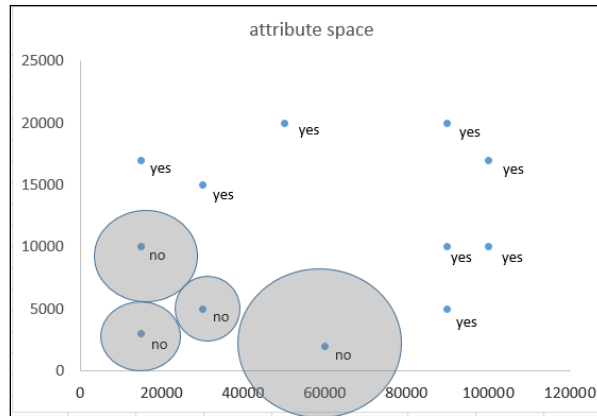


Fig. 2 Expressive power of cases

Cases are prototypical solutions of problems from the application domain. In the most simple situation, a case can be just a vector of values of numeric attributes, but cases can also have a structured form showing symptoms of the problem to be solved, questions that should be asked (together with typical answers) and also the possible solutions of the problem.

The main problem related to the case-based reasoning is how to define the similarity (or distance) between cases. If the cases are represented using numeric attributes only, it is possible to use some of the distance measures designed e.g. for statistical cluster analysis. Among them, the most widely used is the Euclidean distance defined as

$$d_E(x_1, x_2) = \sqrt{\sum_{j=1}^m \delta_O(x_{1j}, x_{2j})}, \text{ where } \delta_E(x_{1j}, x_{2j}) = (x_{1j} - x_{2j})^2$$

If the attributes are categorical, i.e. with values that cannot be ordered, then the basic distance measure used is “overlap” distance defined as

$$d_O(x_1, x_2) = \sum_{j=1}^m \delta_O(x_{1j}, x_{2j}), \text{ where } \delta_O(x_{1j}, x_{2j}) = \begin{cases} 0 & \text{iff } x_{1j} = x_{2j} \\ 1 & \text{iff } x_{1j} \neq x_{2j} \end{cases}$$

In both formulas above, $\mathbf{x}_1, \mathbf{x}_2$ are cases (examples) represented as attribute vectors.

While the distance measures defined for numeric attributes give us sufficiently fine-grained scale, the “overlap” distance can only recognize exact match of the values. So to make case-based reasoning more usable, better distance measures for categorical attributes must be defined. One example how to do this is to consider some domain knowledge concerning taxonomies of values of a categorical attribute. Another possibility, how to measure distance between categorical attributes is to represent cases in the form of a vector of truth values (weights) assigned to all propositions (attribute-value pairs) describing a consultation (questions) as well to propositions (attribute-value pairs) that define the possible results of a consultation (goals). Such representation allows to define distance and

similarity between cases using functions operating on numeric values, e.g. Euclidian distance (Berka, 2011).

The basic idea of the case-based inference is to apply the k-nearest neighbor algorithm (see Fig. 3). The uniform voting scheme shown in the algorithm in Fig. 3 can be replaced by weighted voting, where each neighbor (i.e. case in the case base) votes proportionally to its similarity to the new situation.

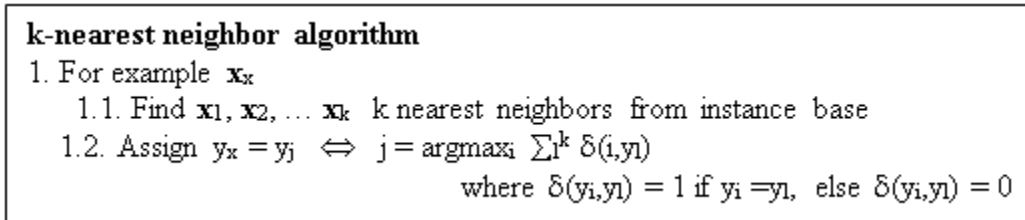


Fig. 3 K-nearest neighbor algorithm

The whole inference cycle of a CBR system usually consists of four steps (Aamodt, Plaza, 1994):

- retrieve the most similar case(s),
- reuse the case(s) to attempt to solve the problem,
- revise the proposed solution if necessary,
- retain the new solution as a part of a new case.

A new problem is matched against cases in the case base and one or more similar cases are retrieved. A solution suggested by the matching cases is then reused and tested for success. Unless the retrieved case is a close match the solution will probably have to be revised producing a new case that can be retained.

3.2. Strengths and limitations of case-based reasoning

To represent knowledge in form of cases instead in form of rules seems to be more natural for human, so development of an application of case-based system can be faster. This inference cycle described above allows to adaptively change and enhance the knowledge stored in the case base, this way of updating the knowledge (case) base better reflects the way of human learning. Similar modification during usage of a rule-based system would only hardly be possible. The main limitation of the case-based reasoning system seems to be the question how to tune the distance measures. Another problem can be the question of indexing and fast access to huge case bases – e.g. the k-d trees can be used here.

4. Example application – sentiment analysis

Sentiment analysis is defined as the task of finding the opinions of authors about specific entities (Feldman, 2013). This task can be turned into a question whether a piece of text is expressing positive, negative or neutral emotions and can be thus understood as a classification problem. Sentiment analysis becomes increasingly popular with the rapid grow of various reviews, survey responses, tweets or posts available from social media like Facebook or Twitter. Sentiment analysis can be performed on the document level (i.e. by understanding the whole document as a single entity expressing one opinion), on the sentence level (here each sentence can express some emotions) or on the aspect level, where sentiment expressions are related to different aspects of the discussed topic (Feldman, 2013).

To perform this process automatically we must first represent the documents in a suitable form. A common method is the bag-of-words representation where the unstructured text is expressed as a set of words occurring in the document. This representation ignores the position of a word in the document but considers its frequency in the document (a document is represented as a vector of values derived from frequencies of words in the document). A number of natural language processing steps like stemming, tokenization or part-of-speech tagging are used here. A more advanced text representing approaches can derive further characteristics (features) from this basic representation form. After this preprocessing, the classification itself can be done using rule-based as well as case-based approach. In both approaches, the used knowledge can be acquired from domain experts or obtained from data using text mining and machine learning methods.

A case-based approach to sentiment analysis is described e.g. in (Ohana et al., 2012). A case base is built by evaluating labeled documents using various sentiment lexicons, a language resources that associate a vocabulary term with opinion polarity. If a document from the labeled training set is correctly classified by at least one lexicon, a corresponding case is added to the case base. A case consists of two main parts: the case description reflects the structure and statistics which describe the document, the case solution stores information about successful predictions using the case. The case is represented by features of two types. First type of features represents document statistics (e.g. total words and sentences, average sentence size), second type of features represents writing style (e.g. ratio of unique words, stop-words ratio). All features are numeric and have been normalized using min-max normalization. For the case solution, five different lexicons are used. A classification is made by retrieving the most similar cases (using Euclidean distance) and reusing the lexicons found in the cases' solutions. The resulting sentiment score is computed by querying the lexicon for sentiment information of terms found in the document.

A rule-based approach to sentiment analysis of tweets is presented e.g. in (Chikersal et al., 2015). The sentiment analysis is here understood as multi-class classification problem; each tweet is labeled as "positive", "negative" or "unknown". The authors propose two types of rules: emoticon-related and sentiment lexicon-related. The rules are created manually and are applied as follows: If a tweet contains only positive emoticons and no negative, it is classified as positive. If a tweet contains only negative emoticons it is classified as negative. If a tweet contains no emoticons, the sentiment lexicon-related rules are applied. Here, if a tweet contains more than two positive words and no negation or negative words (from the used lexicons), it is classified as positive, if a tweet contains more than two negative words and no positive words, it is classified as negative. If none of the rules above can be applied, the tweet is classified as unknown.

5. Conclusions

When comparing rule-based and case-based reasoning we can see significant conceptual differences. The way how the knowledge is represented in the case-based reasoning systems and how the case-base is created well reflects the way of human learning. Also the reasoning by analogy seems to be natural for humans. Rule-based reasoning on the contrary has a long tradition in various logic-based formalisms. There are also some technical, less significant differences in both approaches. To retrieve relevant knowledge, rule-based systems use backward or forward chaining, case-based systems need to index the case base for fast access to relevant cases. To apply a single rule has its counterpart in 1-nearest neighbor method while using k-nearest neighbor approach is similar to compositional inference in which all applicable rules are used.

But rule-based and case-based reasoning are not only competing approaches. They can be considered simultaneously for a given task. Rule based reasoning and case based reasoning can be combined in three main ways: rule-based first, case-based first, or some interleaving of the two. The rule-

based first strategy is appropriate when the rules are reasonably efficient and accurate to begin with. If the rules are deficient in some way, the case-based first strategy may make more sense. If the rules and cases offer more balanced contributions to the problem solving, then an interleaving strategy may be best. One of the early attempts to combine rule-based and case-based reasoning has been presented at IJCAI 1989. In the system CABARET proposed by Rissland and Skalak, both reasoning methods operate separately. An agenda-based controller then heuristically directs and interleaves the two modes of reasoning (Riesland, Skalak, 1989). Since then, different scenarios of combination of both approaches for a particular application have been studied (Cabrera, Edye, 2010, Lee, 2008, Yang, Shen, 2008, Prentzas, Hatzilygeroudis, 2002). One possible general scenario, that probably very closely follows the human way of reasoning and problem solving is to start with case-based reasoning and only if no case is sufficiently similar to the problem to be solved, then switch to rule-based reasoning. Such scenario assumes the partition of domain knowledge into more general part represented by rules and more specific part represented using cases. Another integration method, adopted from machine learning, is to treat the rule-based system and case-based system as an ensemble of classifiers and use both approaches within a proper weighted voting scheme (Bauer, Kohavi, 1999).

6. Acknowledgment

The paper was processed with contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague.

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NEW FACEBOOK ALGORITHM: HOW DOES IT AFFECT SPONSORED POSTS?

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Keywords

Facebook algorithm, online advertising, social network sites, sponsored posts, e-commerce, Facebook ads manager, social media, online marketing

Abstract

At the beginning of January 2018, Mark Zuckerberg, the founder of the social network Facebook, and his team published a new strategy. The main goal of this new strategy is to present in the News Feed firstly the posts of friends and family members in particular. Along with this decision, a new Facebook algorithm disadvantaging company pages has been implemented. The administrators of company pages, with increasing tendency, have to resort to paid advertising to get the posts to their fans. This paper focuses on how the change in the algorithm affected the distribution of sponsored posts. A comparative analysis was performed on two identical sets of posts. The first post was promoted in 2017 and the second in 2018 after the new algorithm was launched.

1. Introduction

Facebook has been the most widely used social network site (SNS) for more than five years (Hsu et al., 2012; Bogaert et al., 2016). According to the statistics from December 2017, 1.4 billion active users visit Facebook daily, and more than 2.13 billion people use this social network at least once a month (“Company Info”, 2018).

Companies logically respond to this trend by moving their profiles to SNS where they try to reach the customers through fan pages and build the brand’s trustworthiness (Novotová, 2018). Research also shows that companies use SNS in human resources management (Ungerma, 2015). Unfortunately, having a profile on an SNS is not a guarantee of achieving success. Facebook's algorithms do not show new posts to all fans but filter them based on relevance and engagement (DeVito, 2017). At the beginning of January, Facebook published on its website a new strategy for 2018. Facebook's goal is to give users more room for interaction. For this reason, new Facebook algorithms prefer displaying posts of friends and family in the newsfeed (“Bringing People Closer Together“, 2018).

The new Facebook strategy puts the owners and administrators of the fan pages in a problematic situation. They must increasingly use paid advertising to deliver their content to the fans. However, it is not clear to what extent these new algorithms will alter the functioning of the current system.

This paper aims to test on a practical example, employing a comparative analysis, the changes induced by the new algorithms.

2. Theoretical framework

An algorithm may be defined as a sum of instructions and sequences for mechanical data processing (Bucher, 2017). Social media algorithms represent therefore a list of variables that evaluate the relevance of the post for a user. These variables may have a different, predetermined weight with which they enter the function. Generally, for the same input, the algorithm always returns the same output (Schou, Farkas, 2016).

Algorithms on Facebook are characterized by their lack of transparency (Powers, 2017). This means that neither a regular user nor a site administrator knows what variables affect the resulting placement on the Facebook's main page.

Although the exact Facebook algorithm remains hidden, it is possible to find some assumptions regarding the functioning of the mechanisms in the scientific research and professional practice. Based on these findings, the algorithms can be analyzed from two perspectives; (1) by the eyes of the user and (2) from the point of view of the site administrators.

2.1. Facebook algorithms from a user's perspective

The user's view of Facebook algorithms has been studied primarily from a sociological perspective. Scientists have been focused on answering questions such as (1) how everyday users understand algorithms when they are hidden, (2) how they perceive them, or (3) how the opacity of algorithms affects the time users spent on social networks (Bucher, 2017).

Another research direction focuses on so-called social bubbles. Facebook algorithms are based on the user interest principle. For this reason, only posts that correspond with their tastes and attitudes appear in the user's newsfeed (Powers, 2017). Research results show that social bubbles represent a potential danger because they provide a distorted picture of reality for the users that are in it. In essence, each user is on the social network himself an enemy.

As can be concluded from the findings above, the user can influence facebook algorithms only in one way - by actively searching for new content and clicking on it (Schou, Farkas, 2016).

2.2. Facebook algorithms from the point of view of site administrators

Facebook page Administrators, when creating new content, must have in mind the underlying mechanisms of Facebook algorithms – the relevancy of content for the target group (DeVito, 2017). If users start responding to the post, Facebook algorithms will evaluate it as beneficial and display it to a broader group of fans (Meire et al., 2016).

The user engagement rate may be divided into three components (Kim, Yang, 2017): (1) passive consumption (likes), (2) active engagement (comments), and (3) content distribution (sharing). A study by Taiwanese scientists has also confirmed that user involvement is affected by the nature of the user. (Fu et al., 2017). If an individual uses social networks only as a platform to maintain social contact, he or she responds more often passively, presses the like button. The button is designed to provide users with a quick form of interest expression (Lee et al., 2016). On the contrary, active forms of engagement are used by users who want to express themselves through social networks and use them as a form of self-presentation (Fu et al., 2017).

If site administrators want fans and potential customers to respond to their posts, they need to think like Facebook algorithms when creating these posts (DeVito, 2017).

As well as users, site administrators can also publish three kinds of content: (1) new information, (2) self-presentation of a company/brand, and (3) expressing one's attitude (Su, Chan, 2017). Facebook

algorithms may also be influenced by the user tagging rate (Oeldorf-Hirsch, Sundar, 2015). In the case of corporate sites, this feature is particularly useful when sharing positive references from the users.

The time, or the day when the administrators share the post also plays an essential role regarding Facebook algorithms (Ballings et al., 2016). Optimal time, however, varies from page to page and depends on the target audience.

3. Data collection and methodology

The aim of the research is to verify how the new, above-described changes to algorithms alter the paid Facebook page advertising.

The same principles as FB posting apply for paid promotion as well. Facebook algorithms prioritize ads that users like and respond to. Therefore, the more user-friendly the ad is, the lower the cost per impression will be.

The following hypothesis has been established to verify the changes to ad impressions on Facebook:

H1: The new Facebook algorithm has a negative impact on sponsored posts.

3.1. Data collection

All of the data used for the research come from the Facebook application for Facebook Administrators – the Facebook Ads Manager.

A total of 6 ad sets were used for the data collection including 3 of the most successful advertising posts on the selected Facebook Page from the period from March to May 2017 and 3 identical contributions from promoted from March to April 2018.

Tested ads were shown to the users in total 103 501 times, and 6 901 users responded in some way to the post.

3.2. Methodology

In order to confirm or reject the above-formulated hypothesis, the comparative analysis methods are being used. Data collection for objective comparison of states before and after the introduction of the new Facebook algorithm was done according to the following principles:

1. From the promoted contributions for the period from March to May 2017 on the selected Facebook page, the three most successful ones were chosen. The effectiveness of the advertised contributions was judged by the average price per click – the lower, the better. Price per click also serves as one of the parameters taken into account when validating the hypothesis.
2. The selected three contributions from 2017 have become the basis for creating three new contributions with the same texts and creatives. For these new posts, the promotion was launched in the period March - April 2018.
3. The post was shown to the same target audience in both years. The target group was set up using the Facebook Ads Manager tools.

4. The equality of promotion in both waves was also maintained in terms of total expenditure on the contribution. Therefore, it is true that $P_{2017} = P_{2018} (\pm 5\%)^4$.
5. The other monitored parameters for verifying the hypothesis were: (1) the reach of the contribution, (2) the ratio between the reach and the post view, (3) the recalculated price per fan (ie the price of the given campaign / the absolute increase of the fans during the promotion period), and (4) the already mentioned price per one click.

4. Results

For better clarity and understanding of the results, the data was divided into several tables.

Table 1 shows the spending on individual campaigns, the number of new fans the campaign gained for the selected Facebook page, the cost per click, and the converted cost per fan (= total cost/number of new fans).

Name	Costs	Number of new fans	Price per click	Price for 1 new fan
Post 1 – 2017	\$10,00	76	\$0,0159	\$0,13
Post 1 – 2018	\$9,84	68	\$0,0212	\$0,14
Post 2 – 2017	\$17,36	146	\$0,0237	\$0,12
Post 2 – 2018	\$17,24	90	\$0,0319	\$0,19
Post 3 – 2017	\$37,36	365	\$0,0140	\$0,10
Post 3 – 2018	\$37,57	285	\$0,0198	\$0,13
TOTAL	\$129,37	1030	-	-

Table 1 – Funds spent.⁵

The selected Facebook page aimed at increasing the number of fans via paid advertising. As stated in the methodological guidelines, the cost of individual contributions in 2017 and 2018 was equal to 5% accuracy level. The cost per click and the converted cost per a new fan increased in 2018 in all three cases. This means that, for the same spending, the selected page earned fewer new fans in 2018 than in 2017. Table 2 shows the impact of the price per click increase on the total reach and the number of post impressions.

Name	Reach	Number of impressions	The ratio between reach and the number of impressions
Post 1 (2017)	6483	7664	0,846
Post 1 (2018)	5238	6087	0,861
Post 2 (2017)	11583	14019	0,826
Post 2 (2018)	6383	7539	0,847
Post 3 (2017)	30007	37737	0,795
Post 3 (2018)	22431	30455	0,737

Table 2 – Ratio of repeated post impressions

⁴ The 5% accuracy level is set because Facebook Ads Manager does not allow to set the final price exactly to the cent.

⁵ Advertising costs were charged in CZK. The conversion to US dollars is based on the CNB exchange rate (April 6, 2018). 1 USD = 20,714 CZK..

The main difference between the reach and the number of post views is uniqueness, meaning the number of unique users who viewed the post. The number of impressions is then counted as the number of post views by one user if he does not click on it for the first time⁶. In other words, it can never happen that the reach would be higher than the number of impressions. Therefore, the ratio between the reach and the number of impressions cannot be higher than 1.

Table 2 shows that for all three contributions from 2018, the overall post reach decreased. As far as the new Facebook algorithm is concerned, it's effectiveness increased, except for the third post. The number of unique views that was higher than the total number of impressions confirms this trend. The reason for less effective delivery for the last post could be a certain "saturation" of the target group relative to the total number of impressions. Confirmation of this assumption will be the subject of further research by the author of the paper.

Table 3 provides a hypothetical cost-per-campaign view if it was not fixed according to the comparative analysis policy. The model situation assumes the equality of the result of the promotion, i.e. in this case the number of new fans of the site.

Name	Price for 1 new fan	Number of new fans (2017)	Hypothetical price (2018)
Post 1 (2018)	\$0,14	76	\$11,00
Post 2 (2018)	\$0,19	146	\$27,97
Post 3 (2018)	\$0,13	365	\$48,29

Table 3 – Hypothetical advertising price in 2018

The last Table 4 captures the hypothetical price difference between 2017 and 2018. This would be the case if the selected page decided to achieve the same results (number of new fans) in 2017 in 2018. As can be seen, the overall cost of the campaign would in these circumstances increased by 34,83% (22,54 USD). Based on these results the hypothesis *H1: The new Facebook algorithm has a negative impact on sponsored posts* was confirmed.

Name	Hypothetical price (2018)	Campaign cost (2017)	Difference
Post 1 (2018)	\$11,00	\$10,00	\$1,00
Post 2 (2018)	\$27,97	\$17,36	\$10,61
Post 3 (2018)	\$48,29	\$37,36	\$10,93
TOTAL	\$87,26	\$64,72	\$22,54

Table 4 – The difference in total costs in the equality of results of both phases of the campaign

5. Conclusions and limitations

Research results show that new Facebook algorithms affect not only the organic reach of the posts but also paid advertising. Three of the four parameters surveyed have experienced a decrease compared to 2017. Even though the costs are increasing for advertisers, the Facebook algorithm can be more powerful in some circumstances. The results implicate this phenomenon in the case of the ratio between reach and the number of impressions. But if it is more effective and what this parameter depends on, it will be the subject of further research.

⁶ If the ad didn't exclude from displaying the users who already responded to the post, the Facebook algorithms would keep showing the ad to the same people.

In spite of all the efforts to ensure comparability of results, it is not possible to explicitly quantify how the increase of the advertising price impacted the demand of advertising companies. To demonstrate this effect, we must have access to the data across the target group and the segment. However, for obvious reasons, Facebook keeps track of this data.

6. Acknowledgments

Research presented in this paper was supported by the funds from the project SGS-EF-3320- 21232: The success of social influencers: Is it possible to influence it?

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RISK BEHAVIOR OF THE "Y" GENERATION SHOPPING ON THE INTERNET

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Keywords

Generation „Y“, Internet, risk behaviour, shopping

Abstract

The paper describes behaviors of different generations when shopping online. The aim of the search was to find out the opinions, experiences and preferences of the „Y“ generation (respondents) from Prešov region in Slovakia to identify trends in online purchasing behaviour, that identify new alternatives to eliminate risk behaviour on Internet, by introducing innovations in their education in the future.

1. Introduction

Generation Y is commonly associated with attributes like lazy generation, digital, generations without interest in many "social" things. Like the previous, this generation also affects the changes and values that become dominant and as important as life style, social values presented in society as current and right now and belonging to the generation.

Different generations and demographic consumer groups are exposed to: (a) different social and economic opportunities and barriers, (b) different types of technology activities, (Hume2010). An important factor is the fact that decides on the motivation to buy and about the means and tools that the generations use for their buying behaviour. „Customer satisfaction depends on his personal feelings, resulting from his personal comparison of real performance to the expected one“. (Lysá et al., 2017) Globalization has always been the factor that connects, but nowadays it also shows the specs of a particular country. (Špírková, 2016) The very take-off of new technologies and the same accessibility define the options that the customer uses and are his own and specific to his generation. That's why generation "WiFi", or generation Y, has a tendency to buy over the internet portal, because this virtual and digital world is "Y" for its own, and its own environment offers them tools that are understandable to them.

2. Literature review

In Europe, it is used "to assess the level of digitization of the Digital Economy and Society Index (DESI) evaluates five dimensions: Internet connections, human capital, Internet use, digital technology integration and digital public services.“ (Klencová, 2018). Extreme development of Internet purchasing is associated with Y generation growth compared to generation X. Generally Y is 3 times larger than generation X. (Belleau & Summers et al., 2007). This fact affects the behaviour

of a large number of consumers and retailers and their value system, and the choice of resources becomes the majority of behaviour in all areas of life, including in purchasing behaviour.

In Slovakia, is other situation. X generation is a relative part of the previous generation, and for this reason the generation is the so-called "Husak Children", which was the "product" of the social engineering in Czechoslovakia. The number of people born in 1975-1989 Generation X is 325 572 and the number of people Y generation (born 1990 to 2005) is 315 005 (Statistical Office of the Slovak Republic, 2015). It does not apply to globalization and the focus on "Y" does not affect their buying behaviour.

Generation Y is three times more the size of Generation X and constitutes the largest market since baby boomers (Belleau & Summers et al., 2007). Determining the specific factors that influence Millennials and their purchasing attitudes and patterns has become an important focus of consumer research as their potential spending power, the ability to be trendsetters, adoption to new products and potential for becoming a lifetime customer. (Martin & Bush, 2000)

Another fact is the fact that the generation Y focuses on shopping. Of course, this is linked to the priorities chosen by the individual and the individual generation, but at the same time it is linked to the emphasis on the value of individual facts, which are connected with the experience of individual generations. E.g. relation to electronics and the digital world.

Generation X is one of the most highly educated generations. Factors that drive Generation X behaviour are their early disillusionment with cultural icons, ongoing preoccupation with the Internet and their seemingly infinite ability to simplify, streamline and enrich the activities and relationships of their daily lives (Jackson & Stoel et al., 2011). Members of this cohort are said to have the following characteristics; they (Jorgensen, 2003): • Value autonomy and independence, • Thrive to open communication, • Do not believe in "paying dues", • Seek to acquire skills and expertise, • Do not have long term loyalty to a company (but are loyal to individuals). Generation Y is the first generation that doesn't need and authority figure to gain access to information. They are the first global generation connected by the Internet, and social media (Espinoza et al., 2010). The social media are so important, they should be taken into formal education plans (Hanclova & Doucek, 2011). Culture is a significant predictor of self-disclosure in social networks. (Pavliček & Strížová, 2017)

In the value orientation of the X generation on a global scale, these value factors are comparable to Y generation. (Pew Research Center, 2010)

A comparison of value reasons for purchasing generations compared to Slovaks can be found in several differences. Gen X is very motivated to search for purchase-related information and is adept at searching. X tends to use information not as a point of pride but as assurance that they are not being taken advantage of by marketers and are getting the best deal possible. Gen X is most likely to look for the lowest cost item or discount rather than thinking of the investment value of purchases. Is the first generation not to give or be given lifelong loyalty by their employers, this generation grew up with no desire to be loyal to corporations or brands. Gen Y buyers select and consume products that helps them to define who they are, what is important to them and what they value in life also serve to express some aspect of the their own personality or image. They use their considerable knowledge about the latest trends, images, and reputations of retailers, products, and brand names to be considered experts or leaders among peers. (Ordun, 2015)

Another factor is the examination of risk and risky behaviour. Perceived risk toward online shopping affects purchasing intention through cognition and affect based attitudes. Lower perceived risk can be anticipated as a way of increasing both attitudes and enhancing purchasing intention (Chang & Wu, 2012). Perceived risk is an important barrier for online consumers because it threatens the operation of the e-commerce, making security issues a fundamental concern. (Wigand, 1997); risk

issues, especially financial security, are still cited as the main deterrents for the rapid growth of electronic commerce (Farhoomand et al., 2000; Szymanski & Hise, 2000; Van Slyke et al., 2004). Risk is a much more salient concern in e-commerce than in many other social and economic interactions involving uncertainty due to the nature of the financial transactions and multiple levels of uncertainties. (Garbarino & Strahilevitz, 2004).

A related finding is that risk measures (estimated via CRRA utility function) are strong significant predictors of the decision to shop online, but risk perceptions are not. (Zafer, A. 2015)

Information technology influences life in all spheres of business and civil life. This situation arises, in particular, from the relatively easy availability of information and communication technologies. (Zimmermanová, 2017) Social media we use them in every aspect, such as personal relationships, work or entertainment (Sudzina, 2013) and life without them is hardly imaginable

The main ways of buying behaviour of the Y generation in Slovakia and identifying the risk of their behaviour is in the following part of the contribution.

3. Case study

3.1. Objective, methodology and research methods

The primary qualitative search focused on getting information on the risk behaviour of the "Y" Generation in the buying behaviour by the Internet. The search was conducted in the first quarter of 2018, the survey technique was a structured questionnaire, was formalized and personally distributed and gathered in secondary schools and universities in the Slovak Republic in the Prešov Region. The questionnaire had 13 questions, first looking for information on own income, savings, consumption patterns, purchasing methods, purchasing specifications in the e-shop, identifying the benefits, disadvantages and risks associated with it. The target group of respondents were young people who, according to the assumed age, belong to the Generation "Y", they were born in the last decade of the last century and after 2000 year, so they are called as "millennials". Three categories (cat.) were identified in the structure of the respondents: 1st category - birth in 1980 - 1989 (38 to 29 years), 2nd category - birth 1990-1999 (28 to 19 years), 3rd category - birth in 2000 and later (18 years or less). Together, 200 respondents were approached, 146 were returns (73 %) and 114 correctly filled in questionnaires (57 %) were used, which provide the required information on the purchasing behaviour of the "Y" Generation on Internet. In the evaluation, the most frequent value of the statistical character by the modus was used, the order was determined and was created a position map. The interdependence of variables, especially the risk's purchasing behaviour of respondents in categories in relation to the other parameters, was examined by regression analysis. To determine the correlation coefficient, the statistical function CORREL in Excel was used.

3.2. Research results

In the structure of respondents from the 1st cat. (38 to 29 years) – 12, also most less questionnaires (11 %) were obtained, from the 2nd cat (28 to 19 years) it was 73 (64 %) and in the 3th cat. 18 and less years old - 29 questionnaires (25 %).

The next important trait of the respondents was their economic autonomy, which we combined with another question about their own income. The answers were very similar. 32 of the respondents (28 %) had their own income, most in the 2nd cat. (28 - 19 years), but 82 of all (72 %) didn't have their own income. The total average value of their own free income is € 100, besides being able to save on average 10 % of their income, especially in the 1st cat.. It was found, that from all respondents were 31 (27 %) economically independent (autonomy) and 83 (73 %) economically dependent (non-

autonomy). In the group of economically independent respondents, they were the most amount in the 2nd cat. of twenties (21 respondents, 68 %), followed by 1st cat. of thirties (9 respondents, 29 %), the least - only one respondent - in the 3rd cat. (18 years or less). Most of the economically independent are in the 2nd cat. (43; 52 %), then of the 3rd cat. (37; 45 %), the least of the 1st cat. (3; 4 %).

Then, how these economically independent respondents from the „Y“ Generation are arrange their own economics. The most of them (51; 61 %) manage their money with parents, the most in the 3rd cat. 18 and less yearly (27; 53 %), then in the 20 year group in the 2nd cat. (24; 47 %) and without answer in the 1st cat. (thirty years).

The survey found out, what is the structure of personal consumption in the "Y" Generation. Were offered answers: nutrition, clothing, housing and others. Of all the responses, it was found, that the largest spending is on nutrition (30 %), but also on clothes (25 %) and on "other" (40 %), but the smallest for housing (5 %) were in 3rd cat. We found out, that most of the spending is used by respondents for entertainment and food, at least everyone spends on furniture. In the 1st cat. (38-29 years) they have spent most on food, health and entertainment; In the 2nd cat. (28 - 19 years) spend most on entertainment, electronics and food; In the 3rd cat. (18 years or less), they spent money on entertainment, traveling and clothing.

"Y" Generation exclusively buys in the stone store (shop), but never in the e-shop: food, medicine, footwear, cosmetics, furniture, followed by other categories. Then in reverse, only in the e-shop: books (86), clothing (79), electronics (77). In the 1st cat.: books, household articles, clothing. In the 2nd and in the 3rd cat.: clothes, electronics, cosmetics. Almost everybody of respondents are using more than 10 times some social network by shopping in the last two years.

Based on the frequency of responses to the biggest benefits, respondents from the full spectrum of all selected three of them: a wide range of goods (96), delivery speed (91). In the 1st cat. (thirties) - wide offer, anonymity, delivery speed; in 2nd and in 3rd cat. the answers were the same - delivery speed, wide offer, simple payment conditions. The three biggest disadvantages: bad quality or wrong product (105) and incomprehensibility of the text in a foreign language (especially in the 3rd age cat.). In the 1st cat. (thirties) - incomprehensibility in foreign language, poor quality or wrong product, fear of transferring money from a bank account. In the 2nd cat. (twentieth): bad quality or wrong product, claiming rights in complaints, high service fee. In the 3rd age cat. they were: bad quality or wrong product, long delivery time from abroad and hidden business conditions. The whole survey culminated in the identification of the risks associated or experienced with buying in the e-shop. The results are shown in the following graphical view, in the next table and then in the position map.

Cat. of "Y" (year)	Economic autonomy		Economic non-autonomy		Count of resp.	Risks by shopping on Internet (Order by frequency of responses)					
	Co unt	Part (%)	Cou nt	Part (%)		Bad quality or product	Transfer of money	Foreign language	Complaint	Long delivery	Hidden shop condition
1st (38-29)	9	29	3	4	12	9	9	8	8	7	6
2nd (28-19)	21	68	43	52	73	68	60	23	48	43	22
3th (18 -11)	1	3	37	44	29	24	22	8	19	23	22
Total	31	27	83	73	114	101	91	39	75	73	50

Table 1 Data for regression analysis of risks in the purchasing behaviour of „Y“ Generation, Source: own search

Overall, the number of economically dependent respondents (83; 73%) predominated in the survey, especially in the 2nd and 3rd categories, from 11 to 28 years. In determining the interdependence of two phenomena: the economic autonomy of the respondents and their risk purchasing behaviour (for each major category), the correlation coefficient was 0.75 - the result has a positive value, approximates to a value of 1, which expresses the absolute direct linear dependence between them. The relationship of variables is strong.

In determining the interdependence of two phenomena: age and risk purchasing behaviour, the correlation coefficient was -0.398, the result had a negative value, expressing the indirect linear dependence between the variables and its weak interdependence.

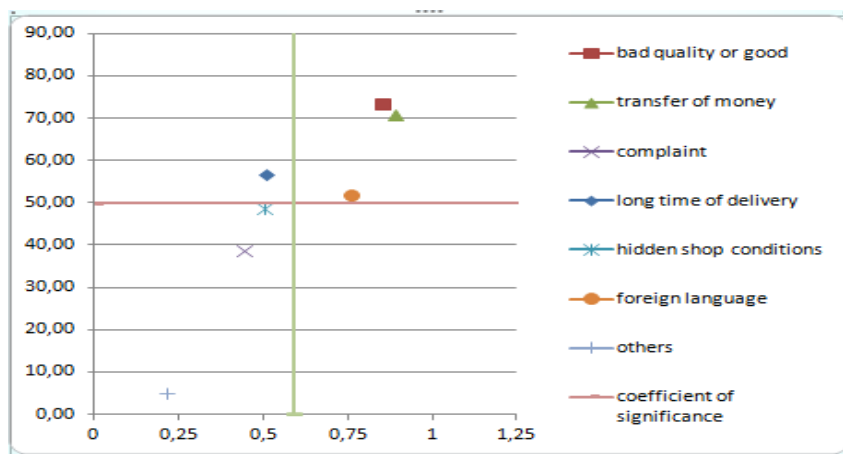


Fig. 1 Risk map for purchases e-shop, Source: own search

It was found, that more worries and risks are seen in the 1st age category, but it is clear, that they are buying in e-shops, of course. Younger respondents also buy products, that don't have the required quality too, or may not be delivered, but are more courageously, but they are aware of the risk of theft or hidden business conditions.

According to the latest available statistical data, the average monthly values per person in the Prešov region in Slovakia in 2016 , were: revenues 375.80 €, expenditure 304.56 €, savings 71.24€. Most expenditure is on food and alcohol (57.61 €), which corresponds to the results of our own survey.

4. Conclusion

The digital world of generation Y has shifted its behaviour to a plane that is difficult to understand for Generation X. Even though generation Y does not have the required financial means but the social values that it shares over its value structure of the virtual world, it moves it to loyalty to the brand to eliminate and displace risks that are very much accepted by the people of generation X. On the contrary, the fidelity of the brand or "modernity" is the X generation with a bigger argument and the reason for a conservative approach to buying ways of being on the Internet.

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VALIDATION OF UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY SCALES FOR FACEBOOK

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Keywords

Facebook, Unified Theory of Acceptance and Use of Technology

Abstract

Facebook, with an evolving user interface, exists already for over a decade. It became a dominant social networking site in many countries. The Unified Theory of Acceptance and Use of Technology is an extension of the Technology Acceptance model that, beside adoption, explains also continued use of software or hardware. The goal of the paper is to validate scales for the second version of the Unified Theory of Acceptance and Use of Technology for Facebook. But these statements could be also used for similar social networking sites, such as Renren or Line. Findings are that these scales could be used in the current form.

1. Introduction

Probably the most used theory in information systems research is the Technology Acceptance Model - TAM (Davis, 1989; Davis et al., 1989). It was later extended - TAM2 (Venkatesh and Davis, 2000) and TAM3 (Venkatesh and Bala, 2008). In order to account for the reality that the decisions are not only about whether to adopt a new technology or not but also about whether to continue using a particular technology, the Unified Theory of Acceptance and Use of Technology - UTAUT (Venkatesh et al., 2003) was introduced. Its second version - UTAUT2 (Venkatesh et al., 2012) tries to address criticism e.g. summarized in (Bagozzi, 2007).

The most widely used social network is Facebook. Unlike almost a decade ago when Facebook was new and the question worth investigating was what influences some people to adopt it, e.g. (Chung et al., 2010), nowadays, it is more interesting to investigate what influences people to keep using Facebook. The goal of the paper is to validate UTAUT2 constructs for Facebook.

2. Data and methodology

Data were collected using an on-line questionnaire (placed at survio.com) for one month from 4 May 2016 when an e-mail with the questionnaire link was sent to bachelor, master, and doctoral students at the University of Chemistry and Technology. There were 361 respondents 19 to 30 years old.

Translating UTAUT2 statements from English required several consultations, as they included the words describing feelings, where the most exact wording was needed to avoid misinterpretation. Prior to launching the questionnaire, a sample of 18 students from the University of Chemistry and Technology was piloted. It has been confirmed that the statements are formulated in a clear way and the answer was not a problem.

Cronbach's alpha will be used to evaluate scales. Correlation matrices with Pearson's product-moment correlation coefficients in the next section will be provided in order to show the relationships between items in each construct. All calculation will be done in SPSS.

3. Results

Correlation matrices in Table 1-8 show that all correlations are positive, so Cronbach's alphas can be calculated. Moreover, all correlation coefficients are statistically significant.

A correlation matrix for performance expectancy is provided in Table 1. Cronbach's alpha is .805. Unlike in (Venkatesh, Thong and Xu, 2012), where the second item was dropped, there is no reason to drop it for Facebook. Similarly, there was no reason to drop the second item also in (Sudzina, 2016a; Sudzina 2016b) which was focused on deal sites.

Table 1: Correlation matrix for performance expectancy

Statement	No.	1	2	3	4
I find Facebook useful in my daily life	1	1	.578**	.394**	.406**
Using Facebook increases my chances of achieving things that are important to me	2	.578**	1	.512**	.509**
Using Facebook helps me accomplish things more quickly	3	.394**	.512**	1	.664**
Using Facebook increases my productivity.	4	.406**	.509**	.664**	1

Legend: **. Correlation is significant at the 0.01 level (2-tailed).

The first item was slightly modified; instead of "Learning how to use Facebook is easy for me", it reads "Understanding Facebook is easy for me". A correlation matrix for effort expectancy is provided in Table 2. Cronbach's alpha is .907.

Table 2: Correlation matrix for effort expectancy

Statement	No.	1	2	3	4
Understanding Facebook is easy for me	1	1	.742**	.722**	.645**
My interaction with Facebook is clear and understandable	2	.742**	1	.817**	.685**
I find Facebook easy to use	3	.722**	.817**	1	.677**
It is easy for me to become skillful at using Facebook	4	.645**	.685**	.677**	1

Legend: **. Correlation is significant at the 0.01 level (2-tailed).

The third item was slightly modified; instead of "People whose opinions that I value prefer that I use Facebook", it reads "People whose opinions that I value are glad that I use Facebook". A correlation matrix for social influence is provided in Table 3. Cronbach's alpha is .836.

Table 3: Correlation matrix for social influence

Statement	No.	1	2	3
People who are important to me think that I should use Facebook	1	1	.700**	.606**
People who influence my behavior think that I should use Facebook	2	.700**	1	.580**
People whose opinions that I value are glad that I use Facebook	3	.606**	.580**	1

Legend: **. Correlation is significant at the 0.01 level (2-tailed).

The first item was extended by examples explaining what is meant by resources in the brackets right after the term. In the third item, the term technologies was replaced by the term devices because the former is not commonly used in Czech. The fourth item was slightly rephrased; instead of "I can get help from others when I have difficulties using Facebook", it reads "Others (in my surrounding) can help me with problems with using Facebook". A correlation matrix for facilitating conditions is provided in Table 4. Cronbach's alpha is .712.

Table 4: Correlation matrix for facilitating conditions

Statement	No.	1	2	3	4
I have the resources (a mobile phone, connectivity, etc.) necessary to use Facebook	1	1	.435**	.650**	.248**
I have the knowledge necessary to use Facebook	2	.435**	1	.434**	.290**
Facebook is compatible with other devices I use	3	.650**	.434**	1	.277**
Others (in my surrounding) can help me with problems with using Facebook	4	.248**	.290**	.277**	1

Legend: **. Correlation is significant at the 0.01 level (2-tailed).

A correlation matrix for hedonic motivation is provided in Table 5. Cronbach's alpha is .860.

Table 5: Correlation matrix for hedonic motivation

Statement	No.	1	2	3
Using Facebook is fun	1	1	.614**	.768**
Using Facebook is enjoyable	2	.614**	1	.636**
Using Facebook is very entertaining	3	.768**	.636**	1

Legend: **. Correlation is significant at the 0.01 level (2-tailed).

Since Facebook is for free, original UTAUT2 price value statements needed to be modified. The first item reads "Facebook is provided for free, I consider it a reasonable price" instead of "Facebook is reasonably priced". The second item reads "Facebook is a valuable product" instead of "Facebook is a good value for the money". The third item reads "At its price, Facebook offers a good service" instead "At the current price, Facebook provides a good value". A correlation matrix for price value is provided in Table 6. Cronbach's alpha is .662.

Table 6: Correlation matrix for price value

Statement	No.	1	2	3
Facebook is provided for free, I consider it a reasonable price	1	1	.240**	.445**
Facebook is a valuable product	2	.240**	1	.502**
At its price, Facebook offers a good service	3	.445**	.502**	1

Legend: **. Correlation is significant at the 0.01 level (2-tailed).

It does no help to remove the second item from the price value construct in order to increase Cronbach's alpha. Without the second item, Cronbach's alpha is only .615.

A correlation matrix for habit is provided in Table 7. Cronbach's alpha is .804. Unlike in (Venkatesh, Thong and Xu, 2012), where the fourth item was dropped, there is no reason to drop it for Facebook. Similarly, there was no reason to drop the fourth item also in (Sudzina 2016b) which was focused on deal sites; the correlation between the second the fourth item was not significant but it was still positive.

Table 7: Correlation matrix for habit

Statement	No.	1	2	3	4
The use of Facebook has become a habit for me	1	1	.582**	.454**	.485**
I am addicted to using Facebook	2	.582**	1	.673**	.497**
I must use Facebook	3	.454**	.673**	1	.367**
Using Facebook has become natural to me	4	.485**	.497**	.367**	1

Legend: **. Correlation is significant at the 0.01 level (2-tailed).

A correlation matrix for behavioral intention is provided in Table 8. Cronbach's alpha is .748.

Table 8: Correlation matrix for behavioral intention

Statement	No.	1	2	3
I intend to continue using Facebook in the future	1	1	.368**	.466**
I will always try to use Facebook in my daily life	2	.368**	1	.644**
I plan to continue to use Facebook frequently	3	.466**	.644**	1

Legend: **. Correlation is significant at the 0.01 level (2-tailed).

To sum up, all scales with the exception of price value have Cronbach's alpha higher than Nunnally's (1978) threshold of .7.

4. Conclusions

Facebook became a common platform. As it was identified by Pavlicek and Strizova (2017), it is used differently in different countries. In spite of different usage patterns, it is probably going to attract additional users.

The goal of the paper was to validate statements designed for UTAUT2 constructs. In general, it is possible to use them in the current form. Although, there is a room for improvement, especially when it comes to the price value construct.

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IMPACT OF PERSONALITY TRAITS AND GENDER ON EXPERIENCING VIRTUAL OFFENSES

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Keywords

Virtual offense, personality traits, gender

Abstract

There is an increasing public awareness of virtual offenses. These offenses existed also in the past but, since general public is more tech-savvy, there is more news on the topic in mass media. The aim of the paper is to investigate whether personality traits and gender are linked to experiencing virtual offenses. With regards to virtual offenses, the focus is on cyber-bullying, identity theft, stalking, phishing, scam, and harassment. Big Five Inventory-2 is used to measure personality traits. With regards to the results, victims of cyber-bullying are more extravert and more agreeable; identity theft is linked to more extraversion; stalking is linked to more extraversion and more negative emotionality; phishing is linked to less consciousness and being a man; scam is linked to less consciousness, more negative emotionality and being a man; and harassment is linked more negative emotionality.

1. Introduction

Bullying, stalking, and trolling are just the beginning. Extreme examples such as GamerGate get publicized, but otherwise the online abuse is largely underreported. Using current events and the latest available research into cybersexism, Bailey Poland (Poland, 2016) questions the motivations behind cybersexist activities and explores methods to reduce footprints of Internet misogyny, drawing parallels between online and offline abuse.

(Lee & Wu, 2018) examines the correlation between risk perception, knowledge, social influence, self-efficacy, and cyber bullying behavior from the perspective of the attitude-social influence-efficacy model – especially on adolescents who have had cyber bullying behavior or have witnessed their peers' cyber bullying behavior. Concludes that attitude towards cyber bullying affected cyber bullying intention, and that intention also influenced cyber bullying behavior. Social influence also had an impact on cyber bullying intention and cyber bullying behavior. In fact, intention was a mediator between attitude and behavior, as well as between social influence and behavior. (Cyberbullying research center, 2016) (Rao, Bansal, & Chandran, 2018)

According to (Lo et al., 2017), personality traits are significantly influenced by genes. According to the meta-analysis conducted by (Roberts, Walton, & Viechtbauer, 2006), people become more agreeable, more conscientious, and less emotionally negative with age. According to the meta-analysis conducted by (Roberts et al., 2017) is negative emotional and extraversion that could be changed as a result of therapy. It is unlikely that just being a victim of a virtual offense would have as high impact on personality as counseling would. Considering the age of the respondents, they would be victims of a virtual offense only in the near past, it probably would not be enough time for impact of aging (identified by (Roberts et al., 2006)) on personality to take place.

The role of gender has been studied in ICT in various areas (Nedomová, Maryska, & Doucek, 2017), but not in the area of virtual offenses yet. The problem is quite wide, it is affected by ethics (Sigmund, 2013), psychology (Potancok, Vondrova, & Andera, 2015) and education theory (Vondra, 2017).

The aim of the presented research is to establish whether gender or personality traits can be linked to experiencing virtual offenses.

Data were collected in the Czech Republic from university students. In the cross-sectional research, it is not possible to test also causality, i.e. whether personality traits influenced a person to become a victim of a virtual offense or the virtual offence changed personality traits.

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 in December 2017 – March 2018 using an on-line questionnaire. Respondents were 478 university students (272 men, 206 women; on average 20.5 years old) from the Czech Republic. They differed also in experience from practice, 106 only study, 176 have a temporary job (brigade), 164 have a part-time job, 16 have a full time outside the field of study, and 12 have a full time within the field of study.

Personality traits were measured using John and Soto's Big Five Inventory-2 (C. J. Soto & John, 2017) translated to Czech by Hřebíčková et al. (Hřebíčková et al., 2018). Only BFI-2-XS (C. Soto & P. John, 2017), i.e. a 15-statement version was used for this conference paper; these statements were "I am someone who..."

- | | |
|---|--|
| ... tends to be quiet, | ... tends to feel depressed, blue, |
| ... is compassionate, has a soft heart, | ... has little interest in abstract ideas, |
| ... tends to be disorganized, | ... is full of energy, |
| ... worries a lot, | ... assumes the best about people, |
| ... is fascinated by art, music, or literature, | ... is reliable, can always be counted on, |

... is dominant, acts as a leader, ... is emotionally stable, not easily upset,
 ... is sometimes rude to others, ... is original, comes up with new ideas
 ... has difficulty getting started on tasks,

on a 1-5 Likert scale where 1 meant strongly disagree and 5 stood for strongly agree. Extraversion was calculated as an average of the 1st (reversed-scored), the 6th and the 11th answer, agreeableness as an average of the 2nd, the 7th (reversed-scored) and the 12th answer, conscientiousness as an average of the 3rd (reversed-scored), the 8th (reversed-scored) and the 13th answer, negative emotionality (neuroticism) as an average of the 4th, the 9th and the 14th (reversed-scored) answer, and openness to experience as an average of the 5th, the 10th (reversed-scored) and the 15th answer.

Since the paper focuses on six virtual offenses, there are six dependent variables. The first dependent variable was measured using the question "Have you ever been cyberbullied during your time at your university or in your high school?" Respondents were to choose one of the following answers:

- No (coded as 0), Yes, at the university (coded as 1),
- Yes, in the high school (coded as 1), Yes, in the high school and at the university (coded as 1).

The remaining five dependent variables were measured using the question "Have you encountered any other form of virtual offense?" For each, i.e. identity theft, stalking, phishing, scam, and harassment, respondents were to choose one of the following answers:

- No (coded as 0),
- Yes, but I managed to defend myself (coded as 1),
- Yes, and I was a victim (coded as 2).

The questionnaire contained additional questions which were not used in the analysis presented in this paper.

Ordinal logistic regression was used to analyze impact of gender and five personality traits (extraversion, agreeableness, conscientiousness, negative emotionality, openness to experience) on the six virtual offenses. A multivariate approach was used. SPSS software was used for the analysis.

3. Results

The first model analyzes impact of gender and five personality traits on cyber-bullying. Parameter estimates for the ordinal (in this case the same as binomial) logistic regression model are provided in Table 1. Cox&Snell pseudo-R² is .026, Nagelkerke pseudo-R² is .048, McFadden pseudo-R² is .034, and p-value is .046.

Variable	B	S.E.	Wald	df	Sig.
Cyberbullying = 0	5.370	1.420	14.290	1	.000
Extraversion	.368	.171	4.632	1	.031
Agreeableness	.426	.209	4.152	1	.042
Conscientiousness	-.117	.207	.321	1	.571
Negative emotionality	.217	.165	1.732	1	.188
Openness to experience	.194	.181	1.142	1	.285
Gender = male	-.137	.283	.235	1	.628

Table 1 Ordinal logistic regression for the full model 1

Parameter estimates for the streamlined model for cyber-bullying are provided in Table 2. Cox&Snell pseudo-R² is .018, Nagelkerke pseudo-R² is .033, McFadden pseudo-R² is .023, and p-value is .013.

Variable	B	S.E.	Wald	df	Sig.
Cyberbullying = 0	4.247	.871	23.753	1	.000
Extraversion	.308	.157	3.866	1	.049
Agreeableness	.404	.200	4.071	1	.044

Table 2 Ordinal logistic regression for the streamlined model 1

In case negative emotionality was also included, its regression coefficient would be positive and its p-value would be .117; regression coefficients for extraversion and agreeableness would be marginally higher and their p-values would be lower. The second model analyzes impact of gender and five personality traits on identity theft. Parameter estimates for the ordinal logistic regression model are provided in Table 3. Cox&Snell pseudo-R² is .012, Nagelkerke pseudo-R² is .016, McFadden pseudo-R² is .009, and p-value is .471.

Variable	B	S.E.	Wald	df	Sig.
Identity theft = 0	2.437	1.120	4.731	1	.030
Identity theft = 1	3.748	1.132	10.960	1	.001
Extraversion	.294	.142	4.297	1	.038
Agreeableness	-.112	.164	.466	1	.495
Conscientiousness	.008	.172	.002	1	.961
Negative emotionality	.118	.137	.740	1	.390
Openness to experience	.027	.149	.033	1	.856
Gender = male	.116	.241	.230	1	.632

Table 3 Ordinal logistic regression for the full model 2

Parameter estimates for the streamlined model for identity theft are provided in Table 4. Cox&Snell pseudo-R² is .008, Nagelkerke pseudo-R² is .011, McFadden pseudo-R² is .007, and p-value is .048.

Variable	B	S.E.	Wald	df	Sig.
Identity theft = 0	2.166	.426	25.894	1	.000
Identity theft = 1	3.473	.454	58.499	1	.000
Extraversion	.256	.130	3.904	1	.048

Table 4 Ordinal logistic regression for the streamlined model 2

The third model analyzes impact of gender and five personality traits on stalking. Parameter estimates for the ordinal logistic regression model are provided in Table 5. Cox&Snell pseudo-R² is .032, Nagelkerke pseudo-R² is .046, McFadden pseudo-R² is .027, and p-value is .016.

Variable	B	S.E.	Wald	df	Sig.
Stalking = 0	1.094	1.143	.916	1	.339
Stalking = 1	2.495	1.154	4.673	1	.031
Extraversion	.408	.146	7.831	1	.005
Agreeableness	-.264	.169	2.431	1	.119
Conscientiousness	-.290	.180	2.594	1	.107
Negative emotionality	.235	.142	2.750	1	.097
Openness to experience	-.117	.152	.593	1	.441
Gender = male	-.225	.247	.828	1	.363

Table 5 Ordinal logistic regression for the full model 3

Parameter estimates for the streamlined model for stalking are provided in Table 6. Cox&Snell pseudo-R² is .019, Nagelkerke pseudo-R² is .027, McFadden pseudo-R² is .016, and p-value is .011.

Variable	B	S.E.	Wald	df	Sig.
Stalking = 0	3.466	.704	24.210	1	.000
Stalking = 1	4.852	.729	44.278	1	.000
Extraversion	.352	.140	6.306	1	.012
Negative emotionality	.307	.136	5.059	1	.024

Table 6 Ordinal logistic regression for the streamlined model 3

If both agreeableness and conscientiousness were also included in the streamlined model, their p-value would be .143 and .119. If only conscientiousness was included alongside extraversion and negative emotionality, its p-value would be .081. If only agreeableness was included alongside extraversion and negative emotionality, its p-value would be .095. In all three cases, regression coefficients for agreeableness and conscientiousness would be negative.

The fourth model analyzes impact of gender and five personality traits on phishing. Parameter estimates for the ordinal logistic regression model are provided in Table 7. Cox&Snell pseudo-R² is .046, Nagelkerke pseudo-R² is .061, McFadden pseudo-R² is .033, and p-value is .001.

Variable	B	S.E.	Wald	df	Sig.
Phishing = 0	1.373	1.003	1.875	1	.171
Phishing = 1	3.355	1.020	10.811	1	.001
Extraversion	.150	.132	1.303	1	.254
Agreeableness	-.003	.150	.000	1	.982
Conscientiousness	-.355	.161	4.864	1	.027
Negative emotionality	.139	.124	1.268	1	.260
Openness to experience	.022	.138	.025	1	.875
Gender = male	.890	.233	14.579	1	.000

Table 7 Ordinal logistic regression for the full model 4

Parameter estimates for the streamlined model for phishing are provided in Table 8. Cox&Snell pseudo-R² is .041, Nagelkerke pseudo-R² is .055, McFadden pseudo-R² is .030, and p-value is .000.

Variable	B	S.E.	Wald	df	Sig.
Phishing = 0	.482	.506	.909	1	.340
Phishing = 1	2.462	.534	21.249	1	.000
Conscientiousness	-.330	.151	4.808	1	.028
Gender = male	.829	.223	13.849	1	.000

Table 8 Ordinal logistic regression for the streamlined model 4

The fifth model analyzes impact of gender and five personality traits on scam. Parameter estimates for the ordinal logistic regression model are provided in Table 9. Cox&Snell pseudo-R² is .112, Nagelkerke pseudo-R² is .136, McFadden pseudo-R² is .068, and p-value is .000.

Variable	B	S.E.	Wald	df	Sig.
Scam = 0	1.680	.919	3.340	1	.068
Scam = 1	3.820	.936	16.669	1	.000
Extraversion	-.072	.121	.354	1	.552
Agreeableness	.023	.137	.027	1	.869
Conscientiousness	-.257	.144	3.173	1	.075

Negative emotionality	.254	.114	4.993	1	.025
Openness to experience	.188	.127	2.205	1	.138
Gender = male	1.381	.214	41.529	1	.000

Table 9 Ordinal logistic regression for the full model 5

Parameter estimates for the streamlined model for scam are provided in Table 10. Cox&Snell pseudo-R² is .108, Nagelkerke pseudo-R² is .130, McFadden pseudo-R² is .065, and p-value is .000.

Variable	B	S.E.	Wald	df	Sig.
Scam = 0	1.169	.625	3.496	1	.062
Scam = 1	3.303	.646	26.176	1	.000
Conscientiousness	-.276	.139	3.978	1	.046
Negative emotionality	.273	.108	6.354	1	.012
Gender = male	1.372	.210	42.666	1	.000

Table 10 Ordinal logistic regression for the streamlined model 5

If openness to experience was also included in the streamlined model, its p-value would be .158 and its regression coefficient would stay positive.

The sixth model analyzes impact of gender and five personality traits on harassment. Parameter estimates for the ordinal logistic regression model are provided in Table 11. Cox&Snell pseudo-R² is .034, Nagelkerke pseudo-R² is .045, McFadden pseudo-R² is .024, and p-value is .011.

Variable	B	S.E.	Wald	df	Sig.
Harassment = 0	2.313	1.044	4.910	1	.027
Harassment = 1	3.643	1.054	11.939	1	.001
Extraversion	.191	.130	2.165	1	.141
Agreeableness	-.063	.155	.163	1	.686
Conscientiousness	.039	.157	.062	1	.804
Negative emotionality	.429	.130	10.851	1	.001
Openness to experience	-.116	.138	.707	1	.401
Gender = male	-.300	.220	1.852	1	.174

Table 11 Ordinal logistic regression for the full model 6

Parameter estimates for the streamlined model for harassment are provided in Table 12. Cox&Snell pseudo-R² is .024, Nagelkerke pseudo-R² is .031, McFadden pseudo-R² is .016, and p-value is .001.

Variable	B	S.E.	Wald	df	Sig.
Harassment = 0	2.261	.380	35.481	1	.000
Harassment = 1	3.579	.407	77.415	1	.000
Negative emotionality	.395	.118	11.260	1	.001

Table 12 Ordinal logistic regression for the streamlined model 6

If extraversion and gender were also included in the streamlined model, their p-values would be higher than .1 and their regression coefficient would stay positive and negative respectively.

4. Conclusions

The aim of the paper was to investigate whether people with a certain personality and of certain gender are more prone to be victims of virtual offenses. Six types of virtual offenses were investigated

- cyber-bullying, identity theft, stalking, phishing, scam, and harassment. More extravert and more agreeable people are more likely to be victims of cyber-bullying. More extravert people are more likely to be victims of identity theft. More extravert and more neurotic people are more likely to be victims of stalking. Less conscientious people and men are more likely to be victims of phishing. Less conscientious and more neurotic people and men are more likely to be victims of scam. More neurotic people are more likely to be victims of harassment. When considering only personality traits significant at .05 level, overall, it is more risky to be more extravert, more agreeable, more neurotic, less conscientious and a man.

With regards to the future research, using a full version of Big Five Inventory-2 (or a different personality instrument), considering facets (not only personality traits) and additional demographic factors may lead to models with a higher explanatory power.

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TOPIC E: E-HEALTH

EHEALTH POLICIES IN AHA AND AAL PROJECTS

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Keywords

eHealth, policies, active and healthy ageing, ambient assisted living

Abstract

eHealth is the digital collection and management of health-related data. In several research projects, health data is collected, transformed, analyzed and evaluated. Also, the data management in relation to the General Data Protection Regulation (GDPR) is a necessary topic. This paper is reporting on the data handling and eHealth aspects of the projects My-AHA (H2020), SOCIALCARE (AAL JP) and WAALTeR (national project). Within these projects, health related data is collected and used for evaluation purpose and for personalizing potential interventions and system design.

1. eHealth in non-governmental environment

eHealth is mainly discussed in terms of electronic health records, access in health care sector to public systems or governmental systems (Oh, Rizo, Enkin, & Jadad, 2005). But the private sector is not discussed so often. As the governmental approach is working with state-wide reach, the private sector is working on a B2C base. There are a lot of systems available, that work with health data and could be used as eHealth systems. The main difference in the opinion of the author between eHealth systems and private health records is the use of the data. Whereas the eHealth Systems are using the data for exchange and to increase efficiency of health care, private systems are using their portals as data collector and self-monitoring of the users but not in relation with health care and treatments. The data collected by the systems is also differing in quality and values. Whereas eHealth systems mainly focus on medical products as data source and integrate blood samples, genetic samples, reports from physicians and hospitals, the private portals use health trackers with lower quality in measurements or at least not certifications. This is paid to the main aim of the platforms: governmental systems are focused on health care and interventions. Private systems are focused on fitness and lifestyle. Some hybrid versions are available as well (e.g. Beurer or Medisana).

In usability the two systems differ as well. The main development focus of eHealth systems is to transfer analog data to digital data. This follows the structure of complex forms and sheets that must be transferred to fit in the overall health care system. Between secure interfaces, exchange of multiple data formats, providing highly secure storages and exchange channels, usability is the point that is neglected most. Private systems are mainly focused on the experience of the user and by this focused on usability and visualization of data for fast and clear understanding.

	eHealth Systems	Private health data collectors
Main aim	Support health care and treatment	Support fitness and self-efficacy
Target group	Physicians and patients	People who want to stay fit and healthy
Data sources	Medical products (CE), laboratory samples, reports from hospitals, reports from physicians	activity tracker, smartwatches, smart scales etc.
Data exchange	Based on secured interfaces (e.g. HL7)	Exchange not always available. Works over dedicated API's
Registration	“Opt in” or “Opt out”, but official registration with ID	email is sufficient
Usability	Low/Middle usability	High usability

Table 1 Overview eHealth vs private health data collectors

2. eHealth in research project environment

In the last years, more and more projects started to work on their own eHealth system to support their trials and improve existing systems. For this paper, three projects from different funding programs are picked that show different approaches how an eHealth-like system. The three projects (links to the websites in the reference list) are the My-AHA Project (My active and healthy ageing), the SOCIALCARE Project and the WAALTeR Project (Viennese ambient assisted living (AAL) test region).

1. My-AHA is project about frailty prevention. In this H2020 project, frailty is defined as a multidimensional phenomenon that combines elements of cognitive frailty, physical frailty and social frailty. This approach allows a holistic approach in conquering frailty from different angles and to provide mixed interventions to increase the effect of each single intervention in a canon.
2. SOCIALCARE was an AAL JP project to develop a multi-device platform for seniors; including apps for eLearning, a social platform and a care support application. This was supported by an IOT application. The main evaluation idea was to identify the impact of technology on quality of life of seniors.
3. WAALTeR is a project, funded by the AAL program “benefit” of Austria government, to test different technologies around topics of activities of daily living like mobility, need for security and safety and medical support. With support of a tablet and a smartwatch, people are introduced to the mobile technologies. In a second step different smart home features are rolled out. One of these technologies is an infrared fall detector, working autonomously and in combination with a home alert system, which is connected to an alarm center.

All three projects were evaluated by experts from different fields. WAALTeR and My-AHA are following the principles of clinical studies by using a setting of a randomized controlled trial (RCT) to allow a clear impact analysis. SOCIALCARE was following a simple pre- post design with participants from the target group. The field trial took finally 6 months, whereas the field trials in WAALTeR are running for 12 months and in My-AHA between 12 and 18 months.

	SOCIALCARE	My-AHA	WAALTeR
Study aim	Increase QoL by social platform	Provide frailty prevention by ICT system and sensors	Increase QoL by use of Smart Home and multisensory systems
Methodology for evaluation	Pre-Post Design	Randomized Controlled Trial	Randomized Controlled Trial
Number of Participants	n=46	n=152	n=118
Technology used	Android Tablet and App	Android Smartphone and activity tracker	Android Tablet, fall detector, smart watch

Table 2 Comparison of three projects

All three projects have in common, that they want to increase fitness and health as well as quality of life for the participants in their study.

Chronologically SOCIALCARE was the first field trial in this line. With a relatively small groups of people aged 55+ (n=24 in AUT, n=22 in NL) were tested for a change with the WHO QOL Bref (T, E, C, R, & H, 2002). The main finding was that there were no significant changes in any domain of Quality of Life (QoL) using technology. Even worse, I general tendency in decreasing QoL was visible. Only one domain was evaluated with a positive tendency: The feeling of being informed and connected. So, the use of technology is providing a key to participate to society. This is indicating that technology use and the introduction to new technology is mainly supporting the need for information.

With this result, the work in WAALTeR and My-AHA was supported. My-AHA was developing the final RCT protocol when the results of SOCIALCARE were available. This influenced the expectations for the evaluation of the new technology developed in My-AHA. It became clear that the participants must have access to their data from the My-AHA system. But also, from evaluation data as well. The participants are forwarded their data with short letter of explanation of the data. Following the data analysis and a related risk model in My-AHA, special recommendations for frailty prevention are given to the participants. In the WAALTeR project a telemedical suitcase is offered to the people to monitor their vital parameter. This data can be discussed with a physician that is part of a trial of an insurance company in Austria. This added value of the project for the participants is supporting the need for information and is also making the project an eHealth system. My-AHA as well as WAALTeR are working as eHealth systems because the collected vital parameter and health data is used not just for research purpose but also for supporting treatment.

3. eHealth between science and support

To support this argument, a closer look into the collected data must be done. My-AHA and WAALTeR are different in their evaluation tools but follow a similar idea. Participants are asked to fill in questionnaires and to provide the researcher with data in a certain time pattern. The set of data, that is collected is at both projects big. WAALTeR is using different subscales of existing instruments with a strong focus on quality of life and psychological markers of health. My-AHA is using a broad clinical set of questionnaires to determine the physical, cognitive and social factors. WAALTeR has about 82 questions that are completely self-assed and include next to questions about quality of life already usability questions (approx. 50%). The questionnaires are send to the participants by mail and collected by return mail or physically during regular meetings with the participants. My-AHA is using 80 items for the screening. All the questions are directly related to frailty and measure the situational health status. A short list as comparison of between the projects shall make the difference clear in Table 3. For the participants, it is very informative to know if their situation has changed

between the measurement points. WAALTeR is focused on the psychological impact. My-AHA is focused on physical and cognitive parameter as well as social parameter of health. Both collect data about a current health status and provide through the repeated measurements a potential trend for health for the participants. This follows the idea of health as a continuum between sickness and health, as it is described in the concept of salutogenesis (Antonovsky, 1997) and allows to set personalized interventions to support participants to increase their quality of life and healthiness. For this it is very important to provide feedback about the results to the participants. This increases the adherence as in another example in the context of blood pressure control could be shown (Breux-Shropshire, Brown, Pryor, & Maples, 2012). The feedback is also supporting the believe in self-efficacy (Moattari, Ebrahimi, Sharifi, & Rouzbeh, 2012) and has a positive effect on the general outcome. Following the idea of hDATA, data that is used for health assessment and treatment from different sources, this leads to the hDATA circle (Aumayr, 2015), which describes a cybernetic system of personal health.

WAALTeR	My-AHA
ARC's self-determination scale	Minimum mental state examination
WHOQOL-OLD	Hopkins Verbal Learning Test
Balanced measure of psychological needs	Physical parameters
Satisfaction with life scale	Blood pressure
User Experience Questionnaire scale	Trailmaking Test
WHOQOL-BREF	Grip strength
Demographics	Demographics
	Body Mass Index
	CES-D
	WMS-III-Spatial Span
	Short physical performance battery
	WHOQOL-OLD
	IPAQ-short
	Hospital Anxiety and Depression Scale
	Timed up and go test
	WAIS-III Digit Symbol Substitution
	ABC (Activities Specific Balance Confidence Scale)
	PSQI (Pittsburgh Sleep Quality Index)
	Stroop Test
	Lubben Social Network Scale
	UCLA Loneliness Scale
	Self-MNA
	Computer Literacy scale

Table 3 Comparison of Assessment tools

4. Examples of usage of eHealth data within projects

Cybernetic systems are relying on their own elements to build further complexity. (Maturana & Valera, 1982) Also within the My-AHA project, this concept is in use. With the repeating questionnaires and health information, it is possible to adjust the health interventions (e.g. physical training, social events or cognitive training) to the participants needs. This is done semi-automatically by a decision support system that is collecting the data and following defined thresholds to make suggestions to the participant what would be best for him and to which extent. Also risk analysis for experiencing a direct impact of long term interventions and strategies are provided to the participants. Within the risk simulator it is possible to see his own risk for certain frailty aspects in relation to certain health data. When changing this data, the risk changes as well. It is possible to see the risk of oneself at the age of 80 or 90 years. And it is comparable when changing for example the weight – which has an impact on cardiovascular risk and on frailty (Bales & Ritchie, 2002). In the opinion of the author, this is a supportive form of eHealth that is directly related to the needs of participants of such a system.

5. Legal aspects to be considered

Since 2018 the General Data Protection Regulation (GDPR) must be in place with national legislation across Europe. Especially personal data and health data are protected by this legal act. Within this regulation it is clearly defined that each person has the right to get their data in a machine-readable format. People have the right to be deleted from datasets as well.

The normal practice of a research project is to provide an informed consent, which is dedicated for each single project. A data management plan must be available, and encryption is mandatory with. This aspects for product development could have been neglected during former research projects. But under the legal situation since 2018 this must be integrated already in the system architecture.

This adds up to the understanding of project related eHealth. Projects need now a data governance.

6. Conclusion

eHealth has changed from a term that was mainly used for large data structures in the health care sector to a term fitting in the needs of research projects. The implications are especially on the legal base interesting because of the right of the project participant to get all data about him or her. This is something new and was not done in all projects. The developments for projects must be more product-like as before and follow more regulatory issues. It is depending on type of research that is done, to which extent it becomes an eHealth project. In accordance to what is measured, the decision must be taken, and the adequate structures must be in place. Next to the benefits of eHealth systems for the participants, the research projects is a little closer to a commercial development. In the opinion of the author, this development is showing that research projects can become a support for health systems in the future because they use more intensive contact and more measurements than a typical patient would get in standard care.

In a vision, this could lead to a situation where people with limited access to high quality of care could participate through research projects on a high-level health care system, even if the economic situation in a country or region would not allow this. The understanding of research projects as eHealth Systems and as part of health care can lead to a more visible return of investment for funding and socio-economic benefits of research projects in this field.

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USAGE OF ADVANCED CRM CAMPAIGNS IN MEDICAL THERAPY

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Keywords

CRM, campaign, omni-channel, medication, pharmaceutical company

Abstract

Pharmaceutical companies have more and more possibilities how to contact health care providers such as doctors or pharmacist thanks to modern Customer relationship management systems like iPad presentations, videos on the internet, etc. Contacting health care providers shouldn't be only simple face to face visit without any complex use case. It is crucial to come up with some well-prepared campaigns which will have added value for doctors and for patients as well. Good opportunity for these campaigns is fasting which relates to many religious holidays, because for patients who suffers from some serious disease like diabetes can be exhaustion of organism caused by fasting life threatening. Based on that pharmaceutical company can run complex campaign using many contacting channels focusing on warning health care providers against health risks who can inform their patients then. Main purpose of this paper is to provide concept of Customer relationship management systems usage for complex campaigns in health care area.

1. Introduction

Customer relationships management (CRM) systems provides business many possibilities how to contact customers through different communication channels thanks to Information Communication Technologies (ICT) as for example e-mails, presentations on tablets, remote desktop sessions etc. If company is using various channels it has possibility to combine those channels in process of communication with customers and on the top of that enrich its campaigns. Proactively driven combining of channels together for communication calls omni-channel.(Frazer a Stiehler 2014)

Companies can create more complex and richer campaigns focused on specific groups of customers by using omni-channel approach. This possibility provides good opportunity to pharmaceutical companies for reaching health care providers (HCPs) who prescribe and recommend medicines to patients.(Champagne et al. 2015) Thanks to that pharmaceutical companies are able to incorporate complex approaches to medical campaigns which will be introduced in 4th chapter of this article. Those campaigns can be focused for example on factors influencing medications to provide health care providers more information about necessary changes in prescriptions of specific medications and basis to aware patients about needs of changes. Examples will be introduced in 3rd chapter of this article.

