

# Management, Enterprise and Benchmarking in the 21<sup>st</sup> Century III.

2016

erenet



**Óbuda University**



**MANAGEMENT, ENTERPRISE  
AND BENCHMARKING  
IN THE 21<sup>ST</sup> CENTURY**

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## INTRODUCTION AND ACKNOWLEDGEMENT

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*„Everything we hear is an opinion, not a fact. Everything we see is a perspective, not the truth.”*

Marcus Aurelius

The 18 studies of this new volume of „Management, Enterprise and Benchmarking in the 21<sup>st</sup> Century” may disprove the well-known motto of Marcus Aurelius...

The presented topics are related to the profile and research areas of Óbuda University. (Small & Medium Enterprises, Security & Safety, Human Resources, Applied Marketing, Management).

I would like to render special thanks to:

- the Authors, who answered our invitation and sent high-standard manuscripts to our annual volume,
- the Referees, who strictly reviewed the articles within the deadlines,
- Prof. Dr. György Kadocsa, Chair of previous MEB Conferences, who looked over the incoming articles and wrote a preface about our traditions,
- Dr. András Medve dean, who supported the organization of the 14<sup>th</sup> Conference on Management Enterprise and Benchmarking which is the foundation of this issue
- Dr. Antal Szabó scientific director, who promotes our issue among the members of ERENET (Entrepreneurship Research and Education Network of Central European Universities)
- furthermore to all colleagues, who's sacrificing work contributed to the publication of this volume.

Good reading!

Pál Michelberger  
editor

## **PREFACE**

---

On behalf of the Organising Committee of MEB 2016, I welcome the participants to the 14<sup>th</sup> International Conference on Management, Enterprise and Benchmarking that is our traditional university event in Budapest.

Keleti Faculty of Business and Management of Óbuda University created a tradition with publishing the volume of “Management, Enterprise & Benchmarking in 21<sup>st</sup> Century”.

Principally, we would like to provide a high-level publication opportunity for our colleagues, and a good material for MA Students learning Business Economics, Management and Enterprise Development every year.

The growing international competition in the economical arena has created a demand to establish a forum in order to improve quality and education efficiency on the field of management, enterprise and benchmarking. The aim of the conference is to provide researchers and practitioners from higher education, academia and industry with a platform to report on recent developments in the area of economy.

In the volume of „Management, Enterprise & Benchmarking in the 21<sup>st</sup> Century”, tutors and researchers of 8 higher educational institutions from 5 countries try to help with 18 new studies. The volume contains mainly the edited and reviewed materials of the best presentations of Management, Enterprise & Benchmarking Conference.

I hope that all attendee of the conference found this event intellectually stimulating and professionally rewarding. I also hope that the studies are establishing further co-operations between the authors and subsequent readers.

I hope that my researcher colleagues, the business professionals and also university students can also benefit from our volume focusing on business development.

I want to acknowledge the effort of the committee chairs and committee members, and all those persons responsible for the background activities from local arrangements to conference secretariat.

Especially I would like to thank Professor Dr. András Medve, dean of our Faculty who supported the organisation of the MEB 2016 Conference.

I would like to remember Professor Dr. János Fodor Rector, who supported our MEB Programs from the beginning, - he died not long ago.

Finally, we are looking forward to meeting You on the next Management, Enterprise & Benchmarking Conference at Óbuda University in Budapest in 2017.

Budapest, April 2016

György Kadocsa

## Óbuda University and the Keleti Faculty of Business and Management



In the first of January, 2010 Budapest Tech became a university called Óbuda University. Budapest Tech was established in 2000 as a result of the merger of three technical colleges. Its history together with its predecessors bridges three centuries. Indeed, in the 2009 Jubilee Year Budapest Tech celebrates 130 years of education including 40 years of higher education. Today Óbuda University is responsible for training altogether 13,000 students in Budapest and Székesfehérvár. In Budapest the campuses can be found in Óbuda (3<sup>rd</sup> district) and Józsefváros (8<sup>th</sup> district). The head office and training premises of Keleti Faculty of Business and Management are located in Józsefváros.