For this article, we used critical analysis based on lessons learned from current set-up of CRM systems in pharmaceutical area based on available sources, personal experience and opinion of

authors. We considered and respected current trends and best practices in this area as well as current data privacy laws.

During preparation of this paper, we used deduction, analysis, synthesis and analogy.

2. Layout and samples

One of important factors, which influence medical therapy is religion which influence medications thanks to religious holidays as Muslim Ramadan, Christian fasting, Daniel fast, etc. The key problem of all mentioned holidays is fasting as significant burden for organism.

The goal of this paper is to explain usage of advance CRM approaches in medicine by way of the omni-channel communication to reduce risks of external factors (for example fasting) having impact into medical therapy.

Based on our research we suppose, that CRM provides a lot of possibilities which can help with reducing of external factors on medical therapy. Purpose of proposed concept is to inform HCPs about possible need to inform their patients about changes in medications or adjust their therapy directly. Main reason is that fact pharmaceutical companies in most of the countries do not have any information about patients and their prescriptions.

3. Customer Relationship and Omni-channel Communication

CRM is a approach to manage integration of people, processes and technologies to maximize relationships with customers. (Goldenberg 2008) Purpose of CRM is to improve marketing impact to customers and bring added value to parties involved in the relationship. (Sheth 2000) CRM is in company usually supported by CRM system. These systems provide framework for managing relationships with customers through ICT. (Schultz 2003) CRM system is also considered as central repository for all data related to customers like contact data, background information, personal details, etc. (Schultz 2003) CRM systems consist of 3 main parts (Buttle a Maklan 2015):

- **Strategic CRM** – core customer-centric business strategy for winning and keeping profitable customers.
- **Operational CRM** – automation of customer-facing processes.
- **Analytical CRM** – process of customer-related data transformation into actionable insight for strategical of tactical purposes.

CRM systems provide possibilities to automate sales, marketing and customer service functions. There are three primary reasons for that (Goldenberg 2008):

- **High cost of direct sales** – CRM provides possibility to help increase sales force productivity and reduce sales costs.
- **Increased global competition** – CRM can help monitor and track market developments.
- **Need for information** – CRM helps to collect, compile and disseminate information about market, especially for customers.

Modern CRM systems are focused on use of internet through which many other systems are integrated together with CRM like Sales force automation (SFA), company websites, social media, etc. (Eichorn 2004; Ascarza et al. 2017; Buttle a Maklan 2015) Main intention is to use all possibilities to achieve quality relationship between company and its customers.

Each CRM system provides many technical possibilities how to contact health care providers (HCPs) as face to face visits, e-mails, remote desktop sessions, Close Loop Marketing (CLM), etc. (Fisher 2017) these channels can be combined during one campaign in matter of omni-channel strategy for campaign communication.

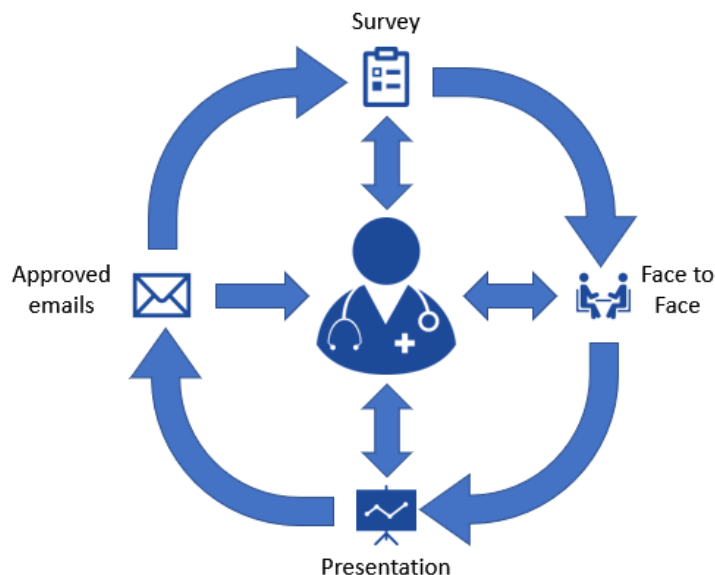


Figure 1 Omni-channel communication, source: Authors

For purposes of omni-channel use in campaigns is necessary to do integration and orchestration on two levels:

- **1st level:** communication channels chosen for campaign based on business process defined for that campaign,
- **2nd level:** add, change or replace tasks in processes for communication to incorporate omni-channel possibilities from 1st level for defined campaign.

IT usually provides possibility to track whole journey of HCPs during campaign and pro-actively drive it for whole campaign cycle, thanks to possible integration between many source systems in company. It means omni-channel campaigns can be done with use of CRM and some external mailing system or with help of external marketing company for example.

On top of all mentioned technical possibilities, business intelligence (BI) as next part of business ICT provides next level of capabilities to do various analysis for checking impact of campaigns to customers and their cooperation. BI can provide to marketing department various views on finished or on-going campaigns, which can lead to findings like for example problems in segmentation of HCPs, wrong timing of sending emails, etc. (Hall 2004) Findings like this are important in case of future campaigns, where we can modify parts of campaign, timing, etc. thanks to them.

For purpose of this paper is necessary to consider CRM system, its parts and possibilities which these systems provide to business. It is crucial not to use CRM systems for transactional operations like tracking visits HCPs, sending emails, surveys, etc. only. It is necessary to incorporate also business processes itself and combine them together with CRM system to use it in its full potential. In this paper is intentionally left analysis part of CRM systems.

As we mentioned, companies can create more complex and richer campaigns focused on specific groups of customers by using omni-channel approach. This possibility provides good opportunity to pharmaceutical companies for reaching health care providers who prescribe and recommend medicines to patients.(Champagne et al. 2015) Thanks to that pharmaceutical companies are able to

incorporate complex approaches to medical campaigns. Those campaigns can be focused for example on factors influencing medications to provide health care providers more information about necessary changes in prescriptions of specific medications and basis to aware patients about needs of changes.

On the other hand, companies can profit from interesting campaigns also in form of feedback from HCPs:

- usability of campaigns based on which campaign can be modified for next use,
- HCP's point of view on problematic,
- new ideas on what to focus in next campaigns,
- stronger relationships with HCPs.

Information technologies also provide possibility to track and evaluate impact of campaigns and engagement of HCPs.(Venkatesan et al. 2018) Information like these can be used during setting segments of HCPs, their prioritization, defining new contact approach to them, etc.

4. CRM Omni-Channel Campaign in Medical Therapy

There are many possible medical areas where proposed concept can be used. For purposes of this paper, we consider two use cases based on religious fasting as examples to show where concept can be used. Each of use cases is based on specific medical area. Example of omni-channel campaign is introduced in 2nd part of this chapter on example of religious fasting and diabetes.

Impact of "Fasting" on medical therapy can be important if the medical therapy is related mainly to problems related to food processing, diabetes, Anti-Retroviral Therapy etc.

Fasting means that peoples (believers), which are living according to rules of the defined religion, cannot for specific period consume food at all or specific sort of food as animal products. (Trepanowski a Bloomer 2010)

We recognize a lot of situations, where CRM Omni-Channel Campaign can be used. From our point of view the most important are:

- Diabetes
- Anti-Retroviral Therapy

Both of them are really frequent and price for the therapy is high (Nall et al. 2015; Yang et al. 2018) and impact of fasting is critical.

4.1. Diabetes and Anti-Retroviral Therapy

In case of diabetes the fasting can cause a problem in case of hypoglycemia which is a complication of diabetes when blood sugar levels are too low, and patient should eat to reach correct level of glucose in blood again.(Cryer et al. 2003)

In case of hyperglycemia is necessary to take medication in form of insulin again and dietary changes for following days. Especially dietary changes can be issue in case of religious holidays thanks to very menus. Thanks to that various dietary recommendations should be given to patients by HCPs. (Hassanein et al. 2017)

The second frequent example is Anti-Retroviral Therapy (ART) and religious fasting. ART is medication therapy to treat Human Immunodeficiency Virus (HIV) infection thanks to reducing viral replication. (Cohen et al. 2011) For proper effectiveness of therapy concentration of anti-retroviral

drugs must be consistently high antiretroviral therapy and this is affected by eating habits, foods and dosing schedules. (Habib et al. 2009)

This paper is devoted to the first example only – to diabetes.

4.2. CRM Process for Omni-Channel Campaign for Patience with Diabetes during Ramadan

Period of Ramadan is every year different from time point of view. The Ramadan Period is driven by lunar calendar. Nevertheless, the Period of Ramadan is well predictable, so company can start campaign on specific date before Ramada itself will start. The campaign can start for example month before holiday to give proper time to HCPs to get familiarize with information regarding to changes in medications and still have a time to inform his patients.

The Figure 2 shows example of campaign, in which segment of HCPs specializing on diabetes will be contacted. Campaign is divided into 4 main steps in blue color and 1 optional in yellow color which are using 5 channels (mass mailing, e-mail, virtual presentation, CLM and survey):

1. In first task HCPs are contacted through mass e-mailing which can announce campaign to and its topic in general as introduction and preparation for further communication chain.
2. In second task HCPs are contacted via Sales representative initiated e-mail with general information about impact of Ramadan on Muslim diabetics and need of changes in medication. Some scientific articles can be attached. On top of that in this e-mail is also link to virtual presentation where more detailed information is with help of infographics, etc.,
3. Few days later HCPs are contacted by sales representatives. If they are interested in CLM presentation where questions about impacts of Ramadan on Muslim diabetics can be raised directly to sales representatives who can provide more information,
4. In 3rd step survey is send to HCPs where questions related to medical things and to campaign are raised for better knowledge of impact of campaign and its helpfulness to HCPs. Based on that changes can be done in campaign for next year or other campaigns can be modified.
5. This step is optional, and it is triggered based on result of survey from 4th step. If HCP will answer key questions by specific way than sales rep can contact him again with another specific presentation.

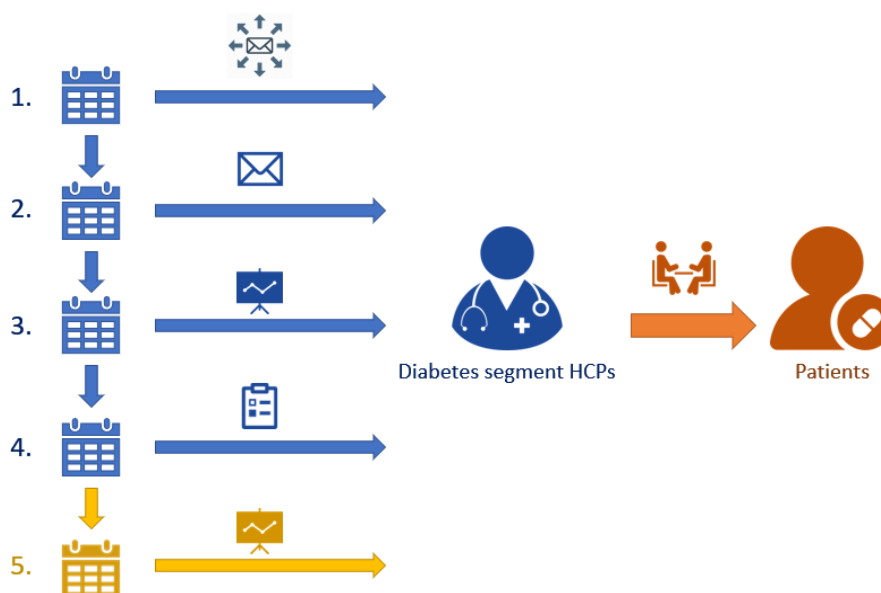


Figure 2 Omni-channel campaign, source: Authors

Thanks to richer campaigns doctors can provide more information to their patients in right time. Time of providing information about external factors of religious holidays to patients by doctors is essential for protecting health of the patients from negative impacts which can lead to serious complications or even death. Example of that can be information about need of adjustment of patient's menu during fasting or need of change in dosing during it to preserve effectiveness of medications.

For patients this proactive communication is extremely important because risk related to fasting traditions can be mitigated and health of patients will not be affected by their behavior during fasting.

5. Conclusion

Modern CRM systems provide many possibilities to pharmaceutical companies to be more creative during campaigns in communication with customers. Important thing for consideration in e-health is building campaigns on specific medical use cases to provide added value also to customers and create richer and interesting campaigns. To meet these objectives is necessary to use omni-channel possibility of CRM systems.

Campaigns built on specific use cases are good opportunity to make campaigns useful for customers, patients and creating community between sales representatives and HCPs thanks to aimed conversation. Aimed conversation is good base for long term relationship between sales representative and HCP.

On top of that rich campaigns can be enhancement of classic communication with doctors for defending patients against various external factors which can influence their health. In the end all sides benefit from well-prepared and interesting campaigns. Companies improving their relationships with HCPS, HCPs get new medical information and patients get early warnings about necessary changes in their treatment. Early warning can reduce the risk of complications as diabetic shock or reducing effectiveness of ART. This article provides insight to advanced possibilities of modern CRM systems and their use in healthcare campaigns. Concept given by article can be enhance for other medical use cases, extended by more information technologies or new approaches which can provide more possibilities in campaigns.

Above mentioned examples of diseases and another examples of diseases can be used for creating campaigns for every religious fasting based on diseases which for company is selling drugs. For example, in case of selling drugs for diabetes as insulin, campaigns for Ramadan and Christian fasting should take a place and campaign should be focused primarily to HCPs specializing to diabetes area. Another example can be HIV and fasting. So, 2 campaigns can run in parallel. One for HIV segment and second for diabetes. In the end both campaign can have same process for omni-channel CRM communication with HCPs, only content will be dependent on segment.

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OPEN HUMAN MEDICINE DATA IN EUROPEAN UNION

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Keywords

Pharmacy, human medicines, open data, European Union

Abstract

Open data are information entities that have become of significant importance for many institutions, businesses, researchers and even citizens. Through the use of open data, they can e.g. analyze many trends, solve serious societal questions, help businesses to be competitive and, last but not least, monitor public spending. The aim of this paper is to analyze the state of open data in the pharmaceutical industry directed towards human medicines in the European Union and to design standardized structure. The authors' perspective is to provide detailed insights into the developments of open human medicine data access through the specific open data web portals of the official medicine control institutions that participate in open data initiatives, and to suggest future improvements.

1. Introduction

Open data plays an important role in all levels of our society and today it affects many sectors including politics, transportation, culture, industry, agriculture and healthcare. It has become a solid part of many national information policies, shifting from governmental even down to local levels. A trackable growing significance was evident mainly during the Barack Obama administration after the official Data.gov site was launched (Kostkova et al., 2016). Data is also an essential part of EU Digital Single Market strategy “*The EU needs to ensure that data flows across borders and sectors and disciplines. This data should be accessible and reusable by most stakeholders in an optimal way.*” (European Commission, 2018)

Moreover, massive digitalization and increasing IS/ICT usage have brought big data challenges and demands for non-traditional analytical methods to uncover global and even regional trends (Gandomi & Haider, 2015). Open data initiatives have become a part of this data revolution progress and healthcare is one of the key sectors. We can define and comment these main directions of open healthcare data.

- Transparent and linked data access for R&D purposes.

Firstly, open data must be accessible, in digital and machine-readable format with free use, reuse and distribution with no limitations regardless of user intentions (HM Government, 2012) to support Digital Single Market. An important feature of open data that should be mentioned here is its broad spectrum, which leads to knowledge production, and trust in this process is underlined by its transparency (Moreno, Gemo, Nicholson, Rana, & Mariachiara, 2014). For example, (Jovanovik & Trajanov, 2017) see a significant problem in dataset availability differences on national levels regarding language, structure, format, granularity and the contextual obstacle of not-linked-data.

They have designed tools to transform open pharmaceutical data from 23 countries to discover possibilities for data consolidation. Other research tendencies are directed toward finding a possible new unifying data structure.

- Open healthcare data as a must-have tool.

(Payne, Huang, Shah, & Tenenbaum, 2017) have a view of open data as the tool for new biomarker identification, the improvement of cost-effective therapies, and a population level influence on disease and wellness assessment.

- Legal functional framework for maximum open healthcare data usage and GDPR

Policy makers should develop a legal functional framework for maximum open healthcare data usage, but with significant respect to privacy. Open data privacy will be a demanding topic regarding GDPR. Open data publication must be strictly anonymous to be not in the conflict with the regulation. However, even anonymous open healthcare data will bring the new insights in the human health.

2. Research

In our study we have analyzed the *on-line available open medicine data* regarding human medicine provided by national control offices. Above all, we have analyzed a data recall based on the following identifiers (see Tab 1) that we consider to be a crucial set for Business / Competitive Intelligence analysis. We have excluded medical aspects such as pharmaceutical form or composition, requesting business and financial information instead.

FIELD VALUE	MEANING	MISSING DATA VALUE
ATC	Anatomical Therapeutic Chemical classification system	F1
CODE_MED	Specific code of the medicine	F2
NAME	Name of the medicine	F3
ADDITIONAL_INFORMATION	Additional information to the name	F4
PRODUCER	Registration holder	F5
COUNTRY_ORIGIN_PRODUCER	Country of a registration holder	F6
NUMBER_OF_PACKAGES_YEAR	Number of packages / year	F7
PRICE_NOSURCHARGE_EXCL_VAT	Price per package excl. a surcharge and VAT	F8
TOTAL_SUM_NOSURCHARGE_EXCL_VAT	Total sum / all packages / excl. a surcharge and VAT	F9
PRICE_SURCHARGE_INCL_VAT	Price per package incl. a surcharge and VAT	F10
TOTAL_SUM_SURCHARGE_INCL_VAT	Total sum / all packages / incl. a surcharge and VAT	F11
NUMBER_DDD	Defined daily doses / package	F12
TOTAL_DDD	Defined daily doses / total	F13
DDD_1000INH_DAY	Defined daily doses / 1000 inhabitants	F14

Tab 1 Monitored open medicine data identifiers. Source: authors

The structure of results was defined as follows. The basic parameters are based on Global Open Data Index (OD4D, 2017) evaluating open data on national level.

- The institution in charge with URL
- Open data accessibility with open data URL
- Missing data values
- Format (if there is machine-readable format)
- Another possible reference for cases if another institution provides some open data.

3. Results

Following table represents each of the EU member state.

<p>Austria AGES (https://www.ages.at/)</p> <p>Open data: Yes Open data URL: https://aspreghister.basg.gv.at/ Missing data: F8, F9, F10 F11, F12, F13, F14 Format: XLS Another possible reference: https://www.basg.gv.at</p>	<p>Belgium FAMHP - Federal Agency for Medicines and Health Products (https://www.famhp.be)</p> <p>Open data: YES Open data URL: https://www.afmps.be/fr/items-HOME/Bases_de_donnees Missing data: F1, F6, F7, F8, F9, F10, F11, F12, F13, F14 Format: ACCDB</p>
<p>Bulgaria Bulgarian Drug Agency (http://www.bda.bg)</p> <p>Open data: NO</p>	<p>Croatia HALMED - Agency for Medicinal Products and Medical Devices (http://www.halmed.hr)</p> <p>Open data: YES Open data URL: http://www.halmed.hr/en/Lijekovi/Bazalijekova/ Missing data: F7, F8, F9, F10, F11, F12, F13, F14 Format: XLSX</p>
<p>Cyprus Pharmaceutical Services Ministry of Health (https://www.moh.gov.cy/moh/phs/phs.nsf)</p> <p>Open data: YES Open data URL: through the search interface from the main website (not up-to-date) Missing data: F7, F8, F9, F10, F11, F12, F13, F14 Format: XLS</p>	<p>Czech Republic State Institute for Drug Control (http://www.sukl.cz)</p> <p>Open data: YES Open data URL: https://opendata.sukl.cz/</p> <p>Missing data: F14</p> <p>Format: CSV (zipped)</p>
<p>Denmark Danish Medicine Agency (https://laegemiddelstyrelsen.dk/)</p> <p>Open data: YES Open data URL: https://laegemiddelstyrelsen.dk/en/licensing/licensing-of-medicines/lists-of-authorized-and-deregistered-medicines/ Missing data: F7, F8, F9, F10, F11, F12, F13, F14 Format: CSV</p>	<p>Estonia REAM (http://ravimiregister.ravimiamet.ee)</p> <p>Open data: YES Open data URL: http://ravimiregister.ravimiamet.ee/en/default.aspx?pv=HumRavimid.PakendidOtsing Missing data: F7, F8, F9, F10, F11, F12, F13 F14 Format: CSV</p>

<p>France ANSM : Agence Nationale de sécurité du Médicament et des produits de santé (http://ansm.sante.fr)</p> <p>Open data: YES (but not on the ANSM website) Open data URL: http://open-data-assurance-maladie.ameli.fr/medicaments/index.php#Open_MEDIC Missing data: F7, F8, F9, F10, F11, F12, F13 F14, F6, Format: CSV (zipped)</p>	<p>Germany The Federal Institute for Drugs and Medical Devices (http://www.bfarm.de)</p> <p>Open data: NO (paid on the AMIS database operated by DIMDI)</p>
<p>Greece Nation Organization for Medicines (http://www.eof.gr)</p> <p>Open data: NO (only search interface of existing medicine on the Greek market without exporting possibilities) Open data URL: NO</p>	<p>Hungary National Institute of Pharmacy and Nutrition (https://www.ogyei.gov.hu/)</p> <p>Open data: YES Open data URL: https://www.ogyei.gov.hu/drug_database/ Open data URL: https://www.ogyei.gov.hu/lists Missing data: F4, F6, F7, F8, F9, F10, F11, F12, F13 F14 Format: CSV</p>
<p>Ireland Health Product Regulatory Authority – HPRA (https://www.hpra.ie/)</p> <p>Open data: YES Open data URL: https://www.hpra.ie/LastUpdatedProducts</p> <p>Missing data: F4, F6, F7, F8, F9, F10, F11, F12, F13 F14 Format: XML</p>	<p>Italy AIFA (http://www.aifa.it)</p> <p>Open data: YES Open data URL: http://www.aifa.gov.it/content/dati-sulle-liste-dei-farmaci-open-data Missing data: F4, F6, F14, F13, F12, F11, F8, F9, F7 Format: CSV</p>
<p>Latvia ZVA (https://www.zva.gov.lv)</p> <p>Open data: NO (only a solid search interface of medicines) Open data URL: NO</p>	<p>Lithuania VVKT - The State Medicines Control Agency</p> <p>Open data: YES</p> <p>Open data URL: https://vapris.vvkt.lt/vvkt-web/public/medications Missing data: F4, F6, F14, F13, F12, F11, F8, F9, F7 Format: CSV</p>
<p>Luxembourg Medicines control process is under the supervision of the Ministry of Health (http://www.sante.public.lu/fr/index.php)</p> <p>Open data: NO</p>	<p>Malta Malta Medicines Authority (http://medicinesauthority.gov.mt)</p> <p>Open data: YES Open data URL: http://medicinesauthority.gov.mt/advanced-search (the search results can be exported) Missing data: F4, F6 (some records contain this information), F14, F13, F12, F11, F8, F9, F7 Format: CSV</p>
<p>Netherlands Medicine Evaluation Board (https://english.cbgb-meb.nl/)</p> <p>Open data: NO (only a solid search interface of medicines) Open data URL: NO</p>	<p>Poland Office for Registration of Medicinal Products (http://www.urpl.gov.pl)</p> <p>Open data: YES Open data URL: http://pub.rejestrzymedyczne.csioz.gov.pl (export from the search)</p>

	<p>Missing data: F4, F6, F14, F13, F12, F11, F8, F9, F7 Format: XLSX</p>
<p>Portugal INFARMED (www.infarmed.pt)</p> <p>Open data: YES</p> <p>Open data URL: http://app7.infarmed.pt/infomed/pesquisa.php (export from the search)</p> <p>Missing data: F1, F6, F14, F13, F12, F11, F8, F9, F7 Format: CSV</p>	<p>Romania National Agency for Medicines and Medical Devices – NAMMD (www.anm.ro)</p> <p>Open data: NO (only a solid search interface of medicines) Open data URL: NO</p>
<p>Slovakia SIDC – The State Institute for Drug Control (http://www.sukl.sk)</p> <p>Open data: NO (only a solid search interface of medicines) Open data URL: NO Another possible reference: National Health Information http://www.nczisk.sk/en/Pages/default.aspx</p>	<p>Slovenia JAZMP – Agency for Medicinal Products and Medical Devices of the Republic of Slovenia –(http://www.jazmp.si)</p> <p>Open data: YES</p> <p>Open data URL: http://www.cbz.si/cbz/bazazdr2.nsf/Search/\$searchForm?SearchView Missing data: F6, F14, F13, F12, F11, F9, F7 Format: CSV</p>
<p>Spain AEMPS (https://www.aemps.gob.es/)</p> <p>Open data: YES Open data URL: Open data URL: https://cima.aemps.es/cima/publico/buscadoravanzado.html (export from the search)</p> <p>Missing data: F1, F3, F4, F6, F14, F13, F12, F11, F8, F9, F7 Format: XLSX</p>	<p>Sweden Swedish Medical Products Agency (https://lakemedelsverket.se/)</p> <p>Open data: YES Open data URL: https://lakemedelsverket.se/LMF/?rs=1&type=product (export from the search); https://npl.mpa.se/</p> <p>Missing data: F4, F6, F14, F13, F12, F11, F8, F9, F7 Format: XLSX, XML (zipped)</p>
<p>United Kingdom Medicines and Healthcare Products Regulatory Agency (https://www.gov.uk/government/organisations/medicines-and-healthcare-products-regulatory-agency)</p> <p>Open data: YES Open data URL (Scotland): http://www.isdscotland.org/Health-Topics/Prescribing-and-Medicines/Publications/data-tables2017.asp?id=2020#2020 Open data URL (Wales): http://www.primarycareservices.wales.nhs.uk/data-publications Open data URL (England): https://openprescribing.net OR https://digital.nhs.uk/catalogue/PUB30234 Open data URL (Northern Ireland): https://www.opendatani.gov.uk/dataset/gp-prescribing-data Missing data: Scotland (F1, F2, F3, F5, F6, F7, F8, F9, F10), Northern Ireland (F1, F3, F4, F6, F14, F13, F12, F11, F8, F9, F7), England (F1, F3, F4, F6, F14, F13, F12, F11, F8, F9, F7), Wales (F1, F3, F4, F6, F14, F13, F12, F11, F8, F9, F7) Format: XLSX, CSV</p>	

Tab 2 Open medicine data survey results. Source: authors

4. Results

Our survey has shown many obstacles regarding open medicine data accessibility. We have summarized the following significant problems and challenges in national control offices in the EU.

Centralization

Although (European Medicines Agency, 2018) is trying to provide through their search interface every medicine that has been granted central marketing authorization by the European Commission, no EU-wide human medicine overview has been reached. To support accessibility, we suggest that the Commission, through the EMA, should issue a regulation that national offices must provide data in a *consistent agreed structure*, with *consensually specified data values*, in *English* and with a minimal frequency of *once per annum*.

Data quality

The data features mentioned above reflect the present level of open human medicine data quality. The biggest issues we face could be identified as the *different data structure* in each of the countries together with *language barriers* leading to difficulties when data should be used in a whole region analysis. Some data sets were complex (for example Scotland and the Czech Republic), others provided only simple insights into specific medicines, e.g. Wales or Slovakia. As for reasonable business analysis, we recommend that the data sets from the central point of view should consist of the following data fields.

- ATC code⁷
- Name of the medicine
- Name of the producer
- Country origin
- Year of approval
- Total packages of medicines / year
- DDD / 1000 inhabitants⁸
- DDD / total
- Wholesale price excl. VAT

5. Conclusion

This paper has presented the state of online accessible open human medicine data for business analysis. The authors have discovered significant quality-level differences in each of the EU member states and therefore the data is difficult to use for complex market trend insights.

The main barriers can be specified as inconsistent data structure and identifiers, and language diversity. In the authors' view, possible solutions would lie in the central regulation of regular data supplies with a solid data structure and English language data values at the very least.

Our further work will continue to demonstrate business data analysis possibilities with the present state of open human medicine data and show the perspectives for centralized data entities.

⁷ Anatomical Therapeutic Chemical Classification System

⁸ Defined daily doses per 1000 inhabitants

6. Acknowledgements

This paper was written thanks to the long-term institutional support of research activities by the Faculty of Informatics and Statistics, University of Economics, Prague. This paper has been supported by the IGA grant “Using Open Data within Competitive Intelligence” VSE IGS F4/32/2018.

We also would like to thank Dr. James Partridge, University of Oxford for his academic support.

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TOPIC F: DIGITAL SINGLE MARKET INNOVATION

DIGITAL SINGLE MARKET STRATEGY AND ITS IMPACT ON TRUST IN PUBLIC ADMINISTRATION

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Keywords

Trust, public administration, DSM, Digital single market, DESI

Abstract

The paper is trying to analyse how implementation of eGovernment initiatives under Digital Single Market strategy influence the trust of citizen in public administration. The aim is to determine whether implementation of concrete eGovernment efforts proposed by Digital Single market strategy lead to increase of trust in public administration. The research is based on cross country comparison of eGovernment part of Digital Economy and Society Index (DESI) with the results of Eurobarometer studies. The mentioned index is used to measure progress in digital policies in the Member States, whereas the Eurobarometer is used to define the level of trust of citizen in public administration. The results showed strong linear relationship between countries' level of adopted DSM eGovernment initiatives and citizens' trust in public administration. On the other hand, provided analysis could not confirm that countries which radically improve their eGovernment profile since the DSM strategy was launch also acknowledge radical increase of citizens' trust in public administration.

1. Introduction

During the last few years European Union starts several initiatives to modernise public administration in order to provide better quality of life for citizens. In 2015, the European Council endorsed a Digital Single Market (DSM) Strategy. Together with previously mentioned modernisation and improvement of quality of life this strategy also aims to achieve better cross-border interoperability and facilitate easy interactions with citizens. To support these efforts the eGovernment Action Plan 2016-2020 was published in 2016. It includes package of initiatives related to the realisation of the Digital Single Market (DSM) strategy in order to coordinate efforts and resources regarding modernisation of public sector. (European Commission, 2017). In the Mid-Term Review on the implementation of the Digital Single Market Strategy, is stated “the eGovernment Action Plan 2016-2020 seeks to accelerate and broaden the scope of digitisation, thereby increasing the efficiency of public administrations and facilitating the free movement of businesses and citizens”. All these initiatives lead to concrete actions that should be implemented by EU member's states. As Oettinger (2015) suggested 2016-2020 eGovernment Action Plan, is key step to realize an idea of united digital market. This plan is about implementation of electronic services into processes of public administration. Question is how citizens perceive impact of these initiatives on their lives. According to results of the Edelman Trust Barometer 2018 study, (which question 500 respondents in U.S. and China and 200 respondents in each of other 23 countries) there is still quite big gap between trust of

citizens in government and trust of citizens in businesses. (Figure 1) On the other hand it also seems that trust in government have increasing tendency during the last few years.

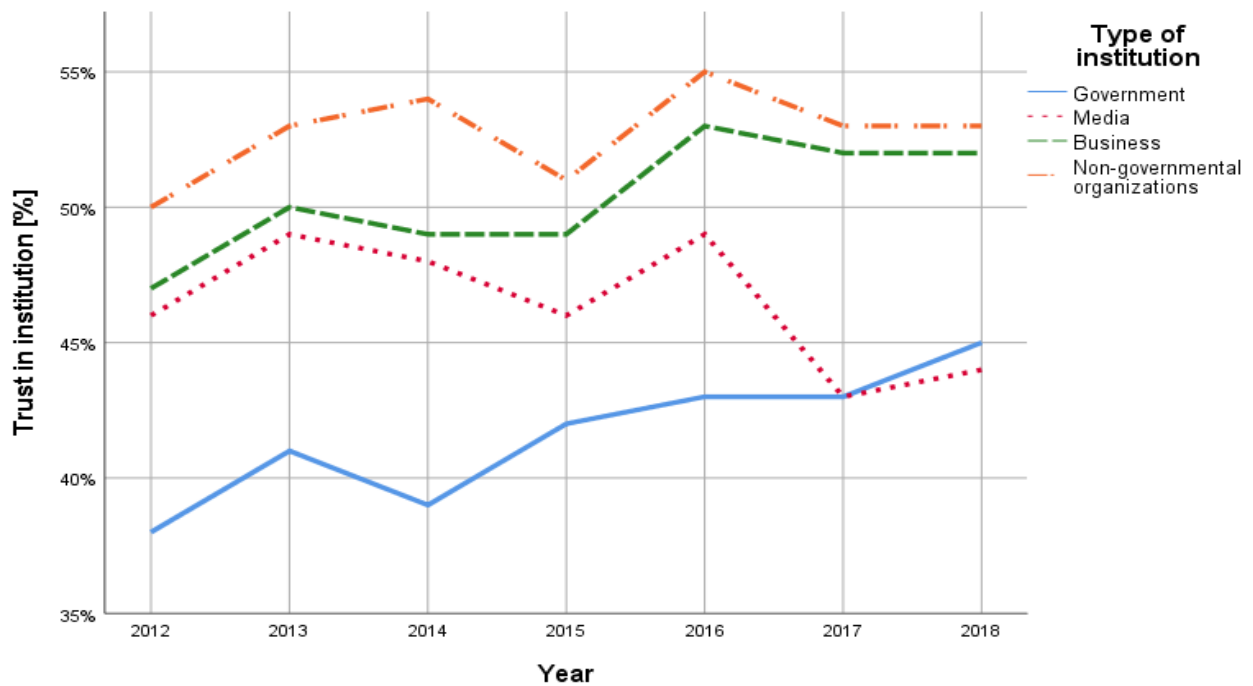


Figure 1: Trust of public in institutions from 2012 to 2018, Source: Edelman (2018)

The trust is together with risk term which is very difficult to define. There are many definitions from several perspectives which are trying to define citizens' trust in public administration. For more information please see review by Alzahrani (2017). Based on this review most of studies regarding trust and eGovernment are dealing with technical side of public services, in term of how to build eGovernment services to be more save, private and citizen can trust that their information would not be misused. It is very hard to find studies describing how implementation of eGovernment can improve trust of citizens in public administration or which trust building electronic services should be implemented to make the citizens trust more in their public representatives. As Delina and Dráb (2010) claimed for electronic environment to be suitable for realization of transaction with huge amount of various unknown participants and third parties, the trust can be defined as: "objective and subjective quantified believe of trustor in certain level of competence, honesty, safety and reliability of second subject or third party, which is presented in specific context, based on historical activities and functionalities of environment." Within this definition trustor can be understood as a subject, which recognize external actions produced by other subjects, and therefore it is a subject, who trust in target entity known as "trustee". Moreover such definition includes interaction between partners and covers the trust in functionality of environment, where these interactions are being created, as well as it encompasses the trust in ability of the environment maintain and manage these interactions. Maintaining and managing of interactions is connected to ability of the environment to solve the problems regarding the trust disturbance or setting back the trust to previous condition. (Delina, Dráb, 2010) Based on this concept, the focus of eGovernment efforts should not be only targeted on security and safety of data economy, but these initiatives should also create online self-regulated environment where can be trust build not only among actors and system but also between actors themselves. Fledderus (2014) argues that a lot of countries tried to connect citizens and public sector using initiatives built on the paradigm of New public management (NPM) This market-oriented approach, where citizen should be understood as consumer (user), came from commercial sector. Research focusing on the impact of above mentioned transformation did not bring any evidence about an

increase of trust of citizens into a public sector (Van de Walle, 2010; Kettl 2000; Pollit, Bouckaert 2004). We have to realize, that in private sector exists competition mechanism, which realizes full repletion of consumer needs and his satisfaction. But in the public sector, there is an absence of competition mechanism. This is reason for an intensive discussion about new management models of public sector, which can ensure a safety access of citizen to process of public sector. For example, Public Value Theory (PVT) says, that approaches based on calculations of economic efficiency cannot adequately include social values which can be found in public services (Hefetz, Warner, 2004). Other theory, the paradigm of new public governance (PGP – new public governance) says, that the base of relationship between citizen and public sector should be partnership and cooperation, not competition (Osborne 2010). Active connection of citizens into processes of public administration constitutes an effective tool how to revitalize trust into public administration, improve social cohesion and increase the level of social capital (Barker, 2010; Bovaird, Löffler, 2012; Ostrom, 1996; Pestoff, 2009). It is based on assumption that change of essence of relationship will result into the change of approach, specifically trust will increase and distrust will decrease. On the other hand, according to Fledderus (2014), there does not exist any empirical research which could support these results.

This paper tries to analyse the relationship between level of implementation of eGovernment's part of DSM strategy by particular country and level of citizens' trust in public administration. The idea behind this research is to find out, whether implementation of DSM strategy can have impact on trust of citizens in public administration. To measure the level implementation we use The Digital Economy and Society Index (DESI) which should quantify digital performance and level of EU Member States in digital competitiveness. (European Commission, 2018a). The level of citizens' trust per state is gain from Eurobarometer studies.

2. Methodology and description of the sample

The data used in this paper are from two different databases. First type of information is gained from The Digital Economy and Society Index (DESI). Based on DESI methodology, we extract information that evaluate implementation of eGovernment actions. Concretely, in term of eGovernment DESI methodology evaluates these five sub-measures: (European Commission, 2018b)

- the eGovernment users indicator, which measure percentage of users who need to submit forms to the public administration
- the pre-filled forms indicator, represent degree of how the data already know to public administration is in prefilled forms presented to the user;
- the online service completion indicator, which measure how big part of dealing with public administration can be realized online.
- the digital public services for businesses indicator, which measure interoperability and crossborder usability of business oriented public services;
- the open data indicator, which measure how is government committed to open data;

Table 1: Overview of the sample

Country	eGov 2015	eGov 2017	eGov Diff	Trust in PA 2016	Trust in PA 2017	Trust in PA Diff	Trust in RLPA 2015	Trust in RLPA 2017	Trust in RLPA Diff
European Union 28	43.25	50.12	15.88	45	49	9	42	51	21
Estonia	62.19	67.61	8.72	53	60	13	45	57	27
Finland	63.98	66.04	3.22	61	77	26	62	72	16
Denmark	62.37	62.92	0.88	69	72	4	70	72	3
Spain	58.56	62.75	7.16	34	42	24	21	37	76
Austria	54.72	62.68	14.55	65	66	2	52	67	29
Netherlands	57.65	62.63	8.64	53	66	25	58	65	12
Sweden	55.39	60.85	9.86	61	65	7	73	69	-5
Malta	54.3	58.79	8.27	56	51	-9	39	52	33
Ireland	49.96	58.39	16.87	51	51	0	36	54	50
Lithuania	49.03	57.81	17.91	40	45	13	43	47	9
Portugal	58.48	56.16	-3.97	36	38	6	42	47	12
France	43.15	53.21	23.31	57	56	-2	45	56	24
United Kingdom	46.26	51.18	10.64	54	49	-9	45	52	16
Latvia	40.58	50.87	25.36	28	30	7	41	50	22
Cyprus	40.33	48.21	19.54	30	36	20	21	47	124
Belgium	42.43	48.06	13.27	51	62	22	52	64	23
Poland	46.56	45.73	-1.78	39	40	3	37	47	27
Slovenia	37.4	45.6	21.93	32	41	28	27	43	59
Germany	37.65	44.79	18.96	56	71	27	62	77	24
Bulgaria	34.67	43.18	24.55	27	31	15	27	39	44
Luxembourg	31.6	43.17	36.61	77	77	0	70	76	9
Italy	39.76	42.21	6.16	23	21	-9	19	23	21
Czech Republic	26.01	41.72	60.4	49	51	4	40	56	40
Slovakia	29.79	41.37	38.87	41	41	0	38	41	8
Croatia	24.79	37	49.25	26	27	4	21	26	24
Romania	28.32	34.85	23.06	30	33	10	32	35	9
Greece	22.41	32.98	47.17	20	17	-15	17	22	29
Hungary	28.43	32.23	13.37	46	58	26	44	63	43

Source: Standard Eurobarometer 84,85,88 and DESI database 2015 and 2017

All these sub-indicators together form eGovernment indicator. In the study we decide to use DESI eGovernment indicator for years 2015 and 2017. The year 2015 (*eGov 2015*) was chosen, because in 2015 the DSM strategy started to be implemented. On the other hand, we chose 2017 (*eGov 2017*) because at the time of writing this article, the most recent Eurobarometer study was published in 2017

and we want to compare data from *eGov* index with data from Eurobarometer studies. The Eurobarometer studies are used to measure level of trust of citizens. Concretely we analyse answers from two questions. First question asks citizens whether they tend to trust or tend not to trust in Regional or local public authorities. Second question asks citizens whether they tend to trust or tend not to trust public administration. From these answers, we extract percentage of citizens that answered “tend to trust”, and create indexes. The *Trust in RLPA* index was created from answers to first question and *Trust in PA* index was created from answers to second question. Similarly to *eGov* indicator, we acquire data for *Trust in RLPA* index for years 2015 (Standard Eurobarometer 84) and 2017 (Standard Eurobarometer 88). On the other hand question measuring trust in public administration was according to our knowledge added to Standard Eurobarometer only in 2016, so for index *Trust in PA* we used information from Eurobarometers studies conducted in 2016 (Standard Eurobarometer 85) and 2017 (Standard Eurobarometer 88). To measure impact of change, we also calculated percentage change for all of three indicators. Names of these variables are: *eGov Diff*, *Trust in PA Diff*, *Trust in RLPA Diff*. The data used in this paper are presented in Table 1.

The research in this paper tries to determine the relationship between implementation of eGovernment digital agenda and trust of citizens in public administration. Our analyses have two parts. In first part we measure the strength of relationship between *eGov 2017* indicator and *Trust in PA Diff 2017* index and strength of relationship between *eGov 2017* and *Trust in RLPA 2017*. In the second part of research we analysed how changes in implementation of eGovernment agenda influence changes in trust. Concretely we measure strength of relationship between *eGov Diff* and *Trust in PA Diff* as well as strength of relationship between *eGov Diff* and *Trust in RLPA Diff*. To test all these relationships we used Pearson's R coefficient (in case that linear relationship is assumed) and Spearman Correlation coefficient (in case that linear relationship is not assumed).

3. The research

As was mentioned before, first part of the research tries to determine strength of the relationship between adoption of eGovernment and trust of citizens in public administration and local, regional authorities. The idea behind this analysis is to find out whether there is a relationship between level of adoption eGovernment infrastructure and trust of citizens in public affairs. To test this relationship we compared *eGov 2017* index, which evaluate level of implementation of eGovernment action in EU member state with two different measures of citizens’ trust. The comparison is done through parametric Pearson's R coefficient and non-parametric Spearman Correlation coefficient. The results of the analysis are presented in Table 2.

Table 2 Analysis of relationship between level of eGovernment’s adoption and trust of citizens

Variables		Pearson's R Coefficient		Spearman Correlation Coefficient	
		Value	Approx. Sig.	Value	Approx. Sig.
eGovernment. 2017	Trust in public administration in 2017	0.519	0.004	0.506	.005
	Trust in regional or local public authorities 2017	0.462	.012	0.451	.014

As can be seen from Table 2, approximate significance (p-value) for all coefficients are smaller than $\alpha = 5\%$. This mean that all coefficient presented in Table 2 are statistically significant at $\alpha = 5\%$. Moreover, relatively high value of correlation coefficients supports the claim that there is a strong relationship between countries’ level of adoption of eGovernment actions and countries’ level of

citizens' trust in public administration. Mentioned relationship is also illustrated in Figure 2. The distribution of points in Figure 2 illustrates linear form of relationship between variables.

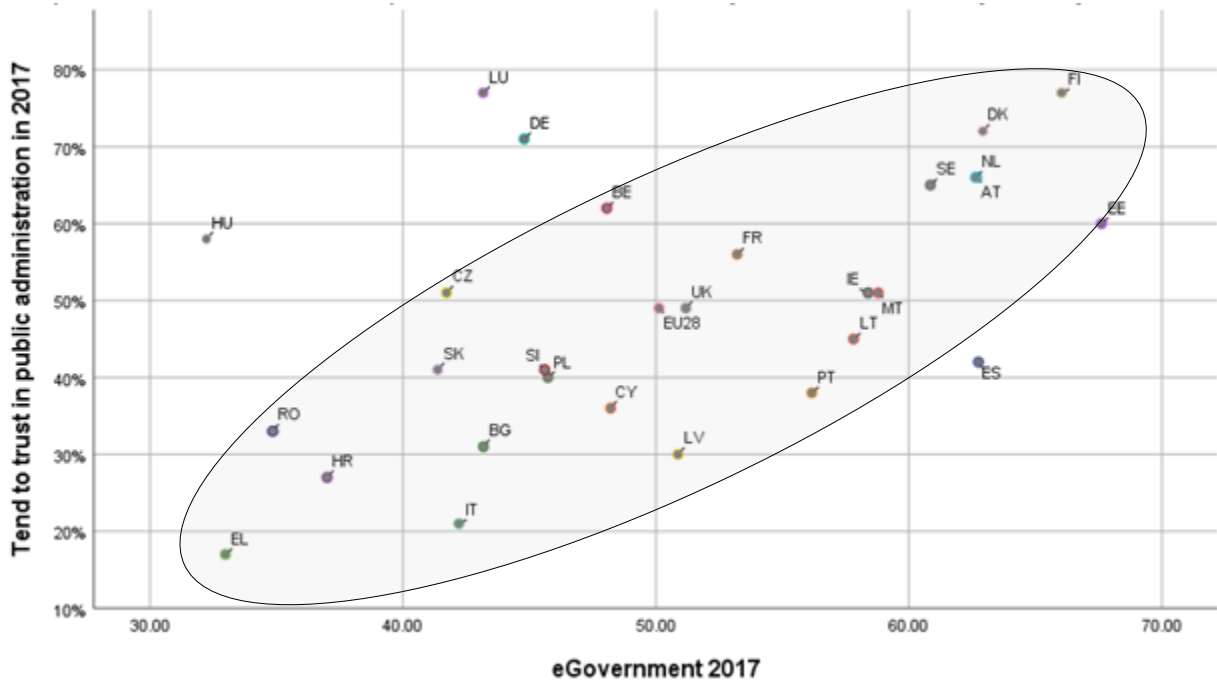


Figure 2 Scatter plot of relationship between adoption of eGovernment actions and citizens' trust in public administration

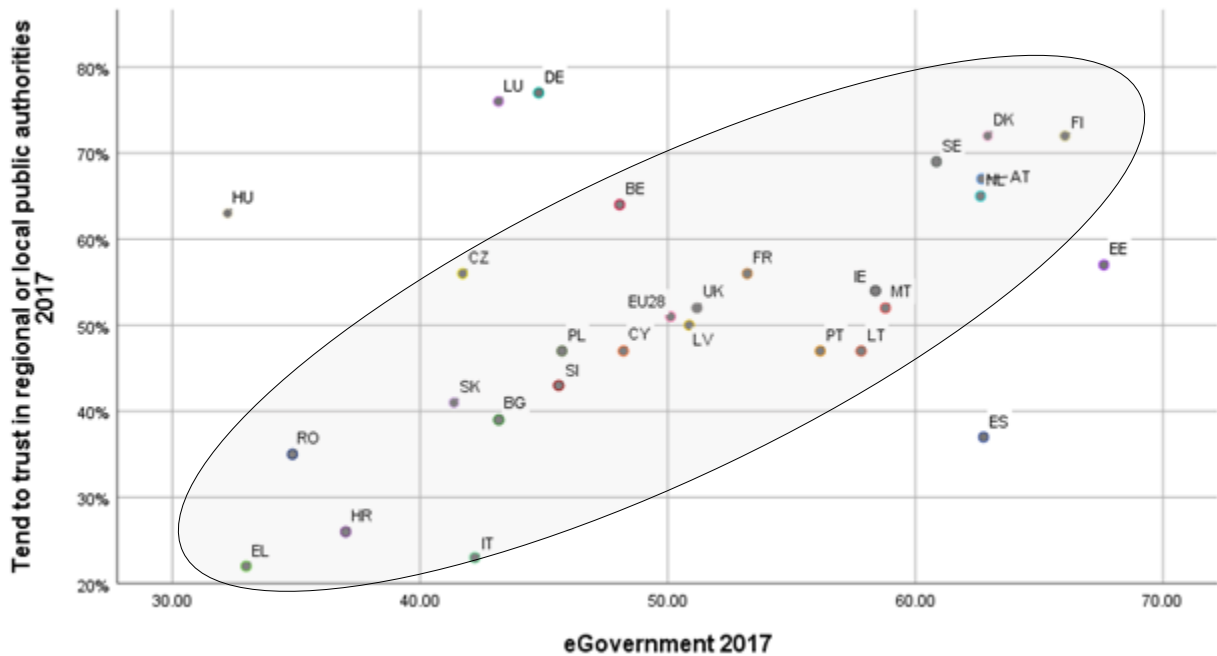


Figure 3 Scatter plot of relationship between adoption of eGovernment actions and citizens' trust in regional or public authorities

The other correlation tested in Table 2 measures the strength of relationship between countries' level of adoption of eGovernment actions and countries' level of citizens' trust in Regional or local public authorities. Also in this case, relative high value of correlation coefficients tend to advocate claim supporting existence of strong relationship between adoption of eGovernment and level of trust in

regional or public authorities. The nature of the relationship is presented in Figure 3. The distribution of points in Figure 3 illustrates linear form of relationship between variables.

The second part of research on the other hand analyses relationship between changes in countries' adoption of eGovernment action and changes in trust of citizens. Motivation for this research is to determine whether improvements in adoption of eGovernment correlates with improvements in citizens' trust in public administration. The comparisons are realised through parametric Pearson's R coefficient and non-parametric Spearman Correlation coefficient. The values of these coefficients are presented in Table 3.

Table 3 Analysis of relationship between countries' improvement in eGovernment adoption and countries' improvement in trust of citizens

Variables		Pearson's R		Spearman Correlation	
		Value	Approx. Sig.	Value	Approx. Sig.
eGovernment Difference	Change of trust in public administration	-0.234	0.221	-0.122	0.528
	Change of trust in regional or local public authorities	0.072	0.709	0.157	0.415

As can be seen from Table 3, approximate significances for all used coefficients are higher than $\alpha=5\%$. It means, that none of correlation coefficients presented in Table 3 are statistically significant at $\alpha=5\%$. It also means that values of these coefficients have no explanation value and therefore cannot be used to measure the strength of the relationship between tested variables. On the other hand, to grasp the nature of relations tested in table 3, we create scatter plots, that are presented in Figure 4 and Figure 5.

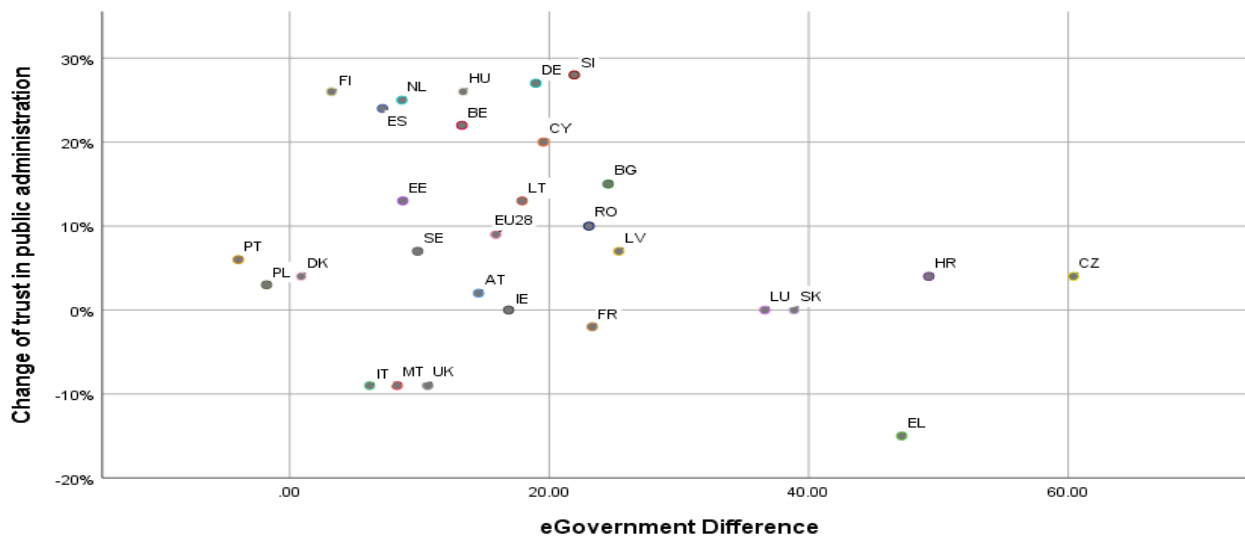


Figure 4 Scatter plot of relationship between countries' improvement in eGovernment adoption and countries' improvement in trust of citizens in public administration

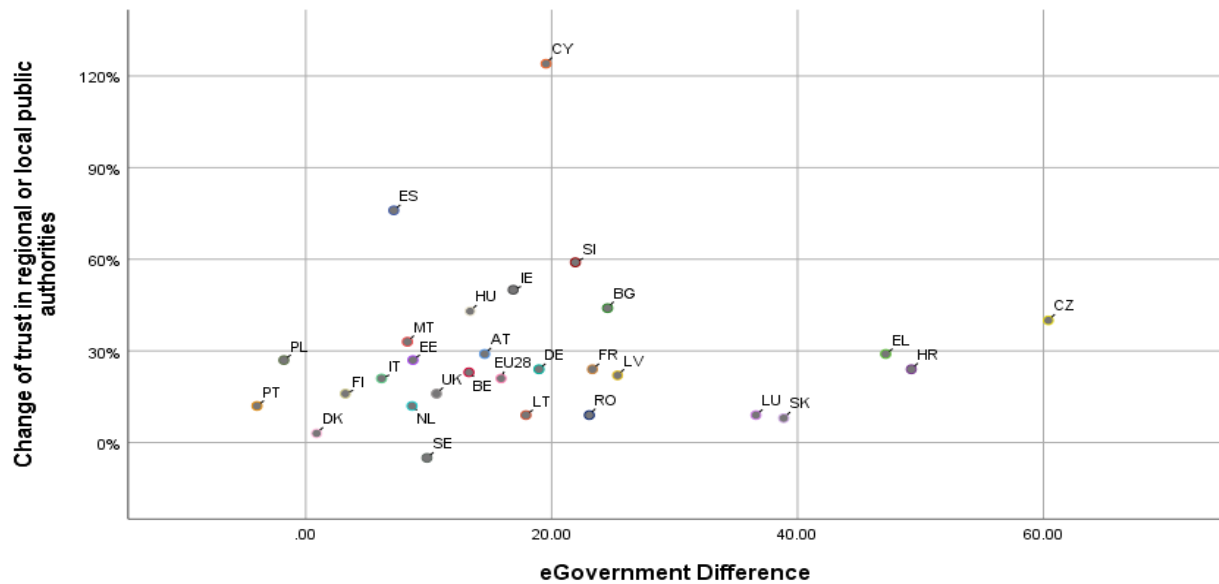


Figure 4 Scatter plot of relationship between countries’ improvement in eGovernment adoption and countries’ improvement in trust of citizens in regional or local public authorities

As can be seen from Figure 4 and Figure 5, presented Scatter plots doesn’t provide any sign of presence of relationship between tested variables. Based on relatively asymmetrical spread of points presented in Figure 4, we cannot support the claim that improvement in implementation of eGovernment actions is in relationship with improvement in citizens’ trust in public administration. The similar situation is presented in Figure 4, where clustered distribution of the points, does not also seem to support claim that improvement in implementation of eGovernment action is in relationship with improvement in citizens’ trust in regional or local public authorities.

4. Conclusion

The presented paper discusses the impact of adoption of eGovernment actions on trust of citizens in public administration. To evaluate strength of this relationship, we used two different databases implemented by European Union to monitor its progress. First of them is DESI database. It quantifies the level of adoption of digital agenda and Digital Single market strategy by EU member states. Because our study is oriented on public administration sector, we analysed only indicator which measure adoption of eGovernment. Second database used in this research was Eurobarometer study, which we used to acquire citizens’ level of trust in public administration and also level of citizens’ trust in local, regional authorities. The results of correlation analyses showed relatively strong relationship between the level of adoption of eGovernment and level trust of citizens in public administration. This mean that countries which have adopted eGovernment initiatives described in DSM strategy seems to have higher percentage of citizens which tend to have trust in public administration and in local and regional authorities. Moreover, based on the scatter plots presented in the paper, it can be assumed that relationship between adoption of eGovernment and citizens’ trust in public administration as well as relationship between adoption of eGovernment and citizens’ trust in regional and local authorities resemble linear character. Based on these findings we conduct second part of research, where we tried to measure strength of relationship between changes in adoption of eGovernment and changes in trust of citizens. The motivation for such research was to determine whether countries, which made the biggest progress in adoption of eGovernment since DSM strategy was implemented are also the countries which recorded biggest improvement in trust of citizens. Unfortunately, calculated correlation coefficients were not statistically significant, and therefore they

have no explanation value. Also scatter plots presented in this paper, do not showed sign of relationship between mentioned variables. These inconclusive results can be explained by short length of time since the DSM strategy was launched. The DSM strategy starts in 2015 and the progress was measured till 2017. It can be argued that citizens maybe need more time to recognise benefits of adopted eGovernment action which will eventually manifest itself as improvement in citizens' trust. That is the reason why mentioned relations should be monitored and subject of further research.

5. Acknowledgment

This work was supported by Scientific Grant Agency VEGA of Slovak Republic within the grant No. 1/0839/17 "Trust building electronic services in public administration."

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THE IMPACT OF ONLINE REPUTATION ON PROCUREMENT DECISION MAKING

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Keywords

e-Procurement, preferences, rating, experiment

Abstract

E-procurement is getting attention of increasing number of companies that are active in trading of both public and private organizations. The effect of reputation in the process of procurement is still not sufficiently researched. In our paper, we focus our attention especially on the non-price parameter – reputation and analyze which attribute influences procurement managers the most to cooperate with the supplier without internal rating. We worked with the experimentally collected data of 21 871 analyzed cases fulfilled by procurement managers of various Slovak companies. The results show that in case of missing experience with the current supplier the procurer's decision is the most influenced by the price level of the supplier.

1. Introduction

Nowadays, procurement is becoming an increasingly important process of trading, both in private organizations and in the public sector, as well. In the business sector, the importance of supply chain management intensifies and creates competitive advantages. This also applies to internal procurement processes, which are one of the key tasks in achieving such a competitive advantage that could lead to higher organizational performance.

The essence of the procurement process is to choose the most advantageous and/or the most efficient contract that fulfills specified criteria the best. At present, electronic procurement is clearly a priority, although the problems raised by offline procurement are transferred to electronic procurement, as well. This primarily includes transparency and non-compliance.

Even though, Europe faces serious environmental, social and economic challenges, business subjects and organizations along with European citizens are increasingly expecting the government to have more flexible cooperation across the European Commission (EC), their greater engagement and interest in providing public services (EC, 2010a). The effort of national governments and businesses in the EU is the optimization of resources, as well as, the development and support of innovative tools with the aim to increase productivity and make more appropriate decisions. In this sense, electronic procurement leads to an increase in process transparency (Costa et al., 2013).

A crucial issue in many countries represents public procurement, the value of which exceeded 17% GDP already in year 2008 (EC, 2010b). Public procurement is characterized by considerable bureaucracy, which in turn requires frequent re-negotiation and proactive conflict management. Relating to this unfavorable and demanding issue in public sector, the aim of electronic procurement is to improve competitiveness and transparency and to reduce complexity (Costa et al., 2013, Croom

& Brandon-Jones, 2007, Johnson, 2011). Electronic procurement can thus support the basic principles not only of public but rather procurement management practices in general in terms of transparency, accountability and integrity (Costa et al., 2013). For these reasons, electronic auctions have become a popular approach to making ecommerce transactions via online platforms (Dráb, 2011).

The understanding of procurement behavior is important also according to the specific characteristics of B2B relationship building that is highly connected to gaining customer loyalty and satisfaction and to building of quality ratings and credibility (Miremadi A et al, 2011). The reputation of the supplier is in our case represented by the internal rating (IR) of the supplier. The internal rating represents the experienced rating of the procuring entity.

The aim of this study is to analyze the impact of reputation represented in our data by internal rating attribute. In our study, we focus on cases, where the internal rating is not given and still the company was able to win the auction. The aim of this study is therefore to find the answer to the following question: “Which attribute had statistically the highest impact on the winning of auction in cases, where the internal rating attribute of the supplier was missing?”.

The paper is further divided into few sections starting with the brief state of the art regarding studied problematics followed by methodology, research results and conclusion.

2. E-procurement

Electronic procurement is often confused/replaced with electronic auctions. Auctions are one of the possible solutions, but overall, e-procurement represents lots of more. Electronic auctions are usually just the last step of the procurement process itself. Electronic procurement is the process of digitalization of the entire procurement process. The auction can be an effective tool for reducing the price of the procurement process, finding the most optimal price and can be an appropriate tool for the procurement of easily substitutable goods and services that are in the required and comparable quality. This reduces costs and simplifies time and administrative demands of the procurement.

Thus, procurement is a complex process of contracts and service trades where, considering the trend of rapid development of e-commerce, the price as the sole/only procurement criterion is not considered sufficient to satisfy the need for real procurement decision making. Competition and negotiation in procurement process include other criteria and dimensions apart from price attribute. In the area of supply chain management, contracts typically consist of a number of tradable attributes, which may include delivery time, product warranty period or quantity of delivered items, as well as experience with the company (Rao et al., 2012). Other significant attributes in the procurement decision process involve ratings, customer forums, and historical transaction evidence, which are mainly used on home electronic platforms (Chen, 2007). The rating can ensure that undertaken actions are taken without the expense of external law enforcement or the third party mechanisms, thereby directly reducing transaction costs while increasing transparency. The higher the transparency, the lower the transaction costs, and therefore the market prices reflect real prices (Dráb & Mihóková, 2014). With consequent higher transparency of the market, competition and the decision-making process itself is influenced by non-price attributes such as company reputation or loyalty and customer satisfaction (Miremadi A. et al. 2011).

It is important to maintain a complete free competitive environment for trading in the procurement process (Rao et al., 2012). Supplier selection in many industries is one of the most important strategic decisions and can be explained as a multi-criterion decision-making problem that takes into account qualitative and quantitative factors. Therefore, also a choice of suppliers must be accompanied with modern and more complex procurement procedures in a systematic and transparent manner/way

(Chuan et al., 2016). As the process of selecting suppliers can be repeated and controlled, it is possible to minimize complications and the importance of the decision-making hierarchy in procurement process can be improved, which can adjust and develop the policies and procedures set out in the choice of suppliers. The importance of metrics and the weighting of suppliers' choice is highlighted by study of Chuan et al. (2016), who also analyzed the relationship between decision-makers, initiators, buyers and, finally, their quantification. At the same time, the definition of new rules and procedures that will lead to higher efficiency in the organization of procurement is inevitable.

Authors Croom and Brandon-Jones (2007) identified five main groups for the implementation and operation of electronic procurement in their study (Fig. 1) and found out that significant incentive for the admission of e-procurement were economic benefits while stressing the importance of organizational commitment.

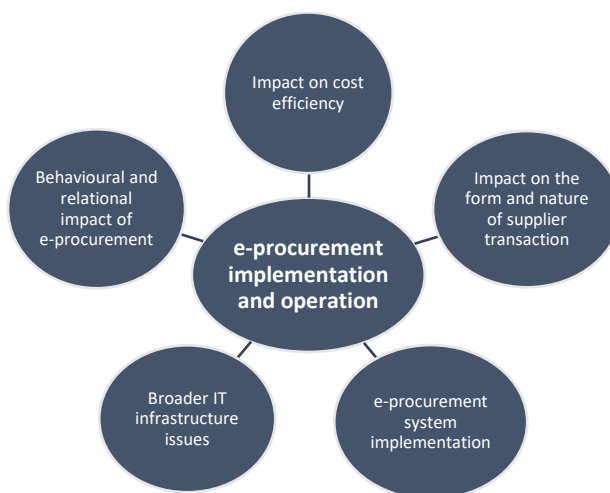


Figure 1. Five key topics of e-procurement implementation and operation, Source: Own processing according to Croom a Brandon-Jones (2007).

Furthermore, Vaidya et al. (2006) focused on examining the benefits and impacts of e-procurement and created a model of the Critical Success Factors (CSFs) that could influence the success of e-procurement in the public sector and consists of 11 factors presented in the Table 1.

Table 1. Critical Success Factors of e-procurement, Source: Own processing according to Vaidya et al. (2006).

Model of the Critical Success Factors (CSFs) of e-procurement in the public sector	
1	Security and authentication
2	Technological standards
3	System integration
4	Top management support
5	User uptake and training
6	Business case and project management
7	Supplier adoption
8	Change management
9	Re-engineering the process
10	Performance measurement
11	e-procurement implementation strategy

3. Methodology

The study is performed at the research data obtained from survey between procurement managers of various Slovak companies. All respondents were asked to choose one option from the three offered suppliers defined by various randomly generated parameters. These options included various combination of given features (price, internal rating, external rating, internal loyalty, external loyalty, financial health) of three given companies from which in each round was selected the winner, the second and the third place by a procurement manager that should be experienced in the e-procurement process. Cases were randomly generated. Each supplier was determined by following parameters:

- Price – from 1 to 5, where 5 was the lowest price
- Internal rating (IR) from 1 – 5, where 5 was the best rating experienced by procuring entity based on historical transaction
- External rating (ER) from 1 – 5, where 5 was the best rating experienced on the global environment not by the procuring entity
- Internal loyalty (IL) from 2 – 4, where 4 is the longest history of business transactions within procuring entity
- External loyalty (EL) from 2 – 4, where 4 is the longest history of business transactions on the global market
- Financial health (FH) from 2 – 4, where 4 is the highest financial credibility.

Altogether the sample consists of 27 871 cases including rating of three places of suppliers chosen by procurement managers of various Slovak companies. The experiment is still running and includes also other parameters not considered in the current study such as experience of the procurer, size of the company, and others.

The given data were further analyzed using SPSS software. Our goal was to give an answer to the following question: “Which attribute had statistically the highest impact on the winning of auction in cases, where the internal rating attribute of the supplier was missing?”. By the analysis of the studied problem were used various approaches including regression models, correlation matrix and descriptive statistics overview. The results of the research are summarized in the following chapter.

4. Research results

To reach the objective of this paper we began with the analysis of descriptive statistics of the given data. It is important to mention that the number “0” in the minimum column is not the worst value, but expresses the missing values in the data sample. The descriptive statistics overview is summarized in the Table 2 and shows that we have worked with the 65 613 individual cases of possible suppliers defined by seven parameters.

Table 2. Descriptive statistics for the dataset Source: Own processing

	N	Minimum	Maximum	Mean	Std. Deviation
Rank	65613	1,0	3,0	2,000	,8165
P	65613	1	5	3,00	1,412
IR	65613	0	5	2,00	1,826
ER	65613	0	5	2,00	1,826
IL	65613	2	4	3,00	,817
EL	65613	2	4	3,00	,817
FH	65613	2	4	3,00	,817
Valid N (listwise)	65613				

In the Table 3, there is showed correlation matrix of the used dataset containing 43 742 options from the first and the second place. There was identified statistically significant negative correlation between ranking and price in the whole data sample. It is, therefore, expected that the lower price (the higher number, because the lowest price is marked by number “5”) the lower rank. There is also positive correlation that is statistically significant between internal rating and internal loyalty and external rating and external loyalty that is more or less obvious situation.

Table 3. Correlations matrix at dataset, Source: Own processing

		Rank	P	IR	ER	IL	EL	FH
Kendall's tau_b	Rank	1,000	-,301**	-,127**	-,084**	-,103**	-,070**	-,061**
	Correlation Coefficient							
	Sig. (2-tailed)		,000	,000	,000	,000	,000	,000
P	Correlation Coefficient		1,000	-,063**	-,031**	-,059**	-,034**	-,024**
	Sig. (2-tailed)			,000	,000	,000	,000	,000
IR	Correlation Coefficient			1,000	-,037**	,507**	-,033**	-,023**
	Sig. (2-tailed)				,000	,000	,000	,000
ER	Correlation Coefficient				1,000	-,031**	,565**	-,008*
	Sig. (2-tailed)					,000	,000	,035
IL	Correlation Coefficient					1,000	-,025**	-,022**
	Sig. (2-tailed)						,000	,000
EL	Correlation Coefficient						1,000	-,007
	Sig. (2-tailed)							,103
FH	Correlation Coefficient							1,000
	Sig. (2-tailed)							

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

We continued to perform econometric models with the aim to show the impact of the internal rating on our given data. We performed three regression models to control different cases. We focused our analyses on the impact of internal rating or rather what influences procurers to choose the winner without internal rating given. We chose to analyze the cases that won, although the internal rating

was by them not given. Only the first and the second place is analyzed. The three models were defined as followed:

- The “*Model 1*” is executed at the data from the first and the second place, where at the first place were data without the internal rating given.
- The “*Model 2*” is executed at the data from the first and the second place, where at the first place were data without the internal rating and at the second place were data with the low internal rating.
- The “*Model 3*” is executed at the data from the first and the second place, where at the first place were data without the internal rating and at the second place were data with the high internal rating.

Table 3. Estimates for the ranking variable in various cases, Source: Own processing

Model	Model 1 – N/A		Model 2 – IR2_low		Model 3 - IR2_high	
	B	Sig.	B	Sig.	B	Sig.
(Constant)	2,397	,000	2,355	,000	2,451	,000
P	-,165	,000	-,155	,000	-,179	,000
ER	-,030	,000	-,023	,000	-,037	,000
EL	-,025	,002	-,035	,055	-,017	,149
FH	-,064	,000	-,055	,000	-,073	,000

In general, all three models generated similar results. We were concentrated on the cases where the winning option was without internal rating and we chose to exclude internal loyalty, because it was expected that there is no previous experience with the supplier.

All the models show that the impact of price level on the probability of winning is statistically significant in all three cases. The models show that the decrease of price level (the higher number the lower is the price) encloses a supplier to the first place. In the first model, we see the results of the case, where is the supplier without internal rating at the first place. All the coefficients were statistically significant. The second model without the rating data of the winning supplier and with the supplier poorly ranked at the second place showed the same effect.

From all three econometric models we can state that in case that there is no internal rating and the procurer does not have previous trading experience the chance of winning is increasing with the lower price.

5. Conclusion

Internal procurement processes present a key role in achieving a competitive advantage in business sector and may lead to higher organizational performance. Hence, procurement is becoming more and more important not only in private institutions but in public sector organizations as well. This paper is focused on the studying procurement decision making and especially on the impact of non-price parameter – reputation, in our case represented by the internal rating and internal loyalty. The internal rating represents the rating of experience of the procurement organization with the given supplier while the internal loyalty represents the number of transaction of the procurement organization with the given supplier. The aim of this study was to analyze the cases where the winning supplier was the one without rating. The results showed that in such cases the price level is still the most influencing factor that is statistically significant. The results are the same also for the cases,

when at the second place is the company with low or high rating. One can conclude, if there is no internal rating and the procurer has no previous experience the chance of winning increases with the diminishing price. The results of presented research should provide important information for traders and help to develop a platform for more efficient concepts of ranking decision making and processes of subsequent e-procurement.

6. Acknowledgements

This work was supported by the Slovak Research and Development Agency under the contract No. APVV-15-0511.