When Budapest Tech was founded, the formerly separately taught economics and social science subjects were integrated into one independently managed organizational unit, the institutes of which are as follows:

- Institute of Economics and Social Sciences
- Institute of Enterprise Management
- Institute of Management and Organization
- Institute of Physical Education and Sport

Our faculty offers training courses in compliance with the Bologna System. In the new educational structure the first level is basic training (BSc, BA). Such first degree courses focus on practical professional training demanded by potential employers, and at the same time provide a good grounding for theoretical knowledge enabling students to further their studies on a Master's degree course (MSc, MA) if desired. In the linear training system such a Master's course normally takes 4 semesters. After graduating from a Master's, a student can start working or opt to continue with his or her studies by applying to enter a PhD programme, the peak of tertiary education. The Faculty offers the following courses:

- Engineering Manager (BSc),
- Management and Business Administration (BA)
- Commerce and Marketing (BA)
- Business Development(MSc)
- Teacher of Engineering (engineering manager) (MA)

Students must obtain 210 credits during the 7 semesters of BSc and BA courses, while 120 credits are necessary on the 4-semester Master's courses. The courses are tailored to the demands of the labour market. Óbuda University's PhD programme in Applied Informatics has been recently accredited completing the range of educational programmes at Óbuda University.



## Clustering for Competitiveness

**Dr. Antal Szabó**

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*Abstract: Competitiveness is the ability of a company or institution to deliver better value to customers than the competitors. Clusters are systems of interconnection between private and public sector entities (firms, institutions). It usually comprises a group of companies, suppliers, service providers, associated institutions like testing and quality standard institutions, education institutions, vocational training schools, trade companies/distributors/associations in a particular field, linked by externalities and complementarities. In our economy competitiveness depends on productivity. Productivity means how the firms compete on a particular field. Companies can be highly productive in their industrial branch if they use sophisticated technology, production methods, and offer unique products and services. As Porter presented, clusters affect the competition by increasing competitiveness of companies acting in their area.*

*Keywords: competitiveness, cluster, global competitiveness index, European Cluster Panorama, emerging industries, CEE Cluster Network*

**Motto:**

“National prosperity is created, not inherited.

It does not grow out of a country’s natural endowments, its labour pool, its interest rates, or its currency’s value, as classical economic insists.

A nation’s competitiveness depends on the capacity of its industry to innovate and upgrade.”

# 1 Competitiveness

## 1.1 Definition

The concept of competitiveness has numerous interpretations of its core issues. Definition of competitiveness is vary from ability of nations to provide favourable environment to firms to prosper and develop, economies to achieve GDP providing high level standards to population, maintain sustainable economic growth, ability of regions, companies and institution to safeguard the environment with lowest level of ecology footprint. The box below contains various definitions regarding competitiveness.

### DEFINITION OF COMPETITIVENESS

The **Global Competitiveness Report** defines **competitiveness** as the set of institutions, policies and factors that determine the level of productivity of an economy, which in turn sets the level of prosperity that the country can achieve.

**Competitiveness** is the ability of a nation or a firm to offer products and services that meet the quality standards of the local and world markets at prices that are competitive and provide adequate returns on the resources employed or consumed in producing them.

At the level of the economy, competitiveness refers to the capacity of a nation or region to provide its citizens with a sustained increase in living standards with jobs available for those willing to work.

SEC(2009) 1657 'Commission staff document

Competitiveness of enterprises is a narrower, but closely related concept referring to the ability of firms to sustain and gain in market share through their cost and pricing policy, innovative use of production factors, and updates to product characteristics.

European Commission

[http://ec.europa.eu/growth/industry/competitiveness/proofing/index\\_en.htm](http://ec.europa.eu/growth/industry/competitiveness/proofing/index_en.htm)

**Global competitiveness** is The existence of competing organizations that serve international customers. Access to global customers has increased through enhanced communications, improved shipping channels, reduction of barriers, and centralized finance authorities.

BusinessDictionary.com  
<http://www.businessdictionary.com/definition/competitiveness.html>

**The competitiveness analyses** how nations and enterprises manage the totality of their competencies to achieve prosperity or profit.”

World Competitiveness Yearbook

**The competitiveness** “... analyses the facts and policies that shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people.”

Academic definition highlighted by the IMD World Competitive Center

**Competitiveness** is the ability of a country to facilitate an environment in which enterprises can generate sustainable value.

IMD World Competitive Center

**Competitiveness** is the ability of a company or institution to deliver better value to customers than the competitors.

Dr. Antal Szabó

## 1.2 Global competitiveness index

In recent years, the concept of competitiveness has emerged as a new paradigm in economic development. Competitiveness captures the awareness of both the limitations and challenges posed by global competition, at a time when effective government action is constrained by budgetary constraints and the private sector faces significant barriers to competing in domestic and international markets. The **Global Competitiveness Report** of the **World Economic Forum** defines competitiveness as "*the set of institutions, policies, and factors that determine the level of productivity of a country*".