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COMPREHENSIVE ANALYSIS OF ONLINE REPUTATION OF LEASING COMPANIES OPERATING ON THE SLOVAK MARKET

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Keywords

Reputation, On-line reputation, Reputation determinant, Reputator, Internet, TOR, Automotive, Leasing

Abstract

This paper deals with the online reputation of leasing companies operating in the territory of the Slovak Republic. In particular, authors compare the reputation of individual subjects in terms of two available methodologies. The first of the methodologies, called Enhanced Sentiment Analysis, is an accessible and simple reputation measurement tool used in common practice. The second method, called total online reputation, is a standardized form for the measurement of reputation used for academic research. Both of these methodologies are used for the analysis of the reputation of the selected subjects themselves, then the differences in the measurement results and the conclusions drawn for further investigation are compared. The contribution compares two approaches, a scientific approach and practitioners' approach. Identifies important factors within both approaches,

describes critical points, and postulates recommendations for more effective measurements. Last but not least, the paper presents the findings on the market situation of the leasing service providers in the selected market. Identified contexts can be used to effectively manage reputation by various entities in order to increase their competitiveness in a turbulently changing market.

1. Introduction

The issue of the use of internet tools in marketing is in itself still very young. However, we may definitely conclude that any new techniques and media used within the portfolio of marketing tools can help distinguish an entity from the competition (Delina 2014, Delina, Dráb, 2009). The competition is huge for both commercial and non-commercial entities. Times when the "only" thing necessary for market prosperity was a quality product are long gone (Fertik, Thomson, 2010). It is becoming increasingly difficult to reach the target audience. Overcapacity of advertising messages on the market, especially on the digital market is a problem the marketing managers worldwide must deal with on a daily basis (Pollák, 2015). Regardless of the resources and the effort is often the case that the advertising message disappears, or simply ceases to exist in the context of other more or less important information of various kinds. An appropriate solution in marketing practice is especially reduction of communication paths through the use of the internet and its tools. Digital market offers us the possibility of a clear and precise message targeting of selected market, often to the individuals themselves. It also significantly reduces the communication path when the entities are allowed to communicate directly with their customers. Customers, in this case internet users, demand themselves the information, thereby significantly increasing the rate of adoption of communicated message. Thanks to its nature the internet allows for easy sharing and transfer of information and creates space for entities whose motives may not always be ethical (Fill, 2009, Dorčák, Štrach, Pollák, 2015). The issue of reputation is therefore highly relevant issue in the context of virtual identity of entities using the digital market to communicate. Undoubtedly, companies with high reputation have at present a competitive advantage in terms of customer acquisition (Kanika, 2016, Marsden 2013). It has been shown that 80 % of customers prefer the company with high reputation rather than an average company or a company with a dubious reputation. In Slovakia, this area has been examined to some extent in relation to banking entities (Delina, Tkáč, 2010). Such factors have been analyzed as value, quality of products or social activities of companies. Subsequently, it has been examined how these factors are perceived and evaluated by the consumers, customers, business partners, public and so on.

1.1. The issue of reputation in the times of digital markets

New technologies, forms of communication, as well as the internet itself, are on one hand positive aspects of this age but on the other, they entail a risk. Dissemination of negative information, rumors or false information through these media is very quick and uncontrollable. Based on the above arguments a study has been carried out in Washington (Madden, Smith, 2010), which has examined the relationship of reputation management and current social media. A similar survey regarding online communication has been conducted at the University of Singapore (Zhigi, 2010) and it has provided a clear view of the relationship between these poles. In the context of scientific literature focusing on e-marketing, specifically on the field of online reputation, conceptual or rather empirical studies are available in limited quantities. The claim in question is referred to by the author (Argryiou et al, In: Pollák, et al. 2016, Pollák, Belovodská, 2016) who states that despite the lack of analyses many authors believe that reputation is much more important in online than in offline context because factors determining trust in offline context are absent and are not yet known (Maryška, Doucek, Kunstova, 2012). Soviar and Vodak (2012) defines online social media as open interactive online applications which support the development of informal user networks. Users create and share

various content in these networks, such as personal experience, opinions, videos, music and photos. The most important online social media include online social networks, blogs, forums and other online communities. However, this division is somehow problematic because the media overlap in practice.

In our territory, we can currently see an enormous increase in the use of social media services. A good example is the largest social network in the world, Facebook, which is with more than billion registered and more than 50 % of daily active users also successful in Slovakia. Approximately 2 million registered people in Slovakia prove it. The age group which is most represented are the users aged between 18 and 24 years (32 %), followed by a group aged between 25 and 34 years (29 %) (Pollak, 2015). The importance of social media has been indicated in the works of foreign scientists and scientific teams published in the Journal of Marketing Research, under the auspices of the American Marketing Association - AMA. Their research has been in particular focused on the perception of the value of social networks by consumers (Stephen, Toubia, 2010), the analysis of marketing strategies and social media (Wehr, 2009), the potential of social networks for the development of e-business (Helm, 2011), the impact of social networks on consumer decisions (Fill, 2009). Virtual social networks are currently the focus of several authors. From all of these authors we may mention Robert Cross and Robert Thomas (2009) who in their writings explore the perception of the value of social networks by consumers. American professor Wehr (2009), for example, has been working on the analysis of marketing strategies of social media for three years.

1.2. Reputation and the possibility of its measurement, various methodologies used in determining reputation

Worldwide research in the area of reputation which has been conducted at the University of Oxford (Schulz, Werner, 2013) shows that reputation is made up of two elements: customer opinion of the respective company and the real truth about the company and its commercial policy, procedures, management system and financial performance. Other research shows that reputation may be responsible for 8 to 15 % of the value of company shares in business sector. Gottschalk (2011) have concluded that a company has a good reputation if it always meets or exceeds the expectations of its customers and vice versa, a company has a bad reputation if it does not meet these expectations. Consequently, they proposed the following formula for reputation: Reputation = experience - expectations. At any moment, customers measure reputation by comparing current experience in contrast to their expectations (Fertik, Thomson, 2010). This formula for the evaluation of reputation can be complemented by the trust evaluation model presented by Lavarc et al., in 2005. They claim that $Trust = 0.5 * Reputation + 0.5 * Cooperation$.

Particularly important is the process of identification of the most important factors that determine the reputation of a company. Fombrun and Veil (2003) prepared a methodology to measure the perception of the company through the prism of its major shareholders. He introduced 20 factors that affect reputation based on 6 criteria. These factors include for example emotional factors, products and services, vision and leadership or social responsibility of the company. One of the most complex structures of reputation factors are specified by Turner. Not only he defines eight main reputation factors, but for each of them he also provides sources of information that affect them. In addition, these factors may be divided into rational and emotional (Turner, 2004). It should be noted that the above factors may help to improve the company's reputation but, at the same time, they may also severely worsen it. Their initial identification is a very important point in building reputation management in the company. It's a long process, very time consuming and actual results are only achieved from a long-term perspective. That is why it is appropriate to use the research and experience of the company which analyze the impact of individual factors on the level of reputation. As we presented on the previous pages, there is wide spectrum of approaches to measure reputation in digital environment. Even domestic author like Sasko (2014) and Dorčák, Markovič and Pollák

(2017) presenting their own approaches, those are even more useful, based on their strong connection to practice and business. In the article we focus on comparing those two approaches.

2. Aims and methods

The main objective of the paper is to compare results from chosen options for measuring online reputation (Enhanced sentiment analysis and Total Online Reputation analysis) of selected entities operating in the automotive sector with an aim to identify important factors within both approaches, describe critical points, and postulate recommendations for more effective measurements. 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 analysis of reputation in the digital market of the internet was conducted on a specific sample of entities 19 leasing companies operating on the Slovak market (Visibility, 2015).

For the purpose of this research we used methodology introduced by Sasko (Visibility 2015) called Enhanced sentiment analysis, and retest original research sample, than we did measurement based on our own methodology called TOR (Pollák, 2015, Pollák et al., 2016, Dorčák, Markovič, Pollák, 2017), Tor is based on modified multi-factor sentiment analysis methodology, which 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.

3. Results and discussion

Each of the set of selected entities, in this case top 19 Leasing companies operating on Slovak market, try to shape their reputation both within real and virtual world through their management. For the purposes of our research, we focused on the digital market of the internet.

3.1. Overview Table of Partial Score

Using the mentioned methodologies of sentiment analysis, we calculated partial score presenting the power of online reputation of entities based on the nature of their appetite on the digital market of internet.

The Figure 1 presents results of measurements in the form of scores – considering limitations of the extend of presenting paper, We does not provide an partial values of individual determinants/ score of partial reputators of online reputation /only the score of total (overall) online reputation for both presenting approaches.

Ranking by Visibility	Leasing company	Visibility Score (points)	TOR Score (%)
1.	Home Credit Slovakia	6 351 752	43.5178
2.	S Slovensko	5 840 081	3.4830
3.	Consumer Finance Holding	1 450 138	3.2625
4.	Mercedes-Benz Financial Services Slovakia	1 320 176	7.5680
5.	Tatra-Leasing	426 097	6.1159
6.	ČSOB Leasing	207 483	27.8547
7.	Toyota Financial Services Slovakia	196 118	5.0740
8.	VOLKSWAGEN Finančné služby Slovensko	149 100	20.2286
9.	VFS Financial Services Slovakia	143 101	4.3430
10.	UniCredit Leasing Slovakia	55 944	6.1920
11.	VB Leasing SK	40 121	5.6101
12.	LeasePlan Slovakia	39 685	7.7451
13.	PSA Finance Slovakia	37 365	3.8977
14.	VÚB Leasing	32 846	3.5449
15.	Oberbank Slovakia	24 660	6.8800
16.	Deutsche Leasing Slovakia	23 959	2.1505
17.	Scania Finance Slovak Republic	9 890	3.8700
18.	IMPULS Leasing Slovakia	8 370	8.4462
19.	IKB Leasing SR	3 180	4.3000

Figure 1: results of measurements

Given the different nature of the results (the Vysibility methodology introduced by Sasko shows the results in absolute terms, the TOR methodology shows the results in the form of a percentage) it was not possible to compare the results directly. Therefore, it was the comparison of the overall orders of the entities of the basic set.

Since both methodologies are based on the same basis, we assumed that the measured data will show the same or similar values in terms of the resulting order. This assumption we are subjected to rigorous statistical testing.

Variables	KENDALL TAU coefficient, $p < 0.05$			
	No.	Kendall Tau	z-score	p-value
ranking Visibility vs. TOR	19	0.13450292	0.769683	0.4415

Figure 2: Dependence between variables

Based on the measured values, we can say that there is only a small dependence between the variables. Therefore, we cannot confirm the existence of a statistically significant relationship between variables.

At first sight it may be a surprising finding, however by a detailed review of partial results we find a significant limitation of the methodology introduced by Visibility in the form of quantification partial data, whereas TOR methodology applies the principles of scientific research and is optimized for academic research. This shows the importance of linking scientific approaches to corporate practice. In order to support this argument, we tested the essential parameter for both approaches, the sentiment analysis result. This is a staged parameter for quantification of the first ten keyword search results in the form of a subject name, where backroad is based on dozens of academic studies.

Variables	KENDALL TAU coefficient, $p < 0.05$			
	No.	Kendall Tau	z-score	p-value
sentiment analysis result vs. TOR score	19	0.70760234	4.19827	0.0000

Figure 3: Dependence between variables

4. Conclusions

Testing revealed a very strong dependence between tested variables, the difference in the results of both methodologies (Visibility and TOR) based on the standardized methodology of measuring first ten results in search engine Google reveals the shady pages of common practice of practitioners where the data or results calculated with lack of methodological and scientific approaches are then presented (or worse, commercialized) as professional analyzes. Here it should be remembered the old wisdom about the impossibility of mixing apples and pears. The interconnection of science and practice is the one and only responsible approach.

5. Acknowledgement

This work was supported by the Slovak Research and Development Agency under the contract No. APVV-15-0511.

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NEW INITIATIVES AND APPROACHES IN THE LAW OF COOKIES IN THE EU

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Keywords

Cookies, Privacy, Data Protection, Personal Data, Website, Browser

Abstract

This paper focuses on issues related to the protection of privacy and personal data in connection with the use of cookies that collect and further transfer information regarding the end-user's activities on the internet, specifically through its visits of different websites. The aim of this paper is to closely look at the changes in the law of cookies proposed by the Commission aiming to repeal the Directive 2002/58/EC of the European Parliament and of the Council concerning the processing of personal data and the protection of privacy in the electronic communications sector currently in force. The new proposal contains several changes to the regulation, specifically concerning the issue of obtaining consent, due to the need to adopt more user-friendly regulation and provide an easy way to accept or refuse third-party cookies. Whether the proposed regulation will result in the simplification of the existing rules is one of the questions this paper will try to answer.

1. Introduction

A definition of the term *cookies* is not contained in any legal acts, whether on a national or European level. In technical terminology this term refers to the state of information that passes between an origin server and user agent and is stored by the user agent (Barth, 2011). In other words, cookies are small text files placed in the end user's terminal equipment by a website's server to store and transmit desired information back to this server.

Various different types of cookies can be distinguished. From the legal perspective, the most important classification recognizes the first-party and third-party cookies. This classification is based on the cookies' domain to which they 'belong', and which is one of their main characteristics. Through this distinction we can describe *first-party cookies* as cookies placed on the end-user's terminal equipment by a website it has actually visited. These cookies are essential for the website's use, as their main function is to recognize a visitor as an individual. In practice, they are usually not blocked by the end-user or targeted by antispyware software or privacy settings for two main reasons: firstly, without them in effect, the content of many websites is not accessible, and secondly, they are beneficial to the end-user, e. g. they allow automatic login or customization of the website's content.

On the contrary, *third-party cookies* are „set by websites that belong to a domain that is distinct from the domain of the website visited by the user as displayed in the browser address bar, regardless of any consideration whether that entity is a distinct data controller or not“ (Opinion 04/2012, 2012).

The use of third-party cookies results from the fact that websites contain not only their own content, but also content from other websites using their own cookies. Due to this, many end-users choose to reject these cookies, despite of the fact that information collected and stored about them is anonymous. This rejection usually does not prevent the end-user from browsing on a website. To illustrate, the use of various cookies is connected to the Facebook 'Like Button' present on many websites other than the Facebook website itself.

Another relevant legal aspect of cookies is the fact that they may be *used as online identifiers*. In accordance with the new legislation regarding the personal data protection contained in GDPR (European Union, 2016), the term 'personal data' is defined as any information relating to an identified or identifiable natural person (data subject). Different factors to identify a natural person are distinguished, one of which are different types of online identifiers. GDPR specifies that "*natural persons may be associated with online identifiers provided by their devices, applications, tools and protocols*" (European Union, 2016, Preamble 30), and recognizes cookies as one example of such identifiers. It further brings light to the relationship that exists between cookies and personal data stating that devices, applications, tools and protocols *„may leave traces which, in particular when combined with unique identifiers and other information received by the servers, may be used to create profiles of the natural persons and identify them"* (European Union, 2016, Preamble 30). In the view of the foregoing and because cookies alone or in combination with other data can be used to uniquely identify a device, data regarding individuals assigned to or using a device could be considered as personal data. This applies despite of the fact that cookies use pseudonymous identifiers that provide them with uniqueness. It is our view that as a result, any cookie file or other online identifier (e.g. internet protocol address) uniquely assigned to a device that can identify a person as an individual will be subject to the relevant personal data protection regulation.

This view is supported by the recent decision of the CJEU in the case C-210/16 *Wirtschaftsakademie Schleswig-Holstein*, regarding the question of the fan page administrator's liability for the processing of personal data of the page's visitors carried out by Facebook, where the Court examined the personal data collection and its further processing through the use of cookies placed on the visitors' device. Cookies used in the case in question were the so-called 'persistent cookies' that are stored on the visitor's device and are active for a specific period of time (two years in this case), unless deleted. The personal data collection started when a visitor opened the fan page and personal data were later processed and provided as anonymous statistical information to the fan page's administrator (without any notification to the visitor in question). This illustrates how cookies can be used to collect personal data and be later processed for different purposes.

The relevant legislation regarding the protection of privacy in electronic communications (including cookies) is currently contained in the Directive 2002/58/EC. However, proposal for a new legislation (European Union, 2017) in the form of a regulation was recently presented and if adopted, it shall repeal the Directive 2002/58/EC.

The new legislation regarding cookies is necessary to further the initiatives proposed in the Digital Single Market Strategy (hereinafter only as "Strategy"). Its impact in this regard can be primarily seen through the end-user's point of view, as their position in relation to their privacy and personal data protection is strengthened. The Proposal complements the provisions of GDPR while also increasing legal certainty and transparency. Moreover, the business use of communications data is supported, within the limits of the consent provision (creating limits to the cookies' exploitation, e. g. for advertising purposes), as the creation of the functioning eCommerce is also one of the aims presented in the Strategy. Furthermore, the Proposal also participates on building an innovation friendly environment through effective enforcement of competition law regarding business practices used within the e-commerce area, as certain practices can be considered as unfair commercial practices, e. g. targeted advertising based on information collected and transmitted by cookies.

Another interesting trend that can be observed in relation to the application of the Strategy's initiatives is the shift from adopting necessary legislative acts in the form of a directive to a more preferable regulation with general application to ensure its correct and uniform implementation.

It must be noted that this paper only focuses on the provision of the legislation's overview (current and proposed) trying to formulate certain problematic issues in this matter.

2. Related works

This section provides overview of papers focusing on *legal aspects of cookies*. From the perspective of EU law, we can find the legal analysis of cookies in the paper (Koops, 2014), where its author investigates new personal data protection intentions in the EU law. On the other hand, Aladeokin et. al. (2017) examine cookies from the perspective of privacy protection laws of several Commonwealth countries. Authors' report contains a study of adherence to privacy protection laws by different categories of websites (e.g. e-commerce, news and media) when setting cookies on users' computer systems. Aladeokin et. al. (2011) focus on the legal aspects of cookies as one of the important aspects of website's advertising. Authors investigate how privacy regulation in the EU has influenced advertising effectiveness according to EU and US law.

Papers discussing *the privacy issues of cookies* are also relevant for our research. Cahn et. al. (2016) present results of a large-scale, empirical study of web cookies. The authors collected over 3.2 million cookies from the top 100.000 Alexa websites in the period of 18 months. Based on the results from their analysis, the authors discuss the privacy implications by examining specific cookie attributes and placement behavior of the third-party cookies. Another example of cookies' use for security purpose is digital forensics. Eggendorfer (2015) focuses on the combination of the IP address and cookies and considers that this combination offers better and clearer evidence pointing to a specific person.

A substantial part of this paper discusses *the phenomena of consent*. Related works can be found in Jackson (2018). Author focuses on consent and its obtaining from the perspective of business companies. Other authors discuss the issues regarding the regulation of the right to be forgotten and the right for revoking consent under the GDPR (Politou, 2018). To illustrate, authors focus on backup procedures. The authors of this paper propose technical solutions that fit the privacy requirements stipulated in GDPR. Some papers deal with the issue of consent in specific areas (IoT, Beig Data, etc.). An example may be the paper devoted to informed consent in the Internet of Things for Smart Health (O'Connor, 2017). Authors discuss the concepts of privacy by design, informed consent and universal usability have to be integrated to the universal design of Internet of Things smart health devices.

3. Consent and its Conditions

3.1. Criteria for Consent

The condition of consent was not stipulated in the first version of the Directive 2002/58/EC, where two conditions were placed on electronic communications networks regarding storage of or gaining access to information stored in a terminal equipment of a subscriber or a user. Firstly, they had to be provided with clear and comprehensive information in accordance with the Directive 95/46/EC (European Parliament, 1995) (e. g. about the purposes of processing), and secondly, they had to be offered the right to refuse such processing. The condition of consent was introduced later in 2009, when the abovementioned conditions were altered. The first condition remained unaltered, while the

second condition was replaced with the requirement to obtain the user's consent. Current legislation refers to GDPR as to the definition and conditions for consent. GDPR defines consent of the data subject as *“any freely given, specific, informed and unambiguous indication of the data subject's wishes by which he or she, by a statement or by a clear affirmative action, signifies agreement to the processing of personal data relating to him or her”* (European Parliament, 2016, Article 4). GDPR (and the Directive 2002/58/EC) defines following obligatory criteria for consent to be considered valid:

- a) *Freely given*. In the context of this paper we may interpret this requirement as the user's free choice to accept or refuse the use of cookies.
- b) *Specific*. In general, we can define specificity of consent as its internal consistency, when any issues that may arise can be resolved e. g. through interpretation. In relation to cookies it would mean that users would express their consent directly to the use of particular types of cookies. Use of different types of cookies with different processing purposes would require valid consent mechanisms for each purpose. The specific consent requires to set up HostOnly flag to prevent consenting to subdomain cookies.
- c) *Informed*. Informed consent requires prior clear and comprehensive notification of the user about the purposes of processing. The information *“should be provided in a way that enables an average user to understand the issue at stake, and then make a deliberate choice”* (Abbamonte, 2014). Currently, the user is linked to the terms of service in the cookie consent notice and a short explanation is given regarding why a website uses cookies, but no concrete information is usually provided. In our opinion it should provide a short explanation of cookies, specification of the types of cookies used by a website and an explanation of their purpose, provided in a way an average user would understand it (taking into account its limited knowledge and usual disinterest towards this matter).
- d) *Unambiguous*. Provision of unambiguous consent can be described as an undisputable and objective expression of the user's acceptance with the use of cookies, strengthening the opt-in principle introduced in the Directive 2002/58/EC. Currently most websites consider obtaining implicit consent as sufficient. In practice, on most websites a visible notice regarding cookies collection can be found together with a link to the cookies' policy document (e. g. *“Our website uses cookies. By continuing we assume your permission to deploy cookies, as detailed in our privacy and cookies policy”*). A significant change enacted by GDPR is that such practice is no longer respected. Websites are obligated to ensure that the user explicitly agrees with the use of cookies. An example that meets the requirements of a new legal arrangement is the darkening of a screen after entering a website, warning that cookies will be collected after obtaining consent. In addition, this alert will contain at least 3 buttons: Cookies Settings button, Accept Cookies button, and Reject Cookies button. The Accept Cookies button accepts settings that the user chooses. In the case of the Reject Cookies button, cookies will not be processed until they are not required.

3.2. Other requirements

GDPR specifies other requirements regarding consent. Firstly, if data processing is based on consent, *“the controller shall be able to demonstrate that the data subject has consented to processing of his or her personal data”* (European Parliament, 2016, Article 7(1)). To demonstrate that users have consented to the use of cookies, the controller will be required to show that they agreed with the use of specific cookies, either through their browser settings or by consent specifically given at the time they visited a website. Proof by the browser settings may not guarantee that the controller will be able to demonstrate the provision of consent. Problematic in this regard is that communication with the website's server is initiated by a browser. The server basically does not know which browser is

associated with a certain cookie. Only after the connection is initialized, the device is identified. Another problem may occur if the user deletes all cookies. It will be practically impossible to identify its device, as the browser does not send cookies to the server. In this respect, the only way the controller can fulfil this obligation is *to demonstrate the procedure through which consent was obtained* and that this method was applied at the time of the consent's collection (e. g. using the settings for a specific website on the server).

Secondly, the user is also entitled to *withdraw its consent* at any time and “*it shall be as easy to withdraw as to give consent*” (European Parliament, 2016, Article 7(3)). From this provision we may assume that the withdrawal should be accessible in the same manner as was the declaration of consent, e. g. in the same form, in the same place of a website or through the same procedure as consent was previously given. Technically, the withdrawal should be solved by requiring the user to resume consent to still include user's cookies. Subsequently, the website removes cookies and all the associated data. The problem may arise if the user blocks the sending of cookies and deletes cookies for the website on the device (e.g. browser). The end user no longer knows how to delete the cookie data on the website, as they only knew how to send this pseudo anonymized identifier.

As there is an option for the provision of explicit consent (e.g. Cookie Accept button), there needs to exist an option for its explicit withdrawal (Consent Withdrawal button). As explicit consent is required (application of the opt-in principle), this will also be reflected in the withdrawal process (when rebooting, it will be necessary for the user *to click*). Ensuring the ease of the consent's withdrawal is not an easy task. The requirements for the consent withdrawal will not be met, if the user will have to click through several levels of settings to withdraw. The solution may be in the form of a specific withdrawal icon or button (cookies withdraw button or pictogram with stubborn cookies), which should be placed on the first page of a website, or more appropriately, in the website's main menu. Lastly, the data subject must be informed of its right of withdrawal prior to giving consent. However, the withdrawal of consent will not have retroactive effects and therefore will not affect the lawfulness of processing based on consent provided before its withdrawal.

3.3. Is Consent Always Necessary?

The Proposal, in comparison with the Directive 2002/58/EC, establishes a new exception to the consent condition. It specifies that the use of processing and storage capabilities of terminal equipment and the collection of information from end-user's terminal equipment, including about its software and hardware, other than by the end-user concerned, is permitted only in four instances: firstly, if it is *necessary for the sole purpose of carrying out the transmission of an electronic communication over an electronic communications network*; secondly, if *the end-user has consented to the use of cookies*; thirdly, if it is *necessary for the provision of an information society service requested by the end-user*. The final and newly constructed exception is defined in the Proposal as *necessary for web audience measuring*, provided that such measurement is carried out by the provider of the information society service requested by the end-user. The Proposal, however, does not define the term ‘web audience measuring’. The Data Protection Working Party has expressed concerns, that this term may be confused with the user-profiling and stated, that it should be expressly specified that this exception “*should only apply to usage analytics necessary for the analysis of the performance of the service requested by the user, but not to user analytics, (i.e. the analysis of the behaviour of identifiable users of a website, app or device)*” (Article 29 Data Protection Working Party, 2012, p. 18). In other words, this exception only enables the monitoring of the website's visitors (the website's ‘traffic flow’) and its performance, using obtained information to improve and optimize the website accordingly; it does not enable the identification of its users individually. It must be noted that various changes have been proposed regarding this exception (e. g. extending its applicability to the measurement carried out by a third party on behalf of the provider of information society service)

and new exceptions have been proposed, but as these changes have not yet been included in the formal proposal, they will not be discussed in this paper.

4. New Players

Problematic execution of the EU's legislation regarding obtaining consent in practice has led the EU to the decision to modify it and regulate providing information to the user on the one hand and obtaining user's consent on the other, in a more user-friendly way. Due to the fact that almost every website uses cookies, most of which are tracking cookies, end-users are constantly required to provide their consent and, as a result, are overwhelmed with such requests. Therefore, it is necessary to find a solution enabling end-users to express their consent through one process and not separately on every website they visit. The solution proposed is to make it possible for users *to provide their consent through appropriate settings of a browser or other application* (e.g. chat application) in a transparent and user-friendly way. This results from the specific and privileged position of browsers which *“play an active role to help the end-user to control the flow of information to and from the terminal equipment. More particularly web browsers may be used as gatekeepers, thus helping end-users to prevent information from their terminal equipment (for example smart phone, tablet or computer) from being accessed or stored”* (European Parliament, 2016, Recital(22)).

The Proposal places a set of minimal requirements on browsers and other applications placed on the market permitting electronic communications, including the retrieval and presentation of information on the internet (hereinafter only as ‘software’). The obligation to meet these minimal requirements for privacy and personal data protection is put on the software providers. It must be noted that such requirements may not be easily met in practice. Companies like Google (Chrome browser), Mozilla (Firefox), or Microsoft (Microsoft Edge) can in future be imposed so their products meet these requirements. On the other hand, open source projects (e. g. Chromium project) are developed by a varied group of programmers and it is unclear, against whom the new duty will be enforced, if there is no legal subject grouping the developers.

First proposed requirement is that software *“shall offer the option to prevent any other parties than the end-user from storing information on the terminal equipment of an end-user or processing information already stored on that equipment”* (European Parliament, 2016, Article 10). This sets out the obligation for software to have the ability to prevent the collection of third-party cookies. Opt-in principle also applies here. The default must be the non-sharing of information with other parties. Now, browsers allow end-users to block third-party cookies. By default, this option is disabled (for all major web browsers). Under the Proposal, third party cookies will have to be disabled by default until allowed by end-users.

The Proposal also introduces a granularity setting for cookies stating that *“end users should be offered a set of privacy settings ranging from higher (for example, 'never accept cookies') to lower (for example, 'always accept cookies') and intermediate (for example, reject third party cookies' or 'only accept first party cookies')”* (European Parliament, 2016, Recital 23), which should be presented in an easily visible and understandable way. Most current browsers meet this requirement.

Part of the minimal standard that must be met by browsers is also the provision of information to end-users about cookies and privacy settings options in and after installation and obtaining consent to cookies. To ensure end-users' understanding, they should be, in our opinion, informed of what cookies are, what different types of cookies exist, what is their purpose, specifically focusing on third-party cookies and risks associated with them (e. g. their use for targeted advertising). Currently this requirement is absenting in most browsers.

Not least important part of the browser is the ease of changing cookies settings. The draft states: “*the software shall provide a clear and easy way for end-users to change their privacy at any time during use*” (European Parliament, 2016, Article 10). The question is how to interpret this requirement. Currently, most browsers allow the end-user to determine its cookies policy through at least 5 clicks (e.g. Chrome browser), or the cookie section is listed under the browsing history name (e.g. Firefox browser). In our view, complying with this condition requires that the privacy settings are in the main menu and the cookie section has been explicitly stated and named.

5. Conclusion

In conclusion, the aim of this paper was to consider the newly adopted and proposed legislation regarding cookies and whether its provisions will simplify the current regulation. The answer is both yes and no. From the service providers’ point of view, the increase in the protection of privacy and personal data entails in itself the creation of new obligations. The nature of these obligations relates specifically to the change from implicit to explicit consent. Moreover, with regard to the *status quo* that burdens the end-users, the newly considered subject are the software providers.

The proposed regulation stipulates the minimum level of the privacy and personal data protection. Certain conditions are already met by the software providers, others will require time and costs. The aim of these obligations is to help end-users to better control the protection of their privacy with regard to cookies. End-users should be able to deal with third-party cookies after 25 August 2018 (proposed due date which will not be met, as the Proposal has not been adopted yet), as well as with default settings regarding cookies already during the browser installation. However, this does not present a 100% solution.

It is necessary to highlight the EU’s effort to regulate cookies. Nonetheless, the critique can be directed towards the time period when the proposed changes shall be applicable. Despite of the fact that cookies still present the most used pseudo-anonymized identifier, various technologies and framework not using cookies are currently created. It needs to be highlighted that the authors of the proposed regulation do not limit this regulation only to browsers, but to any software displaying its content. The application of the minimal level of the privacy and personal data protection can prove problematic as the proposed time period of three months may not be enough. Due to the scope of this paper we were not able to explain, in detail, other initiatives (e. g. ‘Do Not Track’ (Mayer, 2011)) dealing with the issue of the protection of end-users, but instead we focused on the regulation of this issue on the EU level and its possible future direction.

6. Acknowledgements

This paper is funded by the Slovak APVV project under contract No. APVV-14-0598.

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TRANSPARENCY FOR INNOVATION DRIVEN SUPPLY CHAIN ECOSYSTEM – NATIONAL APPROACH

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Keywords

Innovation, supply chain, transparency, ecosystem

Abstract

Innovation is significant for many companies to stay competitive on the global market to address gaps and commercial potential and a crucial economic development factor supported by governments and policy makers. The importance of innovation is supported by the Europe 2020 initiative “Innovation Union”, with the main objective to help Europe to increase investment in research and development, and to better transfer research results into improved goods or services. The main principle is based on the role of private and public demand/procurement to foster innovation. The paper propose framework for innovation driven supply chain ecosystem based on interoperability between commercial and public innovation procurement organization and research environment and developing single digital infrastructure for supporting critical issues in requirements analysis, sourcing, negotiation, contract execution and post-contractual phase to build sustainable, motivational and trusted innovation driven environment.

1. Introduction

Innovation is crucial factor in addressing developmental challenges. Substantial research efforts are needed to find solutions that address global challenges. Although several studies have controversial results regarding the impact of innovation on specific social indicator, e.g. income inequalities, the pivotal role of innovation in economic development still remains. The build-up of innovation

capacities is significant determinant of the growth dynamics. To boost innovations and growth, building extensive innovation capacities has to be the priority in each country.

Innovation is considered as a complex and systemic phenomenon, where a systematic approach to its definition should be taken. Innovation are nowadays frequently used in many different contexts (Kotsemir and Abroskin, 2013; Doucek et al, 2017, Novotny et al, 2016). Innovation implementation is accompanied with significant scientific, technological, financial, organisational or commercial activities, that can produce a competitive advantage for the companies on the market (Maruska and Doucek, 2017, Saruc et al, 2013). Georghiou et al. (2013) defines the innovation as the procuring a non-existing product, or a product with innovative features.

Innovation is significant for many companies to stay competitive on the global market to address gaps and commercial potential. On the other hand, innovation as a crucial economic development factor is supported by governments and policy makers by several approaches. The importance of innovation is supported by the Europe 2020 initiative “Innovation Union”, with the main objective to help Europe to increase investment in research and development, and to better transfer research results into improved goods or services (European Commission, 2012). The main principle is based on the role of private and public demand/procurement to foster innovation. Benefits of existing innovations on the market can be utilised directly through the traditional procurement of innovation approaches. For procurement of innovations that are not in the commercialised phase or are not even developed and research and development has to be ensured a pre-commercial procurement process (PCP) is the key.

The objective of the paper is the proposition of innovative PCP and procurement of innovation solution for any innovation market in form of innovation driven supply chain infrastructure with the ambition to establish unique comprehensive data infrastructure integrated between public and private procurement solutions and R&I environment for research and innovation deployment purposes.

2. Procurement of Innovations

When dealing with innovation development, adoption or diffusion, several approaches to procurement of innovation or R&D activities have been during the time developed (Edquist and Zabala-Iturriagoitia, 2012a). In a case of small or incremental innovations that can be fully or partially achieved by implementing new or currently emerging innovations, that are not conventionally accessible, but available on the market a process of innovation procurement (PI) or public procurement of innovation (PPI) can be adopted (Edquist and Zabala-Iturriagoitia, 2006). Due to the scarcity of the “new” innovation on the market can this process vary among countries from the standard ones used in procurement (Georghiou et al., 2013). In the case when the identified need cannot be satisfied by an innovative product or service already available on the market, acquisition of R&D services and results has to be considered. In this case a pre-commercial (PCP) procurement process could be adopted. PCP is an approach to procuring R&D services and is triggered when a solution to a specific need or problem could not be, as a commercially ready or nearly ready solution, found on the market (OECD/Eurostat, 2005; OECD, 2015). The European Commission (in their communication, 2006a, 2006b) addresses this phenomenon, which was defined as a specific method for procuring Research and Development (R&D) services, later used as mechanisms and schemes for public procurement. PCP as a process involves solution proposal and design, prototype development up to a limited volume of first products or services, but it does not cover the purchase or procurement of the final product or identification of a buyer (CIP Entrepreneurship and Innovation Programme, 2014; Edquist and Zabala-Iturriagoitia, 2012a; ECORYS, 2011; Turkama, P. et al., 2012; Rigby, 2013; Aschhoff and Sofka, 2008; European Commission, 2008). Important is to emphasize that does not include purchase of already existing

products and therefore is often added rather to supply side policies, in contrary to PPI as demand side instrument (Edquist and Zabala-Iturriagoitia (2006). Usually public agencies identify a socio-economic problem for which there is no commercially available solution, yet and use this method for preparing a PCP call (Lucas, R. et al., 2009).

Although the public demand is considered as a potential mean to fostering innovation, majority of the innovation commercialized are from private sector (Palmberg, 2004; Saarinen, 2005). Therefore, PCP can't be seen just as a policy tool for innovation support but has to be considered as a framework applicable to any type of procurer therefore it has to be defined in a more general approach with the focus on crucial aspects that hinder the success in this process. PCP as the driver for innovation should be applicable to the whole market to strengthen the innovation uptake effect.

The negotiation process for innovation procurement or procurement of R&D partially as captured by PCP in the private sector has been well established in the last decades. To support the innovation fostering the concept of the PCP process has to be enhanced and more focused on crucial aspects that are not developed to sufficient extent yet like RTD sourcing, pricing, socio-economic modelling and collective learning.

In this article we propose a framework that would help to find a supplier or procurer regardless of the procurer type.

3. Innovation driven supply chain framework proposition

The proposition of desirable infrastructure should be in line with the latest technologies and approaches and should be based on innovative principles presented by European Commission within several strategies and initiatives, esp. digital single market strategy and open science and open innovation policy which should ensure progressive approach and efficient solutions for the innovation uptake support.

According to EC, the Digital Single Market strategy is made up of three policy areas or 'pillars' which the proposal in this paper is supporting:

Improving access to digital goods and services: Helping to make the EU's digital world a seamless and level marketplace to buy and sell. The objective of our proposal is to improve access to research and innovation through new digitally based approach.

An environment where digital networks and services can prosper: Designing rules which match the pace of technology and support infrastructure development through new digital R&I digital ecosystem and infrastructure proposition for procurement of innovation.

Digital as a driver for growth: Ensuring that Europe's economy, industry and employment take full advantage of what digitalization offers through fulfilling priorities of this pillar as:

- Standardization, which will be applied esp. in sourcing and contractual phase within proposed infrastructure for the purpose of increasing the transparency of market information (innovative products, research and innovation capacities, formalization of contractual conditions and clauses)
- Interoperability, which is applied widely through whole infrastructure proposed later in the paper integrating ERP, SCM and legacy systems on the market with proposed research and innovation performance and knowledge platform integrating also existing academic information systems.
- Digital platforms, of proposed infrastructure utilizing all benefits from digitization.

- Trust, which is crucial in market environment and especially in innovation driven ecosystem and should be built through development of new e-services for reputation management, online dispute resolution, contract execution support and code of conduct application in whole innovation driven supply chain.
- Data economy, which has to utilize benefits from data generation, aggregation, innovative processing and visualization and sharing.

On the base of several interviews and existing technologies, we have proposed the framework for innovation driven supply chain which is determined by national R&I data ecosystem development and accessibility. The framework is presented below on the fig. 1.

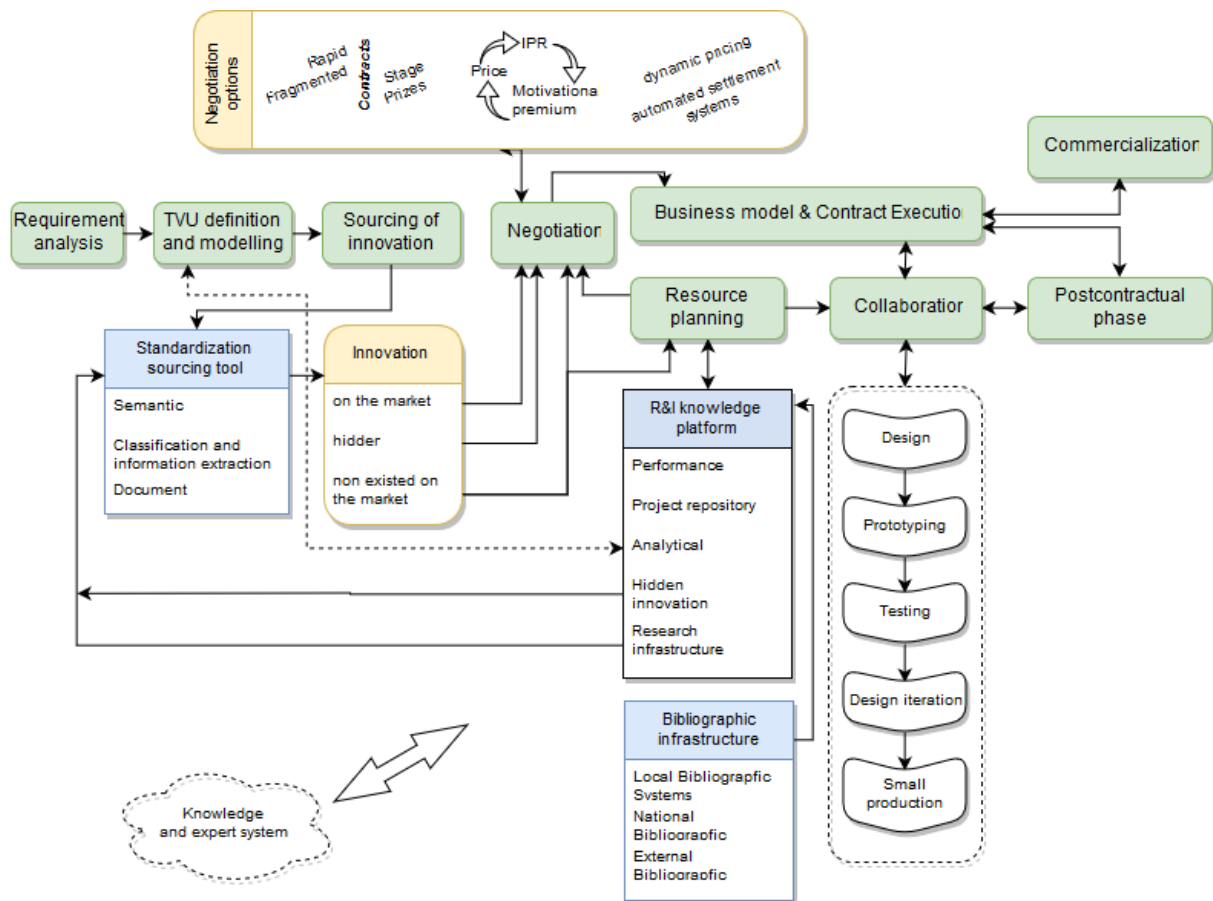


Fig. 1 Framework for innovation driven supply chain

Requirements analysis and pricing - First phase of procurement of innovation or PCP is the identification of organizational needs for the innovation and its detailed requirements analysis with defining the value brought to the organization. Within this functionality, the crucial issue needed to be provided are socio-economic or business modelling tool to support crucial factors of feasibility study identification, description of parameters, modelling and final impact presentation and understanding and innovation trends analysis derived from national single R&I platform describing core information for trends understanding.

Sourcing of Innovation - The most crucial sourcing problem relates to an awareness of innovative product or service existence on the market or the existence of trusted and qualified capacities to design and develop desired solution. This feature seems according to our surveys (interviews with 100 professional purchasers in Czech Republic and Slovakia) to be the most crucial for delivering high quality of innovation. This phase should support the identification of trusted and qualified research capacities in the case of hiring researchers to design and develop desired innovative solution.

This feature should be built on national single R&I knowledge platform aggregating all information from national research environment including bibliometric performance indexes, publication and project reports repository, prototypes and technologies not adopted by the market (hidden innovation) and trust building mechanisms for supporting decision making in searching and assigning the best research team for the innovation development.

Negotiation and Procurement of Innovation - Negotiation phase is specific phase with possibility to set up right form of contractual condition and negotiation type to procure the RTD activities for innovative solution development more efficiently (Tkáč and Sabolová, 2015). Within this paper we will not focus more in deep with this phase, as it is the subject of many studies in the field of PCP or negotiation. But the specifics of negotiation within procurement of innovation are based on total value of utility identification validation, type of negotiation with respect of dynamic pricing models application for several sub-phases of negotiation and types of contracting or procurement/negotiation methods. Standard forms of contracting are because of their complexity and enigmatism deterrent for non-traditional potential contractors (OSTP, 2014) as rapid Technology Prototyping Contracts, Staged Contracts, Milestone-Based Competitions, Incentive Prizes, Challenge Based Acquisitions or other transactions, such as grants or cooperative agreements.

RTD Capacity Resource Planning module - To support the sourcing and negotiation procedure for research and innovation capacities in the form of hiring the research team or individuals to develop innovative solution the RTD Capacity Resource Planning module within the national R&I infrastructure should be implemented. Advanced RTD capacity and resource planning and scheduling (RTD-CRPS) should be based on advanced manufacturing principles referring to a research and development management process by which research and development capacity and related technical infrastructure are optimally allocated to meet production capability, time and technical infrastructure requirements. RTD-CRPS simultaneously plans and schedules RTD work or project based on available human resources in RTD with related technical research infrastructure and expertise and trust requirements. It has been applied where research work is necessary to be procured to conduct all required tasks for development of innovative solution for procurer organization. The crucial functionality should include standard capacity planning and resource allocation.

Procurement decision support and knowledge system - The importance of improving knowledge and skills for innovative procurement methods adoption and effective management is promoted by all European stakeholders active in public procurement areas. The main challenge is to set up unique innovation environment and prepare for Directive 2014/24/EU to modernize procurement market in order to increase the efficiency of public spending and to enable procurers to make better use of public procurement in support of common societal goals in line with ensuring smart, sustainable and inclusive growth. The base for this module is visualized on the following scheme on Fig. 2.

The main principle is the creation of single data warehouse of related information from public and commercial sector, esp. from supply chain environment as well as from research and innovation areas through integrating library systems, creating national project repository and data mining based analytical services. This data warehouse with analytical services have to be interoperable with global supply chain through API for seamless integration into all relevant SW solutions by procurement SW providers and used efficiently by procurers within organizations seeking for innovative solutions. The concept is based on interoperability and integration of relevant databases.

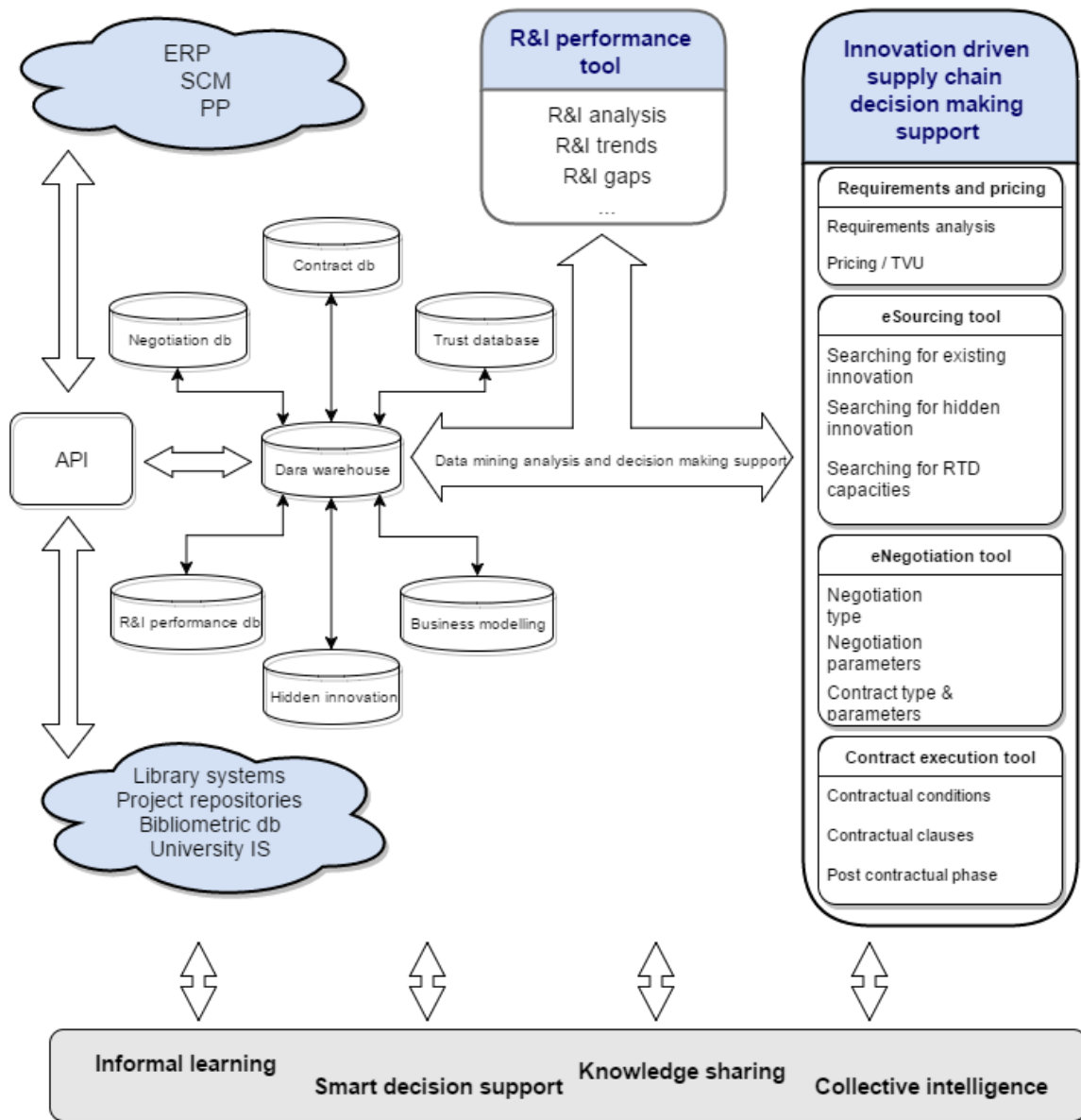


Fig. 2 Procurement decision support and knowledge system

4. Conclusion

The purpose of this paper was the framework proposition to build innovation driven supply chain ecosystem on the Slovak market based on digital single market and open science principles. The basic logic lies on integrating commercial and public market with national research environment to support pre-commercial procurement adoption and development. The specific solutions within different phases of innovation procurement environment was proposed according to results from the survey realized between procurement experts with some experiences with procurement of innovation and research activities.

Propose solution for innovative driven supply chain ecosystem will increase transparency of existing innovative solution, trusted research capacities for proposing and development of innovative solution, support for more objective expected utility identification as crucial factor for expected price set up and general increase of awareness and skills through knowledge sharing and collective awareness and intelligence.

The proposal is only framework, but technologies and approaches for this innovative approach already exist on the market and in FPx and H2020 RTD projects, esp. for semantic innovation to improve standardization, interoperability and big data solutions as well as technologies for collective awareness platforms.

5. Acknowledgement

This contribution was supported by the Slovak Research and Development Agency within the project APVV-16-0368 “Determinants of Digital Single Market development and implementation in the field of global supply chains and in relation to changes of behavior of participants on the market” and the project SGS “Identifikace role referenčních skupin v nákupním a spotřebním chování”, project registration number SP2018/125.

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BUILDING TRUST IN PUBLIC SERVICE PROVIDERS THROUGH ONLINE REPUTATION MECHANISMS

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Keywords

Trust, health care, reputation mechanisms, ratings

Abstract

The importance of reputation mechanisms for building trust in electronic markets is analysed and discussed relatively often. On the other hand trust is playing even more important role in public service sector, where law of supply and demand losing their power. Although some authors considers use of rating as trust building mechanisms for non-profit sectors, only a very few investigate the dynamic of trust in such environment. The presented paper analyses dynamic of trust measured by changes in rating of health care providers within the two year period. By analysing change in rating of the doctors, we would like to know whether satisfaction or displeasure of patients with particular specialist can influence the trust into entire branch of medicine. The analysis of 9290 ratings of 1495 doctors showed that, patients tend to provide more often positive evaluation of doctor than negative. Moreover no significant changes in trust of patients in particular branch of medicine speciality in period of years 2016 and 2018 were recognized.

1. Introduction

The role of electronic trust building mechanisms to support the performance of the company is nowadays relatively often analysed in business literature. In commerce sector the need to increase performance is often motivated by monetary reward mostly in form of increased profitability (Maryska and Doucek, 2015). Situation is different for providers of public services, public servants (public teachers, public clerks, and doctors in public hospitals). Their wage is usually more determined by the length of employment in public sector than individual performance of public employee. There is no surprise that in such environments the motivation for performance improvement is very low and standard management models based on competition doesn't work.

Typical example is public health care. According to Bevan, Evans and Nuti (2018), there have been many efforts in the 1990 to use the competition among providers to enhance performance of hospitals, but most of them have “wanting” effect. Moreover, the reason why these efforts were implemented in the first place was the understanding that without proper stress form outside the variability in the performance will be continuously high (Bevan, Evans and Nuti, 2018). In their study Reputations count: why benchmarking performance is improving health care across the world, these authors propose alternative model based on „the principles of reciprocal altruism“, which „follows conventional micro economics in its design of rewards and sanctions for good and bad performance but differs in that these are non-monetary and based on reputation effects“. The theoretical support for this approach can found in studies related to behavioural economics and the conceptual framework of reciprocal altruism (Oliver, 2017), using the concepts of identity (Akerlof and Kranton, 2010), and reputation effects from ‘naming and shaming’ for poor performance (Bevan, Evans and Nuti, 2018) and awards for high performance (Frey, 2013).

The empirical support for this approach can be found in impact of online rating website. The use rating as online reputation mechanisms is widely discussed in literature (Delina, 2015). Although, the studies focusing on measuring relation between on line rating and quality of health care mostly provides contradictory results (see Holliday et al., 2017), several studies showed that on-line rating from independent web-site lead to change in the behaviours of doctors and to improvement in quality of providing services. Well publicized study of university of University of Utah Health Care showed that for three years nearly half of doctors which receive 30 and more five-star system ratings votes were “in the top decile and a quarter of them in the 99th percentile in patient satisfaction among their peers nationally.” (Lee, 2017)

2. Methodology

2.1. Description of the sample

The main goal of this paper is to investigate how the trust in providers of public services such as health care, is changing during the time. To fulfil this objective, we created sample consisting of 9290 ratings of 1495 doctors. The data were acquired from Slovakian web-site. For the doctors to be on the dataset they must be rated via mentioned web-site and also, they must conduct their activities in second biggest city in Slovakia named Košice. In order to measure how is rating changing, three samples were created. First sample includes ratings of the 1248 doctors valid in March 2016, as well as number raters for each doctor valid in March 2016. The second sample includes ratings of the same doctors as in previous sample, but rating in this sample are valid in March 2018, as well as number of raters for each doctor valid in March 2018. Third sample include ratings of second sample plus rating of 247 doctors which have not had rating in 2016 together with number of raters for each doctor. Some doctors have stated two different specialities. Because we could not determine whether the rating of the doctor is based on first or second specialisation, we decided to include the rating in both specialities. From the data we eliminate doctors with specialities which have less than 1% presence in sample.

2.2. Methodology of the research

The research in this paper tries to analyse how trust of patients in doctors in city of Kosice is changing within the two year period. Secondly, we would like to know, whether there are some branches of medical practice, where there was significant change in the level of trust perceived by patients of doctors from Kosice. The research can be divided into two parts. First part is dealing with the sentiment of ratings. By analysing impact of raters’ votes on positive change, negative change or no

change of the rating, we can establish whether majority of votes have positive or negative character. The logic behind this approach to support or contradict the argument, that patients use rating website mostly to criticise the doctors or to lower the ratings of the doctor. Second part of research focus on medicine specialties. By analysing rating of the doctors based on their specialties, we are trying to determine whether there are some specialties of medicine in which perception of doctors by patients were changed drastically within the period from 2016 to 2018.

3. Research

The first part of the research deal with the analysis of the sentiment. By comparing rating of the doctors valid in 2016 with rating of the doctors valid in 2018 we determine, whether the change of the rating for each doctor have positive or negative character. The results of the analysis are presented in figure 1. The pie chart in the left side of figure 1 represent the percentage of vote which led to positive, negative or no change of rating. As can be seen from figure 1 most of doctor doesn't experience the change of the rating. From those who does, majority of the votes led to positive results. Less than one fifth all rated doctor experienced in 2018 lower rating than in 2016. Similar story is presented in right part of the Figure 1. From all votes gathered within the years 2016 and 2018, almost majority of them lead to positive rating change. Right part of Figure 1 also shows that almost 88% of all votes gather from 2016 to 2018 lead to positive or negative change. Based on the results presented in Figure 1, we can assume that patients provide positive evaluation more often than negative one. Because most of the votes lead to change of current rating, it can be argue that patients more likely provide rating in order to change rating than to confirm existing evaluation.

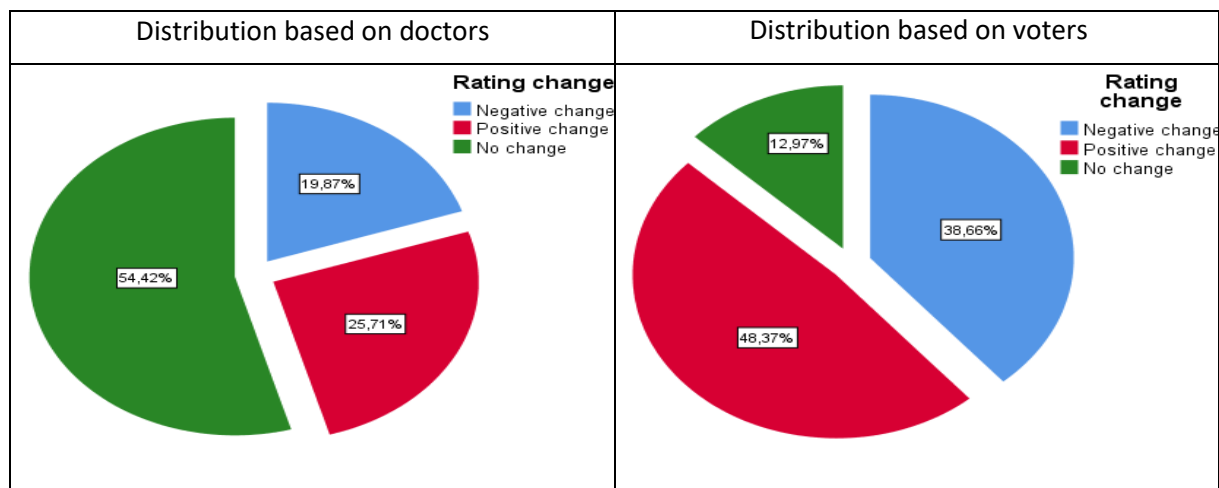


Figure 1: Analysis of change of rating within the years 2016 and 2018

Second part of the research analyses whether the trust of patient in some of medicine specialties is changing within the two-year period. The aim is to find out whether increasing or decreasing trust of patients to doctors can significantly change how the medicine speciality as a whole is perceived by the patients. In this analysis we used first and second sample (see methodology). We would like to investigate differences between rating 2016 and 2018 for every single doctor and how these change influence perceptions of the specialties. To use paired test, we must test normality of distribution. To test normality, we used Shapiro-Wilk test. The null hypothesis of normal distribution of first and second sample based on the medical specialty were rejected at $\alpha=5\%$ for all tested speciality but Dermatology (p-values of S-W tests 2018: 0,285; 2016:0,087), Gastroenterology (p-values of S-W tests 2018: 0,638; 2016:0,486) and Psychiatry (p-values of S-W tests 2018: 0,127; 2016:0,063).

Based on the results of Shapiro Wilk test, we could not reject normal distribution of mentioned specialties; hence we used paired t-test to test whether there are statistically significant changes in ratings valid in 2018 and 2016. The results of the t-tests doesn't confirm any statistically significant at $\alpha=5\%$ changes of distribution of Dermatology (paired t-test: p-value 0,295), Gastroenterology (paired t-test: p-value 0,088), Psychiatry (paired t-test: p-value 0,155) within the years 2016 and 2018. For other tested medical specialties the normal distribution was rejected at $\alpha=5\%$. That is the reason why non-parametric Wilcoxon signed rank test was used to test differences in rating change. The results of the analysis are presented in the Table 1. As can be seen in Table 1, based on pair comparison only in three cases of 23 tested medical specialties, the null hypothesis of equal distribution was rejected at $\alpha=5\%$ by Wilcoxon rank test. This mean that statistically significant difference between distribution of ratings valid in years 2016 and 2018 were recognized for orthopedics, pediatrics, and rheumatology specialties.

Table 1: Non-parametric paired comparison of rating change for medical specialties

Specialisation/ p-values	S.-W. test		Wilcoxon signed test	Specialisation/ p-values	S.-W. test		Wilcoxon signed test
	2018	2016			2018	2016	
Accident and emergency medicine	0,000	0,000	0,905	Allergology Immunology and	0,006	0,023	0,121
Anaesthetics	0,000	0,001	0,461	Ophthalmology	0,000	0,000	0,545
Cardiology	0,000	0,000	0,275	Orthopaedics	0,000	0,003	0,023
Dental, oral and maxillo- facial surgery	0,002	0,001	0,283	Otorhinolaryngology	0,000	0,000	0,435
Endocrinology	0,003	0,002	0,910	Paediatric	0,000	0,000	0,031
Obstetrics and gynaecology	0,000	0,001	0,329	Physical medicine rehabilitation	0,002	0,002	0,286
General practise	0,000	0,000	0,226	Radiation Oncology	0,012	0,051	1,000
General surgery	0,000	0,000	0,807	Radiology	0,000	0,000	0,684
Internal medicine	0,000	0,000	0,546	Rheumatology	0,003	0,009	0,011
Neurology	0,022	0,002	0,987	Stomatology	0,000	0,000	0,835
General haematology	0,040	0,162	0,858	Urology	0,001	0,011	0,307
Vascular surgery	0,002	0,002	0,072				

The differences in median implies that in term of pediatrics (2016: median=89; 2018: median=90) and rheumatology (2016: median=93; 2018: median=94) the trust measured by rating change increase, but trust of raters in orthopedics (2016: median=90; 2018: median=88) decrease. Paired comparisons enable to examine change of the rating for every doctor. These results mean that most of the doctors with pediatrics and rheumatology specialties improve their ratings. Paired comparisons enable to examine change of the rating for every doctor. These results mean that most of the doctors with pediatrics and rheumatology specialties improve their ratings. On the other hand, most of the tested orthopedics experienced decrease of trust during last two years.

The last part of the research compares how distributions of particular specialities changes, by taking into consideration also ratings of new doctors, which didn't have rating in 2016. To compare these samples (first and third, see methodology) the test for independent sample was used. In order to choose precise statistics, we used Shapiro-Wilk test to examine whether ratings of doctors based on their specialty are normally distributed. The normal distribution was confirmed only for gastroenterology (p-values of S-W tests 2018: 0,103; 2016: 0,486). The change of rating in

gastroenterology was tested using independent sample t-test. The test showed that null hypothesis were not rejected at $\alpha=5\%$ (t-test: $t=1,420$ p-value: 0,163; equality of variances is assumed at $\alpha=5\%$ F-test: $F=0,250$, p-value 0,620). To tests differences between ratings of doctors valid in 2016 and 2018, for other 25 medical specialties, we used non parametric Mann–Whitney U test (Table 2).

Table 2: Non-parametric comparison of rating change for medical specialties, which includes new doctors

Specialisation/ p-values	S.-W. test		M.W. U-test	Specialisation/ p-values	S.-W. test		M.W. U-test
	2018	2016			2018	2016	
Accident and emergency medicine	0,000	0,000	0,961	Ophthalmology	0,000	0,000	0,905
Allergology and Immunology	0,000	0,023	0,699	Orthopaedics	0,000	0,003	0,066
Anaesthetics	0,000	0,001	0,392	Otorhinolaryngology	0,000	0,000	0,270
Cardiology	0,000	0,000	0,416	Paediatrics	0,000	0,000	0,264
Dental, oral and maxillo-facial surgery	0,000	0,001	0,560	Physical medicine and rehabilitation	0,000	0,002	0,103
Dermatology	0,000	0,087	0,950	Psychiatry	0,005	0,063	0,741
Endocrinology	0,000	0,002	0,337	Radiation Oncology	0,001	0,051	0,373
General haematology	0,028	0,162	0,662	Radiology	0,000	0,000	0,580
General practise	0,000	0,000	0,506	Rheumatology	0,000	0,009	0,682
General surgery	0,000	0,000	0,202	Stomatology	0,000	0,000	0,550
Internal medicine	0,000	0,000	0,084	Urology	0,002	0,011	0,232
Neurology	0,000	0,002	0,409	Vascular surgery	0,000	0,002	0,391
Obstetrics and gynecology	0,000	0,001	0,141				

The results presented in table 4 showed, that null hypothesis were not rejected at $\alpha=5\%$ for all of tested medical specialties. This mean statistically significant change of ratings from 2016 to 2018 wasn't confirmed for all of tested medical specialties.

4. Conclusion

The presented paper ties to examine how the public trust in the doctors measured by patients' rating is changing within the two years period. Firstly, we analysed sentiment of the rating change among the years 2016 and 2018. Although number rating votes between years 2016 and 2018 represent more than 26% increase of all rating votes in 2016, according to our findings, majority doctors' ratings were not influenced by these additional rating votes. Moreover, comparing positive vs. negative change of ratings more rating votes lead to positive change of ratings. By detailed observation of the votes we also found out that only a small proportion of these rating votes lead to majority of doctors, which ratings were not changed. This lead us to conclusion that potential raters, tend to take an effort to sign up and provide ratings only if they disagree with current one. They probably do not usually provide new rating vote, to confirm the actual rating of the doctor. Second part of research was focused on medical specialties. The motivation within this investigation was to find out whether changes in ratings of some doctors are significant enough to change the trust in medical specialty as whole. In the first phase we analyse only the doctors which have rating in 2016 and we compare these ratings with their ratings in 2018 by paired comparison. According to results only 3 of 26 tested specialties showed statistically significant change of ratings. For two specialties (paediatrics,

rheumatology) change of ratings represent increase of trust and for one speciality change of ratings represent decrease of trust. Within the second phase, we compare all doctors rating valid in 2016 with all doctors rating valid in 2018. This approach taking into the consideration also new doctors, respectively doctors without ratings in 2018. The statistically significant change of overall ratings between the years 2016 and 2018 was not confirmed for any of tested medical specialties. This lead to the conclusion that trust of public to medical specialties tend to have stable character.

5. Acknowledgement

This work was supported by Scientific Grant Agency VEGA of Slovak Republic within the grant No. 1/0839/17 “Trust building electronic services in public administration.”

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THE LAST 5 YEARS IN E-GOVERNMENT SERVICES TRUST, ACCEPTATION AND IMPLEMENTATION

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Keywords

Trust, e-government, e-services, e-health

Abstract

This paper discusses building trust in public administration and government in implementing e-services in selected areas of government. In the paper we analyzed 28 relevant studies, which deal with the issue and subsequently we synthesized the findings of the individual contributions for the implementation of process improvement and trust in these services for the needs of states such as the Slovak Republic, where these e-services are gradually implemented. In particular, this contribution is essential from the point of view of the findings on the importance of building trust, and also points to the various factors that may affect this confidence. It outlines the possibilities of own surveys, which may have the nature of surveys and various other qualitative research. It also provides insight into new trends in data security for e-service users, which appear to be one of the most important and critical factors that may cause people to mistrust in accepting and using such services.

1. Introduction

The role of e-government in developed countries has its irreplaceable place. In most developed countries, selected electronic services are already in place to facilitate communication and interaction between the government and the citizen (G2C), but also between governmental institutions (G2G). There are several studies describing the implementation process of e-government services in e-government in developing countries in recent years. Slovakia is a country that is still developing these services behind developed countries and many e-services are still developing, respectively were not introduced. Most alarming is the fact that e-government electronic services are not reliable and their functioning is questionable. One of the problems of such services is the inconvenience of some groups of citizens, as the safety of these data stored on online servers is being questioned. Trust in these services is even more nauseous if the use of sufficient security measures to prevent third-party access to sensitive data is questioned. In this article, we will highlight selected issues and challenges from various areas of e-government electronics services.

2. Literature review

In this section, we will describe studies from last five years, indexed in database SCOPUS from year 2013 till April 2018. We selected 28 relevant studies, which are connected to e-government, trust, e-services in governmental processes, data security and e-health services.

2.1. E-government in terms of its application

Mou et al. (2015) discusses the role of risk and trust as factors influencing the adoption of electronic services. They point out that while there are many studies pointing to the role of trust in e-services, the field remains fragmented and the research models are contradictory. Therefore, the meta-analysis of 67 contributions has been made and the conclusion is that even though both risk and trust play an important role, trust has a greater impact. One of the key findings is that the risk partly mediates the effects of trust on acceptance.

Abdel-Fattah (2014) describes in his study the factors influencing the adoption and diffusion of government electronic services. The author characterized these factors from three perspectives - individual, service, and governmental factors. These areas should be measured, evaluated, and obtained feedback in order for e-services implementation to be successful. Savoldelli et al. (2013) focuses on describing selected characteristics to measure the introduction of ICT in governmental processes in relation to public value. The authors propose an "eGEP 2.0 model", which corrects the shortcomings of the previous model, which was also aimed at evaluating the effectiveness of the impact of eGovernment assessment on the policies and processes of implementing these technologies. Albesher and Brooks (2014) conducted a survey of factors that affect trust in e-government and e-services. They focused on factors such as age, gender, educational level, and so on. The research was conducted on the Saudi Arabian population. They have found that only the educational level has an impact on perceptions and confidence in e-government services. It is this finding that can also help with similar research in Central European countries. Belanche et al. (2014) examined transfer trust in public e-services, pointing to the fact that e-service confidence was mainly supported by the quality of these services, so low-quality services can be expected to reduce the trust of e-services. The impact of trust in e-services has also been demonstrated on the basis of trust in the internet and government recommendations. Mpinganjira (2015) describes the role of trust in the use of e-services. They collected data mainly from the questionnaires and interviews. Their results have also shown that the impact of trust as a factor that shares a group of people on those who use and do not use e-services is quite observable. They also pointed out that it is important who the provider of government e-services is. This may imply that people are very sensitive to the security and responsibility of individual service providers and are struggling to entrust their personal information to untrustworthy providers. Venkatesh et al. (2016) highlight the important role of trust and transparency as an important factor in people's insecurity with regard to eGovernment services and point to the possibilities of managing this uncertainty. They tested the proposed model on 4,430 Hong Kong citizens, namely 2 e-government services: government websites and online appointment booking. Their results show that information quality and channel characteristics predict citizens' intentions to use e-government. It seems that transparency and trust mediate as well as moderate the effects of information quality and channel characteristics on intentions. Průša (2015) focuses on e-identity as a cornerstone for building e-services in public administration. In his contribution he is concerned with the evaluation of experience with European projects dealing with authentication in the context of cross-border relations. Like other authors, it points to the importance of trust in these electronic authentication services as a key factor in the success of these systems not only in Europe, but also on the experiences of Europe and selected African countries. Mou et al. (2016) investigated the relationship between trust and perceived usefulness. Their results show that perceived usefulness and trust are important at all stages of consumer acceptance of online health services. Healthcare e-services will be discussed in more detail in subchapter 2.3.

2.2. E-government and its application in developing and developed countries

The speed, rate of implementation and range of application of the e-government services is different in developing and developed countries. Slow development in developed countries could relate with

many factors as for example low ICT literacy and infrastructure, missing participation and utilizing services by citizen despite the government's high investment in this area. Authors Alkhalani and Sulaiman (2014) state profits for different types of economic subject. The main advantage of G2C services for citizens is the open access to information about economic development and policy in given country, increasing the speed of request handling in the process of filing and submitting online tax return. G2C services have benefits for local enterprises during their expanding to global markets. Also government as a representative of economic subject the public sector becomes more participative in its form by stimulating the voting, exchanging of information and online debating. Authors summarized most extracted factors that influence the acceptance of G2C services in developing countries as follows: performance and effort expectancy, social influence, facilitating conditions and trust in internet and in government. Studies focused on acceptance and uses of G2C in developed countries, were based on quantitative approach. These findings were based on previous researches from developed countries China, India, Malaysia, Saudi Arabia, Kuwait, Qatar, Iran and Jordan. Dahi and Ezziane (2015) identify factors associated with using of e-government services by citizens in the Emirate of Abu Dhabi. Authors designed the technology acceptance model with implementing the regression analysis and examine factors the perceived usefulness, perceived ease of use, trust issues, subjective norms and computer self-efficacy of citizens. As the significant contribution of research, authors consider the useful information and evidence to improve the strategic planning and development of e-government services provided for e-government officials and researchers. For improving the efficiency e-government services, government should increase the trust of citizens on this services and platform, to raise awareness about e-services by promotional campaign held in schools, malls and organizations or by implement popular people in society to improve confidence and trust in using e-services. By using the model based on customer satisfaction index for the e-services, Al-Ammay et al. (2017) identified key factors affecting the customer satisfaction. The study pointed to the need to focus on satisfaction of specific transaction and cumulative satisfaction of customers. In transformation of the public sector in general, the digitalization play a key role in increasing the productivity and inclusiveness of public sector services. The similar research was conducted in Saudi Arabia by authors Alharbi and Kang (2014).