For more than three decades, the World Economic Forum's annual Global Competitiveness Report has studied and benchmarked the many factors underpinning national competitiveness. From the onset, the goal has been to provide insight and stimulate discussion among all stakeholders about the best strategies and policies to help countries to overcome the obstacles to improving competitiveness. In the current economic context, this work is a critical reminder of the importance of sound structural economic fundamentals for sustained growth. Since 2005, the World Economic Forum has based its competitiveness analysis on the Global Competitiveness Index (GCI), a comprehensive tool that



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measures the microeconomic and macroeconomic foundations of national competitiveness.

The concept of competitiveness includes static and dynamic components. Many factors influence and drive productivity and competitiveness. Investment in physical capital and infrastructure alone is not sufficient today. In more recent years the good governance, macroeconomic stability, education and training, R&D become as important as the capital and infrastructure investment.

The World Economic Forum takes into consideration 12 component – called pillars - while calculates GCI. The Index includes a weighted average of many different components, each measuring a different aspect of competitiveness.

The 12 pillars are organized into three subindexes, each critical to a particular stage of development. These subindexes are the following:

The basic requirements subindex groups those pillars most critical for countries in the factor-driven stage.

- Institutions
- Infrastructure
- Macroeconomic Stability
- Health and Primary Education

**The efficiency enhancer's subindex** includes those pillars critical for countries in the efficiency-driven stage.

- Higher Education and Training
- Goods Market Efficiency
- Labour Market Efficiency
- Financial Market Sophistication
- Technological Readiness
- Market Size

The **innovation and sophistication factors subindex** includes the pillars critical to countries in the innovation-driven stage.

- Business Sophistication
- Innovation

The components are expressed and presented on a 1-7 scale (higher average score means higher degree of competitiveness).

The three subindexes are shown in Figure 1.