Deng, Karunasena and Xu (2018) identified the most significant critical factors mentioned quality of information, functionality of e-services, efficiency and openness of public organizations, qualitative factors as trust, equity and self-development of citizens and user orientations. According their research reveals the use of public value concept as effective in evaluating the performance of e-government including the trust and it's efficiency in developing countries. The main research was provided with data about e-government in country Sri Lanka. Research study from Rwanda (Twuzeymana, 2017) shows that also in least developed countries is visible effort to contribute to identifying critical factors of e-government. This implementation was supported by adopted public-private partnership approach. User involvement in early stages and user centered e-government should help and avoid basic flaws and improve confidence and trust of users and thus decrease likelihood to reject this type of e-services. Mireia (2015) on a sample of EU countries compared to China found out and understands the opportunities to improve the audiences' understandings in EU countries by communication tool websites in the frame of e-government as well working in communist China, for example Internet highlights or e-governance strategy. By online survey consists of groups of respondent with relation to China, research uncovered that European audiences is able to find a correlation between access to e-services and quality of information provided by them and trust and casual relation between quality of information and the image improvement of e-services.

2.3. E-health as the part of the public administration e-services

Healthcare is one of the most researched areas with regard to electronic services, as the use of e-services for citizens is beneficial in this area and in many ways improves the provision of health care

and can help prevent fatal misconduct. Tursunbayeva et al. (2017) selected 22 studies that fully met the required criteria, based on the use of social media for e-government in healthcare. As well as our article, their study points out that most of the contributions have been published over the past five years, mainly from high income countries. Their result is to point out that the lack of robust evidence makes it difficult to draw conclusions about the effectiveness of these approaches in the public health sector and further research is warranted. Mou and Cohen (2014) examined the relationship between trust and perceived usefulness in consumer acceptance of e-services, in this case in the field of e-health services. Their results were almost identical to those reported in Mou et al. (2016). In a later study, Mou and Cohen (2016) examined early stage trust beliefs about the effects on perceptions of information and quality, later stage trust and usage intentions in the context of e-health services. In a later study, Mou and Cohen (2017) examined early stage trust beliefs about the effects on perceptions of information and quality, later stage trust and usage intentions in the context of e-health services. They pointed out that trust in online sources influences the trust in the e-service provider at both early and later stages. On one hand, the perceptions of system and information quality depend on trust; on the other hand, trust and satisfaction are important to continued usage intentions. Persaud and Bonham (2018) discussed the role of healthcare providers in building patient confidence in precision medicine programs. The article was mainly concerned with the medical and biomedical field and did not point out significant conclusions that would be relevant to our research.

Since one of the main causes of citizens' mistrust is the lack of data security and therefore the data security options in the e-health services sector (Small and Wainwright, 2017, Soceanu et al., 2015). Sawand et al. (2015) even describe solutions for the credibility of health monitoring systems, which are also energy-efficient, a trend in today's environmental practice. They describe concepts such as wireless body area networks, mobile crowd sensing, etc., as the latest trends in modern healthcare. As we have already mentioned, there are different approaches and reasons for creating e-services for governments and the public administration. One of the approaches is G2C - government to customer, another G2B - government to business, but in a contribution from Pandey and Gupta (2016) there is a project focused on government to government projects (G2G). They researched the implementation of a statewide Digital Secretariat Project in India. Their results reveal the importance of power dynamics, to identify dominant stakeholder departments and take them into confidence from the beginning of the project and that without extensive government support can projects lead to failure of implementation and waste of public resources, which will lead to losing trust of citizens in such e-services.

3. Implications for future research in Slovakia

It is clear from our own literature research as well as from other authors that the biggest boom of studies has been in the last five years. The influence of the selected factors on the trust was demonstrated and the impact of the trust on the success of the implementation and acceptance of e-services was demonstrated. Critical factors can be grouped into three larger groups, namely individual, service and government factors. Table 1 focus on dividing the literature findings into factor, which most influenced the trust, identified risks of reducing the trust and potential options for improving the trust in e-government. Each factor characterizes the entity that is participating in the implementation. Since the impact of education has been shown to be confidential in such e-services, it is important to focus on building trust in lower-education groups and to support these groups through a variety of educational projects to raise awareness of the importance of these e-services. It is also essential that these services are user-friendly and acceptable.

Table 1: Identified factor, risks and potential for improving the trust in e-government

Factors	Risks	Potentials
Trust, usefulness, satisfaction, Security and responsibility of providers Educational level Quality of services and individual service	Poor security Lack of robust evidence Lack of data security Information quality and channel characteristics	Promotional campaign Communication tool websites ICT and e-identity Self-development of citizens Importance of power dynamics

One of the main factors of trust in the electronic service was the identification of personal data, with the suspicion of untrustworthy security certificates in Slovakia. Such situations cannot occur because they can irretrievably damage the image of these services. There are many problems in the Slovak e-service implementation (e-health domain) and the system that is running has several weaknesses, especially the lack of hardware support. If we look at the studies that are being applied by the very low energy equipment, it can be argued that implementation in Slovakia is significantly lagging behind and the citizens' health data is one of the most vulnerable

4. Acknowledgement

This article was supported by the project VEGA n. 1/0839/17 Electronic services of building trust in public administration.

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TOPIC G: CYBER SECURITY

UBIQUITOUS SECURITY NEEDS UBIQUITOUS EVIDENCE

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Keywords

Cyber security, evidence, forensics

Abstract

Security is typically only as good as it is enforced: if a security vulnerability exists and is published, it is probably not going to be closed unless there is some drawback for the one responsible if not done. Similarly, many crimes will continue to go on if they are forbidden, but the perpetrators cannot be identified or, if found, are not prosecuted. In the IT area this means that some traces of actions are needed: no evidence means no identification of the culprit (the one responsible for the security hole or the one exploiting it) and no consequences. Therefore, systems should be designed with creating (or at least not actively destroying) evidence in mind. This will typically take the form of logging some details of what is going on within the system and at its borders. This paper discusses, which data should be logged and how. These principles are then applied to a practical example from a research project, securing the existence and immutability of electronic evidence in a system for defusing bombs via a mobile robot.

1. Introduction

The Internet of Things (IoT) may be helpful, as intelligent devices can provide very useful services, e.g. in home automation. See for example the widespread adoption of digital assistants like Alexa/Echo, Siri/HomePod and Cortana. But similarly there often exist problems with them: Not reacting, incorrect results, security issues etc (Symantec). While in such devices this is typically just an inconvenience, for other systems this might be much more dangerous. Imagine e.g. the smart door lock opening for thieves - or not opening for an elderly person in winter. How would something like this be proven? Local logs typically don't exist (every command is sent to the cloud, where it is interpreted and matching instructions are sent back). This also explains why such devices are cheap: little local storage and functions that are just not implemented. Note, that they might very well keep some data, e.g. for profiling, but not documented, not as evidence and not accessible to the end-user. Any evidence of incorrect behaviour, if it exists at all, both by the user or by the producer/service provider is therefore located solely in the control of the manufacturer, who is obviously least interested in providing evidence for his own mistakes and has little incentive to provide anything for other reasons and unless ordered to do so by a court (which presupposes that the court would know/suspect that it exists in the first place!). Fernandes/Jung/Prakash (2016) described examples of such attacks.

So while security is necessary and expected of computers today, liability (in a non-legal sense) is often ignored and actively subverted, by ensuring no traces exist. While this might be an active

strategy, there are also some solid and valid reasons for this: privacy laws render storing (potentially) personal data much more difficult, logs need space and might have to be stored securely to be of legal use, and local traces would increase the price of a device (and its energy consumption - important for mobile devices) while not improving its functionality - which can be advertised. At the same time the police complain about “going dark” - everyone using encrypted communication, and reading SMS exchanges is no longer possible as these are now done end-to-end encrypted via secure messengers. It therefore seems necessary to ensure that modern devices do not only work, and perform this work safely and securely, but that at the same time an appropriate amount of evidence is generated. If this is stored locally and criminals can destroy it, then little difference exists to non-IT crime (blood can be washed away, but similarly as on computers traces may still remain!). While it is not necessarily a very happy point of view, in many cases only actual and successful prosecution causes people to follow the laws. Requiring the existence of evidence has already been implemented in at least one area: privacy. Art 30 para 1 lit d GDPR requires that a list of recipients of data transfers is created, so later verification is possible. If it is possible there, it is not completely unreasonable to impose similar requirements on other data or systems.

2. How/where to store such evidence?

Generating useful evidence while preserving the rights and the privacy of owners, users etc is not trivial. Therefore, this was separated into several tasks: What to generate, how to store it, where to keep it and for how long it should remain. It should be noted that such evidence is intended to provide some hints and possibilities for investigation. It is not intended to be absolute proof of any and all crimes or misdemeanours. Rather it should be compared to the private browsing mode of web browsers: these are intended to protect the privacy of users, but they were (widely known and especially problematic in case of Internet Explorer; Mueller 2013a, Mueller 2013b) not designed to render serious investigations useless. Data might not be accessible through the user interface and deleted when closing the browser, but always some traces on the disk will remain for a short (and rarely longer) time. Similarly log files as evidence might be deleted by the user intentionally or accidentally, but this might require additional effort (easy to forget), require special knowledge etc. This could render it more acceptable to system designers as well, as they do not have to produce/guarantee a perfect solution, only some reasonable success.

2.1. What to store

Conceptually this decision is easy: everything that is relevant and nothing else. But this is not very helpful, so some criteria were developed to help the decisions:

- Individualizing data: Is it necessary to attribute actions to individual persons or is it enough that “something specific occurred”? It must be taken into account whether the identity of the person can be ascertained with reasonable certainty at all. This is obviously also a privacy issue and should be avoided in general, as a lots of legal and technical (security precautions!) consequences are tied to it. If the “interface” of the system is the real world, other traces typically exist too (fingerprints, witnesses, location & the persons present there etc), so this is of less importance. For system only contacted electronically this is a higher priority (e.g. storing the IP address), else the only trace is (potentially) located on the other side of the communication link - but which often cannot be determined from this side. The main decision here is whether to store identifying information, pseudonymous data (e.g. hashed identifiers), or nothing at all (=anonymous users). Also, it is necessary to think about the potential targets of the evidence: if it is the user or owner, then they are likely to destroy the device/data or

merely reconfigure it to not keep logs, which often cannot be prevented. It is therefore more sensible to gather evidence to be potentially used against third parties.

- **External input:** The specific inputs used for determining the actions (e.g. a fingerprint image) should only be stored for very important decisions, as this often leads to a huge amount of data and could also pose a security issue (like logging the password entered). Theoretically the whole interface to the real world should be logged, but in contrast to the actions/results the input data is often much larger. Consider cars: whether/when the brake was engaged (=output) is a small data element, but the inputs for this (complete radar/lidar/video data) are much too large to store in entirety. The input might be observed anyway or can be reconstructed from other traces, so this is typically not an issue for secrecy. If the target is not only evidence but should also help in finding bugs, logging input is more important. The main decision is here therefore less whether but how much/which data to store.
- **External output:** These are high-level actions that were initiated in the outside world and had some impact. For the door lock example this would result in “door was unlocked” or “unlock request denied”. These activities can be observed and produce some external results. It is important that it can be verified whether outside observations are correct and the system reacted - or did not act at all but only seemed to have done so. Note that the “outside” world is not necessarily the real world but could also be another computer system (like commanding a different appliance to perform an action in home automation). The reason for this is that human observers often err, forget, or merely none were present. It also helps to distinguish mechanical malfunctions from computational problems. But as the system (and their implementer) always has to take the possibility of observation into account, this is a lesser burden and easier acceptable.
- **Internal decisions/intermediate results:** While internal decisions and the way to arrive at some output can be stored, this can often be deduced from input, output, and software. If important parts are not available (see above), intermediate internal decisions should be logged. As this might give away the internal working of the software, this is not very desirable for the system developer. While they might have to explain their system in court anyway, logs can be accessible in many other circumstances too and excluding the public is often impossible. Regarding what decisions to log the previous explanations can be of help: interfaces between significant part or modules can be of interest, while the detailed inner workings are less useful.

2.2. Method/circumstances of storing

Encrypted storage improves security but should only be considered with devices where theft is an issue (e.g. mobile devices). The reason is, that for symmetric encryption the key would have to be present locally, so unless it is in a secure physical module (e.g. TPM) theft would probably grant access to it. Asymmetric encryption on the other hand requires to store the private key in a separate location, which is complicated and should not be the provider/producer. Additionally, encryption always risks losing the key and then losing the logs and it gives the holder of the key power over the evidence; to reveal it at his/her discretion.

As it is not always easy or possible to predict the content of the logs, the same security measures as for input, output, or intermediate data should be taken, depending on what is logged (obviously implementing the maximum requirements). This includes possible attacks on the evidence storing system itself: filling the log up can be countered by limiting the data/amount stored (with the risk of losing parts of the evidence). Log evasion can only be countered by careful selection and cleaning of the input to store. This applies to output data as well, not only because the system might be faulty, but also because dangerous input might be mirrored to the output or because insiders can be attackers too.

That the log might contain attacks against someone inspecting it can be ignored here: as in contrast to normal log files these are for evidentiary use, typically no “normal” use/viewing/inspection takes place - and experts will take appropriate precautions. But should logs be made with multiple purposes in mind (as probably in most applications), this must be taken into consideration too.

Because the logs are intended as evidence, their integrity is of more importance than normally. Electronic signatures might be considered, but these face the same problem as asymmetric encryption: storing the key. However, “losing” the key does not render the evidence useless like in encryption, it merely strips it of an additional security layer, so this is more useful. A better solution are third-party timestamps. These do not reveal any of the content or require a lot of traffic and give very good guarantees for integrity, while simultaneously preventing falsification by the controller of the system. As empty logs can be trivially timestamped, deleting them leaves suspicious holes (and logs can e.g. be chained, the new log containing the timestamp of the previous one).

2.3. Location of storage

As any evidence kept is pertaining to the user of the system, it should be stored “locally”. For normal devices this means to store them physically inside the device, for cloud services (IAAS, PAAS) in the VMs providing the functionality. A similar consideration applies to SAAS or multi-user systems, where the data should be stored separately for each user (“local” to their other data). If the device requires a cloud service to fulfil its function, at least some parts should be stored locally. Evidence in the cloud is problematic from a legal point of view, and also under the control of the service provider - against whom it might be useful. Note however, that e.g. the destruction of the device then simultaneously destroys any evidence, which would much less likely occur with cloud storage. An important consideration is therefore against whom the logs might be used. Cloud storage is an option, if it is a third-party store. Then encryption is a necessity, and further precautions might be required too (sending only aggregated packages of logs to prevent gathering information via timing, using proxies etc).

2.4. Deletion of evidence

Keeping evidence indefinitely is neither necessary nor desirable, as it will take up a lot of space. If it contains personal data, privacy laws require deletion after some time elapsed too. As a general rule, legal requirements are to be followed. As they rarely prescribe collecting evidence in advance, this mostly refers to the ability to “freeze” existing one: if it is deemed likely or necessary to use it, any automatic deletion must be stopped and the data present at the moment retained. Apart from this, logs should be kept for that length of time, during which it can reasonably be expected that any problem is detected plus a reasonable reaction time (for exporting, freezing...). This depends on the concrete application. An additional limit is when the logged information becomes useless. E.g. when storing IP addresses, in Austria after three month it can generally be assumed that ISPs no longer keep the assignment records, so identifying the person behind the IP address becomes impossible. If this is the reason for the logs, they can and should be deleted then. A very simple strategy, especially for small devices with limited resources, is to set aside a specified amount of storage for logs, and when it is filled up, start overwriting/deleting the oldest entries (=persistent ringbuffer).

3. Example: Mobile robot for defusing bombs

The DURCHBLICK project (see Sonntag/Hofstätter 2018 for an overview) is concerned with integrating more and modern sensors on a mobile robot for defusing bombs. Obviously, evidence is

in such applications of vital interest. Not only if there actually is a bomb, but also if there is not. Reasons for this are:

- If there is a bomb and it can be defused (or is a decoy/dummy), then evidence might be needed for identifying and prosecuting the attacker. As the bomb practically always will have been “handled” in some way for defusing, claims of “tampering with the evidence” will be possible. Logs of the actions performed can then prove, that these did not in fact negatively influence the specific evidence.
- If there is a bomb and it cannot be defused successfully, copies of videos, data measured etc might be the most important evidence remaining, as much of the rest was destroyed.
- Should there be no bomb, evidence might be needed to justify the actions of the personnel - like destroying the suspicious object or cutting it open.
- In any event the activities performed (and the objects investigated) are very important for further learning: How/where are bombs used, respectively how a suspicious item should be approached and handled. In practice this seems to be the most common (and important) case where “evidence” is needed. Obviously not the best quality is needed, i.e. reliability should exist, but need not be proven beyond reasonable doubt (as e.g. in criminal proceedings).

It was identified that evidence is not necessarily desired by the persons performing the investigation: they might later be asked to explain why they did certain things, criticized for being too slow/fast, rash/cautious, performing dangerous or incorrect actions (with these actually being true or just looking alike, especially to laypersons) etc. Additionally, there exists the danger of this evidence being misused: media might really like such material for its sensational appeal or to further some agenda, while the exact method of investigation (including the limitations of the sensors & robot) are obviously of significant interest to all (future) attackers.

Within this project we were tasked with designing and implementing a system to collect and preserve digital evidence (no fingerprints etc, solely signals from sensors and/or commands, videos...).

3.1. Forensic server

For collecting evidence a separate server was implemented. This computer also performs infrastructure tasks, like DHCP or syslog server; these also produce evidence. After an investigation of potential attackers, their motivations and resources, and practicability checks, the system was designed as follows: for easier portability, security, and updates, each service is separated from the others and implemented as a docker container. All the data is stored in a separate directory, which is actually a mounted volume (see below).

A syslog server is used to log all messages from the individual containers. If any other system would wish to log data, e.g. those combining sensor data or issuing commands, this is possible as well. However, at the moment no other sources are envisaged. Anyway, this would allow a unified log of events with a single time source, therefore allowing trivial correlation of entries.

The DHCP server provides IP addresses to the sensors on the mobile robot (all of which either natively support IP connectivity or are immediately converted to such). This enables generating and maintaining an inventory of all connected devices. This is no guarantee as statically configured devices could still be added undetected, but at least all “official” ones are logged when they are powered on. For sensors it is therefore possible to log their first use as evidence of them being employed - malfunctioning of the system (no queries) or the sensor (no responses) can be detected in combination with the heartbeat system (see below).

An NTP server provides time information to all devices. This is important, as for forensic purposes it is much less important that the computer time matches the actual time (this is typically comparatively easy to verify - filming a watch or as trivial as someone noting down on paper when the deployment started), than that all devices (and their logs files etc) share the same time. It must be noted that this time is not very accurate, as it is based on the local real-time clock of the forensics server. For security reasons the whole system is disconnected from the Internet, so online synchronization is impossible. If a better clock is desired, then with small investment an external radio-controlled clock could be added.

A dedicated container logs all traffic going to respectively coming from the mobile platform. This is facilitated by a monitoring port on the switch, which copies all traffic to a separate network interface, on which a logging process is listening. This takes place after decryption, so the secured communication link is not affected. However, this will not be useful if the transmission itself is encrypted. As sensors are typically very “lightweight”, this should not be a big problem. And even if the actual content is encrypted, as these are sensors with very regular data transmission, the timing (delay, absence etc) as well as the size allows some limited conclusions. While forensic analysis of a network trace is a lot of work, this provides the full raw data and enables to reconstruct activities by replaying the content with identical timing.

It must be noted, that while the network traffic alone allows to reconstruct lots of information, this is raw data only. As an important part of the project is to aggregate data from multiple sensors and create better representations like a 3D image from the point-cloud of a laser scanner (sensor data fusion), such results are not represented in network traffic. To include these a further container was created providing a file share via Samba. Results derived from sensor data can be stored there and are kept read-only. This was implemented through waiting for a file to be closed, and then immediately moving it to another directory where no external access is possible. This could lead to problems in the following cases:

- a) An application can open a file and write to it, but unless the file is closed, the file pointer can be set back and content previously written can be changed. To prevent such “attacks”, the file server itself would have to be modified significantly. Additionally, this could easily lead to compatibility issues, as many applications manipulate the file pointer when writing files (e.g. to insert checksums or file length at the start after completing writing the data).
- b) Applications might write a single file in multiple phases, with closing it in between. This seems unlikely but cannot be ruled out. Such applications would fail, as the file “vanishes” after writing the first part. Note that this should not be a problem regarding applications merely appending to files, as these will then merely produce a new file for each “addendum”.

The second case shows a potential difficulty: file name collisions. To reduce this problem, which is significantly more prominent in this scenario (as an application cannot really check whether a file already exists, as they are removed from its view!), files are renamed by prepending the date and time of closing them during their move to the inaccessible directory. Checking them into a versioning system was considered but determined to be too much effort and not bringing a lot of advantages - the time the file was created as well as closed is already available, and multi-user capabilities are not needed. Moreover, the content is typically not files that are evolving over time, but completely unrelated files with accidentally identical names.

In contrast to copying the network traffic, this approach has a second more hidden limitation: it does not obtain evidence automatically, but merely stores such when presented with it. Therefore, it requires the cooperation of other programs to provide the derived data and save it in this share. This is a limitation which cannot reasonably be circumvented, but as the project performs most of the sensor data fusion itself, should not pose a problem.

The last currently implemented container is a heartbeat system to check, whether all systems can still be reached, and potentially identify any third-party devices. This allows later to prove that the sensors could indeed be reached, but did not provide an answer (or that the connection itself was broken). Simultaneously it provides an inventory of the current equipment in use on the mobile platform. This system draws on the reservations via DHCP as well as IP addresses specified statically (e.g. the encryption gateways, as these are configured with static IP addresses), but also performs broadcast pings and reads all entries from the ARP cache. Known systems are pinged very minute, the other checks are performed every 5 minutes only to reduce the network load.

Not implemented (yet) is an Intrusion Detection System (IDS). For security reasons, the whole system is not connected to the Internet. Because of this, attacks are only possible by injecting/modifying data into/within transmissions (potentially feasible if wireless communication is used; otherwise physical manipulation necessary) or attaching additional devices. Simple devices (with IP address and performing active attacks from the base station towards the robot or vice versa) will show up through the Heartbeat and the network monitoring subsystems. Passive attacks, merely listening in on data transmissions, or purely local attacks (within the robot or between systems of the base station) cannot be identified through them. Against passive attacks an IDS is powerless. As exfiltration of data obtained is impossible via the Internet because of lacking any such connection, it can only take place either manually (e.g. pocketing a memory stick) or via a secondary data connection, e.g. an additional wireless link. For these an IDS is again useless. So the only case where an IDS makes sense are local active attacks within the base station, as the network transmission copies only traffic between mobile platform and base station, and for detecting attacks between robot and base station. As sources the IDS then needs all local traffic (would require an additional monitoring port), or local agents on all systems of the base station. Therefore, it was decided that an IDS would only be of limited added value, as there are few and unlikely attacks it would be able to detect.

3.2. Assessment according to the criteria defined above

According to the criteria defined above, this specific application can be assessed as follows.

3.2.1. What to store

- Individualizing data: All network data is stored pseudonymous in the sense, that only IP addresses are logged. However, which sensor and which user station is behind which address is also available through the DHCP information (and for sensors might be apparent from the transmission content). The identities of the operators are not directly stored but may be added as general metadata when creating a new “project”. This is not a priority, as technically the identity is unimportant, and based on external information (e.g. duty roster) it is trivial later to ascertain who participated in a specific mission if necessary.
- External input: All input from sensors is stored completely. Because of technical (access to the communication link) and legal issues (contract with manufacturer of the mobile platform), the input from the robot itself (video cameras) and the commands to it from the operators are not stored. However, the commands could be added easily if access to their communication channel would be granted. Regarding the videos complete storage is unrealistic, as multiple cameras producing a live feed would require a very powerful system for archiving all of them in their entirety. As a compromise, e.g. regular still images (like every few seconds) could serve. Recording only “important” parts is not possible automatically (how to detect) and organizationally (manually starting/stopping this) would place an additional burden on the operators.

- External output: All commands to the sensors are logged identically as their input. For directing the robot see above. No system-external output exists, as no connection to the Internet is provided. But what must be considered is the “display” for the operators. This is especially important as the output is not necessarily deterministic or reproducible. I.e. even if the whole input is available, calculating the output again is not a guarantee for identical results. As this output cannot be directly accessed for copying, it was decided that the system generating them will decide when/which parts to store in the forensic system. For this the file storage part was developed.
- Internal decisions/intermediate results: The same considerations as to the external output applies to the intermediate results above: a possibility for storing it exists, but in this application no need for this is envisaged. No significant decisions are performed automatically as the system is restricted to “merely” aggregate/produce helpful output from multiple sensors.

3.2.2. Method/circumstances of storing

As the data contained is of a very sensitive nature and might e.g. be helpful to bomb builders (capabilities of sensors, operational procedures for defusing etc), a high security level is necessary. During the mission the system is not connected to any outside system and (hopefully) no unauthorized persons have physical access. Therefore, no special Internet-related security precautions are needed. For afterwards however, strict access control is a must. So all the data is stored within an encrypted container. Because no “normal” use exists, no cleaning or inspection of the stored content is made. When creating extracts, e.g. for criminal investigations or to extract teaching material for the education of operators, care must be taken. File should e.g. be scanned for malware and data extracted from the network dump should be verified to be harmless. All these are however external to the project.

While technically possible, very great care must be taken when re-enacting a scenario. Even if sensor data and commands are extracted perfectly and completely, feeding them again into real systems (potentially including a robot) should only be performed after careful inspection. Potential problems can arise from intermediate updates (components now work differently), inexact timing, or different initial states.

For security against modifications, the files inside the container are signed at the end. To avoid a long duration, all files are hashed and the result stored into a file, and only this file is then signed. As this is the same method how digital signatures are created (hashing the document to sign and then signing the digest), no additional security issue is added through this (as long as the hash algorithm is secure). Third party timestamps are impossible because of the lack of Internet communication.

3.2.3. Location of storage

As no Internet connection is present and for security reasons all logs are stored locally. While this could be a large amount of data, this is easily accommodated by providing large (or multiple) disks, which is merely a question of the price but does not pose technical difficulties.

3.2.4. Deletion of evidence

As any evidence collected in this application might be necessary for legal actions, no pre-defined deletion period or destruction function was designed. Also, the information might be needed for education or reviews much later. This is therefore explicitly left to determine externally - according to the system the data is later stored on (which is necessary, as the system itself cannot be used for permanent storage). However, a certain “deletion” was implemented to reset the system to its original

state. In this way it ensures that a pristine start for another mission is possible. This also means that all evidence is destroyed, however this is not the aim of the function and merely an implicit consequence. It remains the task of the operators to secure the information by transferring it to another storage before. Not implemented, but a trivial change, would be to store the encrypted container instead of on the internal harddisk, rather on a removable one or a disk connected by USB (performance issues might exist). Then replacing the hard disk would trivially “move” the data.

4. Conclusions

It should be clear that for security reasons some evidence of input, output, and/or decisions should be collected and retained in all kinds of systems. These might also be useful in case of legal proceedings. What, where and how to store, and for how long to retain it, should be decided before implementation. However, unlike security, retaining certain data is much more easily to retrofit. This is on the one hand advantageous as it allows adding it to existing systems easily, on the other hand it renders the decision to postpone it to the next version much easier too. An obvious drawback of retrofitting is, that this will only work forward in time, i.e. it is useless in regard to a specific past occurrence.

5. Acknowledgement

The DURCHBLICK project has been funded by the Austrian security research program KIRAS of the Federal Ministry for Transport, Innovation and Technology (bmvit) (Grant Nr. 854756).

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CYBERSECURITY AND INTERNET OF THINGS

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Keywords

Cybersecurity, Internet of Things, Geoencrypting, Encrypting and decrypting methods,

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. The Internet of Things (IoT) makes the connection between the real world and the virtual world stronger than ever before. The objective of computer security and or IoT 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. IoT has become a ubiquitous term to describe the tens of billions of devices that have sensing or actuation capabilities, and are connected to each other via the Internet. Security has not been a high priority for these devices until now.

1. Introduction and relative works

Internet is growing rapidly in the last decades and continues to develop in terms of dimension and complexity. Nevertheless, the network security threats increase with internet evolution. Because of the recent trend of extending the boundary of the Internet to include a wide variety of non-traditional computing devices, the Internet of Things (IoT) makes the connection between the real world and the virtual world stronger than ever before, Liu et al (2017). However, connecting various stand-alone IoT systems through the Internet brings many challenges, such as scalability, naming, resource constraints, mobility, inter-operability, security and privacy in content of cybersecurity. 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 by which sensitive and valuable information and services are protected 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 (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. A special concern will be dedicated to the security of the (IoT), since it will include every object or device with networking capabilities. Objects can include simple home sensors, medical devices, cars, airplanes, even nuclear reactors, and other things, which can pose risks to human life (IoT), since it will include every object or device with networking capabilities. Objects can include simple home sensors, medical devices, cars, airplanes and even nuclear reactors and other things, which can pose risks to human life. Traditional security mechanisms like Firewalling, Intrusion Detection and Prevention Systems are deployed at the Internet edge. Those mechanisms are used to protect the network from external attacks. Such mechanisms are no longer enough to secure the next generation Internet. The borderless architecture of the IoT raises additional concerns over network access control and software verification. Zhou at al (2018) analyzes the IoT security issues from a new perspective - IoT features. “IoT features” refers to the unique features of IoT devices network and applications, which are different with traditional Internet and computers.

The World of IoT includes a huge variety of devices that include smart phones, personal computers, PDAs, laptops, tablets, and other hand-held embedded devices. The IoT devices are based on cost-effective sensors and wireless communication systems to communicate with each other and transfer meaningful information to the centralized system. The information from IoT devices is further processed in the centralized system and delivered to the intended destinations. With the rapid growth of communication and internet technology, our daily routines are more concentrated on a fictional space of virtual world Razzaq (2017). People can work, shop, chat (keep pets and plants in the virtual world provided by the network), whereas humans live in the real world. Therefore, it is very difficult to replace all the human activities with the fully automated living. The IoT has successfully integrated the fictional space and the real world on the same platform. The major targets of IoT are the configuration of a smart environment and self-conscious independent devices such as smart living, smart items, smart health, and smart cities among others Abomhara (2014). Fig. 1 shows the IoT and Fig. 2 shows the general concept of IoT with their capabilities.

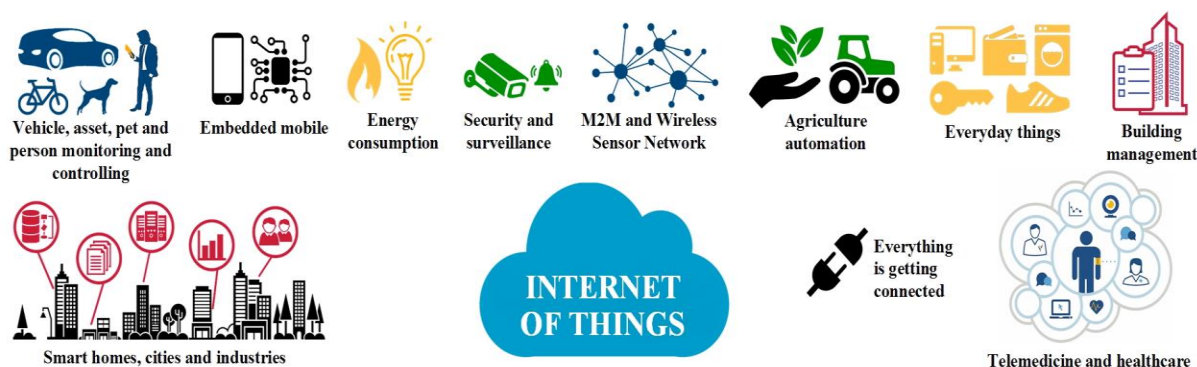


Fig.1 Internet of Things (Source: Oracevic at al (2017))

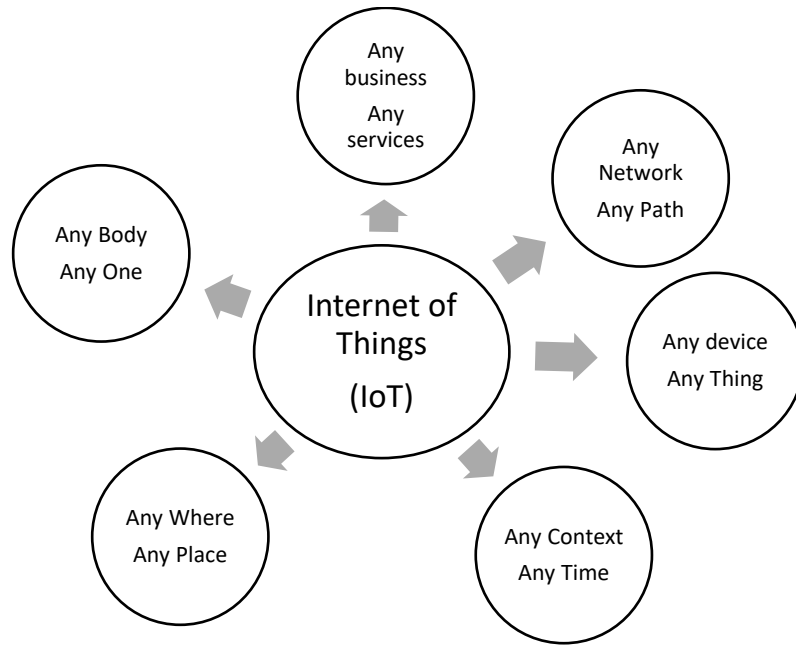


Fig. 2 Definition of IoT (modify according Razzaq (2017))

From technical point of view, IoT encompasses both static and dynamic objects of the physical world (physical things) and the information world (virtual world), which can be identified and integrated into communication networks (See Fig. 3). The essential features of IoT include interconnectivity, things-related services such as privacy protection and semantic consistency, heterogeneity, support of dynamic changes in the state and the number of devices, and enormous scale Oracevic at al (2017).

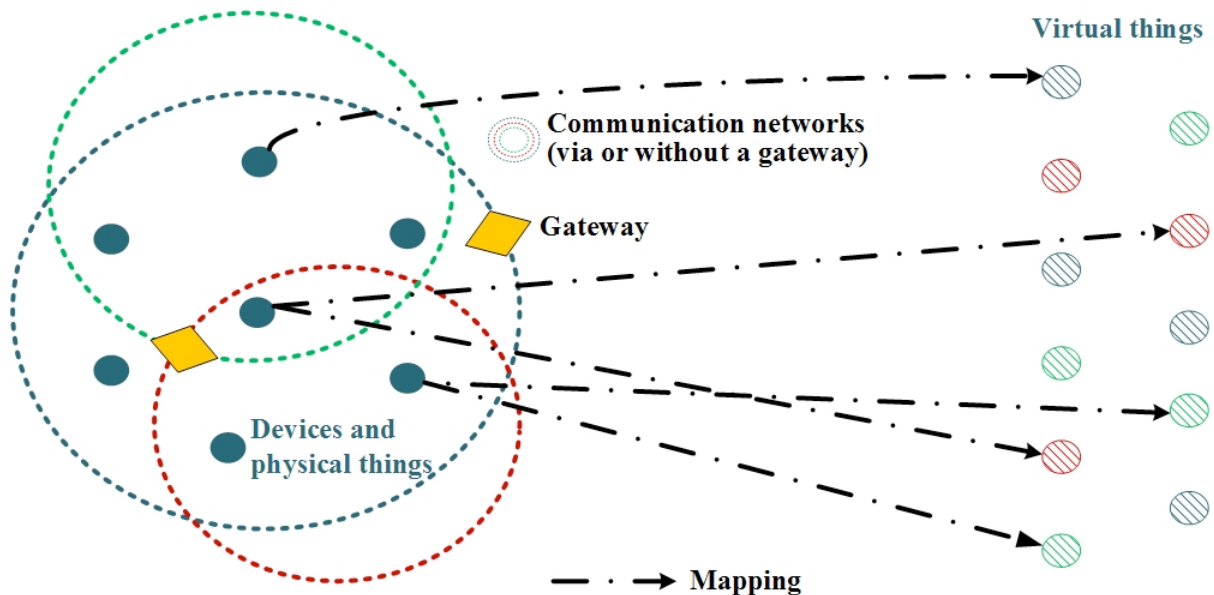


Fig. 3 Technical perspective of the IoT(Source: Oracevic at al (2017))

The paper is organized as follows: on the background of the impact of cybersecurity on the nowadays society and IoT is focused to security of IoT.. Next part is dedicated to security of IoT, then is focused into problems smart houses and finishing with encryption communication based on geocryption ideas.

2. Methodology

According to Xian et al. (2012) the network architecture of IoT consists of the sensing layer, the access layer, the network layer, the middleware layer and application layers. Sensing layer: the main features of this layer are to capture the interest information large-scale by various types of sensors, identify intelligently, and share the captured information in the related units in the network. The access layer: this layer's main function is to transfer information from the sensing layer to the network layer through existing mobile networks, wireless networks, wireless LANs, satellite networks and other infrastructure. Abomhara (2015) argue that network layer: this layer's main function is to integrate the information resources of the network into a large intelligence network with the internet platform, and establish an efficient and reliable infrastructure platform for upper-class service management and large-scale industry applications. The middleware layer: this layer's main function is to management and control network information real-time, as well as providing a good user interface for upper layer application. It includes various business support platform, management platform, information-processing platform, and intelligent computing platform. Application layer: this layer's main function is to build the practical application of various industries, such as smart grids, smart logistics, intelligent transportation, precision agriculture, disaster monitoring and distance medical care. Within this layer is possible use Electronic Product Code for construct a global intelligent network sharing information in real time by establishing a unique identifier for every single article, and then uses wireless communications technology through the Internet platform.

3. Security in the internet of things

From IoT security levels point of view is proposed that IoT security needs to be part of the design at the physical hardware, network, and application levels. According to Ahlmeyer (2016), the IoT device itself needs to be designed using security principles. This covers the sensors that capture data, the data storage mechanism, and the micro-controller or actuator capable of controlling the device behaviour, processing data and establishing a network connection. A key challenge at this level is the fact that IoT devices have important limitations as compared to other computer-based devices – such as limited storage capacity and, if available, processing capacity, lack of battery for passive devices or limitations to “always on” processing for active, battery-powered devices. There is also a variety of IoT device configurations, and as a result, there is large variation in capabilities these IoT devices have for secure operation, Cisco, (2016). The connections between the device and the network need to use secure technologies. The connections can take many forms – directly from the device to the Internet, from the device to a gateway, or peer-to-peer among devices (IBM, 2015). The key challenges for securing the network connections again stem from the device limitations mentioned above, which make it difficult to use the well-established secure network protocols available for traditional computer connections. Therefore, new protocols developed especially for IoT device communication are required Xu et al., (2014). Third, the software applications used to manage the IoT device need to incorporate security features that are appropriate for the device limitations described above but strong enough for ensuring the security of the software.

3.1. Example of IoT smart house

The IoT smart home services are increasing day-by-day Razzaq (2017) digital devices can effectively communicate with each other using Internet Protocol (IP) addresses. All smart home devices are connected to the internet in a smart home environment. As the number of devices increases in the smart home environment, the chances of malicious attacks also increase. If smart home devices are operated independently the chances of malicious attacks also decreases. Presently smart home

devices can be accessed through the internet everywhere at any time. Therefore, it increases the chances of malicious attacks on these devices. A smart home consists of four parts: service platform, smart devices, home gateway, and home network as shown in Fig. 4. In the smart home, many devices are connected and smartly shares information using a home network. Consequently, a home gateway controls the flow of information among smart devices connected to the external network. Service platform uses the services of service provider that deliver different services to the home network. The possible security threats to smart home see Fig. 5. For the communication between smart devices and stakeholders is useful use the encryption way of connections.



Fig. 4 Elements of a smart home in IoTs. (Source: Razzaq (2017))

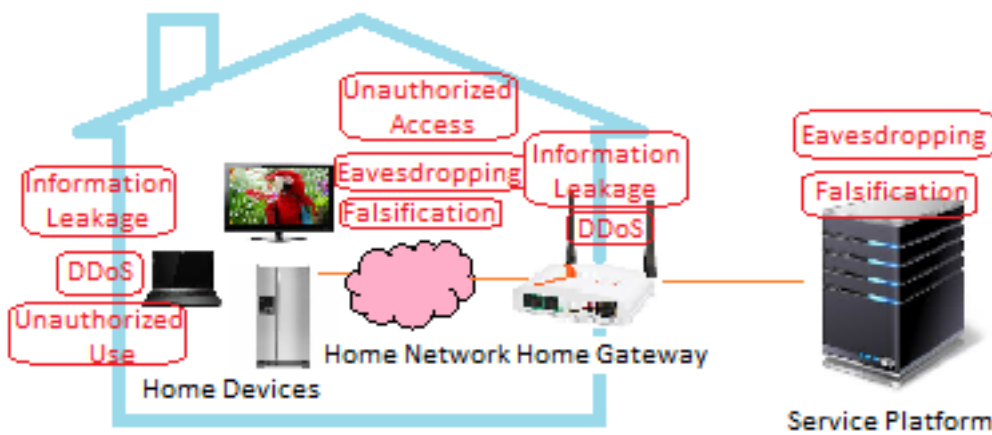


Fig. 5 Threats in smart home in IoTs. (Source: Razzaq (2017))

4. Geomencryption

According to Scott et al (2003) Geomencryption builds on established cryptographic algorithms and protocols in a way that provides an additional layer of security beyond that provided by conventional cryptography. It allows data to be encrypted for a specific place or broad geographic area, and supports constraints in time as well as space. It can be used with both fixed and mobile applications and supports a range of data sharing and distribution policies. It provides full protection against attempts to bypass the location feature. Depending on the implementation, it can also provide strong protection against location spoofing. The term “location-based encryption” is used here to refer to any method of encryption wherein the cipher text can only be decrypted at a specified location. In the case of smart house in this house, only. If an attempt is made to decrypt the data at another

location, the decryption process fails and reveals no information about the plaintext. The device performing the decryption determines its location using some sort of location sensor, for example, a GPS receiver or some other satellite or radio frequency positioning system.

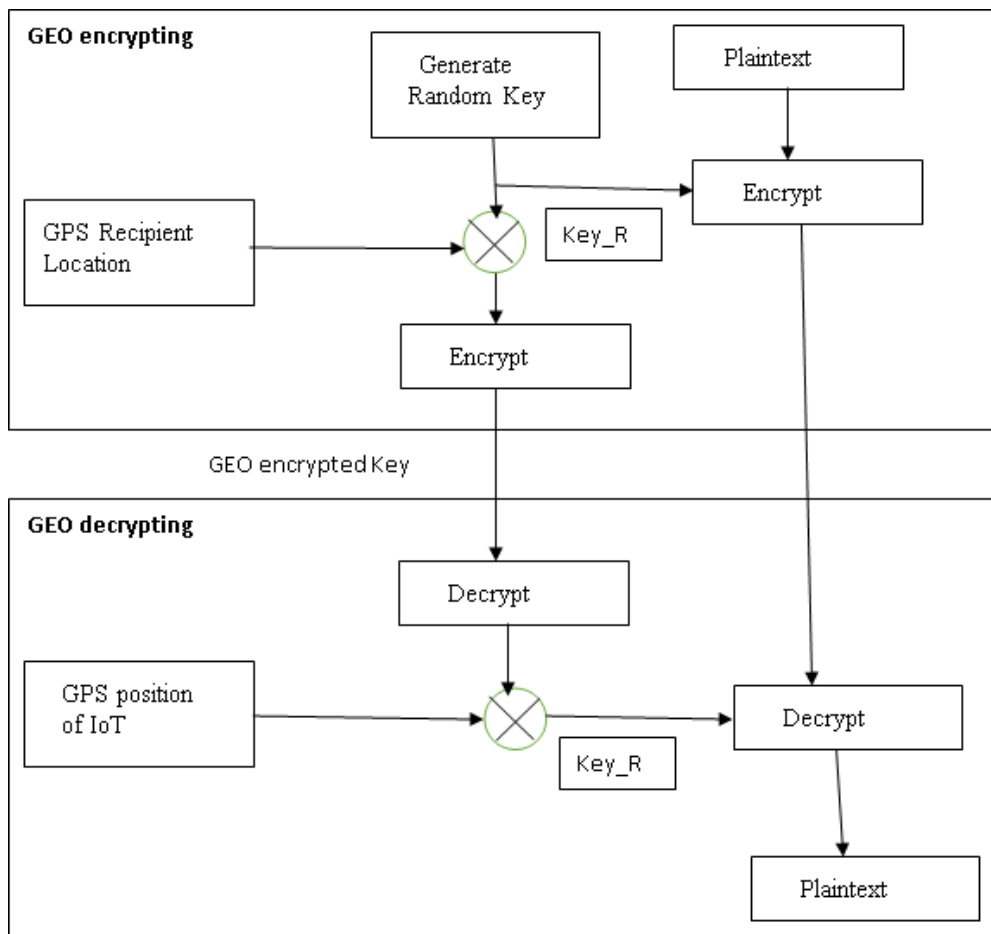


Fig.6 Simplified system of geoencryption (Modified according Scott et al (2003))

The idea of the geoencryption is possible to use in case of communication things in smart house and depressed the possible threads. In case of communication with things, instead geo position is possible, use any suitable password, because the unpredictable key is done by random generation. The deeper details will be discussed and presented.

5. Conclusion

The contribution has aims to describe problems contained cybersecurity from IoT point of view. The Internet of Things (IoT) has become a ubiquitous term to describe the tens of billions of devices that have sensing or actuation capabilities, and are connected to each other via the Internet. The IoT includes everything from wearable fitness bands and smart home appliances to factory control devices, medical devices and even automobiles. Security has not been a high priority for these devices until now. The objective of computer security and or IoT 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 problems of IoT is shown on example of smart house, when for communication between network home gateway and householders is suggest encrypting with helps idea of geoencryption.

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CYBERSECURITY AUDIT/ASSURANCE

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Keywords

Information security, cybersecurity, cybersecurity controls, assurance core components, assurance layers

Abstract

Massive cybersecurity breaches have become almost commonplace and many of us are not just the readers of the news about these attacks, but we have experienced them on our own. The natural reaction of the society and professional organizations is to develop tools helping organizations to face this problem. The consequence of this situation is that there exist the whole set of different regulations, guidelines, programs, norms, etc. and organizations being aware of the cyber risks are not sure where to start, what regulation to be compliant with, what money invest. The article deals with the different types of cyber security audit/assurance in relation to the different layers of the complex cybersecurity control environment.

1. Introduction

Cyber security is a dynamically developing field of information security. The reasons why this area needs increased attention are according to the [ISACA, 2014, p. 1] basically three: ubiquitous broadband, IT-centric business and society, and social stratification of IT skills. These factors together with the fact, that many business transactions no longer have a non-digital (paper or face-to-face) alternative are changing the traditional centrally controlled and managed IT environment towards an open world in which everyone uses multiple devices and boundaries are blurred between business and private domains. Traditional information security thus must be widened to cover the specifics of cyber security risks. New risks requires new types and combinations of controls and new controls need to be assessed by the help of more complex assurance engagements.

The main research question of the article is: What kinds of IT assurance/audit can help involved stakeholders in cybersecurity assurance? The research methodology is based on DSRM and covers its first three steps: problem identification and motivation (Chapters 2 – 4), definition of the objectives for a solution, design and development (Chapter 5).

2. Information Security and Cybersecurity: What is the Difference?

To understand the specifics of cybersecurity in relation to information security, first you need to define the term cyber risk. Risk is commonly defined by the help of simple formula, where the level of risk is dependent on probability (how frequently something bad is likely to happen) and impact (how much loss is likely to result).

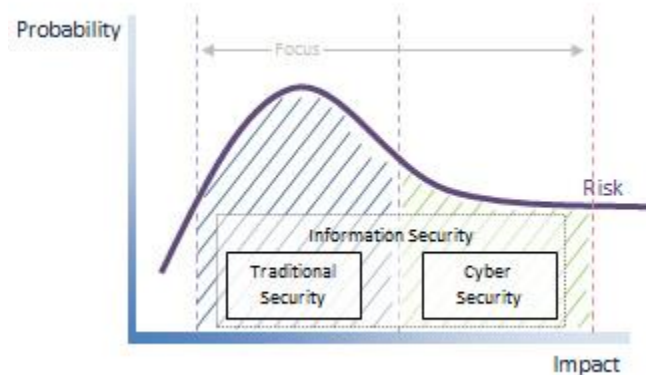


Figure 1: The difference between the traditional information security risk a cybersecurity risk [M. Barzilay, 2013]

Figure shows a graph which outlines the dependence between the probability of occurrence of risk and its potential impact. On the left side of the chart the probability of risk and its impact grow and the organization has been trying to reverse this trend by introducing traditional information security controls. However, having limited resources, it is clear that remain risks that have low probability of occurrence, but in the same time can cause great damage. Traditional approaches to information security management deal with dangers such as malicious codes, standard phishing attacks, DoS attacks, hacker attacks, access to systems, backup and recovery systems, etc. Over time, however, the risks began to change, especially in terms of their combination, integration and utilization of new systems weaknesses. The frequency of these risks appears to be still relatively low, but their effect may be due to the integration of information systems major. It is a risk, such as specially designed malicious code (e.g. ransomware), the use of stolen certificates, exploiting the weaknesses of older computers and operating systems, social engineering penetration into systems using other assets than computers (eg. mobile devices, smart home applications, industrial control systems) etc. These risks represent new category of risks called cyber security risks. Sometimes are abbreviated as APT (Advanced Persistent Threats).

3. Cybersecurity Controls

The described differences between the information security and cyber security have a big impact on the audit universe, as the span of the controls, that should be subject of testing, is extremely wide. Examples of control spheres are

- Corporate controls – represent the internal control system that includes different types of IT controls (governance – management – technical controls, application - general controls, preventive – detective – corrective controls, information security controls, personal data privacy controls).
- Individual controls – the use of private devices and non-standard applications (e.g. BYOD) represent the whole set of hardly identifiable controls.
- Internal IT infrastructure controls – examples of such controls are identity access management controls, backup controls, disaster recovery controls, incident response controls, encryption controls, etc.
- External IT infrastructure controls – controls that are implemented by third-party network owners and operators (cloud providers, internet service providers, public networks, home networks)

- Legal provisions controls – national specific legal provisions may impose or restrict some types of controls (e.g. Czech Act No. 181 On Cyber Security and Change of Related Acts (Act on Cyber Security) and related Regulation No 316/2014 Coll. list the whole set of both the organizational controls (e.g. ISMS, security policy, risk management, asset management, acquisition-development-maintenance, continuity management, auditing of cyber security) and technical controls (e.g. physical security, integrity of communication networks, tools for the authentication of both users' and technical administrators' identity, tool for the protection against malicious code, LOG management, tool for detection of cyber security events).

4. Core Components of Cybersecurity Assurance

Before discussing different types of assurance, it is necessary to state what the basic components of each assurance engagement should be [Cobit5 for Assurance, 2013]:

Three-party relationships means the mutual communication between a responsible/accountable party for the subject matter (auditee), an assurance professional, and an intended user of the assurance report. In case of cybersecurity an accountable party are liable subjects that are responsible/accountable for assets that are to be protected against the cyber threats. Czech Act on Cyber Security focuses on specific categories of the liable public authorities and natural and legal persons in the cyber security field (those operating electronic communication network or administrating important network, critical information infrastructure information system, critical information infrastructure communication system and important information system).

Depending on the circumstances, user of the assurance report could include a variety of stakeholders both external (government agencies, legislators, regulators, creditors, customer and vendor organizations, Internet service providers, cloud service providers, IT services providers, Data Protection Authorities) and internal (shareholders, the board of directors, the audit committee, internal auditors, executives, CCO, CSO, CRO, CIO). For some types of assurance activities, the auditee and the user can be identical, e.g. the role of cybersecurity manager. This situation is typical for self-assessment.

The assurance professional (auditor) of cybersecurity can be either internal or external auditor (third party audit). Czech Regulation No 316/2014 in context of the Act No 181 on Cybersecurity states that administrators of the liable organizations must determine the security role of cyber security auditor (other roles are cyber security manager, cyber security architect and guarantor of assets). The regulation furthermore describes the auditor's competences:

- auditor is responsible for carrying out the cyber-security audits,
- auditor must be trained for that activity and must demonstrate the professional competence of cyber security auditing practices and information security management audits during the timeframe of at least three years or for a period of one year, if he / she successfully completed his / her university education in this or related field of study,
- auditor provides an audit of cyber security independently and the performance of its role is separated from the performance of other security roles.

The next important component is a **subject matter**. Subject matter is naturally cybersecurity but owing to the fact that there is no unified definition of the cyber security and the universe is broad, usually there is a need to apply special methods in order to be able to more precisely identify the subject matter and objectives of the cybersecurity assurance. Examples of such methods are the assessment of the information security maturity, goals cascading based on Cobit 5, risk assessment,

pain point analysis, risk scenario based analysis etc. For more detailed description of methods see [IDIMT,2016].

The **criteria** within each assessment are needed to assure the aspect of objectivity. They represent targets against which the conclusions and recommendations are formulated. Currently there exist a lot of different kinds of cyber security regulations and they are still in development. The consequence is that there is no uniform concept. This situation declare results of the survey about the current state of ICT security certification [Certification, 2017]. The overwhelming majority of the respondents, i.e. 90,9%, indicated that the processes and tools used for security certification should be improved to ensure the required flexibility by allowing different level of assurance. Cybersecurity regulations development takes place in both the United States and within the EU and can essentially be divided into statutory regulation and the various programs, guidelines and recommendations issued by various professional organizations.

Example of statutory regulations is Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union. On the base of this Directive the Czech Act No. 181 On Cyber Security and Change of Related Acts (Act on Cyber Security) was amended. The related Regulation No 316/2014 Coll. on Security Controls, Cyber Security Incidents, Reactive Actions and on the Determination of the Requirements for the Applications in the Field of Cyber Security (Regulation on Cyber Security) is currently in the process of change.

Examples of the professional organization involved in the publishing the documents dealing with the cybersecurity issues are ISACA⁹,ENISA¹⁰ and NIST¹¹ .

Next component of assurance is **execution**. It represents the formal process that the assurance professional should undertake. The general description of the assurance steps (phases, processes, activities) applicable to all types of assurance is available in [ISACA, 2013]. Next category of audit guidelines are those dealing with the information security audits. Examples are ISO/IEC 27007 Guidelines for information security management systems auditing or SSAE 16 (SOC 2)¹² report. But there exist a lot of specific guidelines that take in account specifics of cybersecurity assurance engagements. Example of such a guidelines are ISACA's European Cybersecurity Audit/Assurance Program, Cybercrime Audit/Assurance Program and document published by the Institute of Internal Auditors (GTAG, 2016). The representative of the Czech specific audit recommendation is document called "The Audit Help for Security Measures According to the Cybersecurity Act" [Audit Help, 2017].

The process of assurance ends with the formulation of **conclusions** and recommendations. The most common way of conclusion presentation is audit report. It formally presents the audit results to the auditee (and the audit client if different from the auditee). It provides statements of assurance and, if needed, identification of areas requiring corrective action and related recommendations. It should serve as the basis for a follow-up audit if audit findings were presented and promote audit credibility

⁹ ISACA – is an independent, nonprofit, global association which engages in the development, adoption and use of globally accepted, industry-leading knowledge and practices for information systems

¹⁰ ENISA - The European Union Agency for Network and Information Security is a centre of expertise for cyber security in Europe

¹¹ NIST – US National Institute of Standards and Technology

¹² SSAE 16 - Statement on Standards for Attestation Engagements (SSAE) No. 16, Reporting on Controls at a Service Organization, AICPA; SOC2 Report provides guideline for detailed control of the security of IT systems at service organizations

when well developed and well written. The formal elements of the audit report are well described in (Report, 2015).

5. Types of Cybersecurity Assurance

From theoretical point of view there exist the whole set of different types of assurance. They can be categorized in a number of ways:

- Level of trust: self-assessment, internal, external
- Level of complexity: audit (examination), review, agreed-upon procedures
- System/Management level: governance, business management, IT management
- Time and economy: one time, recurrent, continuous
- Main focus: internal control examination, compliance audit, operational audit
- Way of testing and analyzing subject matter: indirect, direct audit

All above mentioned types of assurance can be adopted within the cybersecurity assurance and to choose the best fitted (effective and efficient) combination depends on many characteristics of particular organization (e.g. maturity level of ISMS, available financial, personal and other resources, need for compliance, own experience with the cyber threats etc.). As stated in [ISACA-Cyb, 2014] “The transformational aspect of cybersecurity is often embedded in overarching management systems operated by the enterprise”. These include the information security management system (ISO/IEC 27001), IT service management (ISO/IEC 20000) or business continuity management system (ISO/IEC 22301 and ISO/IEC 27031). Typical management systems share a common plan-do-check-act (PDCA) cycle for continuously improving their respective capabilities and providing assurance. In practice, it may be convenient for managers and reviewers to align their assurance work to existing management cycles and (re)certifications.

Next Table is an attempt to describe the main types of assurance that can be combined each other. For better understanding they are divided into four layers of checks that differ in their importance with regard to the size of the organization, the resources needed, criticality of the infrastructure, and in the degree of protection against cybersecurity threats:

1. Information security assurance – this is a traditional base for information security management which can be provided using both the self-assessment techniques and the external assurance professionals.
2. Compliance assurance – audit addresses the universe of documents and controls stipulated by these documents. Verifies that documentation covers all cybersecurity requirements and that subsidiary controls cover all provisions made in policies, standards and procedures. These audits can be provided by both the internal and external professionals or by the supervisory entities usually as the recurrent audits.
3. Certification based assurance – are external audits which are provided by the accredited certification body where the criterion is usually ISO norm. The close cooperation with the internal audit is needed.
4. Cybersecurity assurance – represents additional types of assurance against specific cybersecurity threats that are an inherent part of GRC model of management and guarantee the organization of the highest level of protection. The assurance professionals can be both from inside and outside the organization.

	Type of Assurance	Objectives	Comments
Information security assurance	Regular management review	Evaluation of the IT/IS effectiveness and ensuring that all levels of management are made aware of changes, updates, revisions, etc.	Formal, structured meeting which involves top management and takes place at regular intervals throughout the year
	Control self-assessments Audits (CSAs)	Identify and manage areas of risk exposure, as well as highlight potential opportunities	Structured approach to documenting business objectives, risks and controls and having operational management and staff assess the adequacy of controls
	Audit of general controls	Attempts to gain an overall impression of the controls that are present in the environment surrounding the information systems.	Covers overall control environment (organizational and administrative controls), the infrastructure and environmental controls, physical access control
	Audit of application controls	Identifies the potential risks associated with the business activity/ function served by the application	Covers mainly the following areas: the flow and accuracy in processing, validations of various data inputs, logical access control and authorization, exception handling and logging
	Functional/technical testing	Functional testing - testing the application against the business requirements. Technical testing - testing the product stands up to customer expectations	Functional testing is about bring business value to the stakeholders – the validation part Technical testing is verifying the correctness of the software (e.g. load/performance testing, common libraries to the backend and data retention rules, compatibility testing, stress testing, compliance testing)
	Social/behavioral testing	Checks the vulnerability of people to psychological manipulation into performing actions or divulging confidential information	Focuses mainly on mobile devices usage and social networks
Compliance assurance	Cybersecurity audit (Act No.181)	Assessment of the existence and operational effectiveness of the organizational and technical controls listed in the legal regulations	Regulatory review or internal audit Can be based on (Audit Help, 2017)
	Personal data protection audit (GDPR)	Identification of s the gaps in GDPR compliance, recommendations how to solve the missing requirements and what preventive processes to set up	Can be organized as external, internal audit, self-assessment or regulatory review
Certification assurance	ISMS audit (ISO/IEC 27001)	To assure stakeholders that Information Security Management System (ISMS) is implemented and improved	Registered Certification Body must provide a standardized audit, process improvement recommendations, and certification.
	ITSM audit (ISO/IEC 20000)	To assure stakeholders that IT services management system (ITSM) is implemented and improved	Registered Certification Body must provide a standardized audit, process improvement recommendations, and certification.
	Business continuity audit (ISO/IEC 22301)	To assure stakeholders that business Continuity Management System (BCMS) is implemented and improved	Registered Certification Body must provide a standardized audit, process improvement recommendations, and certification.

	SSAE 16 (SOC2)	Detailed control of the security of all IT systems components (infrastructure, software, procedures, people, data)	Detail report to IT services users, auditors and other stakeholders Provides opinion on fairness of description, suitability of design and operating effectiveness of controls
Cybersecurity assurance	Risk management audit	Confirm the reliability of the risk identification process.	This audit will usually span several years
	Risk register review	Assessment of the risk register update, treatment and risk reporting in cybersecurity	One time audit that should address risk register accuracy, completeness and proper updating.
	Cyber security policy review	Assess the cybersecurity policy and related technical key operating procedures (KOPs)	The audit will address the business function/local design and implementation of KOPs
	Attacks and breaches penetration testing	Analysis of functions of a computer system and networks with the objective of finding out weak spots	Can be provides as “black-box” testing or “White-box testing)
	Audit of security incidents recognition and reaction	Confirm monitoring and specific technical attack recognition solutions.	This is an in-depth technical audit
	Audit of cybersecurity transformation	Verification of the existence and completeness of the transformation process	This audit will transpire over several years
	Investigation/forensics	Special category of review focuses on The analysis of the existing or ongoing attacks and incidents	As a precursor, there must be predication or an indication of significant security issues

Table 1: Types of cybersecurity assurance (source autor)

6. Conclusion

The wide span of cyber security controls and types of assurance negatively influences the specification and meeting the assurance objectives. In relation to corporate vs. individual controls audit limitations are imposed due to the fact that private data and private activity are usually legally privileged (unless users have opted into disclosure and auditability). Furthermore while organizational networks are completely within the enterprise sphere of control, and end users can be audited only when working within the enterprise both home and public networks may be audited only by analyzing data and information flow (including attack and breach data) between these networks and enterprise networks. One way how to solve this problem is to include end users working from home under the extended audit rights and in the same time to extent the audit universe by reliance on the work of others. While strict rules apply in practice, there are various security-related standards that may deliver partial assurance over otherwise restricted areas of the IT environment. Cybersecurity auditors should identify and categorize audit areas where reliance on the work of others makes sense. Therefore one of the main problem of cybersecurity assurance is the fact that it must be indirect (around the system) in many instances and the “point of time” assurance engagements must be accompanied by the recurrent or continuous auditing.

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THE CORE OF ENTERPRISE ARCHITECTURE AS A MANAGEMENT TOOL: GDPR IMPLEMENTATION CASE STUDY

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Keywords

Enterprise architecture, GDPR, management, implementation, case study

Abstract

Enterprise architecture (EA) frameworks published in the IT area such as TOGAF are usually very extensive, and that is why their use is considered mainly by larger enterprises as they have both resources and ability to apply them. Because EA captures the essentials of the business, it should provide the knowledge about structure of enterprises (their elements and relationships) which are valuable information for enterprises when making changes in their business operations. If the enterprise is perceived as a system, we can easily follow the relationships between elements that are relevant to the solved problematic area. That is why it would be a shame not to use EA frameworks also in small or medium-sized enterprises (SMEs) when such information is needed there. Nevertheless, due to limited resources of SMEs, the usage of EA framework should be as simple as possible in such enterprises. The paper aims to show on GDPR implementation case study that the application of the basic EA artifacts can bring benefits for making changes in business operations also in SMEs.

1. General

Business environment is characterized by uncertainty, unpredictability with a lot of changes at present. It is still important for companies to be flexible and reactive (or better proactive, but this paper deals especially with the ability to react) behavior. The ability to adapt to changes in the environment is encapsulated especially in structures, people, and processes within a company. The knowledge of company's functioning is a knowledge of running processes, operated systems, used technologies and other elements in the organization. Moreover, in the context of these elements as they form the internal mechanisms of the company.

This knowledge helps to implement changes if needed. In this paper, we would like to demonstrate benefits of enterprise architecture (EA) for SMEs (small and medium-sized enterprises). More precisely, the application of the basic artefacts of the architecture can bring benefits to make changes in business operations. The application of enterprise architecture principles is difficult to implement, especially for small enterprises. However, to capture the basic structure, i.e. the components and their relationships, it is possible to use simple tools such as matrices and catalogs without advanced knowledge of the enterprise architecture or special software support. We will illustrate such situation

in a case study on the implementation of General Data Protection Regulation (GDPR) principles. TOGAF framework will be used as an EA approach.

2. EA as a management tool

TOGAF is well known architectural framework. ISO/IEC 42010:2007 defines the term architecture as follows: "The fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution." TOGAF (Open Group, 2018a) is one approach to implement the principles of EA in practice. Other recognized frameworks include the Zachman (Zachman International, 2018) or FEA framework (OMB, 2007). The Open Group developed TOGAF architectural framework as an approach to design EA that includes principles and building blocks, methods for description, guidelines and tools. TOGAF defines two meanings of architecture: 1) A formal description of a system, or a detailed plan of the system at component level to guide its implementation; 2) The structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time (Open Group, 2018b, Chapter 2). Architecture can serve as an important source of information about the internal structure of the company. It is a different view than process, organizational, functional, and other approaches provide.

Lankhorst (2009) stated that the architecture captures the essentials of the business, IT and its evolution. Important feature of the architecture is a holistic view of the organization. Together with the fact that architecture provides the knowledge of internal components and their relationships, architecture is an important factor that can influence the ability to apply changes and innovations within the context of existing processes and structures (the position illustrated in figure 3). In short, thanks to a well-defined architecture, we do not see the organization as a black box. Nevertheless, there is the problem of how to apply the EA. Especially in the segment of SMEs (definition in EU, 2018) with its specific features that limit the application of comprehensive and extensive frameworks. There are studies discussing specifics of SMEs in adopting IT e.g. (Antlova, 2009; Arendt, 2008; Wymer, and Regan, 2005). According to these studies, it is difficult mainly for organizations from micro and small company categories of SMEs to follow principles recommended in the IT frameworks. The main reasons are in the overall potential of the organization (human, financial, etc.), which does not allow the implementation of complex frameworks. These are unnecessarily large-scale concepts for this segment. As for TOGAF, the critique of this framework can be traced, especially in the area of its practical application and value (Kotusev, 2016). The EA application must be understood as a management tool. The implementation of the frameworks should be understood in the context and uniqueness of each organization. SMEs need simple solution based on easy-to-use tools that allow to realize value (according to Pareto principle, we do not need the ideal solution but a practical one).

EA as simple as possible

EA should provide the knowledge of structure (elements and relationships). TOGAF widely discusses the internal structure of an organization. In chapter 34, TOGAF introduces the metamodel (the Core Content Metamodel and later Full Metamodel with several extensions). The metamodel shows entities that represent (play a role in) structure of the organization. There is also set of artifacts which are used in a metamodel. With a little simplification, we can use the core entities and artifacts that describe relationships. The figure 1 shows entities used in TOGAF metamodel which are also known to managers (as a representative of non-IT specialist in SMEs). The figure 1 is taken from Rozehnal and Novak (2016). The description of relationships has been added.

Actor is an object that performs activities (e.g. an employee). **Role** is a defined position with responsibilities and authority. **Organizational unit** is a separate unit organizing resources with goals,

objectives and measures. **SW Application** is an encapsulation of application functionality. **HW Technology** is an encapsulation of technology infrastructure. **Information/Data** represents data unit important for business. **Process** is a sequence of activities that transforms inputs into outputs. **Function** expresses the ability to provide functionality according to resources. **Service** provides predefined functionality according to an agreement.

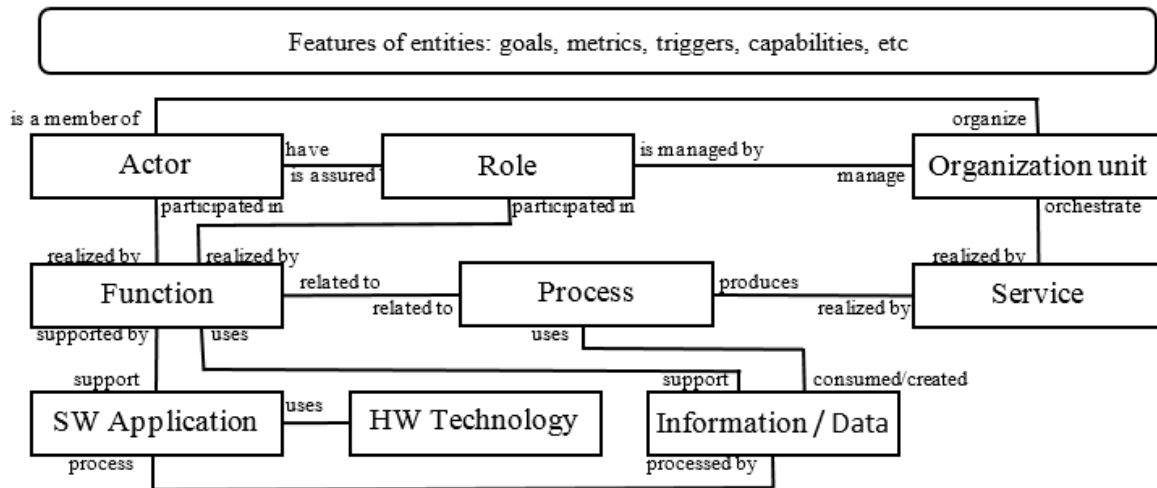


Figure 1 Basic entities and their relationships

TOGAF works with artifacts that can be used for description of relationships. With respect to the target group of people matrices and catalogs may be recommended. Based on entities (figure 1) we need to express the real situation – instances of entities in an organization. The following matrices can be used to express the relationship between two entities:

- SW Application/HW Technology Matrix
- SW Application/Function Matrix
- Role/SW Application Matrix
- Information -Data Entity/Function Matrix
- Actor/Role Matrix
- Actor/Organization unit Matrix
- Process/Function Matrix
- Process/Service Matrix

When we use the above matrices, we have an information about all relationships (relationships are transitive). The process, function and service entities must be treated with greater sensitivity, details in (Rozehnal and Novak, 2017), but for simplification, the relationship can also be expressed with a matrix. Similarly, catalogs can be also used to report instances of individual entities. TOGAF, for example, introduces Role Catalog, Application Portfolio Catalog, or Technology Portfolio Catalog.

By using these simple tools and principles, we have information about the interrelationships between the basic elements that make up the structure of the organization.

3. GDPR is coming

The EU's General Data Protection Regulation (GDPR) changed data protection legislation that will be applied in all EU member states from May 2018. Legal interpretation is beyond the scope of the paper, so we focus on the general application process and impacts on the business environment. For companies and institutions, GDPR means change in data handling to ensure compliance with legal requirements. The main principles can be summarized as follows:

- Transparency and lawfulness is required for the whole data life cycle. Implemented privacy controls are proactive rather than reactive.
- Purposefulness is valid for data and all manipulation, so the data must be processed only for the necessary purposes.
- Accountability. The data processor is responsible for the compliance with GDPR.
- Other data requirements (storage limitations, data minimization, confidentiality) which mean that data should be under control.

Practical impacts are in the following areas:

- The need to define all affected data across the organization. Data security must be ensured throughout the data lifecycle.
- Data security managing needs to be active at all times (always on). Management activities must be encapsulated into business (as well as IT) processes. All activities in processes must respect the requirements of legislation.
- All SW applications or HW infrastructure must be in compliance with the standard. Appropriated measures must be embedded into applications (for example when the application is provided as service).
- In addition, it means the need to identify persons who will operate with personal data.

There are a few areas that are interrelated and must be analyzed and aligned in compliance with the law. The typical ones are: 1) data as the centerpiece of the problem; 2) processes, because they describe procedures how data is processed; 3) information technologies, because they predominantly process data. In addition, we must take into account people, contracts, business documentation, business rules, and legislation. The goal is to ensure that privacy is actively managed by the organization. The characteristics and behavior of all actors must be controlled and lawful.

GDPR directly affects data and processes which involve people. People are understood in two ways: 1) as a data subject, 2) as a human factor (people providing data, people processing data, people responsible for data etc.).

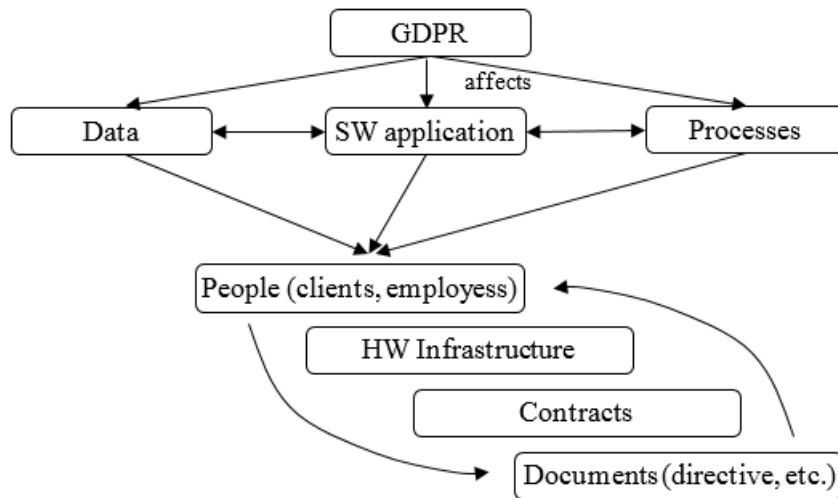


Figure 2 General application scheme

Figure 2 shows the possible application procedure. The key is to be aware of changes in the primary areas concerned. Consequently, it is necessary to address related factors.

4. EA role in GDPR application

As we can see in chapters 2 and 3, GDPR application is related to the similar or same elements that are used in the architecture.

For GDPR, you will need to analyze the organization in selected contexts. For example, when personal data is identified, applications that are involved in their processing have to be identified as well, data processing needs to be justified, agreement for processing ensured, related contracts changed, procedures defined, etc. If the organization is perceived as a system, we can easily follow the relationships between the elements that are relevant to the situation that is being solved.

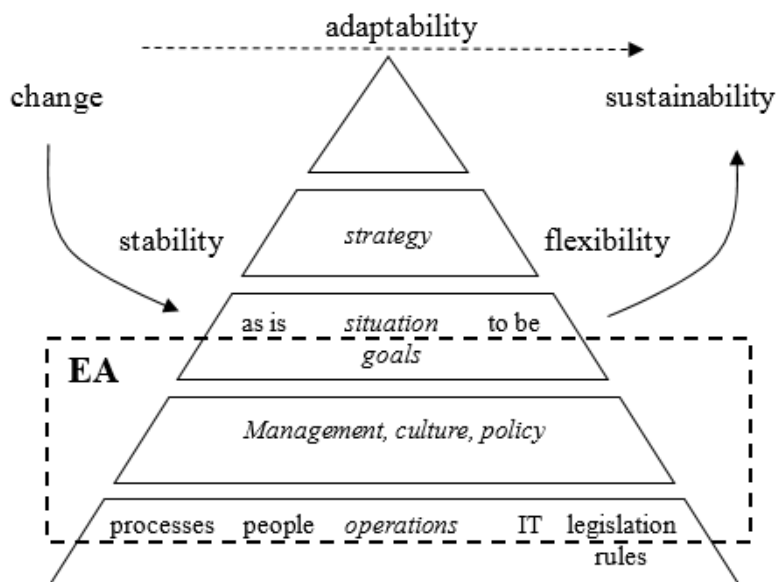


Figure 3 Enterprise architecture works as a tool, adopted from (Lankhorst, 2009)

Applying even the basic principles of the architecture (moreover in primitive form) can help in the implementation of GDPR through the knowledge of internal relationships in an organization.

Especially in the analytical phase, EA may be the source of information. Figure 3 is adapted from Lankhorst (2009, fig. 1.4) and illustrates the situation where EA works as a management tool. EA helps to keep the organization dynamic by maintaining information about the internal structure. The flexibility means ability to react and absorb changes for the sake of sustainability.

GDPR application needs to apply changes in internal processes, data processing, SW applications and other elements because they affect each other. The organization as a whole (as a system) must remain coherent and integral.

The example

An implementation of GDPR requires assessment of key elements in the organization (people and their roles, data and processes). These can be extended to other organization entities (SW applications, storages, other legislation). A matrix can be then used to express the relationship between these entities. Although this tool is very easy, when linking matrices, we can follow how one entity influences other entities. To use matrices is easy enough, but it is still a formalized way how to describe important relationships. An example set of templates of matrices for the TOGAF 9 is available at (Open Group, 2018c).

We can describe an instance of real elements as an example. Consider a contract with a client as an element of data/information. This is processed within the function *New contract processing*. This element contains personal data about clients (related to GDPR). To control this element, it is therefore necessary to change all processes (at least the process corresponding to the *Contracts process*) in which the contracts are processed throughout the life cycle of the contract (e.g. contract preparation and storage, access to the repository by employees, archiving and removal of data). This also affects data processing applications (SW applications and HW as a consequence). These applications should be in compliance with the processing requirements. The solution of the example will continue with modifying the related internal documents and regulations.

Table 1 Elements matrices

Element matrices	The example
SW Application / HW Technology Matrix	MS Office / Computer CRM / Data storage (NAS)
SW Application / Function Matrix	CRM / New contract processing MS Office / New contract processing
Role / SW Application Matrix	Product Dealer / MS Office Product Dealer / CRM
Information/Data Entity / Function Matrix	Contract / New contract processing
Actor / Role Matrix	Mr. John Example / Product Dealer
Process / Function Matrix	Contracts process / New contract processing

The line of relationships is: function (why, when) - data (what) - process (how, when) - SW applications (where) - people (who) - HW technology (where). In this simple way, it is possible to map the basic chain of relationships. At the same time, it is essentially an expression of the structure of the system, the basis of architecture. The introductory phase (analysis) of GDPR implementation into the organization is significantly simplified.

In this example, we can mention the context and consequences of the situation (process) analysis. Consider the importance of process and HW technology elements in details. The principle of data minimization and requirements to control data life cycle (see chapter 3) implies the need to store contracts in particular data storage and the need to follow strictly steps of the process. In result, it is

not possible to save a contract to the vendor's laptop because the vendor wants to have the data on his/her laptop. All contracts saved on laptop are in potential danger (e.g. due to portability) because they are out of control.

5. Conclusion

The paper discussed a possible role of EA for GDPR implementation. The aim of the paper is to provide a demonstration of practical benefits of otherwise rather general concept of the EA.

Frameworks published in the IT area are usually very extensive, as they explain the problem in the scope of a universal approach. It is often considered and misinterpreted that they are intended only for larger organizations that have the ability to apply them. Their application is generally suitable also for smaller organizations, because they are based on a holistic approach and a conceptual solution of the problem. This means to define entities that play a crucial role in the organization and relationships among them. However, smaller organizations need to implement them in a manner that matches their capabilities, i.e. to keep a fundamental idea of the approach and use appropriate (simple and effective) methods and tools to maximize the benefits. Even for SMEs, the EA may be a valuable source of information for decision-making and management.

As we mentioned above, GDPR implementation brings a number of impacts. This change is typical example of a deep structural change. GDPR objective is not to be dependent on technology and established processes. Technologies and processes are the center of a change. EA is an ideal source of information about positions and roles of such elements in the organization. According to EA, the organization – system can be seen as a complex view from different viewpoints. This is valuable for a holistic approach. GDPR implementation requires a solution in a context.

Although the paper focuses mainly on the EA, it is obvious that it is also based on other approaches. The term “process” creates the premise that an organization is able to work with processes as representatives of actions (they express the dynamics of the organization). The question is if organizations are able to use the principles of business process management. To know how elements affect each other is only part of the solution to the issue of GDPR implementation.

We can also mention another framework beneficial to GDPR implementation (Thomas, 2017). COBIT framework addresses the area of IT governance. Among other things, it seeks to address the alignment of business and IT and establish transparency in processes of the organization. The core of the framework consists of processes, resources, stakeholders and organization environment that influence the behavior of the organization. By following principles and managing basic elements, it is possible to realize the benefits even if the framework is not fully applied.

The ability to implement key architecture principles can be the basis for a number of follow-up activities. Elements used in the architecture are also used in other areas. Examples include: Governance of IT (Rozehnal and Novák, 2016), Compliance Management Systems (Ministr and Pitner, 2017), Corporate Performance Management (Maryška, 2016) and other areas. Now that there are many business processes in close interaction with IT, the ability to use information encapsulated in these links is growing.

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SECURITY RISK MANAGEMENT – CLOUD ENVIRONMENT

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Keywords

Risk management, Cloud computing, Security, ISO/IEC 27000

Abstract

Cloud environment differs from the traditional IT systems and infrastructure in many aspects. No control over resources belongs among the most fundamental characteristics of the cloud computing. Furthermore, many approaches and processes that are applicable to on-premise systems must be adapted to the cloud environment. This paper deals with the risk management as one of such example. The main objective is to design a risk management method that focuses on security risks in the cloud environment.

1. Introduction

Cloud computing has become a widely known model that a vast quantity of companies has adopted in a few past years. However, a portion of integrated cloud services differs with every company; some of them operate cloud services only as supportive tools while others move also primary and critical systems into a cloud environment. The amount of use of cloud services is increasing with every year. This trend of cloud computing growth is verified by many reports. As an example, Cisco as a respected organization published its report Annual Cybersecurity Report 2018 (Cisco Systems, 2018) with interesting findings such that the usage of a private cloud is increasing significantly faster than a public cloud and that more than a half of organizations have a majority of infrastructure in the cloud.

Companies adopt cloud services because of many benefits that cloud brings. Among those benefits belong e.g. cost reduction, scalability, mobile accessibility and more timely, effective and efficient updates (Catteddu & Hogben, 2009; Singh & Pal, 2017). However, cloud computing includes also many security risks and issues that give many companies reasons not to adopt cloud services. Since any two companies are not identical, the risks related to the cloud environment vary with every company. For this reason, risk management is an important process that supports effective information security. These risks need to be reduced; otherwise, they may negatively affect the business continuity of companies and cause financial losses (Mounzer, Alpcan, & Bambos, 2010).

As a vast number of different types of risks and companies exist, also many risk management methods and standards are used since each one is suitable for a different case. Examples of the most common methods and standards are *ISO/IEC 27005 Information Security Risk Management*, *NIST SP 800-400 Risk Management Guide for Information Technology Systems* and *OCTAVE*. In practice, companies

often create their own risk management method that is typically built on an already established one and customize it for their purposes (Wangen, 2017).

The objective of this paper is to design a risk management method that supports companies in the management of cloud security risks.

1.1. Methods

The research approach used in this paper is based on *Design Science Research*. The framework *Method Framework for Design Science Research*, presented in the book *An Introduction to Design Science* (Johannesson & Perjons, 2014), was chosen as the appropriate framework. Among involved activities that shape this framework belong: 1. *Explicate Problem*, 2. *Define Requirements*, 3. *Design and Develop Artefact*, 4. *Demonstrate Artefact*, 5. *Evaluate Artefact*. Additionally, *Knowledge Base* and *Research Strategies and Methods*, *Creative Methods* may enter to each activity. The result of the framework is an artefact. The definition of the artefact is stated as "*object made by humans with the intention that it be used to address a practical problem. (...) Methods and guidelines can also be artefacts, for example, a method for designing databases.*" (Johannesson & Perjons, 2014).

The research in this paper covers the two initial activities and a part of the third one (*Design and Develop Artefact*) where only a design of the risk management method is established, not the development. The rest of activities are subjects of the future work.

The literature research, placed in Section 1.2, supports defining of the researched problem that is an aim of the *Explicate Problem* activity. The resulting problem statement is included in Section 1.3. An analysis of theoretical basis related to the risk management forms fundamental requirements for essential parts of effective risk management method. Synthesis of gathered knowledge predates the designing process. Section 3 covers the design of risk management method.

1.2. Literature research

Cloud computing is defined in the *NIST Definition of Cloud Computing* (Mell & Grance, September), published by National Institute of Standards and Technology, along with its fundamental characteristics and two cloud models (deployment, service).

Book *Řízení bezpečnosti informací* (Doucek, Svatá, Nedomová, & Novák, 2011) describes general principles of risk management in relevance to information security management. Furthermore, the book involves parts dedicated to drawbacks of classic methods of a risk management as well as modern approaches and parts that should be involved in an effective risk management process.

For a better understanding of the purpose of the risk management process, it is needed to comprehend its context. Book *Audit informačního systému* (Svatá, 2016) provides answers to all the above. The book presents the theoretical basis for the audit of information systems with the focus on several methods, e.g. COBIT 5, and on typical tools and techniques used in the audit where the risk analysis belongs.

A few frameworks that focus on risk management of cloud services have already been developed where each framework, however, has established a different approach. At the publication *A Risk Assessment Framework for Cloud Computing* (Djemame, Armstrong, Guitart, & Macias, 2016), the authors target their framework on SLA agreement with the focus on maximization of Quality of Service; it includes also various parties that participate in contractual agreements. Another framework was published in *A Risk Management Framework for Cloud Computing* (Xie et al., 2012) and is based on five basic processes: User Requirement Self-Assessment, Cloud Service Providers Desktop Assessment, Risk Assessment, Third-party Agencies Review, Continuous Monitoring.

Security of cloud services involves many specifics in comparison to traditional information security. Report *Cloud Computing – Benefits, risks and recommendations for information security* (Catteddu & Hogben, 2009) provided by European Union Agency for Network and Information Security (ENISA) offers a complex description of cloud security characteristics; hereinafter, it is referred to as the "ENISA report". The report describes main security benefits of cloud computing as well as its security drawbacks that are defined in a form of security risks. Furthermore, the report defines typical vulnerabilities and assets related to the cloud environment and link them to the risks.

The list of cloud security risks from the ENISA report is not fully exhaustive. *Risk Management on the Security Problem in Cloud Computing* (Tanimoto, Hiramoto, Iwashita, Sato, & Kanai, 2011) is the complementary publication for defining the risks.

No publication includes a fully exhaustive list of threats that occur in the cloud environment. For that reason, the author drew from four publications. *Analysing threats in cloud storage* (Yahya, Walters, & Wills, 2015) discusses cloud security requirements and summarizes them from already existed studies on security frameworks. *A survey on data breach challenges in cloud computing security: Issues and threats* (Barona & Anita, 2017) defines security aspects and threats that appear in a cloud environment; moreover, it specifies relevant security challenges and approaches. The authors of the publication *A review of threats and vulnerabilities to cloud computing existence* (Efozia, Ariwa, Asogwa, Awonusi, & Anigbogu, 2017) investigates threats, vulnerabilities, and obstacles of cloud services. Security requirements of the cloud environment are described also in the publication *Cloud Computing Security Threats and Attacks with Their Mitigation Techniques* (Amara, Zhiqui, & Ali, 2017). Besides that, this publication defines a vast quantity of threats and links affected cloud services (IaaS, PaaS, and SaaS) to each threat along with examples of mitigation techniques.

1.3. Problem statement

Many book, standards, guidelines and other publications define various methods of risk management. Although the methods provide different steps within the process, still the analysts should utilize their method for particular domains to perform highly effective risk management. A few frameworks have already been developed for a cloud environment; however, each of them varies with a bit different approach. The developed frameworks mostly do not include already existing works to take advantage of their benefits – e.g. not involving predefined risks, vulnerabilities, threats, and assets in the framework. These existing works include many performed researches in many areas, and as a result, they provide information with high quality.

2. Theoretical basis

Risk management helps companies to analyze, assess and optimize risks that may negatively affect the company business and mitigate them to an acceptable level; it implies that the risk management is an important and significant process that helps for effective management of information security (Douceck et al., 2011).

Risk management is usually a costing process that may be difficult to manage since it covers many levels and departments of a company. For that reason, precise definition of the scope is a necessary step since the risk management deals with a specified company area, system or any other part. However, despite a specified scope of the risk management, the risks should be handled with regard to and in context of a whole company (Svatá, 2016).

Risk management consists of multiple activities that help companies to deal with risks. The activities differ with every existing method. Furthermore, many companies customize these methods for their own purposes since they want to optimize the process for their business and risk management scope.

As an example, Figure 1 shows the process of risk management activities according to *ISO/IEC 27005* and *ISO/IEC 27001 Information security management systems – Requirements*.

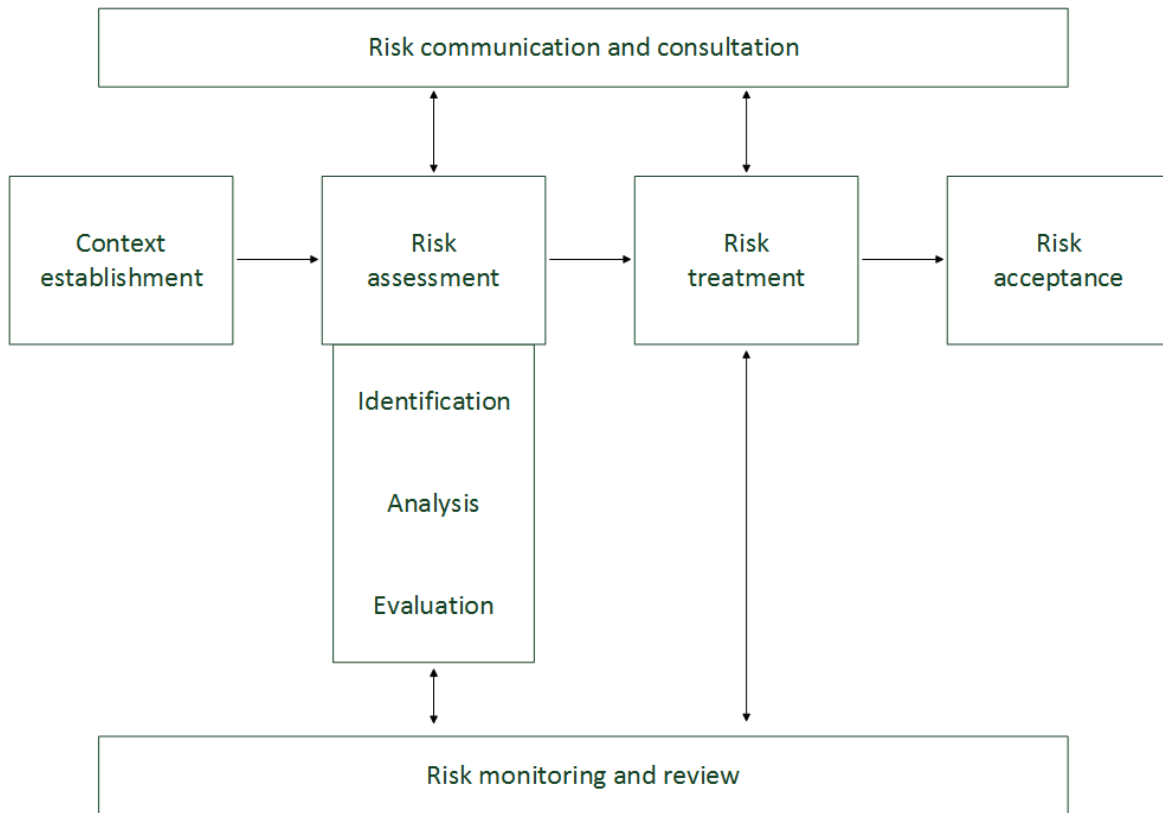


Figure 1 Simplified process of risk management activities according to ISO/IEC 27005 (International Organization for Standardization, 2011).

3. Design of risk management method

The most suitable approach to perform efficient and effective risk management is to use a complex risk management framework. Besides the risk management method that defines the process of risk management, the framework should include also risk assessment tool, guidelines how to use the tool, description of outputs/inputs and other components. This paper describes the main parts of risk management method.

Risk analysts, who would use this designed method or perform risk management in the cloud environment in general, should always bear in mind that the cloud environment significantly differs from traditional IT systems and infrastructures. Examples of matters that should always be considered are:

- The owner of the software as a service (SaaS) may not be the same as the owner of the infrastructure where the SaaS runs on.
- Data are not stored at the cloud service customer (CSC). Their location is often unidentifiable.
- CSC does not have a full control over the services, including their security.
- Resources of cloud services may be scaled up/down, in/out in a short time.
- CSC has a broad access to the cloud services through the internet.

The designed method is built mainly on the combination of several existing components, as it is highly efficient to use their benefits. Overall, the method is based on the ISO/IEC 27005 standard.

For the initial phases of context establishment and risk identification, the author of this paper recommends using, besides the standard from the ISO/IEC 27000 family, all the benefits of *Cloud Control Matrix (CMM)* (Cloud Security Alliance, n.d.-a) and *Consensus Assessments Initiative Questionnaire (CAIQ)* (Cloud Security Alliance, n.d.-b), both developed by Cloud Security Alliance. Nevertheless, the author also emphasizes that the three mentioned components may not be exhaustive for all parts of the two initial phases.

CMM provides security controls related to the cloud environment and categorizes them into 16 domains (e.g. Application & Interface Security, Data Security & Information Lifecycle Management, Datacenter Security). The controls are mapped to different frameworks, regulations, standards (including ISO/IEC 27001 – 27005), cloud delivery model and architectural components. An example of controls is (Cloud Security Alliance, n.d.-a): *Prior to granting customers access to data, assets, and information systems, (removed all) identified security, contractual, and regulatory requirements for customer access shall be addressed.* In addition to CMM, Cloud Security Alliance has established CAIQ that helps companies with analysis of their current state of the controls listed in CMM. CAIQ provides one or more questions to each control that may be answered *Yes*, *No* or *Not applicable*. An exemplary question of CAIQ, that is related to the control above, is (Cloud Security Alliance, n.d.-b): *Are all requirements and trust levels for customers' access defined and documented?*

Along with the context establishment and the risk identification, also the CMM output and the results of CAIQ may help companies during the other parts of risk assessment process as well as during planning of security measures that would help to risk mitigation.

At the risk identification phase, the method includes predefined lists of risks, vulnerabilities, threats, and assets, related to the cloud environment. Each item of these lists should be considered whether it is applicable to the environment or not. However, the identifications of risks, vulnerabilities, threats, and assets, that are specific to the given environment, cannot be omitted. As was already described, CMM and CAIQ may support the identification to be more efficient.

In total, the designed method includes 48 predefined risks that are divided into four categories – *Policy and organizational risks*, *Technical operation risks*, *Technical system risks*, *Legal risks*. As an example, Policy and organizational risks are shown in Table 1.

Table 1 Policy and organizational risks (Catteddu & Hogben, 2009; Tanimoto et al., 2011).

Risk ID	Risk name
R.P1	Lock-in
R.P2	Loss of governance
R.P3	Compliance challenges – internal regulations, standards
R.P4	Compliance challenges – external regulations, standards
R.P5	Loss of business reputation due to co-tenant activities
R.P6	Cloud service termination or failure
R.P7	Cloud provider acquisition
R.P8	Supply chain failure
R.P9	Problem with supervisor of service provider
R.P10	Problem of unique specification of service provider
R.P11	Problem of service provider limiting information disclosure
R.P12	Problem of difference between work important matter of use company and cloud service provider specification
R.P13	Problem whether to fill service level agreement or not

Besides the risks, also predefined lists of threats and vulnerabilities are involved in the designed method. As another example, Table 2 shows 10 selected threats. For a clarification, the ID numbers of Table 1 and Table 2 are independent of each other.

Table 2 Threats specific to the cloud (Amara et al., 2017; Barona & Anita, 2017; Efozia et al., 2017; Yahya et al., 2015).

Threat ID	Threat name
T1	Abuse of cloud service
T2	Account or service hijacking
T3	Bugs in large distributed systems
T4	Cloud-related malware
T5	Data transfer bottle-necks
T6	Denial of service
T7	Infrastructure failure
T8	Online cyber theft
T9	Service unavailability
T10	Shared technology Issues

Within the risks, a vast amount of information should be determined. The author recommends the structure as follows: name, risk category, details of risk, impact, list of vulnerabilities, list of affected assets, risk level, cause, and countermeasure.

Risk analysts should use a risk assessment tool to keep the flow of risk evaluation, gather all necessary information and ensure that the values are counted properly. The analysts have three options: use some of the existing ones without any change, customize some of them for their needs, or develop their own one. In a case of development of own tool, the analysts may use ISO/IEC 27005 that provide general guideline what the risk evaluation tool should include. Except for the lists of identified components, the tool should include following parts at least:

- Analysis of risk impact.
- Definitions of risk levels where the likelihood, impact, and ease of exploitation are combined (e.g. in a form of a matrix), and definitions related to appropriate risk treatment are included.
- Table where assets are combined with relevant threats, vulnerabilities, impacts, and where the risk levels, along with the risk treatment, are determined.

The remaining phases of the risk management process from ISO/IEC 27005 must not be omitted (*Risk treatment, Risk acceptance, Risk communication and consultation, Risk monitoring and review*); however, they are not further analyzed in this paper since the author recommends following the standard. Still, the risk analyst should bear in mind the specifications of the cloud environment.

4. Conclusion

Security holds an important role for companies to sustain successful in their business. Cloud environment influences security in many aspects as it brings both security benefits and risks that might not be known to the CSC. For that reason, it is highly recommended to perform risk identification, assessment and treatment to reduce these risks along with risks that are specific to the given CSC environment.

The main objective of this paper was to design the risk management method with the focus on cloud security. The method is built on the standard ISO/IEC 27005 and involves predefined lists of risks, threats, vulnerabilities and assets that should always be considered in the risk management process. In the context establishment, risk assessment and risk treatment phases, the designed method comprises *Cloud Control Matrix* and *Consensus Assessments Initiative Questionnaire* for the more efficient gathering of information and establishment of risk treatment plan. Furthermore, the method highly recommends using a risk assessment tool. The author of this paper emphasizes that the risk management should always be customized for the CSC environment, size, organization, type of cloud service and other aspects.

5. Future research

This paper did not deal with one important part of the risk management that significantly differs from the traditional IT infrastructure and that will be covered in the future research – security controls and countermeasures. This part will bring substantial benefit and difference from traditional risk management not focused on the cloud environment. Overall, the risk management method will be one part of a GRC framework focused on cloud security that is a subject of author's Ph.D. research. The framework will include software tool with three separate modules for governance, risks, and compliance. The GRC framework will be tested and verified in a form of case-study as one of possible the forms of artifacts verification defined in the used Design Science Research framework.

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INTEGRATED APPROACH TO FORMATION AND DEVELOPMENT OF YOUNG SPECIALISTS FOR INNOVATIVE ACTIVITY OF RUSSIAN COMPANIES

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Keywords

Personnel development; formation of competences; talent management; corporate culture; innovative activity.

Abstract

The article presents the analysis of contemporary trends and also the experience of Russian and foreign organizations in the field of their personnel development and in particular – in the field of people's innovative potential application. The key distinctive features of the contemporary approach to this problem includes building an integrated system of personnel development management so that to form the competences necessary for a truly innovative behavior as well as for the achievement of organizational strategic goals. Creation of such a system presupposes the formation of corporate culture which would motivate more active behavior of personnel in the course of their innovative activity.

On the basis of their own research results the authors of this text offer a model of personnel management which uses an integrated approach covering university education of personnel, their further development within enterprises and also self-development.

1. Introduction

Innovative potential of human resources belongs to the most important strategic reserves of competitiveness for all companies oriented on innovations. This potential can be an asset, or it can be a liability, depending on how a particular enterprise formulates its aims in the field of innovations, what sort of values form the basis of company's corporate culture, which tools and methods are applied in its HR policy. Therefore, the innovative potential of personnel becomes an asset as soon as all these aspects of management are connected in one single whole and at the same time they do not contradict the mission of this organization, its core principles and strategies of work. All these preconditions together form the fundamentals necessary for the formation of innovative potential of human resources at enterprises, and professional, social, cultural and economic potentials of their employees are the necessary components of this potential.

In order to guarantee and maintain own competitiveness at the world market Russian economy needs to solve, first of all, the problem of labor productivity increase. This requires radical transformations in the fields of technologies, management and HR management in particular. To a large extent solution of all related technological, economic and social problems depends on the quality of personnel, its level of preparation and its ability to develop further.

Efficient performance of an enterprise also directly depends on the level of professionalism inside it and on the capacity of personnel to develop and promote their own innovations. Solution of these problems requires a comprehensive approach and also a multi-level structure which would cover education, development and further use of human potential by enterprises.

Provision of company's competitiveness requires an innovative approach to managerial decision-making, and not only at the level of top management, but also on the side of all other staff members inside the organization. This, in turn, can be guaranteed only in the case when organization's personnel is developing as being oriented on innovative activity. Another important factor of increasing the efficiency of companies' activities is availability of highly qualified, motivated and fully engaged employees, all having sufficient competences not only for creation of innovations, but also for their implementation. This means, in turn, that there is a necessity to increase the quality of HR management and especially the level of personnel engagement in the process of company's innovative development. The latter would also lead to formation of truly innovative behavior among all related specialists (Carmeli., Meitar, Weisberg, 2006).

Formation of innovatively active personnel is a multilevel process covering university education, adaptation of a graduate at his/her first place of work, direct engagement in the innovative processes at an enterprise, motivation for being innovatively active. Management over the process of personnel development inside an organization requires today a brand new, more comprehensive approach which would include the following elements: the system of personnel selection, staff evaluation, teaching & training, motivation for self-development, innovative activeness, formation of corporate culture, innovative vector of development, creation of a system for interaction between all related participants (top managers, leading professionals and HR personnel). To a larger extent, personnel development when it comes to innovative orientation depends on the position and vision of top managers as leaders inside the organization (Barsh, Capozzi, Davidson, 2008).

2. Recent research publications' analysis

Lately, talent management has become one of the most actively elaborated concept related to innovative development and innovations' promotion. One of the most known proponents of this concept is Josh Bersin. The issue of talented employees has always been some sort of a trouble for businesses worldwide. Moreover, trends in the companies' requirements and in the demand of their staff have radically changed during the last 10-15 years: companies feel the need for talented professionals, since the latter guarantee and predetermine their success. At the same time, talented employees demand much attention to their own needs and also, they usually are not that much attached to their companies. Foreign companies have already accumulated quite extensive experience in the field of talents' management (Latukha M., Tsukanova T. 2013). However, estimations of this method effectiveness are rather ambiguous. Some of the researchers, after analyzing mostly successful cases and practices of talented employees' management, have become sure that this approach to personnel allows increasing the overall competitiveness, speeds up innovative processes inside organizations, increases companies' incomes etc.

However, some other researchers are of the opinion that the system of talented employees' management must be part of the concept of personnel development and also an integral part of a more general development strategy. Only in such a case a company would be able to get competitive advantages and in the long term – reach higher financial results. In this context interesting would be the results of the research carried out by John Sullivan who studied the experience of talents' management in the Silicon Valley and came up with his own recommendation for the companies implementing talent management (John Sullivan, 2016).

Also interesting are the results of the research carried out by PricewaterhouseCoopers back in 2013. This research study covered 62 companies overall, and 53% of them were based in Russia (others were international). The researchers were interested in the issues of the talent management concept implementation within the more general system of personnel management. The results of this research have demonstrated that 92% of the surveyed companies apply some sort of talent management, 86% of these companies engage all their employees into the program of talent management (PricewaterhouseCoopers International Limited, 2013)

The authors of another research study (survey of 104 managers of the middle and top levels in Russian companies, random sampling) have made an attempt to set a correlation between the acknowledgement of the necessity to take talent management into account (71,6% of positive answers) with the actual actions in this respect. Availability of HR management strategy in a company was mentioned by 39,8% of the respondents, availability of talent management policy – by only 13,6% though. However, programs of talents' management are present in 18,3% of the studied companies, while 20.3% of them have individual plans for talent development (Leadership Development Studio, 2009). Therefore, the results of this survey have clearly showed that awareness of the necessity to introduce a system for talent management is usually not enough, under real economic conditions.

Many authors of the research articles come to the conclusion that talent management means more than just implementation of an integrated approach to organization of various HR processes, including recruiting, onboarding, development and training, efficiency management, leadership skills' development, forecasting and planning of substitutions etc. Talent management is a complex system of organizational, economic and sociopsychological measures, all aimed at increasing the level of competences in critical for business types of activities through introduction and development of talent management programme (Odegov, 2015).

Studying and generalizing the experience of the largest international companies from various sectors (General Electric, Procter & Gamble, McDonald's) allow us making a conclusion that despite some differences in approaches, the major guidelines in terms of HR management are very much the same. Development of the most talented professionals in contemporary companies must be based on the principles of talented specialists' inclusion into the processes of strategic decision-making, engagement in the corporate culture, motivation and development overall (Rudenko, 2016).

In this 2015 publication titled “Why People Management is Replacing Talent Management” (Josh Bersin, 2015) acknowledged that the concept of talent management must be improved further so that to create a whole eco-system contributing to further development of corporate culture, including changes in approaches to HR management, new requirements to top management (leaders inside the organization) etc. This, in turn, would contribute to formation and further development of talents among personnel in all spheres of companies' activities for further achievement of higher competitiveness by the company overall.

Another research, carried out in Russian Federation among both Russian and foreign companies (or their branches) has come up with the recommendations concerning the development and use of talents by organizations. In the view of many respondents of this research study, efficient management of talented employees must be integrated with other best practices of HR management and overall business strategy as well. 40% of the surveyed foreign companies and 34% of Russian ones noted the importance of such integration. Creation and introduction of such an integrated system for HR management, career and leadership development can contribute significantly to company's management efficiency overall, and as a result, in the future may predetermine its competitiveness (Latukha, Tsukanova, 2013). Large Russian companies usually create such a system of personnel management which would include the elements of personnel formation, development, talents' search, motivation etc. The key effect from such system's introduction is that the company is able to develop

and then implement own technological and organizational innovations, necessary for further development. On various Internet portals and forums we can observe quite active discussions and experiences' exchange between the specialists of Russian and international companies concerning talent management and personnel development issues overall (HR Portal).

In the recent years top management of the most successful companies has already come to full understanding of the value of HR potential and of the vital role the related services are playing performing the functions of selecting, evaluating and retraining of personnel. However, in many cases the quality of personnel in HR departments themselves is not high enough for such a meaningful mission. Job descriptions, as a rule, do not contain specifically defined aims and areas of responsibility of each employee. Such center of responsibility as achieving the aim of personnel development is not present in any of 200 job responsibility documents we have analyzed. It is obvious that today's most actual tasks of personnel development require significant transformations of the traditional management systems into new, more flexible and dynamic ones. And this, in its turn, would require reorientation of all HR management processes and formation of an environment which would contribute to the development of organization's innovative potential.

3. Research aim

To develop practical recommendations on the improvement of all organizational processes related to innovative HR potential management in today's companies.

4. Research results

Young professionals comprise a special group within enterprise's innovative potential. They are relatively better prepared to innovative activity, they have more advanced and up-to-date knowledge in the professional field, and they are usually more ambitious. A vital factor in this regard is that all these qualities must be in demand within organization, they must be accordingly supported, and certain conditions must be provided as part of this support. Our own research have demonstrated that many young professionals coming to Russian enterprises as to their first job place, are facing a range of problems with implementation of the competences they have obtained earlier. To a larger extent, their innovative behavior is formed in strong dependence from this environment and also from the attitude of their immediate managers. Our research has covered two groups of such young professionals: young specialists (with work experience of 1-3 years) and specialists (with work experience of 3-5 years). The research has been carried out at two large industrial enterprises – TTE and PRM (the names are coded due to confidentiality reasons).

We have performed the sample survey on a range of specialists and managers at these two enterprises (the questionnaires were developed separately for managers and young specialists). We do not state that our random sample is fully representative, however, we still think that the results of this survey can be used to formulate meaningful conclusions directly related to the topic of this article. Our key tasks was formulated as follows: to study the conditions under which the model of innovative behavior of young specialists is being formed. Special attention has been paid to changes in own perceptions among these young specialists, to development of own professional potential and also to the external effects on this potential from the side of the already established practices of management at the enterprises in question. Under these external effects we mean not the actual behavior of the immediate manager, but rather the extent to which this behavior influences the self-assessment of own potential by young specialists (see Table 1).

Analysis of the survey results confirms our initial idea that young specialists get to enterprises with quite different environment, thus, they have to adapt to it. Young specialists' own assessments of these environments from the standpoint of similarity between the environment and their own potential allow us make a conclusion that work conditions, corporate culture and attitude to personnel development at these two enterprises differ by several parameters at the same time (see more details in Table 1). Even if we take a limited number of parameters concerning only the attitude of immediate managers to young specialists' development, we can clearly see that views and assessments of the surveyed at these two enterprises differ quite significantly. These differences are preconditioned not only by the peculiarities of the already established corporate cultures but also by the individual features of managers at these two enterprises in question.

Table 1 Assessment of manager's actions concerning the creation of conditions for young specialists' potential development

Items	Answers in % (when fully agree)	
	PRM	TTE
Supporting the initiative on subordinates' self-development	40	60
Engaging young specialists and taking into account their opinions in the course of managerial decision-making	20	30
Managerial support when subordinates are trying to promote useful initiatives	30	10
Suggesting the participation in training programs offered by the enterprise itself	20	60

Of interest here is the transformation of specialists' assessments concerning the development of own potential at various stages of professional activity. Let us compare the differences between two groups (1-3 years of experience and 3-5 years) working at the same enterprise – PRM (see Table 2 for details).

Table 2 Assessment of various aspects of own development by specialists

Items	Answers in % (when fully agree)	
	1-3 years	3-5 years
Participation in contests, conferences, seminars, exhibitions etc.	10	30
Own initiative in search for useful information and studying professionally related innovations	30	60
Enthusiasm in relation to changes at the enterprise or in their department	20	20
Offering initiatives on improvement of own work or performance of the related department	0	30
Dedication to own work	50	60
Presence of skills and the potential to become high-class specialist	20	60
Presence of skills and the potential to become a manager in the future	10	90

Our research also shows that, generally speaking, the real situation at both these enterprises turned out to be better than expected and that the environment in which young specialists are working is comfortable enough for their potential development. Assessments on all these parameters turned out to be higher than expected, in some cases – manifold. The only indicator which happened to remain on the same level as it was initially expected (20%) is enthusiasm in relation to changes at the enterprise. This can be explained by the fact that young specialists tend to pay more attention to own development rather than to changes at the enterprise they are working for. Young specialists coming to an enterprise usually get various conditions concerning the demand and the need for innovative

competences, for innovative behavior on their side and for a certain level of innovative culture overall. This only confirms our idea that creative initiatives, active search for new ideas and their transformation into innovations must be supported by all means possible.

Key competences necessary for work in contemporary companies must be formed (at least their basics) in the course of university education already. However, analysis of the Federal state education standards of Russian Federation demonstrates that such competences, on the level of skills and qualifications, are mentioned only in a few education standards. This means that getting advanced and new enough knowledge in the field of science and technologies a university graduate does not have enough competences to promote and/or support innovations so that the latter would be transformed in a certain commercial result. At the same time, we need to note that in a range of largest universities in Russia (first of all we are talking here about the so-called national research universities) the scientific basis and the cooperation with regional enterprises are strong enough so that to support the formation of innovative competences among the students. This task (formation of innovative competences) is being solved mainly through students' participations in research projects and grants in which university research and production processes come together. For example, in Perm National Research Polytechnic University¹³ the students can be active participants of research teams, they are directly involved in project work which is financed from the Federal Budget (through the system of state grants) or by the local companies (mostly from such sectors as machine-building, aviation, chemical production, oil & gas). These innovative activeness of students is promoted and supported on the level of the university top management and also by the local enterprises and companies that are directly interested to get well-prepared young specialists straight after their graduation.

Innovative potential of a young specialist is changing in the course of time due to accumulation of work experience and development of professional competences, more involvement in work processes, establishment of stronger work relations. All of this, as a result, contribute to the growth of confidence in own strengths and formation of stable internal motivation to work more efficiently. And this, in turn, is the major driving force for innovative behavior (Esaulova, 2014). The offered here approach to the formation of innovative behavior of a young specialist is based on a relatively new model of business called VUCA¹⁴. This model covers the following stages:

1. Search for potential candidates among university graduates. This is solved through participation of students in university research projects, in grants and various joint programmes between a university and local businesses.
2. Formulation and introduction of a special programme concerning young specialists' development. Speed and quality of changes taking place in the today's world force all companies to reconsider their approaches and focus more on talents' management. According to the previous model of talent management, future changes were more or less predictable. But today most of the companies are operating under highly volatile conditions, and this means that serious changes may happen nearly every month, if not week. Therefore, the process of young specialists' development must include the formation of skills necessary for work under the conditions of uncertainty and constant development.

¹³ Perm National Research University is ranked 4th among 163 tech universities of Russian Federation by the indicators of demand for graduates.

¹⁴ Here VUCA stands for Volatility, Uncertainty, Complexity, Ambiguity.

3. Retaining young specialists in the company. Staff potential management must be individually oriented on each employee. Trainings and professional development courses, career planning and financial reward mechanisms – all must be flexibly adjusted as per particular needs of each employees, no matter what is their general number in an organization.
4. Informal learning (and also creating all conditions for it) – covers self-development of specialists and deepening of their knowledge in their own field and the related ones, and also studying the related best practices which partially can be performed via e-learning (Akhmetova, 2016).
5. Formation of corporate culture which would further promote positive attitude of all employees in relation to innovative development and various innovative activities, thus contributing to the formation of innovative behavior among young specialists.
6. Formation of an incentive mechanism that would speed up the development of innovative competences.

The largest effect in this regard can be achieved only using the most comprehensive approach to problem solving in the HR field. New requirements to organization and efficiency of HR work, more responsibility for personnel development, its capacity to perform innovative changes increase the value of the HR professionals within companies. In our opinion, the following components must necessarily participate in the process of formation, development and efficient use of HR resources as the key component of company's innovative potential:

- Top management – in part of determining the strategic goals, innovative development vectors and general requirements to personnel;
- The department responsible for personnel development – in part of suggesting and implementing the models of development and professional growth of those specialists who are capable to promote innovations;
- Mid-level managers of various subdepartments, both production and functional – in part of defining the competences necessary for innovative activities of various types;
- Young specialists themselves – in part of defining directions and aims of own professional development, self-development of innovative capacities, acquiring necessary knowledge and skills for that in the course of life-long learning and self-education

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DUPONT ANALYSIS OF COMPANIES IN THE SLOVAK REPUBLIC ENGINEERING INDUSTRY

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Keywords

Return on equity, DuPont analysis, engineering industry companies in the Slovak Republic

Abstract

Profitability ratios provides quick picture of companies' financial situation, but they do not have such explanatory power than overall financial analysis. The decomposition of the return on equity according to DuPont equation allows deeper analysis of the component ratios' impact, whose multiplication is return on equity. Exist more modification of return on equity breakdown. In this paper we used the variant, in which the return on equity is the multiplication of profit margin, assets turnover and equity multiplier. The impact of single component to the change of return on equity were examined by regression and correlation analysis. As a result, statistical analysis highlighted that the DuPont equation is useful tool for financial analysis. The most significant effect to return on equity has component asset turnover, profit margin and the least significant impact has equity multiplier.

1. Introduction

The subject of the paper is analysis of changes in return on equity (ROE) caused by their components according to DuPont equation. ROE was investigated in the Slovak Republic engineering industry companies. This sector of industry with automotive industry represent driving force of the Slovak economy. The engineering industry has strong historical background, stable position, represents growing and key pillar in Slovak industry. This is evidenced by the fact that sales generated in the engineering industry grew at an average annual rate of 13 %, while the average annual growth rate in overall industry is at level 2.9 % (SARIO, 2017). Business activity efficiency of engineering industry companies were analyzed using financial analysis indicators, which reflects efficiency by financial and monetary value factors (Lacko, Hurný, & Rozkošová, 2017). To assess the business activity efficiency are used information from financial accounting, primarily from financial statements (Lovciová, 2017). In order to make financial decision based on financial statements is crucial to be applied the principle of the true and fair view and characteristics such as clarity and accuracy are also important (Juhászová et al., 2014; Kubaščíková & Juhászová, 2016). For the purpose of decision making, the user of the information must determine the weight to be assigned to the individual indicators (Dechow et al., 2013). Development of information and communication technologies and the application of optimization methods for solving problems ensures greater business efficiency, more flexible performance of organizations in the market, accelerating transactional operations, reducing logistics costs and increasing profits (Mijailović et al., 2015).

2. Return on equity according to DuPont equation

Profitability ratios are used to measure ability of company to generate new resources, respectively making profit by invested capital (Šlosárová & Blahušáková, 2017). ROE is the most important ratio for stakeholders, because evaluates the profitability of equity. Based on ROE stakeholders of the company assess, whether the resources they invested to business create profit (Blahušáková, 2017). ROE does not replace the overall financial analysis and does not provide an overall picture of the financial situation (Kharatyan, Nunes & Lopes, 2017; Prajapati & Danta, 2015). The basis for the ROE decomposition is DuPont equation, which was used in the 20's of the 20th century by DuPont Corporation first. Previous studies indicate, that components of DuPont equation resulting from the ROE decomposition have an explanatory power relating the changes of future profitability (Soliman, 2007). DuPont analysis links balance sheet with the profit or loss statement and allows identification of stronger and weaker aspects of financial performance (Kharatyan, Nunes & Lopes, 2017). For example, a high positive ROE may look great. However, it is not excluded that the company got to large losses and both loss and equity are negative (Cvik & MacGregor Pelikánová, 2016), but reflect a highly positive ROE due to mathematical rules, when two negative values are eliminated. ROE decomposition allows assessment of strong and lagging aspect of business activities, which implies giving a more realistic picture than ROE alone (Prajapati & Danta, 2015). DuPont equation is processed in the literature from different points of view, from which we present the most frequently applied modification. In the original DuPont equation, the return on assets (ROA) is calculated as follows (1):

$$ROA = \frac{Net\ profit}{Sales} \times \frac{Sales}{Asset\ turnover} = \frac{Net\ profit}{Asset\ turnover} \quad (1)$$

Till 70's of the 20th century the main objectives of companies were measured based on ratio ROA, which was influenced by profitability and efficiency. Later more attention was devoted to liabilities and debt and the position of ROA deteriorated against ROE (Kharatyan, Nunes & Lopes, 2017). ROE represents the proportion of net profit to shareholder's equity and can be calculated by multiplying ROA and equity multiplier (2). ROE decomposition consists of ROA components as we mentioned above and is completed with equity multiplier (3, 4).

$$ROE = ROA \times \frac{Total\ assets}{Shareholder's\ equity} \quad (2)$$

$$ROE = Profit\ margin \times Assets\ turnover \times Equity\ multiplier \quad (3)$$

$$ROE = \frac{Net\ profit}{Sales} \times \frac{Sales}{Total\ assets} \times \frac{Total\ assets}{Shareholder's\ equity} \quad (4)$$

The individual components of the modified DuPont equation represent all main areas of financial analysis. In term of profitability is presented profit margin, the assets are reflected in ROE through asset turnover, and the last component is equity multiplier, which is related to the indebtedness.

The profit margin indicates how much net profit is generated by one euro of sales. The low profit margin rate means that high expenses reduce income accounted for unit of sales. Asset turnover of total assets serves to assess the company's performance and expresses how many euros of sales accounts for one euro of asset. Equity multiplier reflects the proportion of own resources and debt, so the growth of ratio is due to the increase of debt needed for business activities financing. The equity multiplier shows how many euros of assets accounts for one euro of equity.

Another modification of DuPont equation is the decomposition of ROE to multiplication of five ratios by extending profit margin indicator (Grashuis, 2017). Modification of DuPont equation that breaks ROE into five indicators allows better investigation and understanding of the various financial aspects of company (Prajapati & Danta, 2015). Profit margin in this modification is multiplication of following indicators: tax burden ratio, interest burden ratio and EBIT margin (5). In this paper will be practically applied the first modification and will be used the decomposition of ROE to three components: the profit margin, asset turnover and equity multiplier.

3. Data and methodology

The aim of this paper is to analyze return on equity and the components responsible for its change based on the DuPont equation on the sample of engineering industry companies in the Slovak Republic. The impact of ROE components was examined through regression and correlation analysis on the selected sample of companies based on data from accounting period 2016, drawn from the Financial Statements Register and the web portal Finstat. Into the sample of analyzed companies were selected 59 companies from engineering industry with a minimum of 200 employees. The total number of examined companies is 58, because we excluded one company from the sample since only data for accounting period 2017 were available and subject of examination is accounting period 2016.

Using statistical methods such as regression and correlation analysis were applied to evaluate effect of individual components to the change of ROE. According to Šoltés (2008), nowadays first of all concept regression means, the study of mutual relations between two or more variables through statistical model, which characterizes the dependence between them. Regression model represents a simplified expression of relations between variables using a mathematical formula. In regression model we distinguish explanatory (independent) and response (dependent) variables. An inseparable part of the regression analysis is correlation analysis, which through correlation characteristics allows to assess the intensity of dependence between variables. One of the assumptions of regression analysis is no dependence between explanatory variables. The relationship between response variable Y and explanatory variables is expressed by linear regression model as follows:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_k x_{ik} + \varepsilon_i \quad (5)$$

Where: $\beta_0, \beta_1, \dots, \beta_k$ are the model parameters,

x_{ij} - i^{th} value ($i = 1, 2, \dots, n$) of explanatory variable X_j ($j = 1, 2, \dots, k$).

An absolute member – the coefficient β_0 is called intercept and represents averaged mean value of Y assuming that all explanatory variables are zero. Such an assumption is in many cases unrealistic, but its inclusion into the model is necessary. β_0 together with the random error reflects the effect of not considered and not included factors on the dependent variable. Coefficients β_j ($j = 1, 2, \dots, k$) are called regression coefficients that indicate how the increase or decline in the mean value of dependent variable Y corresponds to the unit increase of independent variable X_j at unchanged values of other independent variables. This interpretation of regression coefficients is correct only assuming mutual independence of explanatory variables. In practical applications, explanatory variables are at least partially dependent, so this interpretation is considered simplified (Šoltés, 2008). Regression analysis was performed using statistical program PSPP.

Based on theoretical analysis were determined the following hypotheses:

H_0 : The components of ROE such as profit margin, asset turnover and equity multiplier are not statistically significant predictors of return on equity.

H_1 : The components of ROE such as profit margin, asset turnover and equity multiplier are statistically significant predictors of return on equity.

4. Results

One of the key tasks of regression analysis is the correct identification of dependent and independent variables. Inclusion of too many variables can reduce the significance and uniqueness of independent variables due to multicollinearity. Multicollinearity shows the presence of dependence between independent variables, which interrupt the basic assumption of regression analysis regarding the independence of explanatory variables (Prajapati & Danta, 2015). Response (dependent) variable in this case is indicator ROE, that depends on explanatory (independent) variables such as profit margin, asset turnover and equity multiplier. Before executing regression analysis were examined mutual dependences between all independent variables by correlation coefficients.

Table 1 Correlation of return on equity components

Pearson correlation coefficient	Profit margin	Asset turnover	Equity multiplier
Profit margin	1	0.23 (0.081*)	-0.06 (0.649)
Asset turnover	0.23 (0.081*)	1	0.25 (0.055*)
Equity multiplier	-0.06 (0.649)	0.25 (0.055*)	1

Notes: p-values shown in parentheses besides correlations; *, ** indicate statistical significance at 10 percent and 5 percent confidence levels.

Source: Author's calculations based on Finstat data retrieved on 19.03.2018 using PSPP program

The correlation of the ROE components is included in Table 1, which includes results of 58 observations. The correlation between profit margin and equity multiplier is weak and negative, while correlation of asset turnover to profit margin and equity multiplier reflects also weak but positive relationship. P-values in parenthesis: 0.081; 0.649 and 0.055 are above the significance level of $\alpha = 0.05$ and we consider them to be statistically insignificant. At the level $\alpha = 0.1$ p-values of equity multiplier and profit margin dependence with asset turnover indicate statistically significant weak dependence. In the model is no strong multicollinearity, so we can continue with regression analysis.

Table 2 Regression model summary

Model summary	R	R square	Adjusted R Square	Std. Error of the Estimate
Values	0.90	0.81	0.80	8.01

Source: Author's calculations using Finstat data retrieved on 19.03.2018 using PSPP program

R value (Table 2) is 0,9, which is close to 1 and states that there is a strong relationship between explanatory and response variables. R square expresses how many percent of dependent variable variability affect independent variable. Adjusted R square also expresses the effect on dependent variable and fits for models with more independent variables. In this model, independent variables so profit margin, asset turnover and equity multiplier affect 80 % of ROE variability.

Table 3 Parameter characteristics of linear regression model

ANOVA	Sum of Squares	Df	Mean Square	F	Sig.
Regression	14 928.47	3	4 976.16	77.47	0,000
Residual	3 468.57	54	64.23		
Total	18 397.04	57			

Source: Author's calculations using Finstat data retrieved on 19.03.2018 using PSPP program

P-value (Sig.) shown in Table 3 equals 0.000 and indicates that the regression model is statistically significant at the level of significance $\alpha = 0.1$ and $\alpha = 0.05$. Testing characteristic $F = 77.47$, whose value is greater than the critical value $F_{1-\alpha}(k; n - k - 1) = F_{0,9}(3,54) = 2.188$ at the significance level $\alpha = 0.1$ and $F_{0,95}(3,54) = 2.776$ at the significance level $\alpha = 0.05$, shows significance of the statistical model.

Table 4 Regression equation coefficients

Regression model coef.	Unstandardized coefficients		Stand. coefficients	t	Sig.
	B	Std. Error	Beta		
Intercept	- 3.62	2.71	0.00	-1.34	0.187
Profit margin	1.83	0.14	0.78	12.69	0.000
Asset turnover	5.93	1.88	0.20	3.15	0.003
Equity multiplier	0.80	0.16	0.31	4.99	0.000

Source: Author's calculations using Finstat data retrieved on 19.03.2018 using PSPP program

Based on Table 4 the regression equation from unstandardized coefficients is as follows:

$$Y = -3.62 + 1.83 X_1 + 5.93X_2 + 0.80 X_3 \quad (6)$$

$$ROE = -3,62 + 1,83 \textit{ Profit margin} + 5,93 \textit{ Asset turnover} + 0,80 \textit{ Equity multiplier} \quad (7)$$

Intercept b_0 equals -3.62 and represents the average value of the ROE under assumption, that all three explanatory variables equal to zero. Since this value is negative, the absolute member b_0 does not have a logical interpretation. The regression coefficient $b_2 = 1.83$ indicates that a positive unit change of profit margin causes 1.83 % growth of ROE, while other conditions remaining the same. Profit margin increase. Positive impact on ROE has increase of profit margin, which can be reached by higher growth of net profit than sales. It points out appropriate control of expenses and economic efficiency of inventory consumption and production inflows. The regression coefficient $b_3 = 5.93$ is responsible for 5.93 % ROE growth by positive one-unit change of asset turnover ratio, while other conditions remaining the same. If the coefficient is higher than one, the company has achieved higher sales than the value of the assets for the accounting period and the company's performance can be judged as fair. A high asset turnover ratio results from the efficient use of assets and also has a positive impact on ROE. Profit margin and asset turnover tend to have inverse relationship, according to which a high profit margin is present in companies with low assets turnover ratio and vice versa (Ďurišová & Myšková, 2010). Management is required to establish reachable goals for performance measurement and can't focus only on maximizing of both indicators which are mutually exclusive. However, in our sample from engineering industry between asset turnover and profit margin is weak but direct proportion according to results of correlation analysis. 0.8 % growth of ROE under

unchanged values of other explanatory variables causes positive unit change of equity multiplier expressed as a regression coefficient $b_4 = 0,80$. A high level of the equity multiplier is a positive feature, when profitability of invested capital is higher, than the amount of interest paid for debt. Increase in indebtedness makes the ROE grow. But debt of the company has a positive impact on the ROE until ROA is higher or equal than interest expense multiplied by $(1 - \text{tax rate})$, when this is not true, the debt starts to be detrimental to the company (Saxunova, 2014). The inverse relationship is predominant between equity multiplier and asset turnover. In the case of low asset turnover is a need for debt financing instruments (Ďurišová & Myšková, 2010). Indebtedness negatively and significantly affects financial performance of the company, because highly indebted companies may be at risk of bankruptcy, if they are unable to pay liabilities. High indebtedness is a barrier, when looking after new investors in future. Then a higher level of liabilities leads to decrease of investments to non-current assets and ultimately reduces the value of the company (Kim, 2016).

P-values (Sig.) for all explanatory variables are lower than the significance level $\alpha = 0,1$ and $\alpha = 0,05$, based on which we reject the null hypothesis. We reject that ROE components such as profit margin, asset turnover and equity multiplier are not statistically significant predictors of ROE. Similar results were concluded by Karathyn et al. (2016) according to which, the most significant impact on ROE have asset turnover and equity multiplier based on linear regression model. Prajapati & Danta (2016) investigated ROE decomposition in Indian pharmaceutical industry, where ROE development was affected the most significantly by asset turnover and EBIT margin. Kijewska (2016) identified EBIT margin as responsible for ROE decrease in Polish metallurgical and mining industry. EBIT margin as we mentioned above is a component of DuPont equation composed from five indicators.

5. Conclusion

The assessment of companies' effectiveness is from the view of management decision making required and different mathematical and statistical methods are used to assess the financial performance. At present get to the focus analyzes of large volumes of data and identifying different relationships among them, whose appropriate interpretation allows faster responses of management to a rapidly changing environment. In this paper was applied regression and correlation analysis to determine the impact of indicators such as profit margin, asset turnover and equity multiplier to change of ROE. At the theoretical level the starting point of our investigation was DuPont equation, which indicates positive dependence between ROE and analysed indicators. To estimate the extent in which the profit margin, asset turnover and equity multiplier affect ROE was used regression analysis of data from the financial statements of companies operating in Slovak Republic. The impact of components on ROE has been investigated on a sample of companies in engineering industry, which includes more large manufacturing companies. The engineering industry cooperates closely with the automotive industry and represents the driving force of the Slovak economy. In this paper was concluded that the regression model based on component indicators is a significant predictor of ROE in engineering industry companies. We accepted the alternative hypothesis and rejected the null hypothesis determined on the basis of theoretical assumptions as follows: *"The components of ROE such as profit margin, asset turnover and equity multiplier are not statistically significant predictors of return on equity."*

The most significant impact on ROA has asset turnover ratio, while the equity multiplier has the least significant impact. Profit margin can be characterized as component with a moderate impact. The regression model equation allows prediction of ROE in the future especially in the engineering industry with certain limitations. The analysis was based on data from one accounting period, from year 2016 and we abstracted from changes in the business environment. For example, significant risk in engineering industry may arise from import tariffs set by USA on steel and for aluminum. Even though Slovakia is not a significant export partner of the USA, but indirectly in companies operating

in automotive and engineering industry with German and South Korean ownership may reflect positive and also negative impacts caused by worldwide development.

The paper points out that DuPont equation is a suitable tool for financial analysis. If the goal of the management or owners is an increase in ROE, the attention should be paid not only to the amount of net profit, but also to the asset turnover ratio, which has the most significant impact on ROE. Based on the results of this paper, is recommended as a subject of further analysis the comparison of the ROE decomposition according to DuPont equation with five components and also the extension of analysis for more accounting periods and industries.

6. Acknowledgement

This article is an output of the project of the Scientific Grant Agency of the Ministry of Culture of the Slovak Republic and Slovak Academy of Sciences (VEGA) no. 1/0512/16 (2016-2018) Retention and Development of Business Property of Company as a Relevant Tool for Sustainable Development in 50 % and internal grant no. I-18-105-00 (2018) Financial Analysis as a tool of Sustainable Development in enterprises of the engineering industry in 50 %.

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TOPIC H: PERFORMANCE MANAGEMENT

MANAGEMENT ACCOUNTING PRACTICE AND CHANGE IN THE CZECH REPUBLIC – REVIEWING LAST 30 YEARS FROM THE PERSPECTIVE OF AN INSTITUTIONAL FRAMEWORK

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Keywords

Management Accounting, Management Accounting Change, Czech Republic

Abstract

The aim of the paper is to understand the influence of institutional factors on management accounting practice and change in the last three decades in the Czech Republic. Primarily, the paper is based on interviews with two Czech professors who were involved in teaching, consulting and publishing activities during whole period. Secondary, the paper also fructifies the literature review and empirical papers published in this field. However, such references focusing on the Czech Republic are quite rare.

1. Introduction

The substantial political changes in the Central and Eastern Europe (CEE) at the turn of eighties and nineties of the 20th century led to the transitioning process from the centrally planned economy to market economy. The new role and challenges of business management had a significant impact on the need for accounting information emphasizing management accounting information. This paper aims at changes in management accounting practice in the Czech Republic in last three decades.

In the Socialist Countries, the control function of accounting dominated under the centralized allocation system and command management of national economy with highly restricted autonomy of state-owned enterprises (Jaruga, 1990). Since 1990, an entirely new role was attributed to accounting by market forces; the need to create and develop conceptually different management accounting systems was growing rapidly (Haldma and Lääts, 2002).

To reach the aim of the paper and with the respect to previous researches, which concerned management accounting change in other countries of the CEE region (e.g. Albu and Albu, 2012; Haldma and Lääts, 2002; Szychta, 2002; Vámosi, 2000), following questions served as a starting-point for the interviews and the literature review:

What was the management accounting practice in the Czech Republic before 1990? Which institutional factors influenced this practice?

What were the main drivers of changes in management accounting practice after 1990? Which contingency factors were the most relevant for these changes?

Was the “older” routine in management accounting practice still prevalent after 1990? Were there some institutional factors hindering changes in management accounting practice in 90ties?

First intention of this study was to summarize the articles focusing on management accounting in the Czech companies, which are written in English Czech and published in the journals listed in Scopus database.

Because of absence of relevant papers, we decided to base the discussion on interviews with two Czech professors who were involved in teaching, consulting and publishing activities in the area of management accounting during the whole focused period. It aims to deliver their personal experience with the management accounting change in the Czech organizations, institutional factors and the contingencies.

2. Literature review and methodology

2.1. Reviewing previous research in CEE

Management accounting (MA) practice and its change in transitioning economies of the Central and Eastern Europe (CEE) has become a subject of numerous research activities. First, they aim at description of management accounting tools and techniques, which are implemented in companies. Second, they analyze the contingency and institutional factors, which influence the implementation process.

Development of management accounting systems in the CEE

In the Socialist Countries, both enterprise accounting and budgetary accounting were completely and compulsorily uniform by law (Jaruga, 1990). As Schroll (1995) summarizes it was achieved through the introduction of a uniform chart of accounts, a detailed accounting methodology and a uniform system of financial statements intended to serve the needs of the central authorities. Schama and McMahan (1990) stated that Soviet accounting’s macroeconomic orientation has restricted enterprise manager’s autonomy ... and divorced enterprise management from important aspects of the decision-making process...” (p. 28-29).

The changes at the beginning of 1990s broke these traditions substantially and transition companies have to make more decisions on their own than under their previous existence (Vámosi, 2003). Nevertheless, the development of management accounting in CEE companies was not fast too much in the first decade. Focusing on Polish companies in 1990, Szychta (2002) found that the majority of companies use the traditional full costing system based on actual costs. The same finding brings Vamosi (2000) focusing on big Hungarian chemical company who emphasizes that company uses the similar cost accounting methods as before 1990 however, for new purposes – for managerial decision-making connected with the responsibility. “The knowledge that what-I-do-will-have-consequences-and-I-or-company-will-learn-the-costs is new and illustrates the essence of “a new reality of everyday’s life”.

Szychta (2002) also found that management accounting served as a source useful for top management decision-making, but only some companies used that for decision-making, management control or performance measurement in lower-management. As Haldma and Lääts (2002) point out that “the transition countries prioritized the development of financial accounting, while management accounting was only in its initial stages of development” (p. 381). The development of management accounting after 1990 was not the same in all CEE countries. E.g. Albu (2012) comparing Romania with some other CEE countries advocates that “Romania’s economic development after the fall of communism did not match that of other CEE countries such as the Czech Republic, Poland, or

Hungary. The 1990s were the most difficult years, with high levels of inflation, political instability, limited development of the stock market, and frequent changes in the financial accounting model”.

Contingency and institutional factors of management accounting change in the CEE

Special attention in the literature is given to interpretation of management accounting changes in the context of institutional framework. As Vamosi (2000) argues “To understand what accounting is in a transition company and what role it plays in such a company’s take-off from command economic traditions en route to survival in market economy, one has to ask how institutional changes affects agents’ modes of thought (rationales), and especially how disputes between rationales are reflected in changed behaviour – e.g. management accounting practice” (p. 38).

Szychta (2002) points out the factors which determined the changes in accounting systems in Polish companies – changes in accounting legislation; increased competition on the domestic market; impact of changes in international economy as a result of globalization and recession on eastern markets; changes in the form of business ownership; setting up of new business entities, also with the foreign capital; development of the money market; development and implementation of new IT and acquisition of MA knowledge by managers and employers.

Similar factors were recognized also in other countries of the CEE region. By exploring the drivers of accounting in Estonian manufacturing companies, Haldma and Lääts (2002) discovered the tightening competition, the organizational size, the legal accounting environments and the shortage of qualified accountants as the most influencing contingencies. Albu (2012) found the type of capital and size as the most important factors associated with the existence and use of MA techniques in Romanian companies. Aver and Cadez (2009) realized that the level of participation of management accountants in strategic management processes in Slovenian companies vary strongly across industry sectors with the highest participation in the contemporary manufacturing sector.

2.2. Research methodology

Empirical research on management accounting in the Czech organizations published in the academic literature is quite rare. Table 1 shows the empirical articles focusing on management accounting in the Czech. It covers all articles written in English or Czech and published in the journals listed in the Scopus database from 1988 – 2017.

The applied search query in Scopus was “TITLE-ABS-KEY (“Czech”) AND TITLE-ABS-KEY (“management accounting” OR “managerial accounting” OR “cost accounting” OR “budgeting” OR “management control” OR “performance measurement” OR “performance management”) AND (LIMIT-TO (DOCTYPE, “ar”))”. Based on this query we received 84 hits. Then, we excluded articles from irrelevant subject areas, research notes and papers without empirical research. Finally, we received 18 papers. We used the same query in Web of Science database (field Topic) without any additional answers.

Table 1 – Empirical articles focusing on MA in the Czech companies (listed in Scopus, ordered according to the year of publication)

Author(s)	Main theme	Sample	Data collection
Stříteská and Svoboda (2012)	Performance measurement systems	133 companies	Questionnaire
Šiška (2012)	Impact of BSC implementation on the quality of managerial information	223 companies	Questionnaire
Hornungová and Milichovský (2013)	Performance measurement in ICT industry	23 ICT companies	Questionnaire
Knápková et al. (2014)	Balanced Scorecard	350 companies	Questionnaire
Štamfestová (2014)	Performance management	781 manufacturing companies	Questionnaire
Milichovský (2015)	Performance measurement	147 engineering companies	Questionnaire
Popesko et al. (2015)	Budgeting practices	177 industrial companies	Questionnaire
Špalková et al. (2015)	Performance management of self-governments	7 self-governments	Interviews
Popesko et al. (2016)	Predictability of business environment with budgeting process	177 industrial companies	Questionnaire
Stříteská et al. (2016)	Performance management systems	126 medium and large companies	Questionnaire
Šiška (2016)	Contingency factors of management accounting	160 companies	Questionnaire
Žižlavský (2016a)	Performance measurement in innovation management control	Manufacturing companies (53; 139; 212; 354)	Questionnaires (four from 2009 - 2015)
Žižlavský (2016b)	Performance measurement in innovation management control	Manufacturing companies (53; 139; 212; 354)	Questionnaires (four from 2009 - 2015)
Novák et al. (2017)	Cost management	1 company (production of rubber tires and tubes)	Accounting data of the company
Popesko et al. (2017)	Operational budgets	177 industrial companies	Questionnaire
Procházka (2017)	Impact of international harmonization of financial accounting on management accounting	74 companies under control of the EU-15 listed companies	Questionnaire
Režňáková et al. (2017)	Factors influencing business performance	80 mechanical engineering companies	Questionnaire
Tuček et al. (2017)	Performance measurement of energy processes in production plants	Manufacturing companies (59 for questionnaire survey, 12 for interviews)	Questionnaire Interviews

As Table 1 shows, all papers were published within last five years of focused period. They concern neither the state-of-the art of management accounting systems before 2000 nor the management accounting change driven by the transitioning process from centrally planned economy to market economy.

To learn the lesson about roots of Czech management accounting practice and change, we decided to make a couple of semi-structured interviews with two Czech professors of management accounting. They both started their academic career in late seventies. In the period of centrally planned economy, first one was a member of accounting department and second one focused on pricing in national economic planning. At the beginning of nineties, they participated in the establishment of Management Accounting Department at the University of Economics Prague and served as a head and vice-head of this department in 90s and 2000s. This department is the only department at Czech universities, which specializes on management accounting exclusively. Moreover, they both were strongly involved in consulting activities in the area of management accounting in the Czech companies and they published a lot of professional books as well as university textbooks. The author of this paper is familiar with all these publication results.

The answers are discussed in the context with published findings about management accounting change in other countries of CEE region to recognize similarities in the development and identify specifics of the Czech companies. Although the set of key questions was the same for both professors, they emphasized quite different issues in their answers. In general, the first professor with accounting background accentuated the development of accounting profession and the role of accounting regulation. The second professor with background in economics pointed out the macroeconomic factors. We can say that the answers are complementary without mutual contradictions. Therefore, there is no need to have strict references for specific answers and we can consider them in a comprehensive way.

3. Results and discussion

Management accounting in the Czech companies before 1990

Similarly to the other Socialist countries, the accounting in the Czech Republic was uniformed by law. The Law on a Unified System of Socio-Economic Information released in 1971 considered not only accounting, but also budgeting, costing, operational information and statistical information as parts of unified information system of organizations, which “serves to recognize the state-of-the-art and the growth of economy and society and their developmental tendencies and patterns”. Each organization was obliged to design own system of information in accordance with the uniform methodology. This system of information should be used for both, internal use of the organization as well as providing information to supervising institutions, to statistical office etc. The state institutions, especially the Ministry of Finance was responsible to release detailed regulation and directives following this law. As Schroll (1995) states “The detailed methodology was issued not only for financial accounting but also for cost accounting. The principle of monism (i.e. the unified perception of reality) was applied strictly. The same result had to be shown in financial accounting and cost accounting.” (p. 828).

All major enterprises were owned and controlled by state. The activities of all SOEs were coordinated by the state plan prepared by central government in compliance with the Law on National Economy Planning released in 1970. The government decided about selling prices of goods and services based on cost-plus approach and these fixed prices were applied in “B2B” as well as “B2C” contracts. In manufacturing companies, revenues were recognized according to the actual volume of production (which should meet the production plan) regardless the goods were sold or not.

Prices of supplied goods and services were fixed, and workers’ wage rates and employees’ salaries were also regulated by government. That’s why the main focus of cost management was oriented on optimization of direct costs’ consumption (especially direct material and direct labor costs). We can say that some principles of standard costing and variance analysis were applied.

Although the basic wages and salaries were fixed, companies could design their own rewarding system for employees based on various financial and non-financial performance measures. These measures were usually linked to the fulfillment of production plan, the cost optimization or the increase of labor productivity.

As the Czechoslovakia was a part of COMECON (The Council of Mutual Economic Assistance) coordinated by the Soviet Union, the economic activities were also harmonized at international level. International trade was organized by state organizations called Foreign Trade Companies (*podniky zahraničního obchodu, PZO*) and trade was oriented to other COMECON countries especially.

Not surprisingly, all the findings about the management accounting in the Czech Republic before 1990 are similar to findings in other CEE states. All countries in this region were under the direct or indirect control of the Soviet Union.