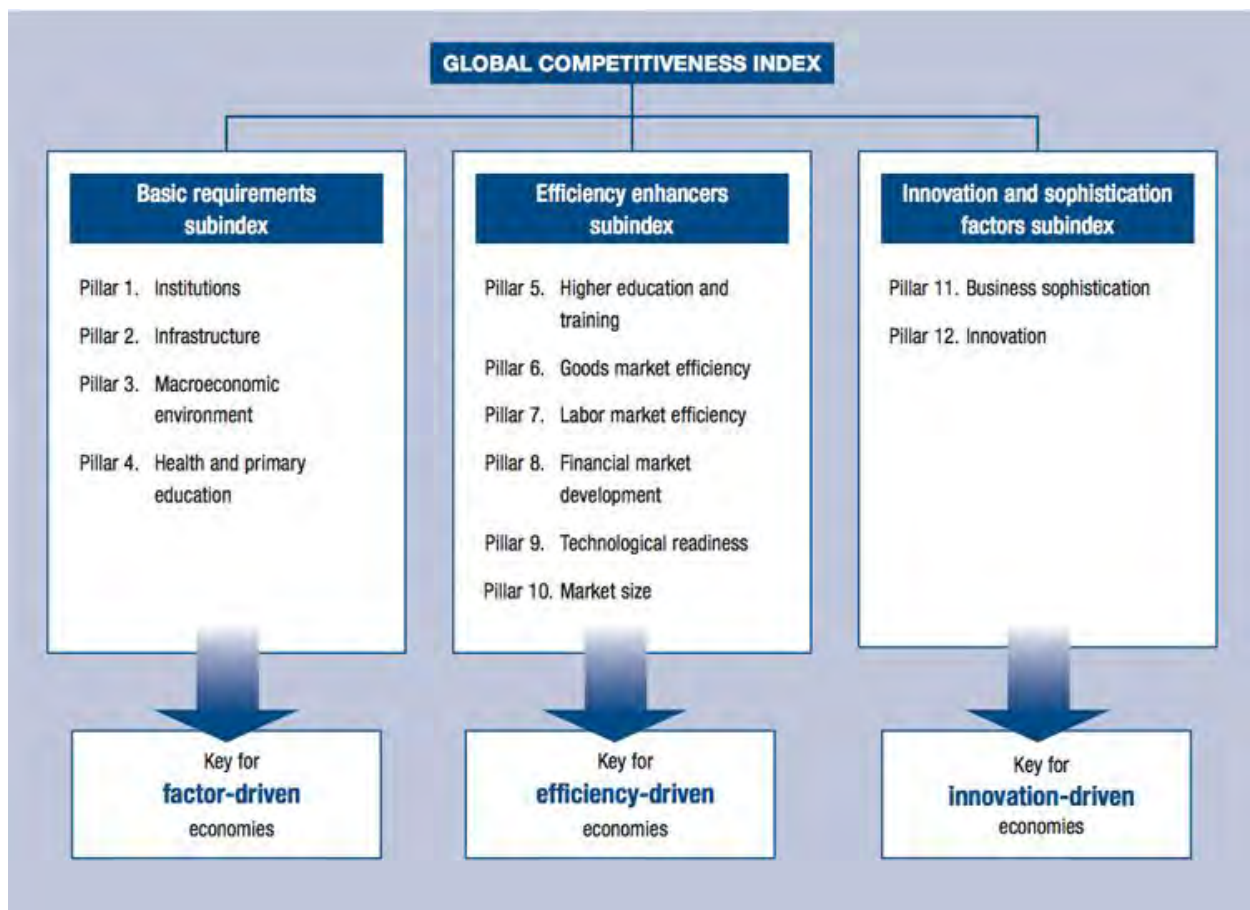


Figure 1

The Global Competitiveness Index framework

Source: World Economic Forum: Methodology – The 12 Pillars of competitiveness  
<http://reports.weforum.org/global-competitiveness-report-2014-2015/methodology/>

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<b>RANK</b>	<b>COUNTRY</b>	<b>SCORE</b>	<b>PREVIOUS RANK</b>
<b>1</b>	<b>SWITZERLAND</b>	<b>5.76</b>	<b>1</b>
<b>2</b>	<b>SINGAPORE</b>	<b>5.68</b>	<b>2</b>
<b>3</b>	<b>UNITED STATES</b>	<b>5.61</b>	<b>3</b>
<b>4</b>	<b>GERMANY</b>	<b>5.53</b>	<b>5</b>
<b>5</b>	<b>NETHERLANDS</b>	<b>5.50</b>	<b>8</b>
<b>6</b>	<b>JAPAN</b>	<b>5.47</b>	<b>6</b>
<b>7</b>	<b>HONG KONG</b>	<b>5.46</b>	<b>7</b>
<b>8</b>	<b>FINLAND</b>	<b>5.45</b>	<b>4</b>
<b>9</b>	<b>SWEDEN</b>	<b>5.43</b>	<b>10</b>
<b>10</b>	<b>UNITED KINGDOM</b>	<b>5.43</b>	<b>9</b>

Table 1  
The top 10 economies in the year of 2015

*Source: The Global Competitiveness Report 2015-2016. Rank out of 140 countries [1]*

<b>RANK</b>	<b>COUNTRY</b>	<b>SCORE</b>	<b>PREVIOUS RANK</b>
30	ESTONIA	4.74	29
31	CZECH REPUBLIK	4.69	37
36	LITHUANIA	4.55	41
41	POLAND	4.49	43
43	RUSSIA	4.44	53
44	LATVIA	4.45	42
53	ROMANIA	4.32	59
54	BULGARIA	4.32	54
59	SLOVENIA	4.28	70
60	MACEDONIA, FYR	4.28	63
63	HUNGARY	4.25	60
67	SLOVAKIA	4.22	69
77	CROATIA	4.07	77
93	ALBANIA	3.93	87
94	SERBIA	3.89	94

Table 2.  
15 economies in CEU & SEE in year of 2015

*Source: The Global Competitiveness Report 2015-2016. Rank out of 140 countries [2]*

The ranking in absolute term does not reflect the total picture of a country. The world's three most competitive economies - Switzerland, Singapore, and the United States - score well in the vast majority of these indicators. Switzerland leads the ranking in GCI for the seventh consecutive year. According to the 2015 World Economic Forum „Switzerland leads the innovation pillar, thanks to its world-class research institutions (1st), high spending on research and development (R&D) by companies (1st), and strong cooperation between the academic world and the private sector (3rd). But many other factors contribute to Switzerland's innovation ecosystem, including the level of business sophistication (1st) and the country's capacity to nurture and attract talent. Switzerland boasts an excellent

education system at all levels and is a pioneer of the dual education system. The labour market is highly efficient (1st), with high levels of collaboration between labour and employers (1st) and balancing employee protection with flexibility and business needs. Swiss public institutions are among the most effective and transparent in the world (6th), and competitiveness is further buttressed by excellent infrastructure and connectivity (6th) and highly developed financial markets (10th). Last but not least, Switzerland's macroeconomic environment is among the most stable worldwide (6th) at a time when many developed countries continue to struggle in this area."

It is remarkable, that Russia improved its ranking by eight steps preceding majority of the CEE countries. In spite of the EU economic sanction against Russia the country improves on some market efficiency aspects, such as the regulatory business environment and domestic competition (96th), reflecting the government's efforts to improve domestic conditions for doing business. Import tariffs have been significantly reduced as an effect of Russia's accession to the World Trade Organization in 2012.