Changes in management accounting in the Czech companies after 1990

Political and social changes at the beginning of 1990s brought substantial changes in management accounting practice of Czech companies. The main institutional and contingency factors, which determined management accounting changes, were as follows:

- Development of sector of commercial banks. As Brom and Orenstein (1994) stated “Although mass privatisation did involve some element of 'real' privatisation and non-bank private investors may now control 30% of the economy (including the independent ICs), the bulk of economic activity occurs in firms that are still ensconced in a thick network of bank and state control.” (p. 919).
- Deregulation of price setting and development of the Czechoslovak and Czech currency. Vintrová (2008) explains that “To gain competitiveness in Western markets, prices and wages have to be significantly reduced in relation to foreign markets. For this purpose, the Czechoslovak crown was severely devalued during 1990.”
- Changes in international trade. Fitzová and Židek (2015) summarize that “One of the key aspects of economic transformation after 1990 was quick (and brave) opening of the domestic market to international competition. At the same time, trade with Eastern markets sharply declined and the weight of the trade shifted towards western markets. ... the Czech and Slovak economies became one of the most open in the world. The overall shape of trade experienced a fundamental change.” (p. 36);
- Changes in the ownership of enterprises. Turnovec (1999) reminds that due to the rapid privatization, GDP produced by private sector increased from 3% in 1990 to 90% in 1996;
- Changes in the accounting legislation – new Accounting Law was passed in 1991 with microeconomic orientation of business accounting. Hellström (2006) mentions that “The main objectives of the new act were to get transparent company data comparable to data obtainable in a market economy and to get data comparable over time and space.”;
- Constitution and development of professions of financial managers, accountants and auditors. New professional organizations were established as well – especially the Union of Accountants and the Chamber of Auditors;
- Knowledge transfer from the Western countries. This transfer was realized through three main streams – by the entry of concern managers into the management teams of Czech subsidiaries, by activities of consulting companies and by the support of Czech professional education.

4. Conclusion

The modern management accounting history of the Czech companies has not been covered by the academic literature yet. All papers about this research domain, which were published in journal indexed by Scopus and Web of Science, cover the period since 2010 only. Moreover, they do not focus management accounting change and its institutional and contingency factors.

This paper aims to make the first step on the way to target this research gap. It is based on the interviews with two Czech professor who were involved in teaching, consulting and publishing activities during whole period. Following institutional factors are considered as leading ones for management accounting change in 1990s - development of sector of commercial banks, deregulation of price setting and development of the Czechoslovak and Czech currency, changes in international trade, changes in the ownership of enterprises, changes in the accounting legislation, constitution and development of professions of financial managers, accountants and auditors and Knowledge transfer from the Western countries.

5. Acknowledgement

This paper is one of the research outputs of the project GA 17-13518S/P403 “Determinants of budgeting and performance measurement systems design and impact of these systems on organizational behaviour and organizational perform” registered at Czech Science Foundation.

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WORKING WITH LEVEL OF DETAIL OF BUSINESS PROCESS DIAGRAMS

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Keywords

Level of detail, business process, material flow, information flow

Abstract

In this paper we review the state of the art in the field of possible settings of detail levels of business process diagrams. We have structured this topic based on two interconnected dimensions: the level of detail of process abstraction and the level of detail of process context. Based on analysis, subsequent synthesis of current approaches to setting up levels of detail of process diagrams and identification of open issues, we propose general guidelines how to set up detail levels of process diagrams with both identified dimensions aligned. In detail we elaborate the main identified issue with mapping input or output material and information flows inside a process diagram and propose a solution based on separate model in form of standard data flow diagram.

1. Introduction

Business process management is one of the widely used approaches to performance management. It relies on proper identification and formal description of business processes so that one has a good understanding of the business system what then makes the performance management possible. It is crucial to have the business processes properly and clearly captured in standard process modeling language so that the diagrams may serve not only as a basis for performance management, but also as unambiguous medium of communication among the business stakeholders.

Business process modeling languages give their users freedom to have the diagrams of the business processes in different levels of detail, ranging from very detailed to very abstract and so there is necessary to use some modeling methodology which guides one through the modeling so that one creates consistent diagrams with different consistent levels of detail. This issue cannot be solved the way that there would be only one level of detail. The diagrams at different levels of detail are necessary since each level of detail has its own consumer to whose needs the level of detail of the diagram fits. It is a natural feature of the hierarchical abstraction, the business process modeling is based on, which we can take advantage of if used properly.

Looking into current standards and methods we do not see one complete approach to setting up levels of detail of business process models and their inherent contexts. This is what we want to offer in this paper. The goal of this paper is not only to review the current standards and methods, but also fill the identified blank spaces with fitting solutions and propose unified approach to how a level of detail of a business process diagram should be set up.

2. Method

We structure the topic first so that we are able to set the direction the analysis should go. Based on the current research we analyze the variety of possible process contexts and discuss their relation to the levels of detail of a process diagram. After the analysis we do the synthesis of identified options how the levels of detail of process diagrams can be set up, identify possible inconsistencies and issues, for which we eventually propose a solution.

Our analysis stays focused on business system architecture. Implications for different architectures like the information system architecture are out of the focus of this paper.

3. Levels of Detail of a Business Processes Diagram

First we have to state the difference between a business process model and a diagram. Business process model as such is a model focused on intentional behavior and contains only those elements which are directly bound to control flow and named references to other elements from different models. The business process diagrams on the other hand contain not only the references but also the particular referenced items from different models as process diagrams serve as a complex of views at the process model which may have the process context from other models included.

In this paper we go by the premise that the depth of detail of a business process diagram has two interconnected dimensions:

- Level of process abstraction
- Level of detail of process context

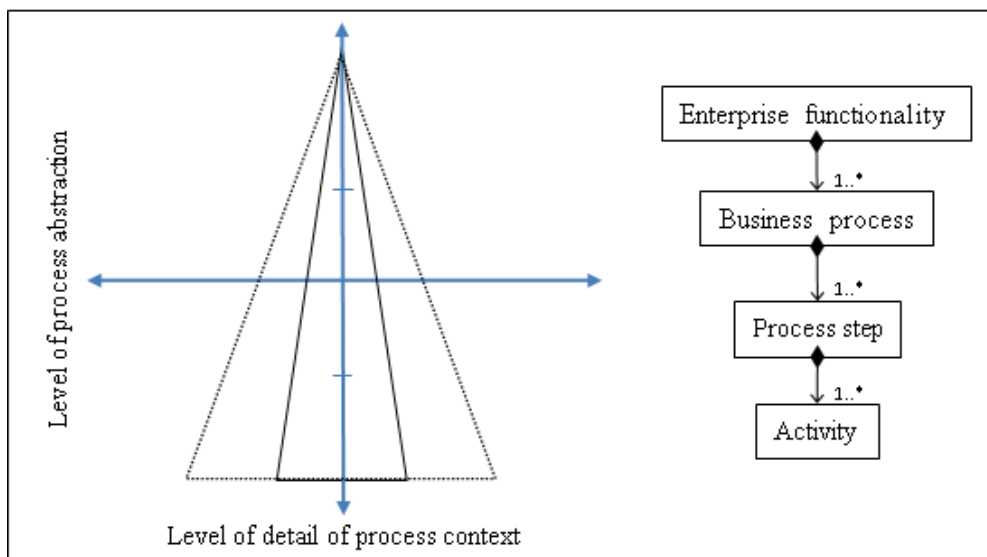


Figure 1: Dimensions of detail levels of a business process diagram and levels of process abstraction

The relation of the two dimensions is illustrated in the Figure 1. The triangles show the optionality of the detail, ranging from focus only on process model elements (solid line) to very descriptive process diagrams with a lot of process context items from other models included (dotted line).

The process abstraction levels are well elaborated in number of different standards and methods (von Rosing, et al., 2015; American Productivity and Quality Center, 2018; APICS, 2017; Rosenberg, 2010) evaluation of which we can find for instance in Svatoš and Řepa (2016). In this paper we will

go along with the conclusions of Svatoš and Řepa (2016) and work with the specified four levels of process abstraction (vertical axis in the Figure 1).

If we would consider only a process model then the process diagram would consist only of process abstractions, control flows with their splits and joins and the events. For some cases it would be enough but there is context (actors, input/output, etc.) which may be essential for the analysis too. The amount of process context is what we call as Level of detail of process context. The area of detail level of process context is much fuzzier and variable than the area of process abstractions. It is always driven by the different focus of business process modeling standards, connected methodologies and the individual needs of analysts. Current standards enable the analysts to note down in a process diagram all kinds of contexts and analytics using these contexts are able to overfill the process diagram so heavily that the process control flow may become almost invisible. In order for a process diagram to be usable, it is necessary that the focus stays at the control flow. The additional context items may be valuable information, of course, but not all has to be part of the diagram as a symbol and not all the detail is relevant at particular level of process abstraction.

The popular standards like ARIS, ArchiMate, BPMN etc. are not very helpful in this case. You can add into process diagram almost anything you want. There is no real method or guidance - whatever context a modeling tool or language has available, one can add it into a process diagram. Level of detail of process context is then driven by an analyst's intuition and the capabilities of tools used and the tools are of course very flexible. This is very unfortunate as the volume of available context items is relatively high and when applied spontaneously it may kill the diagram.

4. Business Process Context

The overview of available business process context we start with the ARIS as it is probably the richest standard on available context. ARIS (Software AG., 2016) provides us in general in its process view with organization units, roles, input and output data, input and output material, IT systems, risks and goals. Other standards like ArchiMate (The Open Group, 2016), IDEF3 (Mayer, Menzel, Painter & Dewitte, 1995), BPMN (Object Management Group, 2013) or UML Activity diagram (Object Management Group, 2018) contain less specific context items: organization units, roles, object states and input and output data or information in form of data associations and object flows. Not all the context is explicitly listed in the current standards. There is also implicit context that the current standards do not usually mention and it is not visible at the first sight. Not only the process abstractions may have context but also the events, process states and conditions associated with the control flow. Events and process states usually refer to class of objects and particular object state from their object lifecycle (Software AG., 2016, p. 88), the conditions of control flows usually refer to value of an object attribute which is tested for given condition. Notes and text annotations we leave out of the discussion as they usually represent unstructured descriptive data which are out of focus of this paper.

The associated context items are not only associated with the process model elements but they also may have relations among themselves as well as with other items from different models, which do not have direct reference to the process model i.e. a context item can be a member of some defined structure in case of an object or an object life cycle in case of an object state.

The associations themselves may be related too. Associations, representing relation in which the associated context items are in roles of inputs or outputs of a process abstraction, are related as the process abstraction represents in this case transformation of the input items into the output item forming so relation between an output and required input(s) for its production. Chaining of such associations creates another type of flow (side by side the process control flow) - the material or information flow.

4.1. Associating the Context Items with the Process Abstractions

As shown above there is wide variety of items and associations forming the business process context and the question is how to work with them in context of all levels of process abstraction.

In case of the context associated with a process abstraction we have to be aware of the hierarchical abstraction, which is in the case of a process model based on aggregation (see process abstractions in Figure 1). The general rule for association of context items with a process abstraction is then that a context item should be associated with the process abstraction at lowest abstraction level possible. To all higher process abstraction levels the associated context items get through the aggregation. It is also important to note that association of the context item with a process abstraction should be done at such level of process abstraction which fits to the context content. In other words: appropriate context for appropriate process abstraction. Only at this proper level of detail an analyst is able to analyze correctly and completely all relevant contexts.

This leads us to interesting question: What if an appropriate level of process abstraction for particular context item would be lower than the lowest level of process abstraction recognized by the given methodology?

In order to be able to answer this question, we have to clarify first how the lowest level of a process abstraction is defined in the methodology we base this analysis on. As we have stated at the beginning, our analysis is based on the process abstractions identified in Svatoš and Řepa (2016) which defines as the lowest level of process abstraction an activity and describes it the following way: An activity is a unit of work that changes particular state of an important object to another. The focus on states from objects' life cycles is in this case important as they define how the people from the business think about their business and what they find important. This mirrors itself in the individual object life cycles, as the life cycle states represent moments in individual object lives, the business recognizes and therefore it has a name and meaning for it. Activities then represent work done which output has some value and meaning for the business. For instance in process of an order creation there are individual order items added (goods, address, etc.). Operations in order life cycle like add/remove order item usually do not change a state of an order and therefore these operations we would not find in the process model in form of corresponding activities. They would be part of an activity which would be covering the whole order creation procedure which final output state would be the submitted order. This way an activity may include several operations from an object life cycle, but the operations are not the next level of process abstraction as they do not represent intentional behavior any more, only processing functions with inputs and an output. The intentional behavior is hidden in the capabilities of the activity performer (the actor) who, using one's skills and knowledge, combines the operations in such way which fits to the actual situation and keeps the course of processing in the direction of the activity's goal (the associated object state).

Trying to go into higher detail than the defined activity level means going into such level of detail in a process model which does not bring any added value from the business perspective and is very demanding and costly to create and maintain. Such detail might be even contra productive as it is taking away the flexibility provided by the individual knowledge and creativity (Voříšek, 2000), if not impossible to capture at all since the control flow may be so optional that it cannot be captured (Ukelson, 2010). The exception would be when there is an idea of activity automation, in process of which there has to be the actor's capability implemented into formal rules, but this hardwiring of the actor's capabilities would not be a subject to the business system architecture anymore but to design of application processes (The Open Group, 2016) of information system architecture.

If we look at the process context discussed in this paper, we can see that there is one subset strongly influenced by the activity definition – the material and information inputs and outputs of an activity which, under these circumstances, actually represent inputs and outputs of individual operations

which may meet together in an activity. As the activities may include several operations, we are not able to match directly the inputs with the relevant output at this level of process abstraction. This mapping has to be done in another model at lower level of abstraction than the process model, which would be based on individual operations and would allow an analyst to do the proper analysis of the inputs and outputs. The association of inputs and outputs with an activity would be then realized over the intermediaries - the identified operations with their input/output associations.

All other discussed context items, as there is not the problem with matching related associations to each other, is possible to associate with the process abstractions either at the fitting process abstraction level or at the most detailed abstraction level – the activity level.

4.2. Context as a Part of the Business Process Diagram

Business process diagram has to describe a business process at particular process abstraction level in order to be clear and consistent. It is a valid question what context items should be or should not be part of a process diagram at particular process abstraction level since the context items and their structures can make the process diagrams pretty messy. We have summarized the available models, the process context may be from, in the Figure 2. The question is whether we should include just a reference to individual item in different diagram, which is focused on particular model, or whether there should be the element from different model included in the process diagram as a symbol.

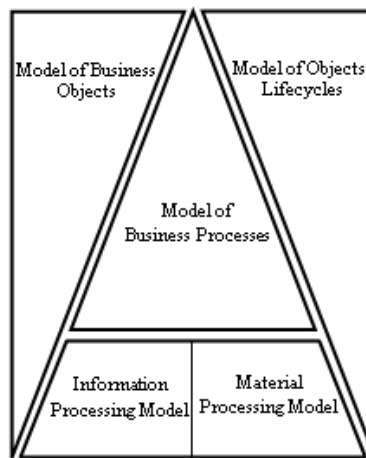


Figure 2: Business process model and its available contexts

Showing direct association between a context item and a process model element in process diagram is generally accepted in most of the methods and standards we have reviewed. The question is whether adding symbols into a process diagram, which actually have no impact on how the control flow will be evaluated, brings any benefit to the diagram itself. From our stand point if there is no special reason a context item can be just listed as an attribute of the particular process abstraction, keeping so the process diagram clear. If the analysis requires having it as a symbol in the diagram, use it consistently and scarcely. Special case is the input and output context items. From the analysis done, it is obvious that the very association of input or output with any process abstraction cannot be done directly in the process model, but through different models, mapping the operations and their inputs and outputs and then associating the operations with the particular process abstraction. But the question whether it makes sense to show the inputs and outputs in the process diagram or to have them only in the appropriate separate diagram is still valid. If we include all the input and output items in the process diagram, they would create together a net which would actually represents a map of information and material flows since the outputs may be also inputs of other process abstractions. The resulting chaos of three types of flow (control, material and information) makes the process diagram ambiguous and confusing. The process diagram should focus on mapping intentional

behavior (the control flow) and not on any other flow, representing for instance possible material or information flows among individual operations. For capturing such information is necessary to use different models and diagrams (in the Figure 2 presented as information and material processing models) and the input and output context items should not be included in the process diagram as a symbol, but only listed as a property of an activity. In the world of case tools with an ability of hyperlinks this is feasible solution as one can switch between two different diagrams effectively having so benefit of focused and clear diagrams.

Another story is the relations among the context items. In case of the structures, the associated objects are part of, we can conclude that in the current methods and standards the general way is to keep the structure definition in different diagrams, which purpose fits this objective. ARIS has special diagrams for capturing structure of an organization, roles, materials etc. and ArchiMate, BPMN and UML Activity Diagram generally reference the class diagram, which eventually can cover the special diagrams used by ARIS too. In addition, the ArchiMate as the only one is able to mix these two different views in a process diagram (The Open Group, 2016, p. 64). Our conclusion would be to go with the main stream and to have separate diagrams for description object structure description (the class diagram) as the purposes of the process and object structure models are significantly different. In case of the states from object life cycles, there is as standard used the state transition diagram (Yourdon, 2006) to capture objects' life cycles. There are alternative versions of it in case of ARIS, UML or IDEF3 but the diagram logic is kept the same and also the agreement that life cycles have to be consistent with the process model but in separate diagrams as the state transitions would create another type of flow, which would make the process diagram confusing.

In case of the context items associated with events, process states and conditions associated with the control flow the current methods and standards keep out of the process diagram. The references to particular objects are in their names or condition definitions but there are no symbols representing particular object and its attribute value or state used. This fits to our approach.

4.3. Material and Information Processing Models

In the analysis above we have concluded, in contrast with the popular methods and standards, there should not be included the input/output context items directly into process diagrams; instead they should be mapped in separate models and diagrams focused on material or information processing. The question is, what diagram to use, as the current standards are not able to give a clear answer.

Input or output material and information flows and the inherent processing operations are interesting phenomenon as we can find them in different business process related standards or methodologies like ARIS, BPMN, UML Activity Diagram, IDEF3, MMABP (Řepa, 2007) and even outside the business process modeling like in ISAC (Lundeberg, Goldkuhl, Nilsson, 1981) or in Stock and flow diagrams from System Dynamics (Forester, 1968).

In ARIS they are captured in the process view either as a part of the process diagram or as separate material or information flow diagram, but in both cases the process modeling language (EPC) is used. In BPMN, IDEF3, MMABP and UML Activity diagram they are captured using the general object flows, not explicitly differentiating information and material. BPMN, IDEF3 or UML do not specify some special diagram for modeling object flows. MMABP on the other hand has a special diagram for modeling information flows based on data flow diagram (DFD) (Yourdon, 2006). Special case is the ISAC with its A-graphs and I-graphs and a Stock and flow diagram from System Dynamics. ISAC in A-graphs maps the material and information flows together with activities (transforming operations) and in I-graph then focuses only on the information flows and transformations. Stock and flow diagram on the other hand focuses on the material flows and material transformations (through the flow rates) and there are included related information flows.

As discussed above, having the information and material flows as a part of process diagram or in any diagram based on process model produces confusing and ambiguous results. This puts off the table all flow diagrams based on a process modeling language i.e. ARIS, BPMN, UML and IDEF3. From the remaining three methodologies we find the DFD used in MMABP as the most standard solution for mapping the information and material flows and transformations rather proprietary graphs (A-graph) or only material flow focused stock and flow diagram, which purpose is rather for quantified calculation than a description. The DFD, unlike the other techniques, can not only map the particular information or material flows and the transforming operations (in form of functions), but also terminators and data stores. Terminators represent external entities, the modeled system communicates with, and this way also the actors in their roles and external systems outside the modeled system may become part of the data flows. Data stores then make possible to differ between synchronous and asynchronous data flows between functions. Direct flow between two functions represents synchronous data flow, while the flow between function and a data store the asynchronous dataflow. Furthermore DFD is based hierarchical abstraction and consistency rules, which help to create consistent diagrams, rather than some kind of illustrations.

DFD as a diagram for modeling information flows and information transformations has been already used in MMABP (Řepa, 2007), but it has not been used for material flows yet. From our point of view the DFD provides us with all necessary means for material flow mapping too. Unlike the information flow model, the functions would represent material transformations instead and the data stores would become material stores, which would introduce a spatial dimension into the model. The DFD also allows through its terminators realization of the close relation of the material and information processing models. Even though the functions in the material processing model would represent material transformations, the material processing model has to include the information flows too, as it is what usually such function starts and also the result of a material transformation is potentially information which can be used elsewhere (for instance information on success or failure of the transformation). As the material processing model contains only material transformations, information always represents a flow from a terminator to a function or flow from a function into terminator, representing element from information processing model.

5. Conclusions

In this paper we have analyzed possible settings of detail levels of a business process diagram. We have structured this topic based on two interconnected dimensions which the level of detail in process diagrams has: level of detail of process abstraction and a level of detail of process context. The level of detail of process abstraction we consider well analyzed by other researchers and we have stated our preferred approach to it. Based on this selection we have continued our analysis in the direction of dealing with the level of detail of process context. For this are we have not found any a general guidelines, only proprietary approaches of different standards and methodologies. Based on synthesis of individual approaches and identification of open issues, we have proposed general guidelines how the level of detail of process context in a business process diagram should be set up so that it is aligned and associated with the proper level of detail of process abstraction keeping so the process diagrams clear, unambiguous and consistent. We encourage the analysts to stay focused on the process control flow elements in the business process diagrams and to keep the most of the contexts and especially their intra-relations in different related diagrams rather than mixing it with the process view.

The main issue we have identified was the mapping of input and output items for which the lowest level of process abstraction is still too abstract. In contrast to other standards and methods we suggest capturing them in other models and diagrams than the business processes which would be then interlinked with the business process diagrams. We have reviewed diagrams in which the material

and information inputs and outputs can be separately captured and proposed extended usage of a data flow diagram, know from structured analysis, rather than proprietary solutions or even solution based on process diagram. The guidelines proposed in this paper can be developed further on so that they fit specifics of different standards and methods.

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THE FACTORS MODERATING THE EFFECT OF FINANCIAL INCENTIVES ON MOTIVATION AND PERFORMANCE: A LITERATURE REVIEW

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Keywords

financial incentives, employee performance, motivation

Abstract

This review examines the effect of financial incentives on employee motivation and performance and points out the moderating factors impacting motivational effectiveness of incentive pay. Four areas of moderators were identified: perception of justice climate and positive workplace culture, performance evaluation process, form and functionality of incentive pay and employee involvement (consensus on strategy implementation and participation in performance measures development). Their impact on the relationship between financial incentives and performance is discussed.

1. Introduction

Financial incentives are considered to be one of the key tools in HRM system aiming to influence employee motivation and job performance (e.g. Bonner & Sprinkle, 2002; Nyberg, Pieper, & Trevor, 2016; Shaw & Gupta, 2015). Recent theoretical and empirical research suggest that financial incentives positively affect employee motivation and job performance (e.g. Garbers & Conradt, 2014; Gerhart & Fang, 2014; Jenkins, Mitra, Gupta, & Shaw, 1998; Shaw & Gupta, 2015) through incentive and sorting effect (Cadsby, Fei, & Tapon, 2007). Financial incentives are effective in work settings as they increase individual performance by improving performance quantity as well as performance quality (Shaw & Gupta, 2015) and as they have positive relationship with job satisfaction, employee commitment and trust in management (Ogbonnaya, Daniels, & Nielsen, 2017).

Moreover, research has confirmed that financial incentives do not erode but rather enhance the intrinsic motivation (Cerasoli, Niclin, & Ford, 2014; Fang & Gerhart, 2012) as they are connected with higher levels of perceived autonomy and competence which positively influence intrinsic interest. Financial incentives and intrinsic motivation are therefore considered to be not opposing but rather working together as their joint impact is critical to performance (Cerasoli et al., 2014).

Thus, by accepting that financial incentives are effective tool that has potential to influence motivation and job performance, the key question is how to use them properly, under which condition they function effectively and why. In our article we addressed this issue by pointing to salient moderating factors influencing the effectiveness of financial incentives.

2. Methodology

In this study, we have followed principles and guidelines of systematic review developed for management and organization studies by Denyer and Tranfield (2009). Specifically, we have tried to follow the identified rules for systematic review: transparency, explanatory, inclusivity and heuristic.

At the beginning of the review we consulted senior academics in order to identify the relevant databases, journals, topics and search keywords for the domain of this research. Finally the scope of the literature review was defined as follows:

Taking into account the interdisciplinary character of the topic the following search keywords were identified to capture relevant articles covering both the performance and motivation issues:

- "performance" OR "management control" OR "management accounting" AND
- "motivation" OR "employees" OR "HR" OR "engagement"

The date range for the relevant papers was restricted to 2004-2017 and as for the document type, only "Articles" were included in the selection. The bibliographic database Scopus was chosen as the primary database to capture the relevant articles.

As the subject of performance management, incentives and motivation is a lot discussed during last decades, the initial search as described above generated over 18 000 of articles in the area of business, management and social sciences.

Finally, we needed to target more precisely the scope of the study and to concentrate on the crucial articles dealing with the topic of the review. The rating of academic journals of the Association of Business Schools (ABS) was used in order to aim for the most valued journals and concentrate on crucial articles. We selected the following subject areas to be included in the study: Accounting; General management, Ethics and social responsibility; Human resource management and employee studies; Management development and education; Operations and technology management; Operations research and management science and Organisation studies. Only the top ranked journals were included in the search, i.e. journal with rating 4* or 4. Additionally, 2 management accounting journals, namely Management Accounting Research and Journal of Management Accounting Research, were included in the search as the management accounting view is in the center of our interest. In total 34 journals were selected and using the search keywords 787 articles were generated.

Subsequently, we filtered the list of articles by subjecting each paper to series of criteria in order to include or exclude the paper to the study. Firstly, all titles were read to assess whether they are or not in the area of our interest. The primary criteria for assessment of articles were defined as follows: the link between the financial incentives and performance of employees is in the center of the study interest, moderating factors of this link are being questioned, motivational impact of incentives is analyzed, and work-setting environment is addressed.

The articles which didn't conform to defined criteria were excluded from the analysis. Consequently, 79 remaining papers and their abstracts were looked through and reviewed, which resulted in the exclusion of 52 articles. Remaining 27 articles were selected as the base for this review. In the last stage, during the reading of selected 27 articles a phase of snowballing was included and additional 8 papers were identified to be crucial for the topic of this study. Summary of articles selection is presented in Table 1.

Table 1: Summary of selection of articles for review

Method	Articles remaining
Bibliographic search – selected keywords, selected journals	787
Reading of title	79
Reading of abstract	27
Snowballing	8

3. Analysis

This section describes and analyzes our findings in terms of the relationship between financial incentives, motivation and job performance. The motivational effectiveness of incentives is addressed and the moderating factors influencing the relationship between financial incentives and performance of employees are examined.

As described in the methodology section, 35 papers were sorted out and are the subject of this review. The characteristic of selected articles is presented in Table 2:

Table 2: Characteristics of selected reviewed articles

Characteristics	Number of articles
Literature review, conceptual articles	8
Empirical studies	27
<i>Field studies</i>	10
<i>Surveys (questionnaires, web based surveys)</i>	9
<i>Experiments</i>	8

The most used theories that grounded the findings of empirical studies are self-determination theory (5 articles), expectancy theory (4 articles), goal-setting theory (3 articles) and agency theory (2 articles).

Recent accumulated scientific evidence confirms the positive effect of financial incentives to individual performance (Fang & Gerhart, 2012; Garbers & Konradt, 2014; Gerhart & Fang, 2014; Cerasoli et al., 2014). Drawing on their findings, we address the question what are the key factors positively influencing the effectiveness of financial incentives and their potential to increase individual performance. Thus, the main focus of our review is to understand how and when financial incentives work rather than if they work (Nyberg et al., 2016; Shaw & Gupta, 2015). Four areas of moderating factors are suggested to be crucial for the motivational impact of financial incentives: perceived justice climate and workplace culture, performance evaluation process, form and functionality of incentive pay, and employee involvement.

3.1. Perceived justice climate and workplace culture

Justice climate of a company influences job performance as it positively relates to trust in organization, need satisfaction and intrinsic motivation (Aryee, Walumbwa, Mondejar, & Chu, 2015). Moreover, positive workplace culture environment can strengthen the link between

performance appraisal and performance outcome of employees such as individual performance, job satisfaction and retention (Cravens, Oliver, Oishi, & Stewart, 2015). The key is whether the culture is perceived by employees as transparent, supportive and positive. Justice climate is associated with the perceived fairness of outcome distribution (distributive justice) and perceived fairness of the process by which performance is evaluated (procedural justice).

Thus, distributive and procedural justice is considered to be one of the crucial moderating factors relating to the effectiveness of financial incentives. The way how incentive system and distribution of bonuses is perceived by employees is essential for the relationship between financial incentives, motivation and individual performance. Recent studies acknowledge the positive effect of financial incentives on performance if they are treated properly and viewed fair by employees (Landry, Gagné, Forest, Guerrero, Séguin, & Papachristopoulos, 2017; Shaw & Gupta, 2015; Sung, Choi, & Kang, 2017). When financial incentives are perceived to be fairly distributed, autonomy and competence need satisfaction of employees is strengthened and motivation and performance increased (Landry et al., 2017; Pepper & Gore, 2015). The perception of distributive justice can overcome the objection of self-determination theory against using money to motivate employees because of the potential risk of diminishing the intrinsic motivation and consequently performance of employees (Deci & Ryan, 2000). Furthermore, Landry et al. (2017) found that financial incentives when fairly distributed are perceived as less controlling and therefore having not the negative impact on the intrinsic motivation of employees.

The fairness of the process of rewards distribution and procedural justice climate is also highlighted by Sung et al. (2017). If the incentive system and reward distribution conform to essential principles of justice, defined as consistency, information accuracy, correctness and bias suppression, it positively influences the reaction of employees to incentive system. Procedural and distributive justice perception can attenuate the potential negative reaction of employees to reward distribution when the reward allocation is not satisfactory. Variability of incentive pay is accepted by employees if they are convinced that the allocation of resources was fair.

Perceived fairness of incentive system can be influenced by implementing subjective performance evaluations (Kelly, Web, & Vance, 2015), such as ex post goal adjustment which filter out the uncontrollable effects. Based on their study, ex post goal adjustments have positive effect on performance of employees if the goals are moderate and achievable (Kelly et. al., 2015). Subjective performance evaluations influence indirectly performance though the impact on perceived procedural justice, i.e. perceived fairness of the incentive system.

Justice climate can be also supported by sharing information about performance among employees. If employees are provided with information about the performance of their peers their performance is positively influenced (Kramer, Maas, & Rinsum, 2016).

3.2. Performance evaluation process

The effectiveness of financial incentives is influenced by the way the performance is measured and evaluated. The question whether the performance evaluations and incentive payments should be based only on objective measures or whether subjective assessment by managers should be incorporated into performance evaluation is addressed.

On the one hand, incentives are expected to be more effective in work settings where performance can be easily measured (Nyberg et al., 2016), and measures should be objective, complete and influenceable (Gupta & Shaw, 2015). The perceived accuracy of the measures positively affects the motivational impact of incentives and contributes to transparency of the relationship between performance and rewards (Bol, Kramer, & Maas, 2016; Kominis & Emmanuel, 2007).

On the other hand, if the measures are perceived as invariable, i.e. absolute standards that must be met without exceptions, work performance can be reduced (Kuvaas, Buc, & Dysvik, 2016). The proactive behavior of employees can be mitigated and employees should concentrate only on achieving the specific goals. Moreover, if goals are perceived as invariable control effect can arise leading to decreased job autonomy and diminished intrinsic motivation.

Proposed solution for more complex environments is the combined use of performance measures and subjective performance evaluations. Subjective evaluations can compensate for the limits of objective measurement by reducing the noise in evaluation and compensate for uncontrollable factors (Woods, 2012). The use of combination of performance related rewards and subjective performance evaluations is encouraged even in creativity-dependent firms where objective measures are not available (Grabner, 2014). The simultaneous use of both the performance pay and subjective evaluations fulfills the requirements for control, goals consistency and directing the effort of employees. Whereas, mixed results were found by Kunz (2015) concluding that positive effects of subjectivity in evaluation process can be reduced by imprecision of subjective assessments.

3.3. Form and functionality of incentive pay

Motivational effectiveness of incentive pay is determined by the perceived value of the incentive and the perceived link between incentive pay and performance (Bonner & Sprinkle, 2002; Nyberg et al., 2016; Park & Sturman, 2016). Employees are willing to exert in tasks where the perceived sensitivity of performance measurement and compensation is high. Motivation is higher if there is a strong link between performance and rewards. (Bonner & Sprinkle, 2002). Consequently, the stronger link between pay and performance is associated with increased job performance (Park & Sturman, 2016).

Merit pay and bonus pay are the most prevalent types being addressed and their effectiveness questioned. Both reward past performance, bonus pay is a lump sum payment, while merit pay is defined as incremental increase in base salary (Nyberg et al., 2016). Even though, economically rational person should prefer merit pay over bonus pay, as merit will lead to increased earnings not only in current period but also in the following year as it increases the salary base, according to Nyberg et al. (2016) individuals prefer bonus pay because the perceived value as well as stronger link between pay and performance make bonuses more favorable. The merit increase in pay is spread over the year, whereas bonus pay is immediate which makes it to be perceived more valuable and compelling.

Conversely, Park and Sturman (2016) assessed the simultaneous use of different forms of incentives and concluded that merit pay have stronger incentive and sorting effect than bonus pay. They argued for merit pay by underlining the importance of the perceived link between pay and performance and deduced that permanent increase connected to merit pay is perceived to have greater value than one-off payment (bonus pay). According to their findings, merit pay is an effective tool influencing positively performance if implemented correctly by creating a strong link between pay and performance.

3.4. Employee involvement

Not only the design of incentive system and performance measures is important, but the employee involvement and participation is crucial for the incentive effect. The consensus on strategy implementation is considered to be related to the effectiveness of performance measures, the consensus increases performance and the effect is higher for employees with higher level of consensus on strategy implementation (Ho, Wu, & Wu, 2014). The crucial recommendation is therefore to focus not only on the design of performance measures but concentrate also on effective

strategy communication and implementation. Incentives can be beneficial and improve performance if there is a broad strategy consensus among employees.

Similarly, employee involvement and participation in the development of performance measures positively affects the perceived quality of performance measures and leads to better performance (Groen, Wouters, & Wilderom, 2012; Groen, Wouters, & Wilderom, 2017). When performance measures are co-developed with employees there are viewed to be of better quality both by employees as well as by managers. Such metrics are more trusted by employees and more used by managers which contribute to higher job performance.

4. Conclusion

This study reviews the current state of knowledge regarding relationship between financial incentives, motivation and job performance. In general, recent research confirmed the positive affect of financial incentives on performance (Fang & Gerhart, 2012; Garbers & Konradt, 2014; Gerhart & Fang, 2014; Cerasoli et al., 2014). Hence, we aimed our effort on understanding the moderating factors of this relationship, i.e. analyzing conditions under which financial incentives operate best and which attributes should be taken into account when designing and implementing incentive system (Nyberg et al., 2016; Shaw & Gupta, 2015).

We have identified four areas of factors impacting the motivational power of financial incentives.

First, the perception of fairness, justice and positive workplace culture are proved to positively influence the link between financial incentives, motivation and performance. If the incentive system is perceived by employees to be fair and incentives fairly distributed then the incentives positively affect motivation, do not diminish intrinsic motivation and performance is increased (Landry et al., 2017; Sung et al., 2017).

Second, combined use of performance measures and subjective performance evaluations is found to be a proposed solution regarding optimal performance evaluation process (Grabner, 2014; Woods, 2012). Performance measures should contribute to transparency and accuracy of the evaluation process, while subjective performance evaluations can compensate for uncontrollable effects and reducing the noise in the process.

Third, the perceived value of financial incentives and the perceived link between incentive and performance are proved to moderate the motivational effectiveness of financial incentives. The higher the perceived value and the stronger the perceived link to performance, the more effective financial incentive is. The effectiveness of the most used types of incentives – bonus and merit pay were analyzed but opposing conclusions found. While Nyberg et al. (2016) argued in favor of bonus pay, Park and Sturman (2016) preferred merit pay.

Finally, employee involvement is considered to positively moderate the incentive effect. Consensus on strategy implementation and employee participation in development of performance measures has been analyzed and proved to positively influence performance (Groen et al., 2017; Ho et al., 2014).

5. Acknowledgement

This paper is an outcome of a project supported by the Grant No. F1/25/2018 – Internal Grant Agency of the University of Economics, Prague.

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WHICH COMPANIES HAVE IMPLEMENTED MANAGEMENT ACCOUNTING?

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Keywords

Management Accounting, Financial Indicators, Mann-Whitney U Test, Product Management

Abstract

Management accounting system gives information about cost allocation for a profit measurement and inventory valuation, to help managers make a better decision and to use planning, control and performance measurement. This article is primarily concerned with the management accounting survey and seeks to identify the financial variables, whose amount is different for businesses that do not have implemented management accounting from companies with implemented management accounting. Several variables for analysis were selected from the balance sheet and the profit and loss statement, but the data were also surveyed on the basis of structured interviews, when it was determined whether companies have implemented management accounting or not, the form of management accounting, how they can break down the costs, how many employees they have or what are the average wage costs. Mann-Whitney U test was used to analyze these variables. On the basis of a statistic analysis (tested at a significance level of 0.05) it was found significant differences in the indicators as fixed assets, EBIT, EBIT, operating costs, EBIT per employee and annual turnover. These indicators have also on higher level the companies which have implemented management accounting.

1. Introduction

Management accounting is important because managers need an information system that will identify and solve problems, such as the possibility of cost overruns or the inability to implement the plans for future. The performance measurement is possible to define as a tracking the costs in a responsibility center (in the business unit) (Drury, 2015). Primary purpose is coordinate management systems for cover information and also to ensure harmonization within and outside the company. According to Reichmann (1997), this system consists of several different components, which must be characterized in organization and then analyzed and structured. These components include targets, tasks, concept, applications and finally the institution. The basic objectives of management accounting and controlling as well are goals, that determine the reasons for planning and design management systems. These goals are derived from organization's main objectives. The goals are primarily in the form of profit, productivity and liquidity (Reichmann, 1997). According to Papenhoff, Halfmann & Schmitz (2018) controlling is leading the company using partial tasks. It is also about the planning and management of economic processes, which are part of company's management. Key information about companies helps with solution of complicated facts. In some industries is usual that besides controlling the company deal with checking the serviced provided as

well. This information is needed by all companies regardless of the size of company. It is important for both middle and small businesses.

The increasing importance of capital markets associated with the separation of the position of the investor from the role of the manager, in the context of lower reporting ability and lower quality of business information based on accounting information, have led to the strengthening of financial reporting in the performance during the second half of the last century. In particular, investors' requirements on qualitative performance characteristics were affected; there was also a need for international comparability of performance information; and measuring and evaluating performance information, in particular, advisory companies appears to be a prospective market (Wagner, 2011).

Product management is one of the basic directions influence to the reproduction process which provides important information to management departments (Hansen, Mowen, Guan, 2009). Product management has information mostly from costing, costing systems and management accounting subsystems. The general purpose of this information is to answer the questions of the product benefits. According to the information can company choose what type of performance should they focus on and can dampen (Hoque, 2005). The product management has connection with cost-performance accounting.

Most companies are established to make a profit. To achieve it a very important part is planning. The management choose from among alternatives that best fits to the company's strategy and objectives. When making this choice, the management must balance the potential benefits on the company resources. The top management looks at the sales volume, profit margin, and costs (Noreen, Brewer, & Garrison, 2011).

Responsibility accountancy is focused on who is responsible for the variances and expects measures to avoid them. Another task is allocation of the costs to the individual responsibility centers. The best way is combination of them. In this term it is necessary to evaluate effectiveness, efficiency and economy (Adler, 1999). The control system can be seen as a set of both formal and informal systems that help manage the organization and direct it towards the goals the organization has set by itself (Chandra Das, 2011).

Effectiveness is an ability to evaluate the resources put into the business and it tells us if the company achieved the planned aims. The best advantage is saving materials, time or energy and even save some money. So basically it is just a measure which helps managers to do their work correctly, properly and mainly without the wasting of money. It always tries to make an economic performance with a minimum waste or unnecessary work and time (Callahan, 1962). Effectiveness express the benefits and it is possible to measure it e.g. by ROI, ROA or ROE. Efficiency reflects the benefit from sales (revenues) and it measures the rate of improvement of costs that are put into the sold products. Economy helps managers to get the best resources of appropriate quantity and quality at minimum level of costs. Measurement of the economy is based on a comparison the actual costs with the planned costs. There are two ways how to increase economy – by the absolute savings and by the relative savings. Absolute savings are possible to achieve when the planned outputs are produced with less resources. Absolute savings are reflected mostly in variable costs and a little part in fixed costs. Relative savings (utilizations) can managers achieve by the utilization when there is a focus on maximization of the products volume with constant exploitation of economic resources (Kral, 2010).

The basic relations in the management accounting are based on the CVP analysis (Cost-volume profit analysis). It analyses how the profits are affected by selling price, sales volume, costs and the mix of products sold. This analysis can help managers to know, what prices is the best to charge, what cost structure is necessary to maintain, what products and services is the most profitable to offer etc. (Garrison, Noreen, & Brewer, 2012). This analysis gives the information about the profit at various levels of activity. The management can distinguish between the effect of sales volume motion and the outcome of price or cost changes upon profits (Pandikumar, 2011).

There are several assumptions to apply the CVP analysis. The assumption is that volume is the only factor that will cause cost and revenues to change. But when e.g. the sales mix or price level change then the analysis is incorrect and it is necessary to recount it. Other assumption is that the single product is sold. The total revenue and total cost have linear functions of product. The fixed cost incurred during the period are charged as an expense for that period. It is important that the cost can be divided into fixed and variable element, even it is sometimes hard to do that. This analysis can be applied only to a short-time horizon (Drury, 2015).

The basis that is used to cost allocation to products is an allocation base or cost driver. The most common bases are direct hours like labor or machine, units produced, and units sold (Noreen, Brewer, & Garrison, 2011). For business is important to set the price to cover production costs and generate a certain amount of profit. Cost information is one of the most important types of management accounting information.

Controlling verifies that everything is in line with the organization's plans, guidelines and established policies. This coordination ensures effective use of organizational resources to achieve organizational plans. It measures the variations of actual power from the standard. It also identifies the causes of these variations and helps in taking corrective action (Cornel, & Lavinia-Maria, 2012).

And why is management accounting so important for a management function? Planning can be done, an organizational structure can be created to facilitate effective achievement of goals and to effectively motivate people by leadership. However, there is no certainty that planning is in line with established plans, and there is no certainty of effectively achieving goals or motivating people. It is important because it is the only way for managers to find out that organizational goals are met. And if they are not, they are able to find by the control where the error is (Robbins, Coulter, DeCenzo, 2017).

2. Methodology

As a statistical test it was used Mann-Whitney U test. This test is a nonparametric test that allows two groups or conditions to be compared without making the assumption that values are normally distributed. The test involves the calculation of a statistic, usually called U, whose distribution under the null hypothesis is known. The null hypothesis asserts that the medians of the two samples are identical (Freund, Wilson, Mohr, 2010; Budíková, Králová, Maroš, 2010)). Statistically, it has always been tested at a significance level of 0.05 where zero hypothesis $H_0: \mu_1 - \mu_2 = 0$ against alternative hypothesis $H_A: \mu_1 - \mu_2 \neq 0$.

Suppose we have a sample of n_x observations $\{x_1, x_2, \dots, x_n\}$ in one group and a sample of n_y observations $\{y_1, y_2, \dots, y_n\}$ in another group. The Mann-Whitney test is based on a comparison of every observation x_i in the first sample with every observation y_j in the other sample. The total number of pairwise comparisons that can be made is multiplication of n_x and n_y . (Hendl, 2012).

U is then given by (Freund, Wilson, Mohr, 2010):

$$U_1 = R_1 - \frac{n_1(n_1+1)}{2} \quad (1)$$

where n_1 is the sample size for sample 1, and R_1 is the sum of the ranks in sample 1.

An equally valid formula for U is:

$$U_2 = R_2 - \frac{n_2(n_2+1)}{2} \quad (2)$$

The smaller value of U_1 and U_2 is the one used when consulting significance tables. The sum of the two values is given by:

$$U_1 + U_2 = R_1 - \frac{n_1(n_1+1)}{2} + R_2 - \frac{n_2(n_2+1)}{2} \quad (3)$$

Knowing that $R_1 + R_2 = \frac{N(N+1)}{2}$ and $N = n_1 + n_2$, and doing some algebra, we find that the sum is $U_1 + U_2 = n_1 n_2$.

3. Results and discussion

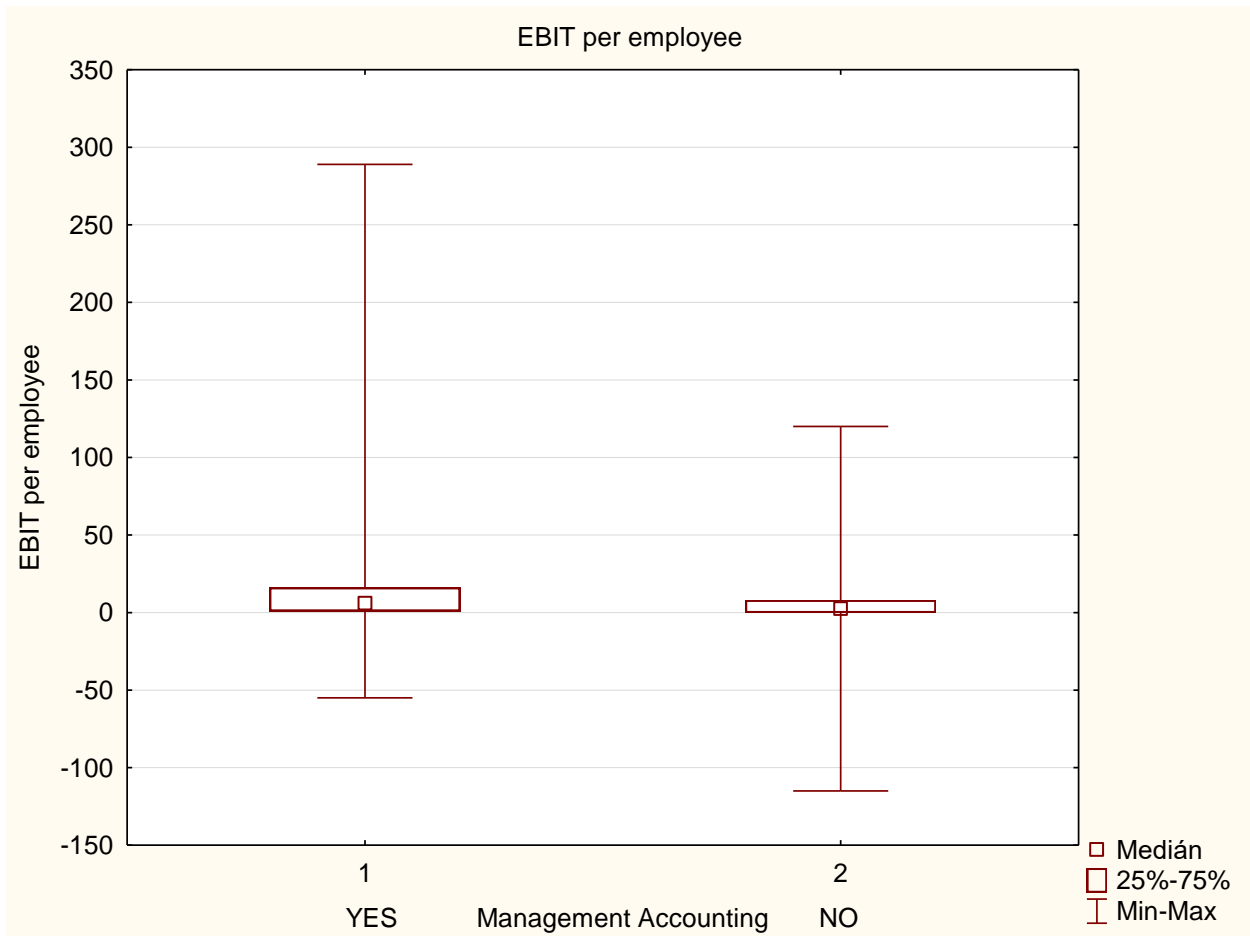
The aim of this article was to analyze the companies that have implemented management accounting and that have not implemented it. The data was obtained from the companies on the basis of structural interviews, where mainly information from the field of management accounting was collected and further data were compared with the data obtained from the Albertina Gold Edition database. In the context of management accounting, there were included questions related to costing, budgets, detecting imbalances, and more detailed cost breakdowns. The research was applied only to enterprises whose number of employees ranged from 10 to 15, the total capital was more than CZK 1 million, and they were enterprises from the regions of the Czech Republic. For these companies it is assumed that they could have established management accounting. The financial data were collected from balance sheets and profit and loss statements. Data obtained from structural interviews and database data was paired based on an identification number. Altogether 308 enterprises were analyzed, of which 239 enterprises were usable for statistical analysis (remaining companies showed either incomplete data or inconsistent data).

Table 1: Mann-Whitney U test, Source: Own research, database Albertina

Variable	YES	NO	U	Z	p-value	Z edited	p-value edited
Number of employees	17 090	11 590	6 234	1,454	0,146	1,549	0,121
Fixed assets	17 476	11 204	5 848	2,183	0,029	2,183	0,029
Current assets	18 129	10 313	4 957	3,792	0,000	3,792	0,000
Own equities	17 549	10 655	5 299	3,062	0,002	3,062	0,002
Bank loans	16 807	11 874	6 518	0,918	0,359	0,952	0,341
Operating costs	17 992	10 688	5 332	3,158	0,002	3,158	0,002
EBIT	17 834	10 607	5 251	3,232	0,001	3,232	0,001
ROE	16 223	12 458	6 907	-0,183	0,855	-0,183	0,855
ROS	16 874	11 807	6 451	1,045	0,296	1,045	0,296
EBIT per employee	17 562	10 641	5 388	2,864	0,004	2,869	0,004
Average monthly salary	16 918	11 523	6 270	1,266	0,205	1,281	0,200
Annual turnover	17 908	10 534	5 178	3,372	0,001	3,373	0,001

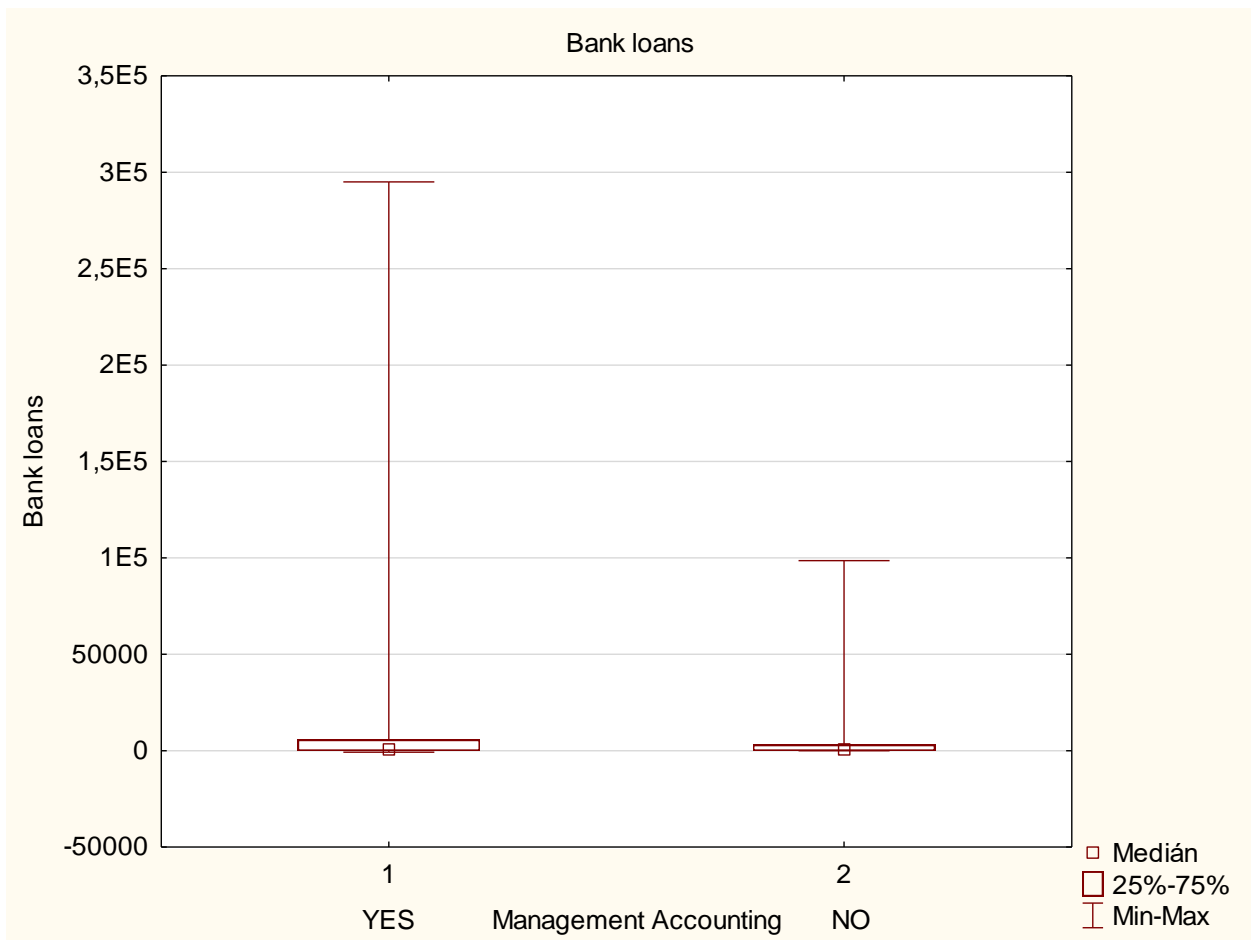
In analyzing the number of employees and average monthly wages in relation to management accounting, significant differences were found between the companies that have implemented management accounting and that have not implemented it. On the other hand, when was analyzed EBIT per employee in relation to the implementation of management accounting, the zero hypothesis was rejected at a significance level of 0.05. In the boxplot 1, there is evident that EBIT per employee in companies that have implemented management accounting is on higher level than in companies that do not have implemented management accounting.

**Boxplot 1: EBIT per employee, management accounting YES and NO, Source: Own research, database
Albertina**



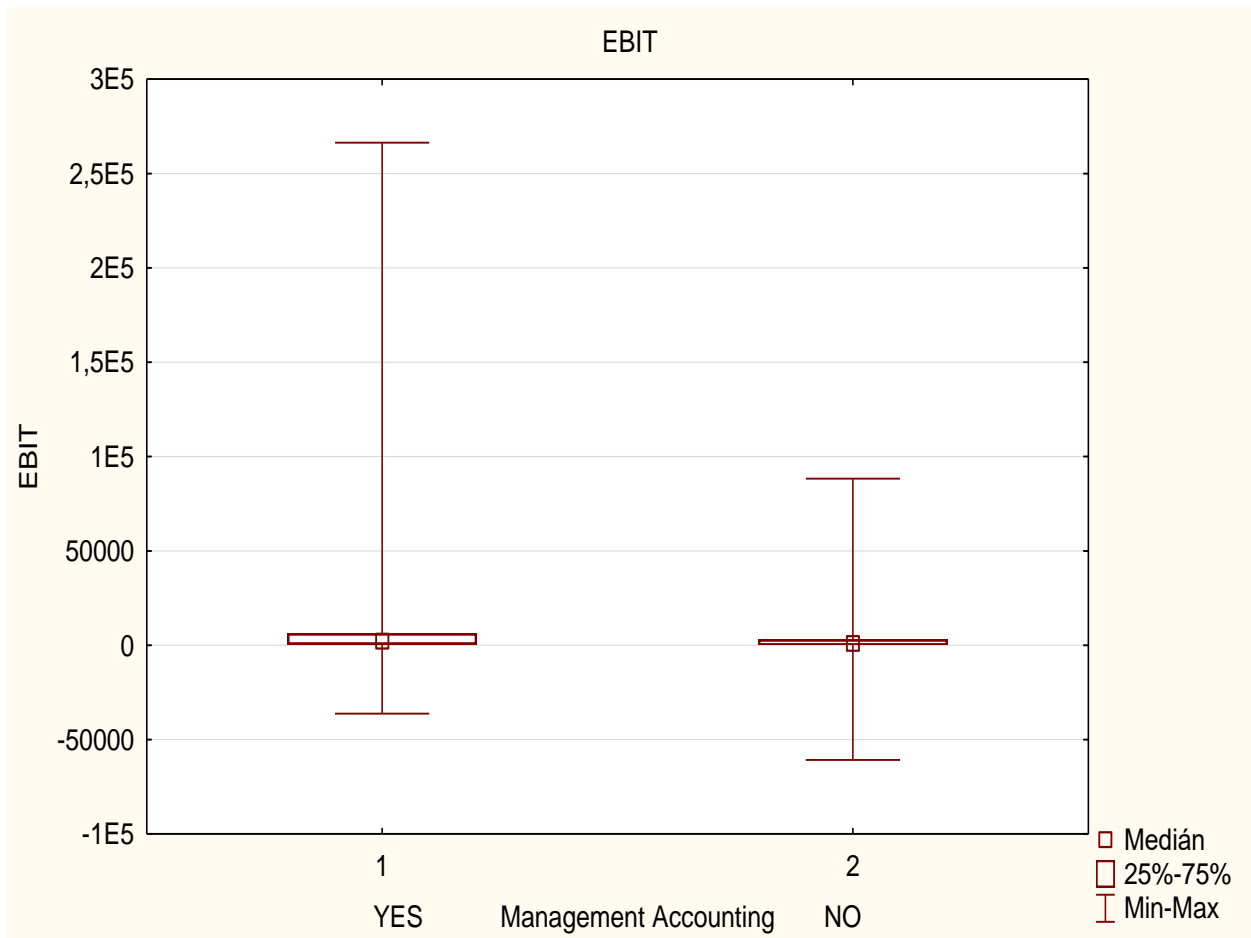
Furthermore, the zero hypothesis was rejected for fixed assets, current assets and equities. Companies with implemented management accounting have significant differences from companies that do not have implemented management accounting and they have also higher average values. This may be due to the fact that they are mainly manufacturing companies with a larger share of machines and equipment, or companies buying and selling goods with a higher share of inventories (ie a higher proportion of current assets). On the other hand, the hypothesis that companies with implemented management accounting have a higher share of bank loans was not confirmed. As it is seen in the following boxplot, the companies are comparable for this variable.

Boxplot 2: Bank loans, management accounting YES and NO, Source: Own research, database Albertina



Other variables as operating cost, EBIT (see boxplot 3) and annual turnover were analyzed. All these variables rejected the zero hypothesis at a significant level of 0.05, and it was found that there are significant differences between companies that have implemented management accounting and that do not have it. On the other hand, for the ROE and ROS indicators (which measure profit to equity and profit to sales), no significant differences were found between companies that have implemented management accounting and that do not have it. This is an interesting fact because both the EBIT and the equity and total revenues indicators have confirmed significant differences.

Boxplot 3: EBIT, management accounting YES and NO, Source: Own research, database Albertina



4. Conclusion

The management tasks must be designed to match as much as possible corresponding with organization’s targets and they must serve to meet the goals. This also applies to the activities for which the managers of the organization are responsible. It is included activities such as information processing, data analysis to evaluation and control. As mentioned above, the tasks are highly dependent on the organizational control objectives. The article is primarily concerned with comparison of companies that have implemented management accounting and enterprises that do not have implemented management accounting. It was found that enterprises that have implemented management accounts show significant differences at the level 0.05 (reach higher values) for indicators fixed assets, current assets, own equities, EBIT, operational costs, EBIT per employee and annual turnover.

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STRATEGIC MANAGEMENT ACCOUNTING – THE LACK OF SUCCESS

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Keywords

Strategic management accounting, activity-based costing (ABC), balanced scorecard (BSC), target costing (TC), life cycle costing (LCC)

Abstract

Strategic management accounting has not developed as had been supposed. One reason is that strategic management accounting offers no innovative methods to improve information support for strategic management. According to the literature and to university courses relating to strategic management accounting, the most important methods are activity-based costing, the balanced scorecard, target costing and life cycle costing. These methods, whilst being very popular, are subject to criticism regarding, for example, their lack of innovation, lack of clearly defined content, and tendency to focus on procedural issues.

1. Introduction

A comprehensive review of the SMA literature, plus evidence from its use in practice, have found that ‘SMA or SMA techniques have not been adopted widely, nor is the term SMA widely understood or used’ (Langfield-Smith, 2008, p. 204). There is a sharp contrast, a paradox, between the vibrant, eclectic development in the practice and theory of strategic management in the last 50 years, reflected in the substantive practice-oriented and academic literatures, and the corresponding developments in SMA that seem ‘to have languished’ (Seal, 2010, p. 107) and look more like a blip or a fad.

The apparent low adoption of SMA techniques also seems inconsistent with business operating environments that, in fact, demand more information, including management accounting. The intensification of competition and the emergence of new technologies, especially web-based technologies, are transforming business models, creating new businesses and wiping out others (Bughin et al., 2010; Arthur, 2011).

Other problems relate to the absence of a fixed list of techniques and methods that management accounting should include. (Langfield-Smith, 2008). One of the most cited lists identified 14 techniques (Cravens and Guilding 2001):

- activity-based costing/management (ABC/M)
- attribute costing
- benchmarking
- competitive position monitoring
- competitor cost assessment

- competitor performance appraisal based on public financial statements
- customer accounting
- integrated performance measurement
- life cycle costing
- quality costing
- strategic costing
- strategic pricing
- target costing
- value chain costing

However, this list presents more ideas and areas of interest than concrete applicable methods and tools.

The purpose of this paper is to analyse the failure of strategic management accounting, illustrating the lack of methods and techniques associated with strategic management accounting and thus explain its perceived failure to support strategic management.

2. Methodology

The research is based on a survey of the literature and related university courses. The literary review consists of an analysis of the books relating to strategic management accounting (strategic management accounting / (management) accounting for strategy) published during the last 20 years. The analysis of university management accounting and strategic management courses consists of an investigation into those courses provided by universities in the top 100 as ranked by the QS World University Ranking.

3. Research

According our analyses, both of books focusing on strategic management accounting and into the content of management accounting university courses, the most frequently applied strategic management accounting methods are target costing, life cycle costing, the balanced scorecard and activity-based costing.

42 management accounting books published over the last 20 years were analysed. Table 1 shows the number of books that explain and analyse the most-described methods.

Table 1. Book analysis

Methods	Number of books	expressed as %
Activity-base costing	40	95.24%
Balanced scorecard	39	92.86%
Life cycle costing	37	88.10%
Target costing	35	83.3%
Just in time	28	66.67%
Strategic planning or budgeting	17	40.48%
Value-based management	16	38.10%
Quality costs	16	38.10%
Strategic business unit performance measurement or responsibility strategic management accounting	15	35.71%
Customer profitability management or analyses	14	33.33%

62 courses from top-100 QS World University Ranking universities were analysed. Table 2 shows the number of courses that explain and analyse the most-described methods.

Table 2. Course analysis

Methods	Number of courses	expressed as %
Balanced scorecard	61	98.39%
Activity-based costing	60	96.77%
Life cycle costing	58	93.55%
Target costing	55	88.71%
Strategic planning or budgeting	38	61.29%
Strategic business units performance measurement or responsibility strategic management accounting	38	61.29%
Quality costs	35	56.45%
Customer profitability management or analyses	34	54.84%
Value-based management	32	51.61%
Just in time	32	51.61%

The results of both analyses are very similar. The most popular methods are the balanced scorecard, activity-based costing, life cycle costing and target costing. However, these methods are subject to criticism, specifically that they are neither innovative nor clearly defined.

4. The literature

4.1. Criticism of Balanced Scorecard

Among others, Kraaijenbrink (2012) disagrees with the claims in practitioner-oriented literature that the BSC improves strategic awareness, communication, execution and achievement. Whilst accepting positive results, Kraaijenbrink (2012) links them to other factors such as an increased attention to strategy arising from the BSC rather than to the BSC itself. Neely et al. (2004) find that BSC implementation is time-intensive for employees and consumes the time they would otherwise

have used to execute their assigned responsibilities. Pessanha and Prochnik (2006) criticize both the objectives and the definitions of BSC measures.

Critics point out that Kaplan and Norton's suggestions regarding the selection of strategic objectives and performance measures leave out several important stakeholders' interests. In fact, the conception of the BSC only caters for the interests of the shareholders, ignoring other key stakeholders such as suppliers, the government and the environment. Despite Kaplan and Norton noting the importance of including new perspectives to cater for the interests of all stakeholders, they fail to discuss the implementation of these additional perspectives and any causal links between the additional perspectives and performance measures.

In addition to the other stakeholders, Pessanha and Prochnik (2006) criticize the lack of explicit involvement of and engagement with employees in the definition of objectives and measures. Whilst the internal process and learning and growth performance metrics involve employees, the BSC does not include employee support and at times seems unfamiliar to employees. Parmenter (2012) criticizes how the BSC develops and defines performance measures, finding fault in Casey and Peck's (2004) observation that the BSC transforms strategy into tangible performance measures by arguing that the BSC fails to define KPIs adequately, hence hampering identification.

The criticism compares key BSC performance indicators (KPIs) to the winning KPIs' methodology and find faults in the approach by which the BSC conceptualizes performance measures. The winning KPIs indicate that the primary role of performance measures is to help managers focus on critical success factors but the BSC perceives the primary role of performance measures to be the monitoring and evaluation of the performance of strategies. Moreover, the BSC neither identifies nor defines critical success factors.

Whilst Kaplan and Norton (1992) argue that the BSC helps managers to modify strategies, in a highly dynamic business environment managers have to modify or radically change their strategies frequently. The result is increased uncertainty regarding the usefulness of defined key indicators. Thus, for firms operating in highly dynamic environments requiring frequent changes in or modification to strategies, it is a severe challenge to establish performance measures which can cope with such modifications and thus avoid the risk of creating a static organization. In practice, managers transform strategy into tangible performance measures and align organizational activities towards the achievement of BSC goals.

The result is an increased focus on achieving BSC goals to the exclusion of other goals beyond the scope of BSC targets, resulting in unutilized potential. The BSC framework focuses almost exclusively on a firm's internal processes, not on links either with related firms or with the environment. The main aim of the BSC is to enhance performance and translate the individual firm's strategy into action without consideration for the interlinked, networked business environment. In today's business eco-system, firms collaborate within their networks to improve their own performance.

The BSC concept is essentially a list of metrics, which makes implementation difficult and frustrating. Casey and Peck (2004) add that the initial step of implementing the BSC consists in expressing a strategy as measurable goals. However, populating the BSC with goals does not mean transforming strategy into goals. Furthermore, the BSC clearly describes neither strategy nor goal formulation – and nor does it claim to do so. Moreover, BizShifts (2010) contends that the top-down design of the BSC is a conceptual limitation since it puts the onus for the success or failure of the BSC squarely on senior management. This design further demonstrates that the BSC perceives as the norm firms with bureaucratic leadership, hierarchical structures and clearly delineated job responsibilities, which is generally not the case. In addition, the BSC is becoming increasingly deficient since one-way linear cause-and-effect relationships are insufficient to describe the complex nature of today's business.

Although the BSC has a learning and growth perspective that deals with knowledge creation and innovation, the perspective adopts the traditional logic of innovation, in which research and development (R&D) deals with innovation but conceals both the process and the innovation itself from competitors. The only difference is that the BSC extends the innovation concept from R&D to the entire organization. However, the traditional logic of innovation is changing from closed to open innovation influenced by the increasingly inter-linked and networked nature of today's businesses. According to Antonsen (2010), implementing the BSC requires an organization to gather new data, which could create work overload for some departments. It could potentially lead to employee resistance and cynicism as well as to managerial resistance due to the increased availability of information with the potential to upset the existing balance of power.

4.2. Criticism of ABC

On the other hand, ABC can be criticized on practical and theoretical grounds. Surveys report that a minority of firms adopt ABC, and there are indications of dissatisfaction among some users. In addition, ABC requires direct proportionality and the exclusion of common costs, which are difficult conditions to meet.

From Malmi's (1997) perspective, it appeared that one of the major criticisms faced by ABC is that of information utilisation. This problem of not utilising the output of the ABC process is the main bone of contention as a huge amount of resources can be expended in processing that cost information.

Another major problem of ABC is the fact that it requires complex, resource-heavy formalities in gathering and processing information. This, in fact, is the main reason why companies that embrace ABC, with high hopes, all of a sudden abandon it for the old, traditional cost-accounting process.

This development was of concern to many, including Kaplan and Anderson (2005), who subsequently advocated what they termed 'time-driven ABC'. Kaplan and Anderson (2005) are strongly of the opinion, demonstrated in 'Rethinking Activity-Based Costing', that abandonment is not the way to solve the identified problems of ABC.

The fact that one need create an environment where ABC can function without friction before importing the system into an already existing system makes it imperative that a systematic approach be employed. Any systems integrator will tell you that conflict resolution is the key to integrating two systems.

This is to say that the implementation problems and drawbacks of any process are not solely embedded in the process but also in the attitude and behaviour of the custodians of the process. The law of inertia entails that human beings are reluctant to adapt to change even when not adapting could be disastrous.

Those who follow the traditional system of allocating overhead costs tend to have some reservations regarding the information produced by ABC. According to Cohen et al (2005), research indicates that stretching the ABC process time schedule, exceeding the budget and the inadequacy of computer software (which would no longer be a problem in today's world) are the main culprits in criticism levelled at the ABC system.

Another area where ABC is found wanting is in assigning costs that have no solid driver.

4.3. Criticism of Target Costing (TC) and Life Cycle costing (LCC)

TC was mainly initiated by Japanese companies in the 1960s as a cost reduction and control system, used to manage product costs during the earlier stages of product life-cycles. The evidence reviewed

suggests that TC has been promoted in non-Japanese companies to ensure product competitiveness in terms of cost, quality and functionality.

TC implementation spread to some developing countries during the 1980s and 1990s. In supporting this view, Kaplan (1994) asserts that the 1980s to 1990s were characterised by a revolution in cost and management accounting theory and procedures. Our literature review reveals that increased attention had been paid by many organizations worldwide to this technique not only as a cost reduction tool, but also as a cost management tool, aiming to improve product quality, functionality and timeliness. This is the key feature of TC implementation, enabling organizations to improve profitability and ultimately to compete with their competitors. Recently, especially since 2000, the focus of most organizations has been concerned with the integration of management accounting techniques.

Three main challenges concerning data used in the LCC were identified.

- Firstly, data from all life cycle stages has not traditionally been collected by providers or customers, and thus is unavailable, so their organizational setup is not geared towards utilising this data.
- Secondly, it is a challenge to obtain data which is relevant to the PSS because a PSS means redesigning the products and services to fit. This renders irrelevant the data from when the product and service were offered separately, although often this fact is not immediately clear to the practitioners carrying out cost estimations.
- Thirdly, the design paradox is applicable to PSS because the data needed for optimal design may be available late in the life cycle when the costs of redesign and optimization are large. This is amplified by the partial lock-in effect the product has over the service because it is produced before the service.

5. 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, one of the reasons being that SMA is not associated with specific methods and techniques.

According to our survey of books and university courses focusing on SMA, the most important methods are activity-based costing, the balanced scorecard, target costing and life cycle costing. These methods, whilst being very popular, are subject to criticism which points out, among other things, that these methods are not innovative, have no clearly defined content, and tend to focus on procedural issues.

The first stage of this project shall inform the next stages, as we continue towards an in-depth quantitative analysis.

6. Acknowledgement

This paper is an outcome of a project "Analysis of relationship between strategic management accounting and corporate management and performance" supported by the Grant No. F1/ 71/2017 (internal number IG107027) – Internal Grant Agency of the University of Economics, Prague.

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**TOPIC J: LEADERSHIP DEVELOPMENT, INNOVATION
BEHAVIOR AND CREATIVITY**

NOVELTY DIGITALIZATION, REVOLUTION, TRANSFORMATION RR INNOVATION?

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Keywords

Digitalization, sharing economy, sharing types, Airbnb.

Abstract

Digitalization as a term becomes well known at the turn of a millennium not only amongst scholars. All of us commonly use the benefits of digitalization in some way. The novelty and complexity of the digital age has led to an increased academic interest in the area of digitalization. Scholars ask themselves many questions: “Is the impact of digitalization on the markets revolutionary, does digitalization create new markets, or does digitalization bring the “winds of destruction” as a consequence of innovation activities described by J.A.Schumpeter in the first half of last century. The text below tried to answer these questions.

1. Introduction

Digitalization is not a topic only for ITC specialists, also professionals outside the IT territory should understand digitalization as a new phenomenon, which has much to offer.

Scholars ask themselves many questions: is the impact of digitalization on the markets revolutionary? Does it create new markets? Is it a “digital bubble”, which is fed only by digital electronics manufacturers and vendors to support their sales? It is noteworthy that most scholars are very cautious when it comes to predictions of the future development in this area and they do not give any specific scenarios of development for the next 10 or 20 years. Scholars give multiple scenario views and discuss pros and cons with focus on impacts, which are observable now or may come into effect in the future.

2. Theoretical background

Digitalization is a common term for mass deployment of devices and IT related systems (internet, micro-sensors, high-speed networks, mass data storages, super smart computers, automation and robotization), software (data storage, business intelligence, software used for daily decision making, feedbacks, controls, etc.). This all is connected via hardware, software and communication-wise (cyber-space) and secured against data losses, leaks or cyber-attacks.

Dynamic onset of digitization is sometimes referred to as a digital revolution (Tapscott 1995). There is no doubt the logic that led the German theorists to adopt the term Industry 4.0, which came from the four development stages of the industry, which are often referred to as industrial revolution stages

in the German professional circles. There is no doubt also, that in its development the industry is experiencing a number of qualitative shifts. The question is whether to vote for these stages of development the concept of revolution?

On our mind the term “revolution” (see, for example, Tapscott, 1995; Mando, 2015) might be overstated and too strong. Along with the authors (see, for example, Evans, 1995; Kane et al., 2015; Khan, 2017) we prefer to use term transformation.

Although talk of digital transformation seems to be a recent hot topic, the trend has been developing and impacting communications (both professional and personal) for nearly 30 years. Beginning with the invention of the World Wide Web in 1989 and continuing right up to this very moment, innovative technology continues to emerge at a rapid pace. As societal norms begin to catch up with the enormous amount of transformation that has occurred technologically, it’s important to consider the reaction that specific industries have had to such drastic change.

Digitalization is not a novelty and it is not fully established term yet. Digital transformation is described as "the total and overall societal effect of digitalization"(Khan, 2017). There are more terms related to it as: “information society”, term “smart” in relation to various subjects (city, technology, economy), “industry 4.0”, “digital economy” and “digital society”. Although talk of digital transformation seems to be a recent hot topic, the trend has been developing and impacting communications (both professional and personal) for nearly 30 years. Evolutionary novelties are interesting because it’s often puzzling to understand how they arise. But let us clarify what is novelty and what is innovation and how the difference between them can affect future growth.

Novelty and originality are always a measure of inventiveness. When you develop products or when you create patents it is one of the much important criteria. However when we think about innovation it is not a central matter or concern always. Innovation stems from intrinsic and extrinsic factors influencing the viability, feasibility and usability of ideas, concepts, prototypes, products, platforms, services etc. While novelty is simply incremental change to, for example, an existent product, true innovation changes the way industry operate. In certain innovation models novelty assumes central importance and pivotal existence. Disruptive innovation is one among such models. While business model innovation may require new capabilities, these new capabilities will constitute business innovation only when they significantly disrupt the competitive dynamics of an industry (Euchner and Ganguly, 2014). When a platform enters the marketplace of a pure pipeline business, the platform nearly always wins, causing the transformative change to the industries: so, Amazon changed retail buying patterns; Bitcoin challenged traditional currency; Tesla reshaped the auto industry; Airbnb upset the status quo of hotel industry; Uber disrupted the taxi industry.

First lessons learned show us following things. The current digitalization evolution does not happen in steps, it is gradual and also asymmetric. To this date, new applications were developed across all industries, mainly in manufacturing, transport, agriculture, construction, health care industries. Less intense is the development in the service industry and in public administration, which offers great opportunities for deployment of digital applications. Big differences in development are also territorial. EU countries use the Digital Economy and Society Index (DESI) to measure the level of digitalization in the EU by five dimensions of digitalization: connectivity- dimension measures the deployment of broadband infrastructure and its quality; Human Capital/Digital skills - dimension measures the skills needed to take advantage of the possibilities offered by a digital society; Use of Internet by citizens – dimension accounts for the variety of activities (from consumption of online content - videos, music, games, to modern communication activities or online shopping and banking)performed by citizens already online; Integration of Digital Technology by businesses - dimension measures the digitization of businesses and their exploitation of the online sales channel; Digital Public Services - dimension measures the digitization of public services, focusing on

eGovernment. From figure 1 we can observe, that the level of development even amongst the EU countries is quite different (DESI, 2017)

The important thing is if digital transformation should be meaningful, it has to be based on strategic decision-making. To stay competitive in digital business, companies should look at where they are now and determine what core elements of digital transformation they need to focus on.

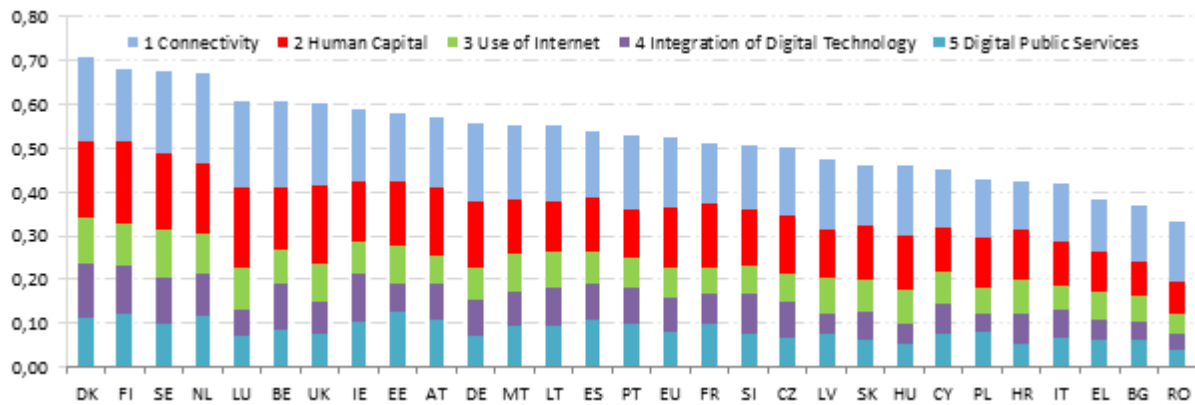


Figure 1 The Digital Economy and Society Index – DESI (2017). Source: European Commission DESI (2017).

The transformation should focus on core business in a complex way. Changing just one aspect, which will help the business look modern, is not sufficient. At this point, it is no YES or NO decision, we speak about prioritizing. The questions we should ask are: “what”, “why” and consequently we can ask “how”? In other words: what should be transformed, in which order and what the optimal speed is?

Digitalization can offer unexpected synergies. In these cases we should think of the specifics of the industry we operate in first, to realise all benefits, which digitalization can offer. Moreover, in many cases, digitalization enables you to connect business concepts with activities from different areas. The results of research conducted by MIT Sloan Management Review and Deloitte in 2015, which included 4800 companies from 129 countries underlines the importance of strategy. The findings show that the strategy is the key force of digital revolution and technological integration. The key force is not solely technological advancement, as some people thought. Almost half of the respondents answered, that digital transformation brings a range of competitive advantages, and however the missing strategy of digital transformation is a challenge for one third of them. 80% of respondents said that the digitalization strategy has to reflect the needs of customers and growth of efficiency (Kane, et al., 2017).

3. Ways of digitalization transformation spread

Digitalization and its spread is happening at least in 3 following ways:

- Global spread – predominant is the spreading in developed countries, however various application find its use also in developing countries, at spots with the internet access.
- Layer spread – digitalization is becoming part of many layers of our society (corporate, public administration and private life) and therefore results in intelligent automation, replacements of many human activities by robots and software programs.
- Spread by modification – you can do many common activities with the help of digital technologies, which results in faster and cheaper processing.

3.1. Global spread

The first precondition for the increase in digitalization is the internet coverage. The internet is not available in all parts of the world. Only about one-half of world population in developed countries have internet coverage and about 80% of population in these countries are regular internet users. In the developing countries the internet coverage is only partial and about 40% of population has access to it (in Haiti, Yemen, Ethiopia only 15% of population has access to internet). Developing countries not only face the difficulties with lower internet coverage and low access to internet. These countries also deal with lack of computer literacy and budget restrictions. It is not surprising that mostly young people lead the digitalization transformation. It is 830 millions, who represent 80% of young population we find them in 104 countries and they are connected on-line (ICT, 2017).

3.2. Layer spread

Digitalization is associated with a term Industry 4.0. This concept is recognising four developmental stages of industry, the fourth of them dealing with the use of computers, connection and automation. This fourth developmental stage is called “the fourth industrial revolution”.

The term Industry 4.0 is widely used in Europe and many countries use the term “smart” (see Figure 2).



Figure 2: Map of German Industry 4.0 approach „Industrie 4.0“in Europe. Source: Industrie 4.0 Berlin/Stuttgart 2014

Germany with no doubt is the leader in the Industry 4.0 theory but it is also a leader in digital applications deployment in industries. German government embedded the vision of Industry 4.0 into its strategy as a national economy developmental instrument and it started supporting it accordingly. German Academy of Science and Engineering (Acatech) presented the concept of Industry 4.0 in 2013 (Industrie 4.0, 2014). To date there are first machines and devices ready for the implementation of Industry 4.0 principles in factories and corporations, however, there is still work to be done around the IT security, standardisation and regulatory compliance. The German Ministry of education and research budgeted 470 mil. EUR for research and development and the Ministry of industry budgeted another 80 mil. EUR for Industry 4.0 support [5, 6]. The expectations of the benefits, that digitalization is projected to bring, are high. It is expected to bring to Germany competitive advantage

in the global competition. Digitalization is also supposed to ensure more efficient, more flexible and faster manufacturing, decrease in costs mainly in through decrease in energy costs and labour costs. The 6 key industries of German economy (heavy manufacturing, electro technical, automotive, chemical and ICT) are expected to grow by 1,7% annually (ICT, facts and figures, 2017).

Development in the industry sector very often foreshadows the development of the whole national economy, therefore the priority put on industry sector development is understandable. However, digital applications are deployed also in logistics, in construction industry, agriculture, health care, public administration and in army. Therefore it would be misleading to associate digitalization only with the industrial sector.

Today we know that digitalization influences internal and external activities of wide range of companies and organizations including public administration and municipalities, etc. Industries such as automotive, retail, financial services and healthcare are in the throes of innovation, disruption and transformation due to today's digital economy. No industry is immune from the gale force winds of creative destruction catalyzed by social, mobile, analytics, cloud, and the Internet of Things technologies, just to name a few. Although digital transformation can indeed have a profoundly positive impact on the way in which our society conducts business and communicates interpersonally, digital transformation can be just as painful as it is beneficial — but it's necessary for businesses to survive.

3.3. Spread by modification. Sharing Economy

Digitalization brings changes to sales activities and services. These are in most cases represented by the sharing economy. The sharing economy is an example of spread by modification, when digitalization enables us to do certain activities differently and in most cases, this is done in a cheaper way and with added comfort for the end customer. The sharing economy principle is not new to our society. In some form it has always been here.

The assumptions of the sharing economy are:

- Existence of certain goods (or service),
- The will of the owner of the goods (or service) to share it with another user (the reason may be, that the owner is not able to fully use the goods or it wants to share it),
- Existence of the subject (usually a person), who wants to use such goods (or service) free of charge or for the agreed fee.

Small landings, rentals, or service offers used to be common in many cultures mainly between relatives, neighbors, friends, etc. The advantage of this approach was the ease of transaction, little transaction costs, flexibility. Trust was the important part of this business between the sharing partners, which knew each other very well.

4. Results and Discussion

Without no doubt, the word “sharing” is booming now, however its meaning is shifting from its original sense (mutual help of people, who knew each other), and its used in many new connotations and sometimes it's even misused. What experience do you have with sharing economy? Contributions with vase studies and research topics like Freelancing, Co-working, Peer-to Peer lending, Fashion, Sharing resources and other services are welcomed (Doucek et al., 2017). We still hold to our opinion, that to describe even wide known cases (Uber, Airbnb, as the examples), it is

reasonable to discuss pros and cons with focus on impacts, which are observable now or may come into effect in the future.

4.1. Sharing types

Digital technologies, mainly on-line platforms enable new form of connection with a high level of comfort for the potential unused goods (or services) owners and individuals interested in these goods:

- at both ends there may be hundreds or thousands and often even more individuals, which may be connected through the on-line platform,
- goods owners and goods seekers communicate comfortably via phone, tablet or computer from whichever place at whenever. The only condition is the connectivity to the internet,
- the communication is real-time or with very little delay (in terms of seconds or minutes).
- payments are very often non-cash money transfers, which is positively accepted at both ends of the transaction

To sum up, on-line platforms represent a new model of distribution, which offers wide range of choice, it is fast, flexible, convenient and thus interesting for many population segments.

The models of goods distribution went through numerous changes over the last couple of years: the typical local grocery stores increased in size to “super” or “hypermarkets” which are mostly large supermarkets chains. When we look 10 or 15 years back, we see the emergence of the first e-shops, which already require good internet coverage. Initially trust in on-line vendors had to be established and it took some time. Currently on-line distribution channel is growing in number of distribution units as well as in volume of units sold.

4.1.1. E-shops

E-shops are an alternative way of goods and services distribution, where the seller has the goods available and sells it through on-line software application. On-line platform enables the customer to select goods or services described on the web-site, accompanied in most cases also by picture. Customer on the web-site also order the goods and chose the method of payment. Then the e-shop vendor delivers the goods or service.

It is estimated (Krajčák et al., 2017) that there is about 40 thousand e-shops in the Czech Republic, which is an on-line market comparable size to the on-line market size of the Great Britain, given the fact that Great Britain is six times bigger in size of customer base. To date, there is about 10% or all goods and services sold on-line in the Czech Republic which is the European Union ranking represents a fifth position, where number one is Denmark (24% sales on-line), followed by Great Britain (21%), Germany and Ireland (11 and 10%). E-shops are popular for young generation and for people living in small municipalities, where the business infrastructure is not developed. The development trend of E-shop performance in the Czech Republic presented in table1.

Table 1 Development of E-shop performance in the Czech Republic Source: Authors' calculations

Year	E-shop turnover in bill. CZK	% annual growth
2005	12	.
2010	39	21
2014	67	15,5
2015	81	21
2016	98	19
2017	115	18
2018	139*	20*

4.1.2. Car sharing

If fact car sharing is a car rental in an e-shop form. The service provider owns cars, which are usually parked at various convenient places in a city. Upon registration at the car sharing provider (usually face-to-face meeting), the client gets access to on-line application and can rent cars on-line. The application locates the nearest available car, it can also “unlock” the car. The application monitors the distance driven and it calculates the price for car sharing. Moreover, the application identifies convenient parking spot. After the car is parked, the application will make it available for the next client. Municipalities usually support car sharing e.g. by providing parking lots free.

There are multiple benefits of car sharing for mobility in cities. The usage of the shared car throughout the day is multiple times higher, compared to the typical owned car. Furthermore, it is planned, that mostly electric cars should be offered for car sharing. Then this form of mobility may also contribute to improvement of cities' climate.

4.1.3. On-line platforms

Whereas e-shops own the goods sold on-line, the *on-line platforms* providers do not own the goods and they own only the on-line software application, which connects the vendor and customer. The platform enables to present the offered goods or services on-line. The customer can shop from home or via smart phone applications, view and choose from the offered range of goods. If interested, customers can buy those goods or services. The vendor will provide and deliver the goods. The on-line platform is usually charging vendor a fee for usage of the platform.

Probably the best-known on-line platforms are Airbnb offering accommodation services and Uber offering transportation services. Let's show an example of Airbnb, analyzing its pros and cons.

4.2. Case study: the Pros and Cons of Airbnb

Airbnb is a short-term accommodation provider, which has is offering a service in 65 thous. towns and cities, 191 countries worldwide (Statista 2017). The accommodation services were used by 160 mil. users. The user is on average working 11,5 min. with the application and the company is employing 3100 employees. Airbnb, which generates its profits from fees charged for provided accommodation arrangement was valued 31 bill.USD. “European” Airbnb operates from Dublin headquarters and it was authorized by the Financial Conduct Authority as the Electronic Money Institution. Like other successful entrepreneur concepts, also Airbnb faces growing competition,

which offers accommodation services in a similar way. HomeAway, WIMDU, VRBO, Roomorama, only-apartments, Interhome, 9flast.com, BedyCasa, Novasol, Homestay.com, Way to Stay, etc.

Airbnb has to offer wide range of services to keep its lead position in this area. Therefore next to “traditional” shared beds or separate or rooms with sanitary facilities, Airbnb is offering a whole flat/house without the owner at premises. Airbnb launched “Airbnb Plus category” – verified accommodation in terms of extraordinary location and equipment. Special is the category Beyond by Airbnb, which is superior to prior described category and offers complex services and experiences offered by the host.

Shared accommodation of Airbnb has its pros and cons:

Pros:

- Greater variety of accommodation exceeding the standard offered range, thus support of tourism in a given locality. Often we hear arguments, that this category of tourists would not use the services of hotels anyways, because they look for cheaper and more interesting accommodation, experiences associated with this type of accommodation, etc.; According to our research study (Krajčik, V., Veber, J. 2017), which is based on data from AirDNA, AirBNB, Annual Market Research, Prague, there were 70 thous. beds in Prague available through Airbnb, which is a number similar to a number of beds offered by all hotels in Prague. Results of research analysis prepared by Airbnb on Visegrad countries presented in Prague by Anita Roth, Head of Policy Research at Airbnb (Roth, 2018). Her findings show that the number of guests accommodated through Aribnb grew annually by 55%. In the areas outside of Prague the annual growth was even 108%. According to Vysegrad insights report, (2018), the Czech Republic still represents the biggest market in terms of Airbnb guests (1 million in 2017) – followed by Hungary (800,000 in 2017). Four times bigger Poland offered accommodation to 3/4 billion of guests via Airbnb in the same year (Figure 4).
- Extra money for the host – this applies to occasional accommodation offered by low-income or middle-income groups (e.g. the retired), who offer a free room, while they are on vacation. This can be also seen as a benefit of shared accommodation; Results of the research (Roth, 2018) show that even though the average age of the “Airbnb host” is 38, there is a significant category of about 10% of senior citizens, which see the extra money earned by providing short-term accommodation as an interesting income. It is difficult to find revenue of the senior citizen group. We know however, that on average 1 host on Airbnb earned 1850 EUR in the year 2017 (Visegrad insight report, 2018). For the Czech Republic the average income has been even 2100 EUR per 1 host. The average is saying little about different ranges of revenue location-wise and it does not offer any insights about host segments. However, we know that in Prague the revenue earned via Airbnb is higher than average and it’s about 5 960 EUR (152 186 CZK), the average pension is 11 607 CZK per month, so 141 687 CZK per year.

Cons:

- Hosts offering accommodation via Airbnb don’t do it always just occasionally to make extra money. Some hosts are also entrepreneurs, who own more flats or houses. These entrepreneurs very often offer accommodation in downtown and create shortage of flats on retail markets. Due to these speculative purchase of Airbnb hosts the price of flats is raising. Often noisy guests in flats disturb other people living in the house, who consequently move to quieter areas. Public institutions in downtown areas as kindergartens, schools, etc. are then less used.

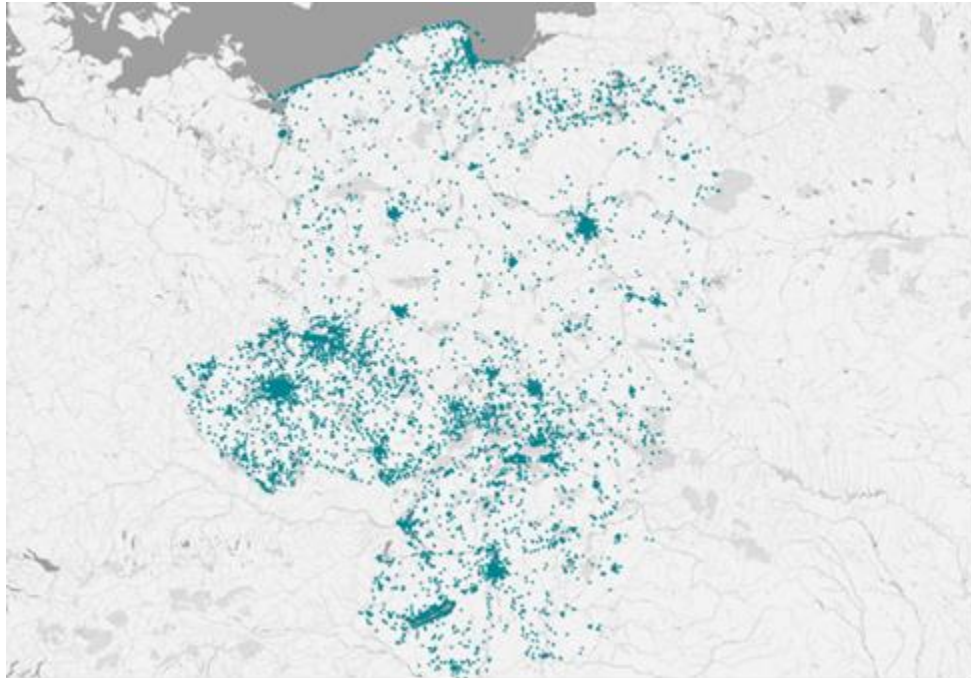


Figure: 3. Irregularity of accommodation offer via Airbnb in Visegrad countries. Source: www.czechcrunch.cz/2018/06

- The Airbnb provider does not disclose personal data of hosts providing accommodation. There is certain unwillingness of the provider to disclose it. Consequently, many regulatory requirements, which are associated with providing accommodation to international community, are not met:
 - Hygiene, security and fire safety requirements. We can't say that these requirements are not met, there are no formal controls set and standards required.
 - Record keeping of accommodated guests. This is not done for also international guests. This practice is favorable for people who do not want to be reported (including individuals wanted by police).
 - Hosts are also motivated to offer their services through Airbnb to avoid taxes and tourist fees (if it's not really only occasional accommodation).

According to our calculations (Krajčík, Veber, Bejček, M., Ključnikov, 2017) there were 18 586 registered accommodation units, which offered accommodation via Airbnb with the capacity of 72 thous. Beds. Most of it located in downtown Prague (Prague 1 – almost 31thsd. beds, Prague 2 – 29thsd. beds).

In some areas of Prague 1 there were 36 accommodation units available on 100 m². Even though some bed and breakfasts offer accommodation via Airbnb too, the research study underlines the fact, that there is an alarming concentration of accommodation units in hands of very small number of owners: 662 owner (7,4% Airbnb hosts) control 39,56% of the market and offer accommodation 7338 accommodation units. In other words 15 hosts offer on Airbnb over 50 accommodation units each in Prague. The host with the highest turnover in Prague owns 54 accommodation units and has 14 800 reservations per year and a turnover of over 42 mil. CZK (1,65 mil. EUR).

Common drawback of shared accommodation offered by on-line platforms is the distortion of business environment, where some subjects are required to comply with the above mentioned regulatory requirements and other subjects avoid them.

5. Conclusion

We see the signs of digitalization in our everyday life, no matter how we like it. Some people see it as an opportunity others have some concerns. In the era of electrification, the electricity was described as “a good servant but a bad master”. We can use this statement today when we speak about digitalization. We have the opportunity to learn how to take a good use of digitalization in the personal life as well as in the national economy, but we need to learn how to regulate it and use it with appropriate security.

To describe even wide known cases (Uber, Airbnb, as the examples), it is reasonable to discuss pros and cons with focus on impacts, which are observable now or may come into effect in the future. It is reasonable to discuss pros and cons with focus on impacts, which are observable now or may come into effect in the future

And the initial question: linking digitization to revolution is exaggerated. It is more transformation when it comes to an application that integrates a number of activities or processes. As far as the sub-applications are concerned, it will probably be a technical or managerial innovation.

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INTEGRATED MANAGEMENT APPROACH TO QUICK RESPONSE MANUFACTURING IMPLEMENTATION

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Keywords

QRM, implementation, integrated management approach, organizational innovation

Abstract

The implementation of Quick Response Manufacturing (QRM) Concept, using traditional management mechanisms and classical project management methodology not always carried out with planned results and remains a challenge for many industrial enterprises. The authors consider the concept of QRM as a strategy and the organizational innovation and develop an Integrated Management Approach to QRM Concept Implementation. Focusing on maintenance and development stages, the authors expand significantly the content of the "implementation" mechanism with presenting new management subsystems, such as: nurturing, QRM mindset and developing culture, leadership, creativity, reward system, alliances, time savings, others. Practical applications of management mechanism in the Russian industrial enterprises has proved its effectiveness. Article is addressed to both theoreticians concerned with the QRM implementation issues, and practitioners who manage the organizational innovation in manufacturing firms.

1. Introduction

Quick Response Manufacturing (QRM) is a concept, which advocates a companywide focus on short lead times that include quick response to demand for existing products as well as new product and design changes. The innovative principles of QRM have been proven with impressive results at many companies, in a variety of industries. However in practice the introduction of QRM in the manufacturing enterprises involves certain difficulties caused by the transition to cellular organizations, as well as the psychological unpreparedness of staff to refuse piece-rate work. Despite the articles written on lead time reduction, there are many misconceptions about how to implement quick response. These misconceptions prevent successful results (Suri, 2010). Implementation of QRM concept, using the traditional management mechanisms and classical project management methodology not always carried out with planned results and remains a challenge for many industrial enterprises. Companies from one side do not implement QRM approach through the whole

organization, and from the other the problem is that once implemented QRM with project management principles, after a while there is a process of "forgetting" and a gradual return to the original positions. The aim of this study is to introduce the new integrated management approach to QRM implementation in order to make this process irreversible, preventing enterprises from failures and lead them to sustain continuous improvement

2. Theoretical framework

Quick Response Manufacturing concept was first developed in the late 1980s by Rajan Suri. QRM is a company-wide strategy that pursues the reduction of lead time in all aspects of a company's operations, both internally and externally (Suri, 2003). QRM is not just a shop floor strategy, it extends across your whole enterprise including material planning and control, supply management, office operations, and new product introduction (Suri, 2010). A Companywide Approach to Reducing Lead Times requires fundamental structural changes, cardinally transforming the company to cellular organization.

Change management as a science (Adizes, 2008) is the instrument for strategy implementation and the basis for building effective enterprise development management systems. The basis for a universal mechanism for change control, used in the development of production systems, lies on the intervention system technology and business process management, which assumes a consistent implementation of the three phases: diagnosis, design of innovations, and implementation of developed action plan with project management principles (Popov & Ostapenko, 2016). The effective change management goes beyond project management and technical tasks undertaken to enact organizational changes and also involves leading the "people side" of major change.

Organizational change may lead to organizational innovation (OI) or, in other words, OI implementation, both for radical or incremental innovations is equal to organizational change. The organizational innovation is a broad concept that encompasses strategies, as well as structural and behavioral dimensions. According to the OECD, an organizational innovation is the implementation of a new organizational method in the firm's business practices (including knowledge management (KM), workplace organization or external relations that has not been previously used by the firm (OECD, 2005). Organizational change may lead to OI as the successful organizational change increase the level of personal involvement, creativity of an organization which is a key factor which can become a base of organizational innovation (Khazanchi et al, 2006). OI involves modifications in the social system such as reassignment of tasks and fundamental changes in routines (Teece, 1998). Effectiveness of the OI requires carrying out the systemic processes of adapting, maintaining and progressing (Evan, 1976). The adoption of innovation is intended to ensure adaptive behavior, changing the organization to maintain or improve its performance (Damanpour, 2009).

Maintenance is an important part of system development that includes the activities which corrects errors in system design, implementation and constantly support the development. In this way, the organization avoids wasting resources on re-discovering knowledge, re-working past achievements (British standard, 2008). The risks that the "old processes and manners" will return and efficiency will come back to the levels they were before the project are high. Even the companies are in a long QRM implementation journey, they can "get tired" of it. All maintenance improvement projects have a crucial human factor that requires change management and constant management attention. Employees in maintenance stages may need skills training in addition to reward system strategies. Maintenance phase support the existing system of innovation implementation, the development replaces the existing system through continuous company's way to sustainable competitive advantage. In order to be a source of sustainable advantage, development capability must be continually expanded, upgraded, and improved (Wheelwright and Clark, 1992).

3. Hypotheses and Methodology

The theoretical design based on literature review, the content analysis and practical experience of industrial enterprises introducing the QRM strategy during 2016-2018 years as well as the authors' practical experiment (Popov& Ostapenko, 2016) when we proposed to build management mechanism for QRM concept implementation on the synthesis of the system intervention technology and project management. Considering QRM as driving strategy and organizational innovation we based our improved approach on the mechanism of organizational change management, numerous tools and concepts, including system intervention technology, project management, and innovation management. The research questions are: 1) How to introduce QRM concept in manufacturing firms with enterprise-wide changes, affecting their processes, products and people with continues to change the way people work ? 2) What needs to be done to ensure that the implementation of the QRM concept is more successful in order to prevent failures?

The hypothesis is that in order to solve a complex of issues it is necessary to use the system integrated approach to QRM implementation management, which, on the one hand: a) will allow to consider the QRM concept as a strategy and organizational innovation and therefore it will be expedient to apply the complex of change management mechanisms in enterprises, b) will answer the question how to make the process of QRM implementation more successful. Therefore we focused on implementation phase with two assumptions or predispositions: 1) QRM as a new organizational method and new strategy for enterprises is an organizational innovation, which drastically change the current state of enterprise and the way people work; 2) the implementing QRM requires to go through organizational changes, when the whole organization, both management and employees should understand the manufacturing systems and its part of the process, therefore in this case the effective change management mechanism is required.

The conceptual logic of the QRM implementation strategy presented in figure 1.

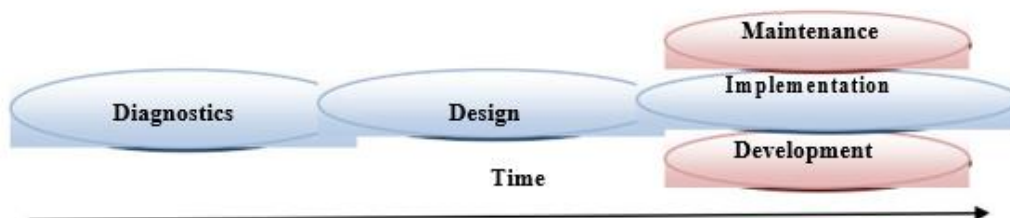


Figure 1: Stages of QRM strategy implementation

There are 3 individual phase: diagnostics, design and implementation which can go in linear process and overlap one another. We added the implementation process with two more separate phases: maintenance and development that might go in parallel with the implementation phase. This phases reinforce QRM implementation, consider it in term of continued use, what lead to success of QRM implementation.

4. Results and Discussion

The outcome of this authorization concept is the structural design of new integrated management approach to QRM implementation (see figure2). It includes both elements of the systematic technology of intervention and project management (the stages 1, 2, 3). Since the content of stages 1-3 is discussed in sufficient detail in authors' work (Popov& Ostapenko, 2016), we will reveal the content of the QRM concept implementation, including stage 4 (Maintenance/Support) and stage 5

(Development). The structured elements of implementation phases and disclose the content with additional tools provide the logic answer to the question: what needs to be done to ensure that the process of implementing the QRM concept is more successful.

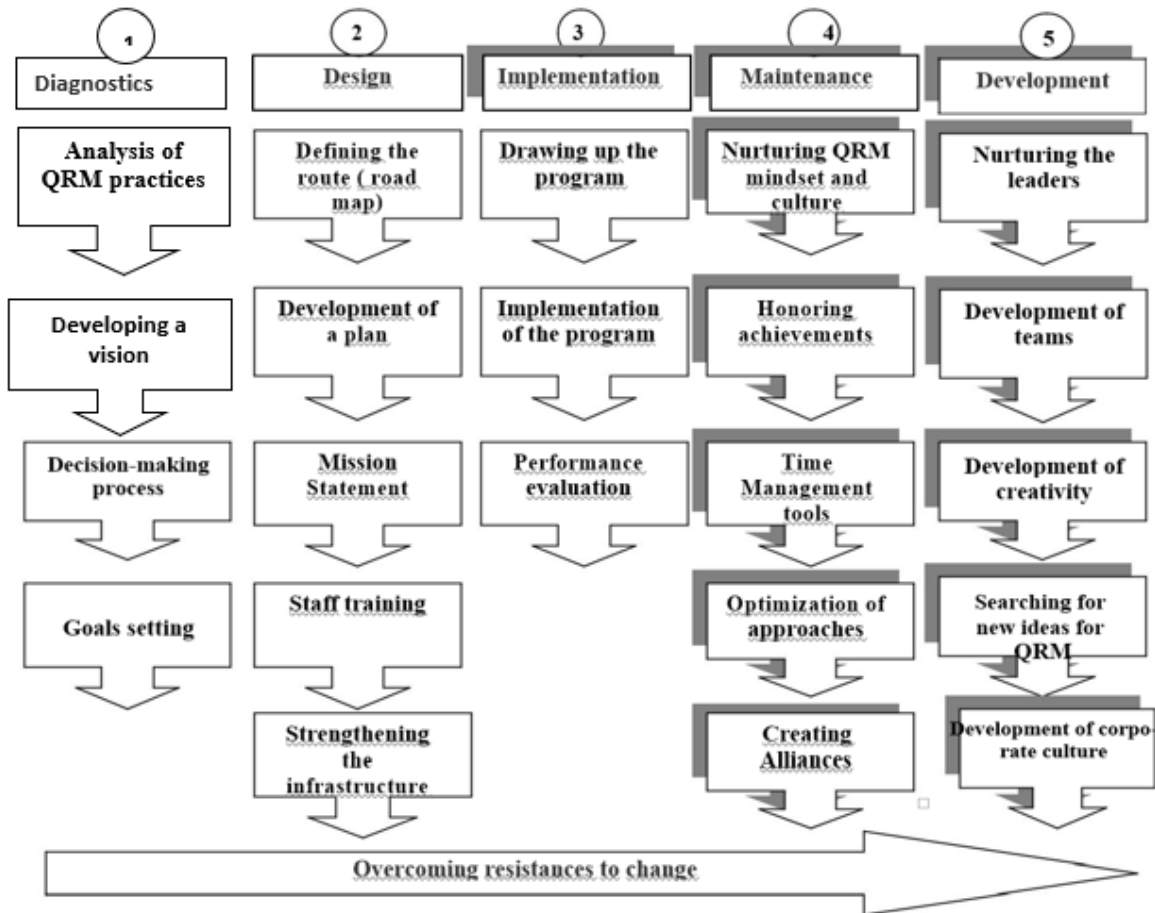


Figure 2 Structural diagram of mechanism of QRM implementation

4.1. Maintenance. Nurturing a QRM mindset and culture

Considering the QRM system an organized innovation for the whole enterprise we discovered as consultants, that the biggest barrier during implementation of QRM is mentality, based on productivity, resistance to change behavior and culture of new way of doing business. That is why from the beginning of process implementation it is important to develop and improve the emerging time-based

QRM mindset and culture. If we “challenge” people to act differently, but don’t then “nurture” them while they practice the new behavior, we’re leaving them on their own. It is important to extend the QRM principles to everyone in the enterprises, explaining how it is work, why it is necessary nurturing a persistent belief about the strong influence of the concept on the company's future. Achievement of a higher knowledge degree regarding QRM can provided with maintained education such as: special periodic trainings for all the personnel of the enterprise; short-term seminars; independent self-study of theoretical material, group discussions and work on specific projects to reduce the critical path of production

It is necessary to strive for wide application not only of its positive experience, but also be able to draw conclusions from negative experience, both one's own and others'. After absorbing the lessons from this experience, the whole company should be reorganized with a new mindset shifts for organizational transformation.

4.2. Maintenance. Honoring achievements

Refers to organizational innovation, which drastically transforming the company, QRM implementation can last for several years. Given the possible "tiredness" from the reforms, the classics in the field of change management recommend planning "small victories" or "generate short-term wins" (Kotter, 1996). The rewards, social recognition and performance feedbacks should be implemented even with the fact of creating a new production cell with not a very significant reduction of manufacturing critical-path time. As an example of honoring achievements, we cite the decisions taken by the management of the company operating in the light industry. Table 1 shows the dynamics of changes in the performance of the two divisions: "U" - which was engaged in the preparation of finished products for transportation (packaging, transport marking, order picking and loading); and "M" - which dealt with the primary processing of resources for subsequent production stages. It can be seen from the table that during the first two weeks the results of the activity (number of completed requests/orders were unchanged; during the third week the results grew insignificantly. Nevertheless, the company's management decided to report on the short-term wins achieved and to encourage the performers.

Table 1: Dynamics of changes in the results of company divisions Source: Authors' calculation

Measured indicator	First week		Second week		Third week	
	U	M	U	M	U	M
Percentage of completed requests	67%	52%	67%	54%	72%	68%
The number of completed requests	19	7	19	8	21	11

4.3. Maintenance. Time Management tools

The QRM concept is based on the desire to constantly reduce the Lead Time critical path of production. Additional reserves in this direction are provided by the use of the recommendations of classical time management (Tracy, 2014). For a specific performer, this is a careful planning of the working day, a rational expenditure of time. Embedding time management tools in QRM gives an additional effect. This is convincingly demonstrated by "STEM +" company, which carries out the installation of engineering equipment for buildings and structures. At the same time, the company "rebooted" personnel both in Time Management and QRM. After that, a program of concrete actions was developed and implemented. As a result, taking into account the effect of synergy over a period of six months, the company achieved outstanding results. The critical production path was reduced by 50%. The processing time for basic orders decreased from 79 to 23 days. Overhead costs decreased by 25 - 30%. The problems with the fulfillment of urgent orders have disappeared. The cost of work has decreased. The wages of employees working in production cells have grown.

4.4. Maintenance. Optimization approaches

The Quick Response Manufacturing seizes all the precedent approaches, i.e. JIT, flexible manufacturing, group technology and lean production, six sigma (see also: Brzeziński, 2002; Suri, 2010). Focused on lead-time reduction, QRM also works well with existing materials requirement planning (MRP) systems. MRP systems can be used to high-level materials planning while the lower level details can be managed through POLCA cards. Once QRM principles and techniques are in place, companies can embark upon the journey of being truly adaptive and agile (Nambiar, 2010). Techniques such as TPS and lean principles are focused mainly on waste elimination and quality

improvement. QRM and agile manufacturing, which are mostly applicable is high-mix, low-volume production, help making the organization respond quickly to changing customer demands. Implementing the concept of QRM in parallel with the application of special design methods presented in table 2.

4.5. Maintenance. Creating alliances

If within the framework of the QRM concept we strive to work with small lots in the "just in time" mode, then we will have to convince all our suppliers to work in such a way. In QRM, it is essential that the company works with suppliers that are aware of the importance of time and seek to reduce the lead time in its operations. Suri (2014) emphasizes the importance of making suppliers understand the company QRM program, and it is up to the company to train and influence them accordingly. For this reason, for example, the regional representative of "Rostelecom" company during the strategic sessions on the introduction of the QRM concept invariably invites representatives of supplier companies to participate in them. In the course of developing a strategy for the introduction of the concept, mutual understanding is achieved, and problems of building mutually beneficial relations are also solved.

4.6. Development. Nurturing QRM leaders

Leadership should be considered as a starting point in the QRM strategy. They constantly develop a new mindset and tools to continuous improvement. Moreover, in addition to traditional leaders who are at different levels of the company's management hierarchy, a special layer of leaders is needed - the managers of production cells. Assuming that not every qualified employee can show leadership qualities, companies need to make efforts to determine and educate them. The practice of the company "5" (see Table 2) showed that primarily qualified specialists under the age of 40 years fit for the role of the leader of the QRM cell. The company makes efforts for the upbringing with full support, including inspiring, energizing, educating and motivating such employees.

4.7. Development of QRM teams

The multi-functional QRM cell is an organizational unit that satisfies special interconnected requirements, most important of which is self-management within the cell. The practice of implementing the QRM concept in company "E" (Table 2) showed that the most painful stage of the cell's operation is the first 2-4 months of its operation. This is due to the fact that the reward of each member of the self-governing team now depends not on how he or she worked, but on how effectively the team worked as a whole. There are conflicts of interest of individual members of the team, and the team can "squeeze" negligent employees from their ranks. After the cell leaves for a stable operation mode, another problem arises - it becomes increasingly difficult to reduce the critical path of production, since light decisions are taken first. In any case, the issue of the all-round development of team members will be topical, while the leader of the cell must play a decisive role.

4.8. Development of creativity

To develop a production system built on the basis of the QRM concept, it is necessary to master the development and application of various methods of generating ideas in practice. In general, methods of creative thinking are divided into two large groups: methods of collective creativity and methods of individual creativity. Methods of collective creativity based on teamwork can be successfully applied in the design and improvement of the work of multifunctional QRM cells. Methods of individual creativity are most applicable to solving technical problems aimed at reducing the time of the critical path of production. The practice of implementing the QRM concept at enterprise "5",

(Table 2) shows that the creative process is facilitated by a correctly constructed system of moral and material motivation of personnel, fixed by the relevant regulations. Efforts to develop the creative potential should be also directed towards the ongoing system of corporate education and personnel training.

4.9. Development. Search for new ideas

Any production concept is far from perfect. The QRM concept is not an exception. For example, a significant improvement requires a methodology for recording costs when executing orders by production cells. Large reserves of time are hidden in the work of office units. Among them - large reserves to reduce the development time for new products. This problem is especially acute in the case of enterprises developing science-intensive objects of new technology. Some of them seriously study the question of implementing the concept of QRM in parallel with the application of special design methods. Table 2 presents information on 5 enterprises operating in high-technology industries, which are striving to shorten the development of technical facilities. It follows from the table that Lean and Parallel engineering are the preferred technologies for the majority of the enterprises under consideration, which allow minimizing costs and shortening the time of launching new products to the market. Most developers of new equipment objects among the enterprises believe that the best results should be expected on the basis of a combination of tools from different conceptual approaches. Therefore, it is necessary to look for combined solutions based on the specifics of the products being developed.

Table 2: Characteristics of enterprises developing new equipment objects Source: Authors' elaboration

Enterprises characteristics	Innovative Industrial Enterprises				
	A	B	C	D	E
Industry	Gas Turbine Technologies	Mechanical Engineering	Mechanical Engineering	Mechanical Engineering	Instrument Engineering
Production	Power Plants	Oil Gas Equipment	Oil field Equipment	Pumps	Aircraft devices
Number of employees, thous.people	2,7	3,0	7,0	5,0	2,0
Design methods	Parallel engineering Lean	Parallel engineering Lean	Parallel engineering Lean, QRM	Lean	QRM

4.10. Development of corporate culture

QRM strategy will only be successfully implement, when specific competences in Lead time reduction be adapted as a result of learning. In other words, new behaviors may be learned by individuals and groups and subsequently repeated until they become incorporated as part of the organization's 'culture'. Behavior changes from job involvement to high involvement and proactivity are necessary for both capability development and organizational learning as they provide continuous improvement. The development of organizational culture is a managed process. For example, in the company "C" (see table 2) during the process of reforming the production system a complex diagnosis of corporate culture was made. It turned out that for such indicators as internal long-term motivation, decentralization and internal entrepreneurship, unity of the goals of individuals and groups, multi-level leadership, knowledge sharing, acceptance of responsibility, the manifestation of initiative in the company has significant potential. The results of culture diagnostics became the initial data for the development of the corporate culture for the organization as a whole.

5. Conclusion

The transition to a new cellular enterprise means the transformation to a new paradigm of production system, which is accompanied by changes in all part of company's system (strategy, processes and culture). Considering this process as a new strategy and organizational innovation, combining proven methods and methodology, we introduced the integrated management approach to QRM implementation. We contribute to the mechanism with new phases: "maintenance" and "development", representing them in detail, using the tools of innovation management and the behavioral mechanism focus on people such as: leadership, motivational actions, employee training and constant education, creating alliances, teamwork, creativity and culture development.

The expediency of using new tools is confirmed by examples from practice. The integrated management approach to QRM implementation could prevent enterprises from failures and lead them to sustain continuous improvement. We recommend managers and management consultants to use it on different stages of process implementation.

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DETERMINING FACTORS FOR INTERNAL PERSONNEL MARKETING

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Keywords

Personnel marketing, Employee, Employer, Satisfaction, Importance, Research, Internal personnel marketing

Abstract

The aim of this contribution is to present output from two conducted quantitative studies, the main theme of which was personnel marketing. The aim of both studies was to identify the most important determining factors for internal personnel marketing. Internal personnel marketing can be viewed as a modern tool for personnel management. The most important task of internal personnel marketing is to carry out activities with the aim of increasing or maintaining attractiveness of a business both in the eyes of current employees and in those of potential job applicants.

1. Introduction

An attempt to gain and achieve stabilisation of quality staff has prompted companies in recent years to use of marketing approaches in the management of human resources. Companies use these marketing approaches in hiring in the pursuit of more effective implementation and maintaining the necessary workforce organisation. These innovative approaches are supported by creation of good employer reputations related to the organisation and research of the job market (Koubek, 2000).

However, acquiring and retaining an employee who is reliable, hard-working and loyal is not at all easy on a job market with minimum unemployment. The general unemployment level in the Czech Republic in January 2018 was 2.4 % according to data from Eurostat (ČSÚ, 2018). The lack of skilled workers is a problem that is constantly increasing (Personalista, 2017) and which negatively affects the development of industry (Businessinfo, 2017). Yet the success of the business as a whole in most cases depends on the availability of skilled workers. Whenever an organisation gains such an employee, the organisation tries to retain the employee for as long as possible. This can be aided by proper and active use of personnel marketing tools and internal personnel marketing.

Internal personnel marketing is focused on a company's existing staff, who are offered financial and non-financial benefits with the aim of retaining and stabilising staff and with the aim of reducing fluctuations (George, 2015). Internal personnel marketing, which will focus on the needs and interests of existing staff, is a good reputation booster on the external labour market. Information about employee satisfaction in this case extends to the labour market without the active support of the business.

The aim of this contribution is to present output from two conducted quantitative studies, the main theme of which was personnel marketing. The first study was focused on employees. As part of the

process of electronic surveying, respondents expressed the degree of their current satisfaction with the presented attributes of employee satisfaction, and they stated in their answers how important these attributes were for them. This study was conducted over a period of four years, and therefore the recorded trends can be interpreted. The study also enabled a comparison of the perceived importance of individual attributes and satisfaction with the attributes.

The second study was focused on employers. Also as part of electronic surveying, respondents / HR officers evaluated the importance of the presented attributes of employee satisfaction. The primary research was conducted at businesses in the Liberec Region.

The contribution presents a comparison of both primary studies, and this helps convey both the employees' view and that of employers.

2. Internal Personnel marketing

The aim of internal personnel marketing is to achieve employee satisfaction (Barrow & Mosley, 2005). Armstrong and Taylor (2015) characterise work satisfaction as a *mental state, reflecting an individual's assessment of current well-being in combination with involvement in an employer's company*. Satisfied employees have a good rapport with the business, are loyal to their employer, are willing to work for the business beyond the scope of their duties, willingly recommend the business as a good employer, help the business to get through difficult times and promote its economic growth (Zarnik-Zulavska, 2012; Altkorn, 2002; Skare & Lacmanovic, 2015).

Loyal and permanent staff are those who maintain and influence business culture, knowledge and awareness of the needs of customers (Kucharčíková & Vodák, 2011).

Work satisfaction is influenced by:

- Job security;
- Sufficient financial and non-financial appreciation of work;
- The style of management and organisation of the business;
- The relationship of the employee to the work performed;
- The prospect of meaningful work and self-satisfaction from achieved work results;
- The level of working conditions, which the business is willing to ensure for employees, the opportunities for professional development and training and development plans;
- Style of communication and information sharing, ensuring of awareness at all levels of the business, ensuring the standardised communication routes, or sharing of credible information (Herzberg, Mausner & Snyderman, 2011).

3. Methodology

The contribution presents output from two primary research studies (study A and study B). These primary surveys were preceded by a qualitative survey, involving HR experts from leading business in the Liberec region. One secondary aim of the qualitative survey was to identify the attributes used in the quantitative research.

The aim of both primary surveys was to identify the attributes of satisfaction that have a significant impact on employee satisfaction. The benefit of the results of the questionnaires is the fact that this objective was identical for both of the primary surveys conducted, and so the results showed

differences in how the importance of the individual attributes is perceived by employees on the one hand and by employers on the other.

In terms of used methods, the quantitative method was applied in research. Quantitative research requires strong standardisation, which ensures high reliability. The purpose of the quantitative research was to determine the frequency that the variables acquire (Molnár, 2012). In view of work objectives, a descriptive purpose can be identified in the research. The descriptive purpose directly examines frequency and effectiveness (Saunders et al., 2009).

Research study A (realised from 2015 to 2018) was focused on *employees*. The respondents were all graduates of presence study, the Economics Faculty of the Technical University of Liberec, in master's degree studies. A total of 165 respondents were questioned.

Research study B (realised in 2016) was focused on the employer. The respondents were HR managers from companies in the Liberec Region. From the MagnusWeb database of companies, all companies from the Liberec Region were selected -- the basic set contained approximately 10,000 units. However, only companies that were economically active, generating profit and not in insolvency or liquidation were contactable were addressed (so that they could be subsequently addressed by e-mail). In total 1,605 subjects were addressed, of which 53% were micro enterprises, 34% were small businesses, 10% were medium sized businesses and 2% were large companies. The research was participated in by 156 respondents.

Data collection methods: For their targetability and for their financial and lack of time demands, a research method involving data collection via online electronic questioning was used, CAWI – Computer Assisted Web Interviewing (Kozel et al., 2011). Information from respondents was obtained via a link in an e-mail, which directed respondents to a questionnaire located on the Survio website. A structured questionnaire was used as a tool for collecting primary data.

The data evaluation methods: have been derived from the objectives of research and the type of examined data. The obtained data were evaluated using the statistical program Statgraphics 16.

4. Data and Results

This part of the contribution will present the results of research from the point of view of employees (research study A) and the results from the point of view of employers (research study B). A benefit of the contribution is comparison of both outputs of research.

Research study A: The respondents (employees) were in 2015, 2016, 2017 and 2018 (always half a year after the end of the study) asked about customer satisfaction with the determinants of employee satisfaction on a scale of 1–6 (1 = totally satisfied, 6 = quite dissatisfied). Employees are in their jobs satisfied with the determinants, whose median lies within the interval <1;2>, but rather disappointed with the determinants, whose median lies within the interval <5;6>.

At the same time, it was determined how important determinants on a scale of 1–6 were for them (1 = quite important, 6 = totally unimportant). The determinant, which is important for staff, has a median at an interval of <1;2>, while the determinant which is not important for employees has a median in an interval of <5;6>.

Research study B: The respondents (employers) were in 2016 asked about the importance of the particular determinants of employee satisfaction that they use in practice. They answered on a scale of 1–6 (1 = quite important, 6 = totally unimportant). The purpose of the findings was to determine the importance of defined determinants that lead to the satisfaction of the employees. An attribute is calculated as important, whose median lies within the interval <1;2>, and neutral importance is held by an attribute whose median lies within the interval <3;4> and an unimportant attribute has a median

within an interval of <5;6>. Table 1 shows the comparison of the employees' view of the importance of the particular determinants of employee satisfaction and staff's felt satisfaction with these determinants in their jobs.

Table 1: Satisfaction and the importance of the determinants from employees' point of view. Source: (own)

	Satisfaction				Importance			
	2015	2016	2017	2018	2015	2016	2017	2018
	Me	\bar{x}	Me	\bar{x}	Me	\bar{x}	Me	\bar{x}
Salary level	3	3,05	2	2,29	3	2,90	2	1,97
Relationship with superior	3	2,11	2	1,89	2	1,78	2	1,78
Job security	3	2,25	2	1,97	2	2,00	2	2,12
Self-fulfilment	2	2,84	2	2,42	2	2,22	2	2,12
Social prestige of the position	2	2,77	2	2,35	2	2,00	2	1,92
Good reputation of the company	3	2,06	2	2,04	3	2,43	2	2,36
Possibility to apply own initiative	2	2,62	2	2,22	2	2,27	2	2,04
Management effectiveness	3	2,89	2	2,98	2	2,31	2	2,26
Working hours	2	2,32	3	2,50	3	1,87	2	2,08
Employee benefits	2	2,54	2	2,43	2	2,64	2	2,29
Job description	2	2,70	2	2,40	3	2,59	2	2,08
Workload	2	2,81	2	2,59	2	1,83	2	1,78
Work variety	2	2,57	2	2,22	2	2,46	2	2,20
Increase of qualifications	2,5	3,00	2,5	2,59	3	2,00	2	1,92
Friendly relationships with colleagues	2	1,89	2	1,65	2	1,67	2	1,52
Work environment	2	2,03	1	2,00	1	1,78	1	1,88
Career growth	3	3,37	3	2,67	3	2,74	2	2,13

Table 2 shows a comparison of the view on the importance of the particular determinants both from the point of view of staff and from the perspective of employers (in the last monitored period).

Table 2: The importance of the determinants of employee satisfaction from the point of view of employees and employers. Source (own)

	Importance employees		– Importance – employers	
	\bar{x}	Me	\bar{x}	Me
Salary level	1,9	2	1,9	2
Relationship with superior	1,7	2	1,9	2
Job security	1,9	2	1,9	2
Self-fulfilment	1,8	2	1,9	2
Social prestige of the position	2,4	2	3,3	3
Good reputation of the company	2,5	2	2	2
Possibility to apply own initiative	2,1	2	2,4	2
Management effectiveness	2,4	2	2,2	2
Working hours	2	2	2,3	2
Employee benefits	2,0	2	3,5	3
Job description	1,7	2	2,2	2
Workload	1,9	2	2,4	2
Work variety	2,0	2	2,5	2
Increase of qualifications	2,0	2	2,9	3
Friendly relationships with colleagues	1,7	2	1,9	2
Work environment	2,0	2	2,2	2
Career growth	2,1	2	3,3	3

5. Interpretation of results

This article presents the outcomes from the surveys, focusing on satisfaction and the importance of the given determinants. The reason for this is the fact that employee satisfaction or dissatisfaction is influenced by the conditions they are given and the options available to them (Kucharčíková & Vodák, 2011). Another substantial reason is the fact that employee satisfaction has a direct impact on customer satisfaction and on the employee's individual performance (Lippold, 2014).

The following can be stated based on the results of the research:

Comparison of satisfaction and the importance of the determinants from employees' point of view: None of the specified determinants of employee satisfaction has a median at an interval of <5;6>. It is therefore unimportant for employees, and they are not dissatisfied in their jobs with any of them either. All of the specified determinants for staff are important, and their median lies within the interval <1;2>. Among the most important aspects of job satisfaction among employees are relations with superiors, job responsibilities, work diversity, opportunities for increasing qualifications and friendly relations with colleagues and the working environment. Self-realisation is also becoming more important for employees. Another possible interpretation is that employees are not entirely satisfied with the management of the organisation, the scope and variation of work and the opportunities for career advancement. During comparison of perceived satisfaction and the importance of particular determinants, it is possible to identify a non-conformity between work duties and increasing of qualifications. These aspects are important for employees, but in practice they are not completely satisfied with them.

Comparison of the importance of particular determinants from the point of view of employees and employers: it can also be stated here that both groups of respondents (employees and employers) do not consider any of the specified determinants to be unimportant. (For both research studies, there was no median in the interval <5;6>). If the particular determinants are important for all employees, then for employers some of the particular determinants are less important. They are: Social prestige of the work position, employee benefits, increasing of qualifications and career advancement.

6. Discussions and conclusions

The aim of this contribution was to expand knowledge about internal personnel marketing, which can be regarded as a type of innovative approach to HR management. The application of internal personnel marketing will lead to satisfaction and stabilisation of employees.

Given the context and for the purposes of comparison, the article presents the results of a survey carried out by Hays (2017) – of the 700 employees it addressed, 57 % of them said they did not feel well motivated in their current job. The results of the survey also show that pay, pay rises and praise from superiors are the factors that most motivate employees to perform better. The importance of these attributes corresponds to the results of our survey.

The primary aim of the conducted research was to identify the attributes that would lead to employee satisfaction. In view of the requirement for comprehensiveness and objectivity, both representatives of job supply (employers) and representatives of job demand (employees) were surveyed. A certain limitation could be the fact that the representatives of job demand represented only one homogeneous segment – employees with university education.

Based on the results of research, the following can be considered important tools for stabilisation of employees: relations with superiors, work duties, work diversity, increasing of qualifications, friendly relations with colleagues, the work environment and opportunities for self-realisation. In view of the results of research and the sometimes different view of the importance of particular determinants, it can be recommended to employers in accordance with the application of internal personnel marketing to monitor employee satisfaction. Also according to Ungerma and Dědkova (2017), effective targeted communication is important. The research studies realised by the author have proved the dissatisfaction with the targeted communication.

7. Acknowledgments

The paper was created with the financial support of the grant scheme of specific university research projects (SGS 2018) at the Technical University of Liberec.

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COMMUNICATION COMPETENCIES OF HOSPITAL LINE MANAGEMENT

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Keywords

Communication competency, management, hospital

Abstract

The Faculty of Health Studies cooperates on a long-term basis with 5 hospitals in the East Bohemia region, which are joined into one joint-stock company. One of the topics of mutual cooperation is focused on communication competencies of managers' leadership. The Dewhurst and FitzPatrik model of 12 competencies provides a possibility of evaluation and development of the communication skills that strongly influence the employee's engagement. The article brings summary of findings that is a comprehensive base for recommendation for the hospital top management.

1. Introduction

The importance of a managerial communication is reflected in all managerial work: planning, decision-making, organizing, controlling, leading, and mentoring, coaching and performance management. The aforementioned processes often fail due to a lack of proper communication. All managerial tools are based on work with information and its processing, i.e. communication. Communicating is an inseparable component of managerial work, therefore managers should be equipped with desirable communication competencies and the organization should create conditions to allow them to be put into practice (Feng 2009).

Line managers create a communication link between the company (top management, owners or shareholders) and workers, i.e. the employees who are led by them in a team. They transfer tasks and aims to the team and transfer feedback and ideas from the team back to the top management. They also ensure communication from their team with the whole company, among particular departments, with external partners and, foremostly communication throughout the team. Communication is a tool of leadership.

Line managers coordinate all of the activities of the teams in a company and lead its employees. They allocate tasks, check progress, evaluate performance and results, but also they influence work behaviour and lead by example. These managers represent the company within their team and reflect the image of the company towards all employees. Their communication is responsible for whether or not employees accept company aims and targets. They are also responsible for the results of the team that correspond with company interests.

Managers are different from other employees and have become leaders because of their responsibility and competence, i.e. authority, knowledge, skills, abilities and experience. Managers are responsible for team results and the attitude towards work shown by the team members.

It is necessary to highlight that managerial communication arises from the attitudes and opinions of the individual managers, which are a reflection on the attitudes, and opinions of the organization. Company culture forms the managers, top management must not underestimate communication with line managers, and how, in turn, those managers communicate (Andersen, Rasmussen, 2004).

If a manager is not willing to understand that a partnership with employees is the key to success, his employing company should terminate their relationship with that manager as soon as possible. It is necessary to review managerial performance regularly and objectively, not only should this be done by the top management but by the manager's colleagues. Professional knowledge and experience in managers should not be the only necessity when hiring new managers but it should also be their personal characteristic and communication competency. If the owner of the company is also the manager, they should also ask for feedback to improve their managerial skills. All in all, the success of all teams and companies is influenced by communication competencies of managers (Gibson 2002, Lloyd-Reason et al. 2003).

Even if a manager is trained in communication skills, it is usually only a course for them to improve rhetoric, verbal and non-verbal presentation. It often lacks trying to understand and actively listen based on mutual respect, trust and empathy. Accepting the principles of open communication (arising from empathy and feedback) is not possible if the manager only pragmatically accepts them because they consider them easier and faster, but has not fully identified with them (Reinsch 1996).

Open communication between managers and employees arises from the moral values of the managers concerned, their attitudes and the personal examples that they set. If the manager is not mature enough, they consistently worry about their perfection and are afraid when anyone criticizes them because they consider it is a threat for them. All managers should have a clear communication plan based on the strategy of the company. Communication lacking any logical or clear structure can never be sufficient or work properly. Their plan will support cooperation between all employees and help build the team.

Managers ensure communication outside the team as well, analysing the reactions of employees to the plans of the company. Of course, this communication must be supported to get the desired feedback (Miller, 2009).

2. The model for communication competency developing

Communication competencies create the most crucial part in the set of managerial skills. Desired communication competencies must then be developed and supported by the owner or the top management of the company to retain the competitive advantage of the company.

The models of organizational communication mention the managerial communication competencies as one part of the internal communication systems. The results of Communication ROI Study, conducted by the consulting company Watson Wyatt Worldwide during 2003 – 2006 proved the important influence of managerial communication on the company financial benefits (Yates, 2006). D'Aprix (2006) model brought the evidence of influence of the managerial communication on employee's engagement. Holá and Pikhart (2014) in their own research validated the model of internal communication system that includes also manager's responsibility for their communication and the unifying managers' communication like important forces of business driving.

The most important communication competencies are summarized in paper by Dewhurs and FitzPatrick in Wright (2009); there is a list of 12 communication competencies for a competent communicator. These competencies should help the managers to understand their managerial skills in communication and should help them to set their own communication, evaluate and develop that.

Authors handled competencies in several levels and showed the way towards improvement. Table 1 shows the main competencies base on the international research finished in 2007. These competencies create a useful framework for development of managerial communication competencies. The authors describe each competency in 3 levels – basic, intermediate and advanced and they describe ineffective behaviour for better understanding.

Table 1 The twelve core competencies according Dewhurs and Fitzpatrick (Wright, 2009)

Competency	Definition
Building effective relationships	Developing and maintaining relationships that inspire trust and respect. Building a network and being able to influence others to make things happen.
Business focus	Having a clear understanding of the business issues and using communication to help solve organisational problems and achieve objectives.
Consultation and coaching	Recommending appropriate solutions to customers, helping others to make informed decisions, building people's communication competence.
Cross functional awareness	Understanding the different contribution from other disciplines and working with colleagues from across the organisation to achieve better results.
Craft (writing and design)	Using and developing the right mix of practical communication abilities to hold the confidence of peers and colleagues.
Developing other communicators	Helping other communicators build their communication competence to reach desired competency in their career.
Innovation and creativity	Looking for new ways of working, exploring best practice and delivering original and imaginative approaches to communication problems.

Listening	Conducting the surveys and managing mechanisms for gathering feedback and employee reaction.
Making it happen	Turning plans into successfully implemented actions.
Planning	Planning communication programme and operations, evaluating results.
Specialist	Having specific subject matter expertise in a specialist area.
Vision and standards	Defining or applying a consistent approach to communication and maintaining ethical standards.

3. The survey of communication competency

The Faculty of Health Studies cooperates on a long-term basis with 5 hospitals in East Bohemia region. One of the main long-term aim from 2017 is improving the communication in two main areas: communication with patients and managerial communication. That is why the faculty has provided the hospital communication trainings. That activity is also supported by the results of employee satisfaction survey. The results show the insufficient communication of the managers. The survey was conducted on a sample of 102 nurses, doctors - line managers who lead the departments, directly manage the others and are the interface between the organisation top management and its front-line workforce; they represent the lowest level of management within the organisational hierarchy. All of the respondents attended the 8-hour training (workshop) of managerial communication from February 2017 to March 2018. The course was voluntary and the managers in this way demonstrated their need and interest to improve their work in this area. The workshop included a model of managerial communication competencies and at the end of the workshop, the participants filled in a questionnaire in which they assessed the importance (M) of each competency for their own work and evaluated the level of their own skills within each competency (E). Both assessments were using the Likert scale from 1 the maximum to 5 the minimum. The competency was defined as the ability to do something successfully or efficiently. The lower the number, the more positive rating. The obtained data were analysed firstly by descriptive statistics see table 2.

Table 2 Descriptive statistics of competencies evaluation

variables	descriptive statistics									
	N	mean	median	modus	sum	min	max	variance	SD	d
1. M/BER	102	1,196	1	1	122	1	2	0,159	0,399	
1. E/BER	102	1,951	2	2	199	1	3	0,443	0,666	0,755
2. M/FA	102	1,784	2	2	182	1	3	0,270	0,519	
2. E/FA	102	2,010	2	2	205	1	4	0,505	0,711	0,225
3. M/C&C	102	1,647	2	1	168	1	3	0,528	0,726	
3. E/C&C	102	2,216	2	2	226	1	4	0,646	0,804	0,569
4. M/CFA	102	1,735	2	2	177	1	3	0,395	0,628	
4. E/CFA	102	2,167	2	2	221	1	3	0,437	0,661	0,431
5. M/Craft	102	1,902	2	2	194	1	3	0,505	0,711	
5. E/Craft	102	2,108	2	2	215	1	3	0,295	0,543	0,206
6. M/DoC	102	1,931	2	2	197	1	3	0,560	0,748	
6. E/DoC	102	2,196	2	2	224	1	4	0,357	0,598	0,265
7. M/I&C	102	1,833	2	2	187	1	3	0,239	0,489	
7. E/I&C	102	2,353	3	3	240	1	3	0,528	0,726	0,520
8. M/Listen	102	1,382	1	1	141	1	3	0,417	0,646	
8. E/Listen	102	1,706	2	1	174	1	3	0,507	0,712	0,324
9. M/MiH	102	1,578	2	2	161	1	3	0,345	0,588	
9. E/MiH	102	1,931	2	2	197	1	3	0,599	0,774	0,353
10. M/Plan	102	1,539	2	2	157	1	2	0,251	0,501	
10. E/Plan	102	2,069	2	2	211	1	3	0,362	0,601	0,529
11. M/Spec	102	1,392	1	1	142	1	3	0,340	0,583	
11. E/Spec	102	1,853	2	2	189	1	3	0,523	0,723	0,461
12. M/V&S	102	1,775	2	2	181	1	3	0,473	0,688	
12. E/V&S	102	2,186	2	2	223	1	3	0,569	0,754	0,412

The table 2 shows the assessment of each competency by the managers. The competency order is the same as in table 1. All evaluated competencies are described by statistics: mean, median, total sum, minimum, maximum, variance, standard deviation. All statistics provide a clear comparison of competency assessments among themselves and a comparison of managerial importance and skill in each of them. Variance shows the managers' consensus (the smaller the value, the greater the consensus). The last column of table 1 contains the difference (d) between the assessment of managerial importance and the skill of each competency.

The managers marked the competency *Building effective relationship* as the most important meaning competency for manager's performance (the lowest mean and sum). This competency gained the biggest difference between the importance and the manager's own evaluation. When assessing this competence, the managers also showed the greatest consensus (the smallest variance and standard deviation of evaluation). On the contrary, the managers assessed *Developing other communicators* as the least important of their competencies; this competence gained the largest amount (240). Each assessment of importance competency gained less mean than 2 and a median of maximum 2. This result shows the managers consider each competency important for their own performance. The evaluation of manager's own communication competencies was different for each competency. The competency *Craft* gained the smallest difference. Managers best rated their own competency *Listen* and they marked the worst ranked competency *Innovation and creativity*. The box plots on figure 1 illustrates some interesting differences. All differences were tested for statistical significance (alpha=0.05). All differences were significant (see table 3).

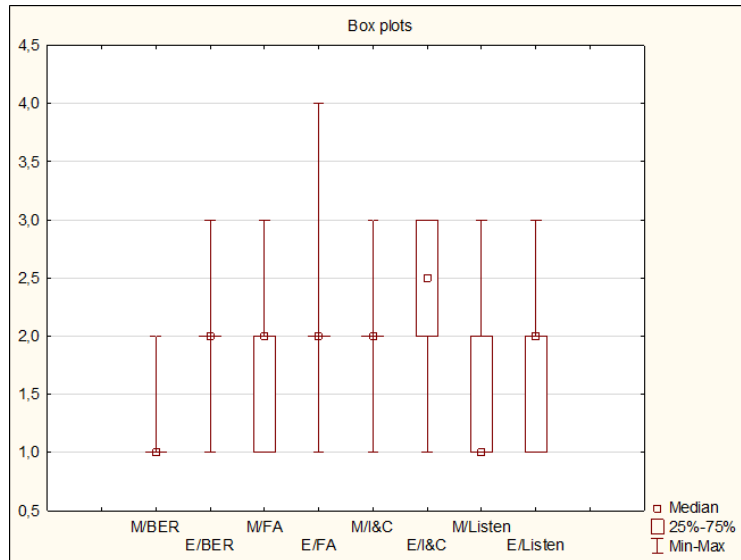


Figure 1 Box plots of competency evaluation

The data do not correspond to the normal distribution and the professional groups do not match their representation in the employee population, therefore the data were tested by the nonparametric Wilcoxon test at a significance level of 0.05. However, the difference in evaluation of each professional group was not tested.

Table 3 Results of Wilcoxon test for comparison of 2 variables - evaluations

$\alpha=0.05$	Wilcoxon test (data.sta)	
comparison of variables	N	p-value
M/BER & E/BER	102	0,000000
M/FA & E/FA	102	0,008415
M/C&C & E/C&C	102	0,000000
M/CFA & E/CFA	102	0,000014
M/Craft & E/Craft	102	0,042698
M/DoC & E/DoC	102	0,010601
M/I&C & E/I&C	102	0,000003
M/Listen & E/Listen	102	0,009545
M/MiH & E/MiH	102	0,001265
M/Plan & E/Plan	102	0,000000
M/Spec & E/Spec	102	0,000000
M/V&S & E/V&S	102	0,000005

4. Discussion

A competent manager is a person who is able to use the right competencies and thus be the right manager. The model of 12 competencies creates the frame for managerial development as well. It is also crucial to assess and evaluate the current state of competencies of the desired manager and then create a personal development plan for them.

All findings of the survey illustrate how the communication competencies are important and there is space for their development and improvement. The model of 12 competencies can show the detail

which skills must be developed more or less. These findings are very important for survey participants and for their top management.

The personality of a manager is the most significant influence over their communication and, to improve it, the first step is that managers will accept their own responsibility for communication (Miller, 2009).

Managers must be fully aware that their messages present certain ideas and the understanding of those ideas is fully dependent on the way they are transferred to other people. Communication transfer not only influences how the information is passed to other people, but also whether those other people understand it in the way that it was intended (Leech 1981). In addition, of course, it is necessary to take into account the communication channel that can distort the message. Therefore, in the end, it is necessary to check if the transfer was successful, i.e. that the information has been understood. (Dobravová, 2002)

All of these points can only be entirely effective if the communicator is willing to take on partnership and trust. If the manager is not able to accept these basic principles of open communication, these competencies and skills will not be permanent and communication will fail (Smith, 2008).

From the above-mentioned, it is clearly seen that managers' communication consists of a cluster of various activities, namely: personnel management, internal marketing and the direct management of teams and their members. It is a vast field of human effort being performed at least in these three defined levels (Holá, 2017).

- The level of the company: The communication between the top management and individual employees (mostly internal marketing communication in the form of internal public relations).
- The level of the team: The communication between line managers, their teams and an individual team member, and also between the members (team cooperation, performance management, performance reviews and employee development).
- The level of personal communication of the manager: The line manager is the communication link between the company's top-management and the team; they require sufficient communication competencies and negotiation skills to eliminate communication barriers.

Communication, in all of the three above-mentioned levels, is based on several layers and their interaction is crucial for success – their concord and harmony are the only key to better performance and efficiency. Managerial competencies, however, are only one part of the building elements of the internal communication system. This system must be complied. Holá (2017) offers one of the ways of internal communication system setup. The design of the system is based on concrete prerequisites for a functioning internal communication (strategic organisational culture, unified team of company leaders, social policy, communication competencies of managers, formal communication, communication standards, internal PR, open communication) (Holá, Čapek, 2015).

5. Conclusion

No manager, who attended communication training and participated in the survey, had any previous managerial qualification. They were promoted to the management position without the required managerial education. Managerial education is not required as a qualification for managers. Their qualifications must comply with statutory qualification requirements. All the competencies of their professional performance are defined by law, e.g. Česko (2011). The managerial competencies are not defined; hospitals are still searching the suitable model of managerial competencies.

Although the hospitals have no internal communication system and most of their line managers have no management education, managers want to learn and improve their competencies because they feel responsible for their work. Communication in a hospital, as in any organization, affects the quality of work, thus more attention should be paid to communication in team; e.g. Kalish and Rochman (2010) brought the evidence that nursing teamwork strongly influences failure in nursing.

The results of the survey can provide a basis for the further development of communication competencies of managers. The authors recommend adding communication courses on the list of compulsory managerial training. Every manager has to attend the course in several stages. The survey findings also provide a good base for setting a model of managerial competencies, which will be created to unify the model of managerial competencies. At present, much more emphasis is put on the professional competencies associated with providing care rather than managerial. Therefore, the authors include communication skills in the competency model within the "Competent Nurse of the 21st Century". Managerial competencies for doctors and paramedical staff are not described and defined, although the importance of managerial communication and its impact on employee engagement and quality of their work is evidence based.

6. Acknowledgements

This paper was created within the project The Competent Nurse for the 21st Century: The Analysis and Design of the Optimization of Nursing Education and Professional Practice supported by Technology Agency of the Czech Republic TL01000094.

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ANALYSIS OF INNOVATIVE DEVELOPMENT OF THE NCFD REGIONS IN RUSSIA

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Keywords

innovation activity, regional policy, regional development, statistical information

Abstract

The article is devoted to the analysis of the innovative development of North Caucasian Federal District on the basis of statistical information. The main directions of the regional policy in the field of stimulating innovation development are singled out. A comparative assessment of the level of development of innovation activity in the regions of the North Caucasian Federal District was carried out. The theoretical significance of the research is to expand the methodology of analysis of regional innovative activity on the basis of government programs. Practical significance consists in an innovative survey of the regions of North Caucasian Federal District in the context of the prevalence and importance of interrelationships among such parameters as the organizations that carry out scientific research and development, personnel, funding sources and the coefficient of inventive activity.

1. Introduction

The purpose of innovative development of the region is to increase the level of innovativeness of the regional economy by organizing high-tech industries based on the use of intellectual work and creating a high added value of the product.

The composition of statistical information in modern conditions is largely determined by the practical needs of society. The quality and reliability of statistical data is the basis for effective solutions that contribute to the successful development of the economy.

The competitiveness of enterprises, their products, services and orders in the domestic and world markets largely depend on the achievements of science and technology which affect the improvement of product quality, saving labor and material costs, an increase of labor productivity, improvement of production organization and its effectiveness increase.

Reflecting the existing trends and anticipating their possible changes in the future, statistics is a tool for science and innovation monitoring, justifying the scientific and technical policy.

2. Methods

Studying the quantitative parameters of the phenomena and processes in the field of science and innovation in unity with their qualitative nature, statistics meets the needs of society for accurate and reliable statistical information on the value, structure and dynamics of resources and the results of scientific and innovative activity, their influence on socio-economic development of the country and regions. The mechanism of working out and implementing the state scientific and technical policy that involves the coordination of the interests of various government bodies, economic entities and the scientific community itself has become more complicated. New directions in the statistics were the analysis of the state of scientific potential in the main areas of research, evaluation of the activities of scientific organizations in the current market conditions.

Innovative development of the region is a socio-economic process, which is based on the formation of the regional innovation system.[4] It must be able to increase the innovation potential of the region and its implementation through the organization of high-tech industries based on the use of intellectual work and products that create high added value. Innovative potential of a region is a combination of factors and conditions that characterize the ability of the region to innovative development. An innovative potential is a kind of characteristic of the system's ability to change, improve, progress [3].

A comprehensive assessment of the innovative potential of the social and economic system assumes, first, the use of a sound and scientifically verified system of indicators, and secondly, the presence of a statistical base. The result should reflect the degree of the region preparedness for creation, adoption and distribution of different types of innovations and for the implementation of the results of innovation [6].

The lack of innovation development in the regions of Russia is indicated by statistical data on the level of innovative activity of organizations of industrial production and services.

The lagging behind in the level of innovative activity is typical for the Southern and North Caucasian districts from 6.5 to 7.5% and from 5.2 to 6.2%, respectively, for organizations that carry out all kinds of innovations.

According to the Federal state statistics service, the leader of innovative activity in the NCFD in 2016 is the Republic of Dagestan - 10.3%. Data for regions was the following: Kabardino-Balkar Republic - 9.3%, Stavropol Territory – 8.01%, Republic of North Ossetia-Alania – 5.3%, Karachay-Cherkess Republic - 2.7% and there is no available data for the Republic of Ingushetia and the Chechen Republic.

Investigating the level and the state of innovative development of the region it is necessary to use statistical information about the main indicators characterizing the state and the level of development of scientific and innovative potential of the North Caucasian Federal District in comparing the regions to assess their competitiveness. As innovation activity according to the Federal State Statistics Service is based on a number of indicators, consequently, the assessment of innovation in the region will be carried out in accordance with the proposed methodology.

The section "Scientific Research and Innovation" provides information on the number of organizations that have carried out scientific research and development, the number and composition of employed personnel, the training of scientific personnel and the internal costs of research and development. The data on the creation (development) and the use of advanced production technologies, as well as on the innovative activity of organizations, the volume of innovative goods, works, services, the costs of technological innovation is given.

3. Analysis

The first indicator of interest for the analysis is the number of organizations performing scientific research and development, so in the Republic of North Ossetia-Alania, we observe a stable dynamics. According to Table 1, there were registered 18 enterprises carrying out research and development activities in 2017 that is 6% higher than in 2012. The leader is the Stavropol Territory where the increase from 28 organizations in 2013 to 35 organizations in 2016 is observed. This indicates a properly implemented strategy for the development of innovation in the region.

Table 1 Organizations performing research and development

	2014	2015	2016	2017
The North Caucasian Federal District	105	99	116	117
Republic of Dagestan	29	28	30	30
Ingush Republic	4	4	4	4
Kabardino-Balkar Republic	14	14	14	14
Karachay-Cherkess Republic	5	5	7	8
Republic of North Ossetia-Alania	17	16	17	18
Republic of Chechnya	8	9	9	8
Stavropol Territory	28	23	35	35

The current dynamics of scientific personnel in Russia is characterized by a decrease, although the rate of this in recent years is reducing.[5] The growth of the personnel potential in the field of science and technology is possible due to the concentration of resources on the work carried out by scientific teams, capable to perform scientific research at an international level, the correct formulation of tasks, and the personal motivation of scientific personnel.

An important indicator which characterizes the development of the region is the number of researchers per 10 thousand inhabitants. This category includes employees who are professionally engaged in scientific research and development and directly carry out the creation of new knowledge, products, processes as well as the management of such activities (administrative work). Such employees usually have completed higher professional education.

According to Table 2, there were 669 researchers per 10 thousand inhabitants in the Republic of North Ossetia-Alania in 2017, which is slightly higher than in 2015. According to the data of 2017 the region inferior to the Stavropol Territory (2383 researchers), the Republic of Dagestan (1548 researchers), Kabardino-Balkar Republic (744 researchers). But it is necessary to take into account the population of the investigated regions when analyzing this indicator.

Table 2 The number of personnel involved in scientific research and development (person)

	2014	2015	2016	2017
The North Caucasian Federal District	8585	7188	6330	6628
Republic of Dagestan	1628	1606	1561	1548
Ingush Republic	112	114	114	130
Kabardino-Balkar Republic	704	746	783	744
Karachay-Cherkess Republic	506	505	508	561
Republic of North Ossetia-Alania	685	648	650	669
Republic of Chechnya	639	592	646	593
Stavropol Territory	4311	2977	2068	2383

Among them 140 researchers with academic degrees of Candidate of Sciences and 50 researchers with academic degrees of PhD in 2017.

Despite the fact that nowadays the Republic of North Ossetia-Alania is inferior to other regions of the North Caucasian Federal District in terms of the level of scientific and technical potential, a high educational level of personnel can provide the region in the medium and long-term opportunity to become an innovative platform for the introduction of modern (advanced) technologies in the sphere of life support and sustainable growth of the quality of life under the conditions of severe sharply continental climate.

Special attention should be paid to the creation of competitive conditions for attracting young researchers, including graduates from leading foreign universities, supporting scientific teams of state scientific organizations that demonstrate high results of scientific and publishing activity.[1]

Presidential Decree No. 597 of May 7, 2012, "On measures to implement state social policy" outlined the tasks of increasing the economic attractiveness of work in the field of science and fixed the need to increase the average salary of scientific workers to 200 percent of the average salary in the region by 2018.

In accordance with the Strategy of innovative development, the dynamics of the volume of domestic expenditure on research and development will outpace the growth of basic macroeconomic indicators. As a result, the share of science expenditures in GDP will be 3 percent in 2020, compared with 1.12 percent in 2012, which corresponds to an increase of 1.88 percentage points. In the structure of the domestic costs on research and development, qualitative changes are also expected and are associated with a more dynamic growth in the volume of extrabudgetary funds, the share of which will increase from 31.1 to 57 percent over the period from 2012 to 2020. At the same time, the share of budget funds in the expenditure on science will decrease from 68.9 to 43 percent. The calculations show that the share of educational institutions of higher professional education in the internal costs of research and development in 2020 will reach 15 % that is 6 percentage points higher than the value of this indicator in 2012.

The most important source of funding for domestic science has been and remains the funds of the state budget. In 2012 the share of budgetary funds was 65.6 percent in domestic expenditures for research and development. The Innovation Development Strategy also aims to overcome the recent trend of preserving (and in some years even increasing) of the share of the budget in research and development expenditures, ensuring funding at the level of at least 50 percent from extrabudgetary sources by 2020. [2]

According to the Federal Service for State Statistics of the Russian Federation, in the whole 4,197.3 million rubles in 2015, which is 13.5% more than in 2014, and the share of the Republic of North

Ossetia-Alania 470.9 million rubles, which also has a tendency to by 26.3% compared to the previous year.

According to the Federal state statistics service of the Russian Federation the internal expenditures for scientific development and research in the whole North Caucasian Federal District amounted to 4197.3 million rubles in 2015, which is 13.5% more than in 2014, and the share of the Republic of North Ossetia –Alania was 470.9 million, that also has a tendency to increase by 26.3% compared to the previous year.

Taking into account the specifics of the State program, the main goals and objectives of which are related to the development of fundamental and applied research of the target indicators the system of target indicators reflecting its most significant results includes: the share of Russia in the total number of publications in world scientific journals indexed in the database "WEB of Science"; number of publications of Russian authors in scientific journals indexed in the Scopus database per 100 researchers; number of citations per 1 publication of Russian researchers in scientific journals indexed in the database "WEB of Science"; the coefficient of inventive activity (the number of domestic patent applications for inventions submitted in Russia per 10 thousand population).

So, according to the statistical data presented in Table 3 the receipt of patent applications and the issuance of patents in the NCFD are distributed as follows: the absolute leader in 2017 is the Republic of Dagestan and Stavropol Territory, in which 388 and 172 patents for the invention have been granted, respectively. In the Republic of North Ossetia-Alania, 68 patents for utility models were issued, which amounted to 94.4% of filed patent applications for utility models.

Table 3 The receipt of patent applications and the issuance of patents in the NCFD

	2015				2016				2017			
	Filed patent applications		Issued patents		Filed patent applications		Issued patents		Filed patent applications		Issued patents	
	for inventions	for utility models	for inventions	for utility models	for inventions	for utility models	for inventions	for utility models	for inventions	for utility models	for inventions	for utility models
The North Caucasian Federal District	1539	157	994	124	1666	209	581	179	683	175	742	188
Republic of Dagestan	1096	43	603	27	1188	24	271	19	285	14	388	19
Ingush Republic	2	-	-	-	1	-	-	-	1	-	2	-
Kabardino-Balkar Republic	81	7	66	7	116	11	63	5	72	19	80	20
Karachay-Cherkess Republic	14	12	4	10	27	10	15	6	15	9	12	6
Republic of North Ossetia-Alania	100	15	95	13	115	78	77	72	96	54	72	68
Republic of Chechnya	25	6	19	1	24	11	13	7	27	10	19	11
Stavropol Territory	221	74	207	66	195	11	142	70	187	69	172	64

In the practice of international comparisons the results of scientific and technological activities by indicators of patent activity, technological balance and the results of fundamental research are assessed using bibliometric indicators.

The absolute and relative citation rates are also important. The absolute level of citation is determined by the number of publications.[8] However, this approach does not fully reflect their quality. In addition, there are significant differences in a citation in different disciplines of science and their

popularity in different countries. Therefore, the most interesting is the indicator of the relative level of citation, in the calculation of which the normalized values are used. It reflects the level of citation of scientific publications of the country relative to the average world citation level equal to 100. Such an indicator allows performing direct international comparisons.

Decree of the President of the Russian Federation of May 7, 2012 N ~ 599 "On measures on the implementation of the state policy in the field of education and science" defined the tasks: the systematization of scientific activities and the determination of priorities for its development through the formation of the Program of fundamental scientific research in the Russian Federation for a long-term period and the development of mechanisms for its financing, the development of competitive mechanisms to support scientific research through the expansion of the activities of state scientific foundations and the increase of their funding by 2018 up to 25 billion rubles; internationalization and dissemination of the results of the scientific activities of Russian researchers through an increase in the number of publications in the total number of publications in world scientific journals indexed in the "Web of Science" database to 2.44 percent by 2016.

4. Conclusion

The implementation of the State program of the Russian Federation "Development of science and technology" for 2013-2020 will contribute to increasing the effectiveness of scientific activities in the Russian Federation and enhancing the global competitiveness of Russian science. It is expected that the share of publications of Russian researchers in the total number of publications in world scientific journals indexed in the database "WEB of Science" will increase to 3 percent in 2020 (2012 - 2.12%). In general, in the forecast period, the increase in the value of this indicator will be ensured by approximately 0.88 percentage points. Thus, in accordance with the decree of the President of the Russian Federation of 7 may 2012 No. 599 "About measures on realization of state policy in education and science", in 2015 the value of this indicator should reach 2.44 percent. According to the Strategy of innovative development in 2014, 2017 and 2020, the corresponding values are 2.3 percent, 2.5 percent and 3 percent. The coefficient of inventive activity (the number of domestic patent applications for inventions filed in Russia per 10 thousand population) is projected to increase by about 1.5 times from 1.85 in 2012 to 2.8 in 2020. Provided by the Strategy of Innovative Development target values of this indicator will reach 2.1 in 2014, 2.3 in 2017 and 2.8 in 2020.

An important reason for strengthening the role of regional innovative development is the fact that in the modern world the success of innovation policy largely depends on what new knowledge is formed depending on the nature of tasks in the implementation of the plans for economic development of the region. The spatial proximity of the creators of "intellectual capital", "technological resources" and business is critical to the success of innovation.

Uneven development of innovative potential is objective. All regions should not have equality here. However, the current world trend is that the regions and specific territories in the developed countries of the world, nevertheless, increase scientific and innovative potential, create favorable conditions for attracting intellectual resources to the territorial economic complex.

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NEW TYPES OF ORGANIZATIONS (COMPANY TYPES) IMPLEMENTING THE PRINCIPLES OF SELF ORGANIZATION AND SELF DEVELOPING

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Keywords

Organization formation and organization development; new types of organizations; self-organization and self-development

Abstract

The article explores numerous concepts of the evolution of organizations in transition to a new management paradigm 2.0, based on leadership and new behavioral mechanisms of personnel management. Introduces the basic conceptual approach to successful organization formation with modern management mechanism, based on self-development and self-organization (2S), leading to successful companies organization development. The organization formation target-setting and principles of 2S-system organization are classified. Subsystems of mechanisms of self-development and self-organization, such as Organizational Structure; Organizational Culture, which is based on Personnel Engagement and Creative Tension; Mechanism of Motivation are defined. On the example of more than a dozen of leading international and Russian organizations of various industries content analysis and evaluation of new forms of organization and management system formation, implementing the principles of 2S is carried out. It is proved that the development of organizations based on 2S principles formation leads to convincing economic and social success. The article makes a theoretical contribution to organizational development management theory and has the practical importance to leaders, managing the process of company formation and organizational development.

1. Introduction

Unlike the classical management there does not exist any “new” coherent theory in modern management facing XXI century challenges. One of the first (early) attempts to build the new management program for “entity humanization” has been undertaken by a group of famous scholars and top executives who have offered 25 major problems (Hamel, 2009). The analysis of these problems brings us to the conclusion that they are all focused on new management principles realization. However, still open remains the issue on approach development, theory concepts, the models driving the new management type. And it is still important to associate them once embedded into the system.

Ichak K. Adizes has formulated the principles of company management in conditions of rising uncertainties and risks (Adizes, 2017), most important of which is a breakaway from authoritarian style, the rejection of the hierarchy.

These processes testify to the reduction of the average company lifecycle, from 56 years in 1970 to 31 years in 2010 (the research based on 30 thousand American companies study). The main reason

of this statistics is complexity of adaptation to the changing business environment (Reeves, Levin, Ueda, 2016). Hence, the major conclusion: adaptability, flexibility and changes implementation mechanisms should be built into management.

Direct government and subordinates' control leads to loss of adaptability at the sake of lack of initiative and low motivation for the changes. In turn, this abates the compatibility of the system as a whole under the changing environment. It is more correct to create the conditions for efficient activity, encouraging the people and fostering their autonomy and initiative. Such policy would allow to form the new processes relevant to the external medium faster and more effectively, i.e. make the system emergent, self organizing and self developing.

After identifying the nature and reasons causing the transition necessity it is worth treating few other issues:

- Formulate the trappings and targets for a management model based on self organization and self development;
- Analyze and evaluate the existing theoretical approaches to building the new organizations;
- Review the existing practice around the companies;
- Form the assessment of the situation and new organizational types development.

2. New concepts of institution development.

It can be stated that the new stage of organisation's evolution is emerging to mark the transition to a new management paradigm 2.0 based on leadership and new behavioral mechanisms of personnel management revealing first and foremost its creativity.

While exploring the formation of the self developing organizations and objectively arising from the change the transformation processes together with target setting (Molodchik, 2001), the basic principles of 2S organisation system as well as relevant processes and mechanisms have been generated (Komarov, Molodchik, 2013) (see table 1).

Table 1. Trappings and targets of self organization and self development.

Trappings of self organization and self development	Targets of self organization and self development
Decentralized management	Establishing a new type of organizational structure that implements the principles of self government capable to respond quickly to external changes
Internal motivation factors priority	Building the prerequisites for developing the staff initiative and creativity
Leadership as prevailing form of management	Managing the people's behavior on the bases of shared values and unity of purpose
Collective action	Dominance of team work, personal responsibility and synergy of interaction
Self development of staff	Personal responsibility for competence development for results
Individual-oriented corporate culture	Norms and rule governing the human resources prioritization

The purpose of this management system lies in establishing an active mechanism of staff involvement into the human resources on-going increase as the main source of innovative development and building sustainable advantages.

The characteristic traits of such 2S system are defined as basic and supporting. The basic ones contain goal setting to ensure unity of purpose and interests of the individuals, groups and organizations, taking on responsibility and self control by the employees, multilevel leadership and staff involvement, team work and their performance synergy effect. The supporting traits comprise internal long-term motivation with its intensity as a driver for every individual, the decentralized government and internal entrepreneurship as organizational developing and learning mechanisms followed by accumulating and knowledge sharing among the employees as organization's development capacity.

Let's consider approaches to the new types of organizations one by one in a chronological order. Requisite Organization, comes as the first approach which has defined a concept of smart organization, relying on the employees potential (Jaques, 1988). The organizations based on the organizational entrepreneurial network reveal decentralized entrepreneur's responsibility and internal entrepreneurship of the unity leaders (Wissema, 1996). The learning organization theory arose interest as it is based on the potential personal learning of every employee, flexible company structure and staff involvement in decision making (Senge, 1999). The concept of the horizontal organization is built on the key processes format which quickly respond to external changes (Ostroff, 1999). Another approach to creating adaptive organization is interesting for it treats the company as a "living being" – a biological corporation with the brain and the body (Gouillart, Kelly, 2000). Relatively recent appeared another concept of a holacratic organization, where the basic principle is self government and absence of the directors. All the processes are defined as "Constitution" (Robertson, 2010). More known today is the concept of turquoise organization which looks like a live self-developing system with no hierarchy and no formal posts, the government and the activity are being performed by the self managing teams endowed with the responsibility of authority to achieve the result. (Laloux, 2017). Research carried out by the author brought about some results of the approaches compiled in table 2.

Table 2. Evaluation of the new types of organizations, realizing the 2S principle

Self development and self organization traits	1 Jaques	2 Wissema	3 Senge	4 Ostroff	5 Gouillart	6 Robertson	7 Laloux
Decentralized management	1	2	2	2	1	3	2
Internal motivation factors priority	0	1	2	1	2	2	3
Leadership as prevailing form of management	1	1	2	2	2	2	2
Collective action	0	1	2	3	1	3	3
Staff self development	2	1	3	2	3	3	3
Individual-oriented corporate culture	2	1	3	2	2	3	3

The adopted scale to assess ranges from 0 – not shown, 1- weakly manifests itself, 2 – there is a sign, 3 - manifests in full least. The approaches from 1 to 7, listed in the above table, are given in chronological order and the first conclusion indicates temporal dynamics of 2S trappings completely implemented. The most vivid representative of the new concept is turquoise organization of Frederic Laloux. The author gives lots of examples to confirm his approach unlike earlier concepts of Peter Senge and some others authors. However, concept implementing mechanisms have not been noted down and there is no suitable fitting technology for building such an organization. Thus the second conclusion lies in the fact that all the theoretical studies have come pretty close to a quality breakthrough: appearance of the perfect theory for the new organization type that would reflect the management transformation processes.

3. Company practices, demonstrating the principles of 2S

It is a pity quite a few companies worldwide were implementing the principle of self organization and self development into practice, much fewer came to be the object of analysis and material for publication.

When choosing the suitable companies we were seeking those where the processes of self organization and self development were mostly explicit, i.e. minimum hierarchy and maximum personnel involvement in all the spheres of activity management included. Another significant factor chosen was ability to work in a team, leadership traits, responsibility for the result. And it was this particular combination that had laid the foundation for checking the effectiveness and efficiency of the new management model in practice. The factual basis for the research were the studies made on the papers of Laloux F., Hemel G. and other scientists, then internet sources and personal observations of the author who had been leading RMC Business School for over 25 years (Molodchik A., 2013).

3.1. Types of the companies

There has been studied 12 companies, 6 of which are producing, 3 are in trading, 2 of them specialising in back office services and flat rent, 1 company is caring for the sick and elderly and another 1 is working for school education. As can be seen from the list the range is pretty much varied so it is hard to assume the preferences of either businesses to the self organization and self development processes. Geographically wise all the companies are located in 6 counties: the USA, France, Russian Federation, Germany, the Netherlands, Brazil, and some are noted multinationals performing all over the world. The staff numbers from few hundreds to 40 thousand employees.

A special niche is taken by the companies set up in the last decade due to internet and IT technology. These are platform companies where the new business model is being realized. Here the customer is involved in the process of service formation and its selling. The self organization process is activated as the customer is doing the job of an employee. The results of the research are combined in table 3.

Table 3. Company practices, demonstrating the principles of 2S

Company types	Characteristic features of management model
Moring Star – tomato processing company	No bosses, self governing, voluntary responsibility, for the results, collegial award
Favi – copper smelting works	Staff if split into 21 teams working on the principles of self governing and group responsibility for the result
AES – power company	Management based of self organization and responsibility delegation for the result
Sun Hudraulies – high tech valve production	Self governing teams generating and implementing hundreds of innovative designs and engineering
Semko – pump manufacturer	High degree of decentralization and staff involvement
Goore – chemical company	No bosses, lattice structure, leadership
Zappos – internet trading	Principle of holacratic management
Taste Will - sales network for products	Turquoise company culture, priority of trust and customer
Buurtzorg – care for elderly and sick	600 client oriented self organizing teams
Platform companies: Airbnb – private property rent	Self organizing network involving the clients into the process of service formation and sales

Lavka Lavka – farmer’s produce sales	
ESBZ – evangelic school	Self government, children’s involvement into learning processes (curriculum formation and study)
Regional School of Business-RMC	Self organizational business units, flat structure, internal entrepreneurship

3.2. Management system specifics

All the companies studied and presented possess the characteristic features of the new management model which creates most favorable conditions for self organizing and self developing processes: focus on the clients’ interests; absence of hierarchy, formal posts and bosses; delegation of the decision making straight towards the groups (teams, circles) and employees; coordination of responsibility and obligations in between the groups (teams, circles); staff involvement into projects initiation and implementation; trust as the core value in the company.

3.3. Organisational Structure

Organisational structure refers mostly to the flat, horizontal type with integrated elements of project structure, in some cases it can be a network. The main working link is a group (a circle, a team), consisting of 10 to 30 people responsible for the realization and result achievement of the production and assisting processes. As a rule, there is no job description, or structural unit provisions or the system of planned indicators. Each group is having its own budget, accounting of income and expenses and is striving to achieve maximum results, like quality, profit and cost saving. The groups are quickly reformatted depending on the targets and the tasks changed. Group members are floating as any member may join more than one group. The project groups tend to appear at the initiative of the employee after the peers’ coordination and agreement. On completion of the project the group is dissolved.

3.4. Involvement and tension.

Nearly all the companies investigated revealed personnel involvement into the company management. The employee in his working place defines the methods and forms for the better result achievement, he is a decision maker within his zone of responsibility, he possesses all the information needed on the adjacent zones, is initiating and implementing the project changes. Tension as a concept is supported by taking personal obligations and responsibility for the job fulfillment. Group pressure is target oriented because all the members work for this particular result. Besides, company goals are closely linked with the individual goals of all the employees in the organization.

3.5. Motivation mechanism

The abolition of hierarchy and total control exchange for trust gave birth to a new motivation form – it is personal responsibility before the team for the results achieved on common obligations. This possibility of choice of the job relevant to the interests and competences of the individual and real opportunities to its independent creative realization sets up a pre condition of self identification: the better the result is the more satisfaction the employee gains. These are all internal motivation factors which are giving the joy of the completed work. Material motivation as a means does exist in all the companies analysed but it fades out into the background and is meant as an effect of the effective work. Statistics shows that the salary levels in all the companies studied is 10-12% higher than in the analog firms in the industry. This is evidence that material motivation under the new management model is fairly spread among the owners and the hired staff.

4. Conclusion and discussion

Growth dynamics of economic indicators at the companies going along the 2S path is impressive. “Morning Star” has got 10 % with industry average 1%; “Semco” demonstrated annual profit rise by 30% from 1991 to 2005; “Zappos” increased turnover from 870 mil USD to 1 billion USD from 2003 to 2008; “Willie’s Taste” is doubling the speed from year to year, over the period from 2009 to 2015 it has set up 450 shops with turnover of 5,6 billion Roubles; “Buurtzorg” increased employees number from 10 to 7 000 in 7 years; “Airbnb” established in 2008 expanded to 31 000 employees in 9 years having serviced 150 mln clients. It can be concluded that the new management model being correctly applied, by far outperforms the competitors in dynamics of business development. Established in 1992 regional business school RMC has developed by 2010 into a leader in business education, demonstrating annual growth by 20-30%. By that time majority of the 40 similar regional schools set up all over Russia ceased to exist as they failed to adapt to the market environment.

As a rule, all the companies reviewed are reported industry leaders in quality and client satisfaction. It is this criterion that is a cornerstone in building the new management model and responsible for its economic success. The forms of work with the buyer vary but are united by one shared thing and this is a happy client.

The analysis made induces an axiom: client satisfaction is achievable only with company staff high loyalty. Indeed, the world statistics proves that personnel turnover in this type of companies is by far lower than industry average. On the one hand it points to the effective recruitment, though on the other hand it indicates a new personnel retention mechanism, the most valuable resource in conditions of increasing uncertainty and competition.

Besides, the new management has another definite plus – this is maintenance of the horde of leaders. By expert opinion the direct costs on the chiefs remuneration make up to 30% from the Wage Fund. The examples presented in this study have revealed that the executive functions are redeployed to regular staff without any surcharge. Such significant cost saving gives significant competitive advantage, especially at the manufacturing companies. Innovative company types indicate positive dynamics in initiation and project realization, namely the projects aimed at improving the processes and technologies as well as innovative products and markets.

Here arises a question: can one repeat the success? In theory, yes, but there must be will and conviction of both the owner and the company director. Absolutely all the cited examples testify the individuals who initiated transition to the new management model – they are the founder and company CEO. No traces of “bottom-up management revolution” has been revealed so far. Why are there still so few positive examples of the new organizations built on the principles of self organization and self development despite their obvious advantages?

In our opinion the explanation is pretty simple and complex at the same time. The whole history of human development illustrates that any innovation radically changing the usual order of life is perceived gradually in an evolutionary way. At the beginning there is a denial and resistance. The pioneers of the example show the way to the new and if it is correct it gradually becomes natural. The major problem sits in the head – the chief is not ready to give up power and the staff does not wish to undertake initiative and responsibility.

Only time will tell whether the companies mentioned above are the future or will remain just an exotic exception. One thing is evident: management model and mechanisms transformation are inevitable. Today is the time for a change and the search experiments. The second important conclusion can be summed up: both practice and theory studies confirm the correctness of the stated features and goals for the self developing and self organizing company type.

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THE IMPACT OF THE LEADERSHIP ON THE EMPLOYEE PROACTIVITY

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Keywords

Employee proactive behavior, employee proactivity potential, behavioral leadership model, self-leadership, self-directed learning, employee engagement.

Abstract

The article deals with leadership and its influence on the internal driving forces of the employee proactive potential. The personal drivers of employees proactive and innovative work behavior such as self-leadership, self-development and engagement are determined. The behavioral leadership model, initiating proactive and innovative employee work behavior is developed. The empirical study of leadership influence on the employee proactivity potential in Russian companies identified the following: “self-leadership”, as predominant of employee proactivity, empowering by delegating them the authorities in creation, promotion and innovations implementation; employee “self-development” increase by provision of resources and time for searching and creating new knowledge; the recognition by company’s leader, that the employee’s initiative behavior is relevant to the company force the employees engagement in innovation company development. The article is addressed to both theoreticians concerned with the leadership development and its influence on employee proactive behavior and practitioners who manage the company’s organizational change and innovation development.

1. Introduction

Personnel initiative plays a very important part in modern organizations facing continuous and often unpredictable pressure exerted by highly competitive business environment when the ability and readiness of mere employees to generate and implement new ideas intended to enhance the operating process and product quality control, participate in organizational changes and innovations become an important factor for stable efficiency and development of a company (Høyrup, 2012; Jong 2007).

The role of a manager becomes a critical factor for innovative behavior of employees because exactly the manager may vigorously promote grassroots initiative through encouragement and support of new ideas and their implementation in the work process; at the same time the manager may become a difficult obstacle for initiatives of his/her subordinate employees, poor foster an innovation culture (Milichovský & Bumberová, 2015). A great number of studies are dedicated to these issues and there are a lot of recommendations concerning development of efficient leadership practices in innovative organizations. However such recommendations mainly touch upon the way an “average” employee may be involved in innovative activity. Contrary to that it is suggested studying leadership influence on personal drivers which trigger employee proactive behavior assuring such employee’s intended and voluntary contribution to the organization’s success.

In the light of the outlined approach the article describes personal determinants of initiative such as: self-leadership, self-directed learning, and employee engagement, the combination of which forms employee proactivity potential; the article describes the behavioral leadership model focused on these determinants, presents results of the empirical study, and gives practical advice to managers.

2. Methodology

2.1. Personal determinants of initiative and employee proactive behavior

Initiative is a particular organizational phenomenon as it implies proactive and unplanned actions of “mere” employees whom innovative or creative work has not been assigned to (Kesting & Ulhøi, 2010). There are a lot of studies referring to the fact that employee proactive behavior manifests employee potential which includes creativity and problem solving skills thanks to which employees can contribute to innovations and changes through suggestion and promotion of new ideas and proposals (Høyrup, 2012; Kesting & Ulhøi, 2010).

Proactive behavior is explained by the fact that in his/her activity an employee is focused on self-actualization at work and in day-to-day activity it is manifested in the persistent desire to follow his/her own big ideas though initiatives, need, ability, and readiness to develop his/her professional and personal capacity to improve performed work, activity of a department and an organization as a whole (Crant, 2000; Semenova, 2017). Employees of a high level of personal initiative are distinguished by their natural taste for creation and enthusiasm towards something new, readiness to take responsibility for implementation of new ideas and projects, strong sense of responsibility; such employees do not give up in case of problems and they are confident of success. That is why they do not need any special instructions and somebody’s approval, they are able to go ahead themselves overcoming difficulties and opposition, they know which initiatives are useful and vigorously look for information needed and opinion allies, they set challenging and future-oriented goals and know the ways to achieve them, they engage required resources and promote their ideas making use of personal influence (Crant, 2000; Frese & Fay, 2001; Parker, 2000).

The study (Semenova, 2017) empirically shows that the basic personal mechanism of proactive behavior represents a combination of interrelated employee capacities for self-leadership and self-directed learning and a degree of his/her engagement, which together form “employee proactivity potential” (EPP).

Employees of high self-leadership level are open, intellectual, creative, dynamic, and flexible persons capable of setting long-range future-oriented goals and insistent on their achievement; they have self-motivation and self-rewarding ability (Stewart et al., 2011). As a rule, they are more successful in activities requiring business initiative, i.e. they are those persons who voluntarily produce a positive effect on a company’s activity through overcoming inertia of organizational processes and procedures.

Employees focused on self-directed learning are distinguished by their craving for continuous search for new knowledge, integration of new knowledge into the available repertoire of knowledge or creation of new combinations of knowledge through transformation of their personal experience in order to find new solutions to current and forthcoming problems (De Clercq et al., 2013; Gong, 2010). Such employees, as a rule, do better their work associated with problem solving, demonstrate creativity more frequently, adapt to changes more easily and quickly, and they regard creation of new ideas as one of self-actualization sources (Rees & Bary, 2006; Ellinger, 2004). Self-directed learning is perfectly consistent with the need to generate new knowledge to develop innovations and novelties.

Employees' striving for self-fulfillment and self-actualization within an organization is supported by engagement which increases employees' confidence of their own ability to have a positive effect on decisions taken by the management, facilitates creation of strategic goals of an organization as vitally important for employees themselves. Engaged employees, as a rule, demonstrate their initiative more intensively and systematically, update knowledge needed to deal with one or another task in day-to-day operations (Ho et al., 2011), demonstrating adherence to an organization, its culture and values.

As we see, all EPP elements naturally complement each other but their origin and effect on proactive behavior are different. For instance, self-leadership and self-directed learning are based on naturally hardwired capacities and preferences of an employee that allow overcoming internal and external barriers for an initiative – short-sighted leader not interested in novelties or changes – but through the only possible way, however, i.e. through transfer to another organization. That is why engagement represents a binder which is going to be responsible for personal involvement of an employee in a company's success in spite of difficulties and obstacles.

2.2. Leadership role

A “work manager” (foreman, group leader, middle manager, etc.) plays a particular part in the support of initiatives; his/her actions are critical for inspiration and motivation of employees to make them be proactive, free and autonomous when they perform their duties; actions of a work manager are critical for management of resources and creation of environment where new knowledge may appear and, consequently, exactly work managers should bear daily responsibility for collection of ideas and suggestions concerning improvement of operations and processes and act as tutors, “trainers”, or “negotiating partners” in promotion of subordinates' ideas (Amundsen et al., 2014; Kumar et al., 2013; Esaulova & Semenova, 2015).

Proactive behavior is most influenced by leadership exerted by an open and inspiring manager stimulating autonomy, delegating responsibility to employees, demonstrating tolerance to errors, and emphasizing creativity and innovations (Carmeli et al., 2006; Sethibe & Steyn, 2017). For instance, J.P.J. Jong (Jong, 2007) distinguished 13 leadership behavior samples having an effect on employee innovative behavior: innovative role-modeling, intellectual stimulation, stimulating knowledge diffusion, providing vision, consulting, delegating, support for innovation, organizing feedback, recognizing, rewarding, providing resources, monitoring, and task assignment.

However general models of efficient leadership are often negated by actual practice when a leader, despite all efforts, is unable to “launch” his/her employees' initiatives, even through stimulation. According to C.L. Tan and A. Nasurdin (2011) annual formal assessment of employee performance has a direct and indirect effect on the level of administrative innovations rather than on product or process innovations, whereas career support and incentive plans are not related to any type of organizational innovations.

It seems that a big number of mere employees' initiatives may appear if a leader understands personal drivers of proactivity contained in EPP, and if self-leadership, self-directed learning, and employee engagement are used in everyday practice.

2.3. Study method

To check leadership influence on EPP elements the most representative samples of leadership behavior corresponding to “self-leadership”, “self-directed learning”, and “engagement” elements were interpreted and included in the check list as affirmations. The answers proposed were evaluated based on Likert scale (5 options: from “strongly agree” to “strongly disagree”). A structural model of an object was built in SmartPLS statistical package and it included the following:

A. One latent endogenous variable of “EPP” represented by affirmations allowing evaluation of intensity of EPP in the interrelation of its key elements:

- “self-leadership” (P/SL) block characterizes the ability of an employee to go beyond the framework of his/her normal day-to-day duties and assume responsibility for achievement of a result, insistently go towards achievement of a stated objective, find opinion allies and provide them with support in promotion of his/her ideas;
- “self-directed learning (P/SD) block reflects focusing of an employee on regular intellectual self-initiation of personal competence improvement through searching for, analysis, and interpretation of information for the best performance of work and promotion of novelties;
- “engagement” (P/EN) block as a deep personal concern of an employee about an activity performed and success of the organization, and association of his/her future with priorities of the organization.

B. Three latent endogenous variables each of which includes affirmations (exogenous variables) allowing us to explain leadership influence on EPP via the mechanisms mediating real proactivity of an employee: self-leadership, self-directed learning, and engagement:

- “leadership/ self-leadership” (L/SL) variable evaluates how much readiness of an employee to be proactive, independent and insistent in pursuing an objective and achieving results needed is influenced by delegation of powers and responsibility by a manager to an employee in taking decisions on work performed, by regularity of setting tasks to search for new solutions, by support rendered to promote ideas and suggestions, by availability of resources to work on employee’s personal suggestion or project, as well as by a possibility to discuss difficult questions with the manager and get an expert advice;
- “leadership/ self-directed learning” (L/SD) variable allows us to evaluate how much intellectual self-initiation of an employee is favored by assistance rendered by the manager to reveal strengths and weaknesses of an employee and by readiness to provide resources necessary to create new knowledge;
- “leadership/ engagement” (L/EN) variable allows us to evaluate how much development of personal concern of an employee about the organization’s success is influenced by the manager’s “human” support given to employees’ new ideas and by the manager’s understanding of complexity of the process, as well as by the manager’s ability to recognize personal success of an employee in the process of creation of a novelty.

The study was conducted in eight Russian companies which differ in business activity, size, and type of business entity. The companies studied describe themselves as companies focused on innovation in the nature of business and/ or priority of the organization development and clearly declare the importance of personal and group proactivity of mere employees for the success of business; that became a unifying criterion for the selection. All in all the study embraced 422 employees whose activity implies regular goal-oriented self-initiation of the creative power in day-to-day work and readiness to go beyond the framework of their duties taking decisions on their own (developers of unique products, research engineers, sales advisors, etc.).

3. Results

Processing the polling data of employees of all companies with the use of PLS-analysis and subsequent interpretation of its results applying SPSS (Statistical Package for the Social Sciences) software allowed us to reveal dependences explaining the importance and power of influence of

behavioral leadership model (“leadership/ self-leadership”, “leadership/ self-directed learning”, “leadership/ engagement”) on EPP mobilization.

All dependences between affirmations and endogenous variables have high factor loading proving that a big amount of dispersion of answers may be explained by a latent variable. All coefficients between endogenous variables are significant and have positive values indicating their direct relations in the model. The determination coefficient value R2 for endogenous variable of “EPP” is equal to 0.738 and it provides evidence that over 73 % of dispersion of this composition may be explained by the model developed (fig. 1).

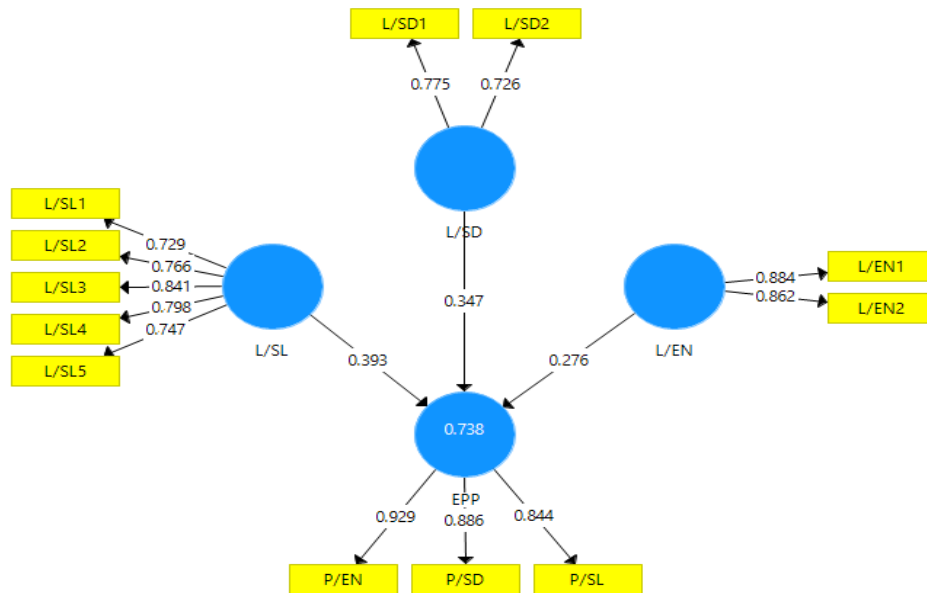


Fig. 1 PLS-analysis results in SmartPLS package (based on the data of aggregate selection of all studied companies)

All selected elements of the behavioral leadership model favoring employee proactivity have an important positive effect on EPP.

EPP is most influenced by “leadership/ self-leadership” variable (0.393), evidencing that company employees have a good support on the part of their immediate manager who is interested in their proactive behavior. According to the polling the overwhelming majority of employees of studied companies always can discuss business issues with their manager (63%), get advice concerning evaluation of an idea (61 %), get clarifications and answers to difficult questions (64%), and, being supported by their manager, can do their work and take decisions on introduction of novelties and assume personal responsibility for the result (78%). Employees have trust in their manager and, therefore, they are not afraid to propose ideas and make suggestions on their own and implement new projects.

“Leadership/ self-directed learning” variable has a significant influence on EPP and the power of its influence is 0.347, which means that employees rely on the manager’s help who actively assists in their self-actualization in day-to-day work and employees have trust in the way their manager evaluates their personal and professional qualities. For instance more than half of employees mention that the manager allocates additional time and resources to search for, analyze, and apply new information at work (64 %), and that the manager helps to understand strengths and weaknesses at the moment of working on a new idea (55%).

“Leadership/ engagement” variable (0.276) has the lowest but considerable influence on EPP. That means that proactivity is related to an important form of employee recognition by the manager and

to the manager's paying attention and exhibiting patience to subordinates who are carried away by a new idea or project. The most part of employees think that the manager always emphasizes personal contribution of an employee who decides to assume responsibility for implementation of a novelty (53%), a part of employees are sure that the manager is truly interested in searching for new ideas, does not accelerate and does not fix strict deadlines (37%).

The following analysis showed that leadership influence on EPP in different companies has clear variability depending on EPP dominants: self-leadership, self-directed learning, and engagement (Table 1).

Table 1. Leadership influence on EPP with different dominants

EPP dominant	Company	Leadership and power of its influence on EPP *			
		Strong positive influence (0.3-0.4)	Moderate positive influence (.02 to 0.3)	Moderate negative influence (0.1 to 0.2)	Strong negative influence (≤ 0.1)
Balanced EPP	1			0.195	
	2			0.198	
Self-leadership	3		0.227		
	4		0.289		
Self-directed learning	5	0.328			
	6	0.357			
Engagement	7	0.389			
	8		0.273		
Prepared based on PLS-analysis results (based on data of selection of each company studied).					
* – the indicators were grouped based on Student's t-criterion					

The variability of leadership influence is explained by the fact that employees having different EPP dominants see the importance of actions of their manager in different way for self-actualization in innovative activity: 0.198 to 0.389. Moreover no strong negative influence of leadership on **EPP** was seen in any company due to strong and significant influence of the mechanisms mediating the actual proactivity of an employee (fig.) and thus enhancing the efficiency of the manager's actions focused on development of the company's personnel innovative activity.

4. Discussion

The study demonstrated a stable relation between the behavioral model of a leader favoring employee proactivity and EPP as an aggregate of its elements: self-leadership, self-directed learning, and engagement. That is why in general the manager's ability and readiness to demonstrate trust to employees, give a possibility to fulfill their potential in their own innovative activity, give expert advice, and render assistance providing all necessary resources, making use of methods for personal initiative recognition valuable to employees contribute to employee proactive behavior in a company.

An important result of the research is that employees may have different EPP types as their proactive behavior dominants (self-leadership, self-directed learning, and engagement) differ. Therefore, the behavioral leadership model should vary as well and should take into consideration the dependences found, for instance, in the following way:

- EPP with “self-leadership” dominant: a leader who gives employees possibilities to develop new ideas, motivates them to strive for their implementation, provides resources necessary to work on a new idea, gives expert advice concerning evaluation of an idea, a suggestion, a solution, delegates powers to take decisions concerning performance of work and introduction of a novelty when an employee is fully responsible for results;
- EPP with “self-directed learning” dominant: a leader who provides employees with feedback allowing them to understand their strengths and weaknesses, provides them with resources to search for and create new knowledge necessary to develop a novelty, and thus favoring intellectual input to employees to rethink existing methods, processes, and procedures;
- EPP with “engagement” dominant: a leader that pays attention and exhibits patience to subordinates when they are carried away by a new idea or project, uses various methods to recognize the importance of employee initiatives, which, as a result, lead to the development of deep personal concern about the organization’s success and relates goals of employees with those of an organization.

Balanced EPP needs to be studied separately as leadership is less important here. However it can be assumed that the leadership role is seen as insignificant by employees because all EPP determinants are manifested so much that an employee does not need any particular additional support on the part of his/her manager or the latter is not able to render it as it may be necessary for development and promotion of initiatives.

5. Conclusion

Leadership development within an organization from the point of view of partner relationships between an employee and a manager, where the latter can smoothly combine efficiently guided and supported grassroots initiatives with operative coordination of management initiative implementation, assures involvement of employees in top priority tasks, make them feel confident of themselves, understand strategic vision of the company and its innovation priorities and this, in general, contributes to employee innovative activity. A manager must know that his/her actions influence directly on the deployment of employee proactivity potential for the benefit of the company. A leader favoring employee proactivity must take EPP dominants into consideration in order to focus his/her efforts on those actions which can lead a particular employee to useful proactivity. To do this no special researches are needed; it is enough to give employees a wide range of options for self-actualization and monitor where they have apparent aptitude. For instance, an employee with “self-leadership” dominant will be more active if he/she is given a possibility to find and bring a new solution up to implementation, whereas conditions and access to expert advice to search for and adopt new operating practices shall be arranged for an employee with “self-directed learning” dominant. EPP variability may be taken into consideration at the moment of project team formation combining advantages of different EPP dominants for the success of a project.

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INNOVATIVE APPROACH FOR THE EDUCATION QUALITY ASSESSMENT

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Keywords

Quality of education, Innovative approach, antifragile

Abstract

Quality of education depends on many factors caused by the results of the implementation of educational processes. There is no definitive interpretation of the notion "quality of education", as well as there is no methodology for determining individual quality indicators and their integration into a generalized criterion. The purpose of the article is to justify the innovative approach to the interpretation of the notion above and to determine its adequate characteristics. The society evaluates the quality of education on the basis of the level of the demand of specialists in the labor market and their adaptability. The level of demand depends on the criteria which are developed by employers to select candidates for vacant positions. Adaptability correlates with intellectual potential, innovative behavior, creativity, leadership qualities and the ability to think creatively. The authors made an experiment and its results became the basis for the synthesis of mathematical models using the theory of possibilities. These models allowed to justify an integral indicator of the quality of the implementation of educational processes - the antifragile index.

1. Introduction

The level of quality of education is one of the most important indicators of the socio-economic development of the country as well as society in general. The large number of scientific articles are concerned with education processes quality issues and its results, in particular, with the development of innovative behavior skills and leadership qualities of university graduates. The relevance of these

problems has been mentioned in the final documents of the summits of the Ministers of Education of Europe, which are held within the framework of the Bologna Process. But, unfortunately, there is no unambiguous interpretation of the "quality of education" concept today. Also there is no unified methodology for the numerical determination of individual quality indicators or efficiency, as well as their integration into some generalized criterion.

This is explained by the multidimensionality, hierarchy and dynamism of educational processes, as an integral part of the social and economic sphere. The result of their implementation depends on plural factors of different nature. The society, acting as a global customer of educational services, cannot always unequivocally formulate the criteria for assessment of educational institutions, as well as the requirements for the structure and content of education. The absence of the clear formulation in explicit form of the principles of the formation of a unified educational system for Europe confirms this thesis. Creation of such system is the goal of the Bologna process. This is recorded in a number of declarations, communiqués and other outcome documents.

2. The purpose of the study and its methodology

The development and justification of the approaches to the definition of such quality and the relevant means for its provision and assessment is a crucial task. The purpose of this publication is to justify the innovative approach to the interpretation of the "quality of education" concept, as well as the selection of adequate indicators and management mechanisms.

The authors of scientific publications often confuse two notions that are not equivalent, the quality of education and the level of education. Mass media consider certain numerical values of relative indicators, showing the existence of diplomas that confirm the graduation from educational institution and the mastering of a certain qualification as the level of education of citizens and society. Such interpretation is not correct, as it cannot be the basis for a serious analysis or forecast of the social and economic relations development in general, and the sphere of education in particular. In our opinion, it is not entirely correct to argue that there is an unambiguous connection between the wealth of society, as well as its individuals, and the level of education (the economic approach to the interpretation of quality). In developed countries, a higher level of education of citizens, as a rule, provides them with substantial incomes. Such a statement about similar patterns in the so-called developing countries is not correct, and the indicator of correlation between income and education levels is low (OECD, 2016).

The analysis indicates that the nature of the correlation between the level of education and incomes of specialists in various spheres of socio-economic activity is significantly different. Similar conclusions can also be made with a gender perspective. And, consequently, the quality of education cannot be adequately determined only within the framework of an approach that involves the use of a number of economic indicators. The effective approach cannot be always applied, it estimates the ratio of real incomes received as a result of getting high education and the costs of educational services. In this case, important is the time interval between the period of realization of expenses and the receipt of corresponding dividends. Investment in education is long-term. In addition to the criteria examined above, other criteria for assessing the quality of education are also used in practice. In particular, it is a set of various statistical indicators, indexes, etc., which appear in the reports of the UNESCO Institute for Statistics, the Organization for Economic Cooperation and Development, the World Bank and etc. (funds allocated for education in selected countries; Education Index; Global Index of Cognitive Skills and Educational Attainment; possibility of employment and average income of specialists with relevant qualifications; number of universities with a high international rating; the relative number of participants in educational programs; indicators that testify to the "export" of specialists trained in the country and the "import" of prospective university students from

abroad; results of national examinations and tests; number of winners of international olympiads (UNESCO, 2016 etc.). Part of the above indicators for countries in Europe and the world is presented in Fig. 1.

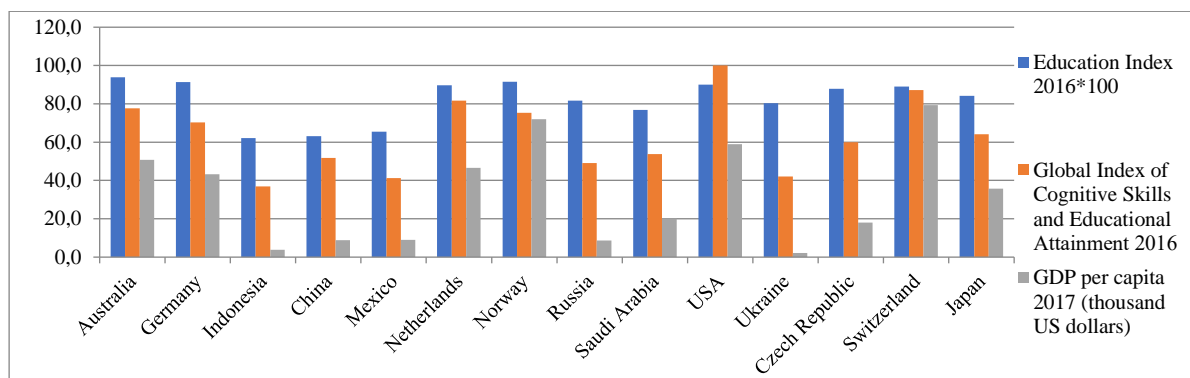


Fig.1 Statistical indicators of the quality of education in Europe and the world

The indicators listed above show the level of education in some country or region. But, in the conditions of the modern information society and the fourth technological revolution, the adaptability of university graduates to dynamic changes of the conditions of the socio-economic sphere and the labor market, their innovative behavior and creativity has become more relevant. According to several observations of educational processes, today it is necessary not only to teach the student how to use technologies and mechanisms that will be relevant in 5 years, but also to build up an intellectual potential that will successfully acquire the knowledge necessary for active work during the 30–40 years. In addition, it is necessary to promote the demonstration of leadership and creativity (Yablochnikov, 2018; Kuptsov, 2016). The authors of this publication suggest, without limiting the foregoing statistical indicators, to determine the quality of education through a set of indicators that characterize the adaptability of university graduates to changes in working conditions in the short and long term. Such adaptability is conditioned, first of all, by continuous creativity and innovative behavior. This approach (we will call it adaptive or innovative) corresponds to the concept of "lifelong learning".

3. Adaptation of university graduates to changes in social and economic conditions

In our opinion, analyzing the demand for a certain category of professionals in the international labor market, there are only two statistical indicators out of a number used by international institutions that reflect it. This is the level of income and the number of unemployed per 1000 population (QS World University Rankings, 2016; Interstate Education Interstate Education, 2016; Humanitarian technologies, 2014; Education Index, 2016; Global Index of Cognitive Skills and Educational, 2016).

The demand of specialists in the labor market and their adaptability to changes in working conditions and the demands of the relevant market are certainly interrelated. But, the demand is more determined by the criteria formulated by employers to choose candidates for vacancies (external factors), the adaptability correlates with intellectual potential, innovative behavior, creativity, leadership qualities and the ability to think creatively (internal factors). Thus, the adequate indicators of the adaptability of education primarily are subjective assessments of the satisfaction with educational services level by the graduates of higher educational institutions, expressed by a particular scoring system.

The authors conducted an experiment, during which the satisfaction of graduates of a number of universities was assessed on three criteria: work and motivation for leadership, self-education and creativity, achievement of the desired social status. To determine the level of satisfaction with

education, we developed a questionnaire (Kuptsov, 2016), the respondents (1,200 people) answering the questions have assessed the quality of their education, taking into account the following aspects: how much the knowledge and skills obtained contribute to effective work, satisfaction of leadership ambitions, self-education and creativity, implementation of the principle of "lifelong learning", achievement of a certain social status due to innovative behavior. The answers were evaluated according to the scale that provides five gradations (-2, -1, 0, 1 and 2). The mark "-" expressed some negative attitude. The aggregate level of satisfaction with the received educational services was determined as the arithmetic average. The generalized experimental results are shown in Fig. 2.

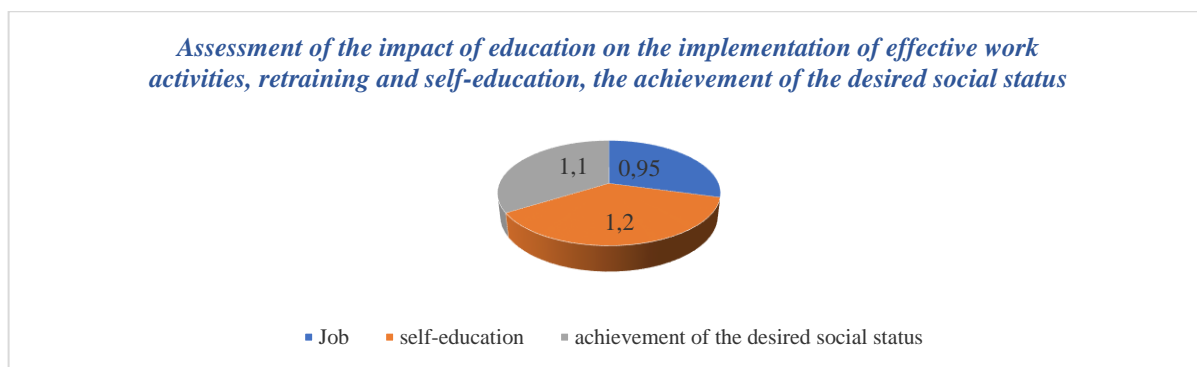


Fig. 2. Distribution of mathematical expectations of assessment of the level of satisfaction with the quality of education

In the earlier publications (Kuptsov, 2016) the authors of this article synthesized and analyzed mathematical models of education as a time-continuous Markov-random process $\zeta(t)$. The variant was considered both with a finite number of discrete states of the system, and processes that are continuous. Moreover, the authors (Yablochnikov, 2017) presented a method for assessing the quality of educational services provided by educational institutions on the basis of the theory of fuzzy sets. Further, we propose the modernization of these ideas, using the basic concepts of the theory of possibilities (Kaufmann A., 1977; Dubois D., 1988).

Within the framework of the approach proposed by the authors, the educational process $\zeta(t)$ is analyzed for each fixed time t as a quantity that reflects some possibility. This allows escaping from the binary interpretation of occurrences and synthesizing a mathematical model. In previous publications, we considered only two possible options: occurrence A - "the student has mastered the educational program entirely"; the alternative to A occurrence - "the student did not master the educational program (did not receive a diploma)." At the same time, intermediate options, which are very significant for employers, were not taken into account. For example, the student will continue studying for a while at university, or in the nearest future he/she will finish his/her studies, etc.

The above-mentioned aspects are difficult to formalize within the framework of the classical theory of probability. This is the consequence of the ambiguous assessment of the educational level of the individual, both by educational institutions and employers. Therefore, the final decision on the applicant's correspondence to the available vacancy is taken by the employers not after consideration of the documents on the applicant's education (qualification) and even not on the basis of the interview results, but only after assessing the success of the short-term internship or the effectiveness of professional work during the probationary period. It means that the real professional and social qualities are evaluated (ability to communicate, innovative behavior and creativity, leadership qualities of thinking, etc.) of an applicant. The result of the educational process implementation $\zeta(t)$ should be analyzed in the following categories: "the applicant corresponds to the vacancy"; "the applicant meets the vacancy requirements with some reservations"; "the applicant does not meet the vacancy". It is necessary to take into account the priorities of the applicant. Mathematical

interpretation of such categories is consideration as a quantity that characterizes a certain possibility in the realization of the educational process.

4. Practical use of synthesized models

As an example of the practical application of mathematical models synthesized by the authors, including the formation of the above-mentioned measures of opportunity and necessity, let us consider the assessment of the success of educational program mastering by university graduates during the selection of applicants for a vacant position by the employer. In this particular case, we will use the distribution of the relative frequencies (Figure 3) and the list of requirements set by the employer when conducting competitive selection of candidates for the position of "business analyst" in the "Tinkoff Bank". The data which were received by the authors during the experiment are presented in Table 1 and in Fig. 2.

Table 1. Accessory functions

Levels	The membership function
Level №1	$\mu_{A_1}(x) = \exp(-2,98(x-1)^2)$
Level №2	$\mu_{A_2}(x) = \exp(-3,08(x-2)^2)$
Level №3	$\mu_{A_3}(x) = \exp(-3,11(x-4)^2)$
Level №4	$\mu_{A_4}(x) = \exp(-3,12(x-5)^2)$

The level "1" corresponds to the initial selection of applicants that is their testing, the level "2" is the interview, the level "3" is the internship, the level "4" is the final decision on the compliance of the applicant. Significant number of applicants (about 90% of the total number) does not pass the implemented testing, including on-line tests, about 6% of the applicants do not pass the interview and only 4% of candidates are invited to undergo the on-the-job training.

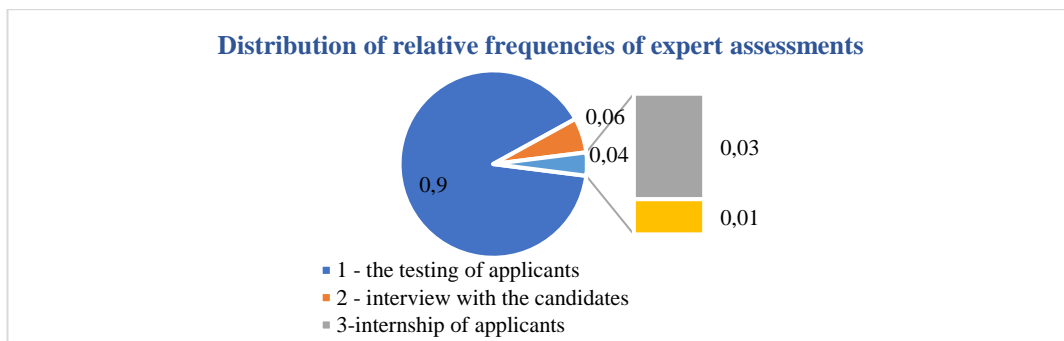


Fig. 3. Distribution of relative frequencies of expert assessments in the selection of applicants for the vacancy of "business analyst"

In the case under consideration, membership functions (Table 1, Figure 4) are constructed for each of the fuzzy sets $A_i = \{(1|\mu_{A_i}(1)), (2|\mu_{A_i}(2)), (3|\mu_{A_i}(3)), (4|\mu_{A_i}(4))\}$ as following $\mu_{A_i}(x) = \exp\left(-\frac{(x-i)^2}{2\sigma_i^2}\right)$, where $i = \overline{1,4}$, σ_i is also determined on the basis of expert estimates, taking into account the actual distribution of relative frequencies (Figure 3). The functions $\mu_{A_i}(x)$ induce the function of the

distribution of the possibility on the set (occurrence) $A: \pi_A(x) = \max_i \{\mu_{A_i}(x)\}$ and the necessity distribution function $\eta_A(x) = \min_i \{\mu_{A_i}(x)\}$.

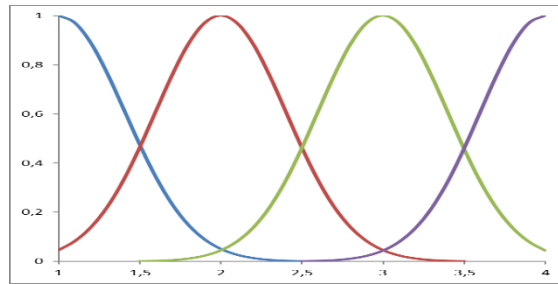


Fig. 4. Graph of the membership function

As an example of the distribution functions of possibility and necessity, we consider the implementation of the occurrence A ("testing passed successfully"), which means the union of fuzzy sets $A = A_2 \cup A_3 \cup A_4$. Then $\pi_A(x) = \max\{\mu_{A_2}(x), \mu_{A_3}(x), \mu_{A_4}(x)\}$ (Fig. 5) and $\eta_A(x) = \min\{\mu_{A_2}(x), \mu_{A_3}(x), \mu_{A_4}(x)\}$ (Fig. 6).

Thus $\Pi(A) = \sup \pi_A(x) = 1$, $N(A) = \inf \eta_A(x) = 6,38 \cdot 10^{-13}$. It means, that $\Pi(A) \geq P(A) \geq N(A)$, where $\Pi(A)$ –possibility, $P(A)$ –probability, $N(A)$ –necessity of the event occurrence A . It should be pointed out, that functions $\pi_A(x)$ and $\eta_A(x)$ almost everywhere in the interval of the domain of definition, are differentiable except for a finite number of points in which there are one-sided derivatives. Similarly, membership functions are formed for fuzzy sets B_j (assessment of quality of the implementation of pedagogical processes by their participants is an internal assessment), C_k (external assessment of the quality level of educational services provided), D_l (assessment of the graduates' satisfaction with the quality of education). Then the general level of education quality can be defined as the product of fuzzy sets $F_s = A_i \times B_j \times C_k \times D_l$ with the corresponding membership function $\mu_{F_s}(x_1, x_2, x_3, x_4) = \min_{i,j,k,l} \{\mu_{A_i}(x_1), \mu_{B_j}(x_2), \mu_{C_k}(x_3), \mu_{D_l}(x_4)\}$. This membership function $\mu_{F_s}(x_1, x_2, x_3, x_4)$ also induces the corresponding distribution functions of necessity and possibility. Considering the result of the implementation of the educational process $\xi(t)$ as an opportunity-probabilistic value, we constructed for cross section $\xi(t)$ such distribution functions possibility $\pi(t)$ and necessity $\eta(t)$, that, starting from a certain moment of time t_0 , is completely feasible: $\pi(t) \geq \xi(t) \geq \eta(t)$.

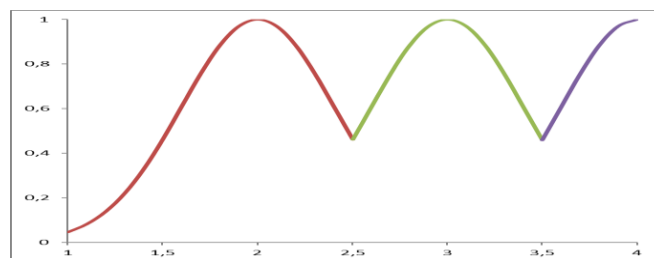


Fig. 5. Graph of the distribution function of possibility $\pi_A(x)$

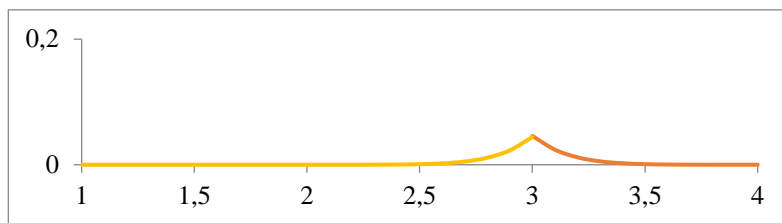


Fig. 6. Graph of the distribution function of necessity $\eta_A(x)$

The experimental data obtained by the authors make it possible to assert that there always exists an instant of time t_1 , from which $\pi(t) \equiv 1$. But, $\lim_{t \rightarrow +\infty} \eta(t) \neq 1$. Thus, equations $\lim_{t \rightarrow +\infty} \xi(t) = 1$ and $\lim_{t \rightarrow +\infty} M(\xi(t)) = 1$, unlike the cases considered by the authors in (Yablochnikov, 2017), may not be satisfied. This is more in line with the reality.

5. Antifragile index of education

Taking into account the above and real statistics on the implementation of educational processes in higher education institutions (Yablochnikov, 2017), the authors proposed the antifragile index of higher education as a generalized criterion for the university graduate adaptability.

$$IAO = \alpha_1 \cdot \frac{d_2}{d_1} + \alpha_2 \cdot \frac{r_1}{r_2} + \alpha_3 \cdot U$$

where, α_i is weighted coefficients, d_1 is unemployment rate among people with high education (%), d_2 is general unemployment rate (%), r_1 is average income of citizens with high education (thousand roubles), r_2 is overall average income of population (thousand roubles), U is overall index of satisfaction with the quality of higher education (determined by the results of the survey). According to our calculations on the basis of statistical data for 2015 (for 2016 and 2017 on the site, there is no information on average income depending on education), the IAO index for higher education in Russia is equal to $IAO_{2015} \approx 1,32$. As a comparison: similar index of the year 2014 of higher education is $IAO_{2014} \approx 1,38$, and a similar index of secondary vocational education is 0,95. Thus, it can be argued that the structure and content of higher education in Russia are more adaptable to changes in social and economic relations than secondary vocational education. But, the tendencies to decrease the IAO level make us think about the need managing actions.

We propose to introduce the antifragile index of education by analogy with the antifragility of economic systems, the theory of which was developed by N.Taleb (2012). This researcher associates some redundancy of the economic system with antifragility (determining its effectiveness), as well as its ability to "survive" due to this redundancy and develop in crisis conditions, when implementing unexpected and sufficiently profound changes in the economy. The spheres of economics and education are the integral components of the aggregate of socio-economic relations, so it seems logical that these processes which are implemented in these sectors are congruent. For purposes of higher education under antifragility, we mean the demand, flexibility, adaptability of graduates, their innovative behavior and creativity, ability to adapt to changes in the political, economic situation, including crises, and also, if necessary, the ability to change the scope of activities radically, applying the knowledge and skills developed in the process of learning to new conditions. And in this sense, higher education should be redundant to allow you to master sufficiently new technologies, adhering to the principle of "lifelong learning."

The formation of an individual antifragility index IP of education also involves the use of theory of possibilities, in particular, to assess the level of satisfaction with the quality of educational services U. The empirical distributions obtained in the course of the experiment series make it possible to assert that if IP is considered as a parameter, then the distribution of the "benefit" (the level of the graduate's income) has a clear "Taleb's antifragility" structure, that is, as the IP value increases, the "positive" asymmetry of the distribution function increases, and antifragility $\int_{-\infty}^K (\Omega - x) \frac{f_{IP_1}(x) - f_{IP_2}(x)}{\Delta\rho} dx$ reduces for same values of Ω . In particular, this makes it possible to interpret the IP as an index of the antifragility of education. Here $K < \Omega < r_1$, $\Delta\rho$ is numerically defined as the Euclidean distance in terms of the indices entering into *IAO*, $f_{IP}(x)$ – income distribution function depending on the IP value.

6. Conclusions

Proceeding from the above, a quite logical question arises: «Which factors ensure the antifragility of education, as the demonstration of its quality?» First of all, this is the presence of an essential fundamental component, which should not be opposed to or replaced by the other components, but it should reasonably complement and contribute to the formation of a scientific understanding of the processes that are realized in various fields of activity. In particular, due to this, vocational education can receive a new impetus for the implementation of dynamic development. Secondly, this is the formation of the ability to think systematically, to apply in practice universal approaches, technologies and tools for conducting the research, congruent for solving any tasks (and not only narrowly professional ones). Thirdly, this is ensuring the continuous updating of the totality in the presence of knowledge, skills and acquirements, thanks to the use of the principles of "lifelong learning", innovative behavior and creativity.

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