From the new EU countries the Baltic countries are doing better than other CEE. Estonia (30th) takes the lead followed by Lithuania (36th). Poland (41st) and Romania (53rd) takes the second position in the region improving their position by two respectively six position.

### **1.3 Europe 2020 Competitiveness Index**

In early 2000s, Europe faced a moment of transformation. The crises slowed down the economic and social progress attracting structural weaknesses in Europe's economy. Parallel with this the globalisation has been intensified and Europe was forced to take decision and take up the gauntlet with global challenges. In 2010, the European Commission proposed the Europe 2020 strategy, which sets out the vision for Europe's social market economy for the 21<sup>st</sup> century. [3]

According to this strategy, EU has to be transformed into a „small, sustainable and inclusive economy, delivering high levels of employment, productivity and social cohesion."

At the heart of the competitiveness is the level of productivity of an economy. Only competitive economies could provide high living standards. At the same time these economies have to be sustainable, that means meeting the needs of the present generation and safeguard the resources for the future generation.

The World Economic Forum has been studying the Europe's competitiveness, the Lisbon strategy and its failures, and cooperated to the European Commission in elaboration of „The Europe 2020 Competitiveness Report on Building a More Competitive Europe" [4]



Figure 2  
The Europe Competitiveness Index framework

Source: World Economic Forum, 2014.

**The Europe Competitiveness Index** (see Figure 2.) composed seven pillars: enterprise environment, digital agenda, innovative Europe, education and training, labour market and employment, social inclusion and environmental sustainability. Each pillar has the same weight in the overall index score. [5]

The seven pillars are organized across three sub-indexes:

- Smart growth: composed of the enterprise environment, digital agenda, innovative Europe, as well as education and training pillars;
- Inclusive growth: composed of the labour market and employment, and social inclusion pillars; and
- Sustainable growth: composed only of the environmental sustainability pillar.

Comparing the performance of the EU Member States, a significant gap exists between the so called „innovative rich” and „innovative poor” economies. Important national and regional disparities exist in creating an enabling entrepreneurial and innovative environment in Europe, with advanced Northern and North-Western European countries and the lagging CEE and SEE countries. Highly competitive markets, well-developed clusters and sustainable entrepreneurial environment in one-side, while continuously changing legislation

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 Budapest, 2016

and high taxes on the other side shows the difficulties in catching up to the leaders. The competitiveness divide requires differentiated strategies for national economic development programmes.

COUNTRY	RANK (out of 28)	Score (1-7)	RANK in 2012 (out of 27)
Finland	1	5.70	2
Sweden	2	5.55	1
Netherlands	3	5.41	4
Denmark	4	5.32	3
Germany	5	5.28	6
Austria	6	5.16	5
United Kingdom	7	5.13	7
Luxemburg	8	5.07	8
Belgium	9	4.93	9
France	10	4.81	10
Ireland	11	4.75	12
<b>Estonia</b>	<b>12</b>	4.74	11
Spain	13	4.47	15
Malta	14	4.44	18
Portugal	15	4.44	14
<b>Slovenia</b>	<b>16</b>	4.43	13
<b>Lithuania</b>	<b>17</b>	4.38	20
<b>Czech Republic</b>	<b>18</b>	4.33	16
<b>Latvia</b>	<b>19</b>	4.32	19
Cyprus	20	4.22	17
Italy	21	4.05	21
<b>Poland</b>	<b>22</b>	3.97	23
<b>Slovak Republic</b>	<b>23</b>	3.91	22

<b>Croatia</b>	<b>24</b>	3.87	n.a.
<b>Hungary</b>	<b>25</b>	3.83	24
Greece	26	3.79	25
<b>Bulgaria</b>	<b>27</b>	3.75	27
<b>Romania</b>	<b>28</b>	3.65	26
<b>EU28 average</b>		<b>4.56</b>	

Table 3  
Ranking and Score of EU Member States in 2012 and 2014

*Source: Findings from the Europe 2020 Competitiveness Report 2014 Edition*

*Remark:* (i) The bold letters show the new EU member States; (ii) n.a. means not available

Analysing the competitive divide a special attention should be devoted to disparities in the field of training and education. In the old EU countries, like Finland, Ireland, Germany and the Netherlands the populations do well in education and training; this is not the case in SEE and CEE. In the Nordic EU Member States more than 80% of the youth following the secondary school are engaged in tertiary education – mainly in industrial schools, only 65% of the young people in doing the same in CEE. The German vocational system is an outstanding one in this comparison. The quality of education and the ability of the education in providing the necessary skills to find gainful employment is crucial in competitiveness of a nation.

The innovation and the creative thinking is another important pillar of a national competitiveness. In this regards, the regional disparities are even higher as compared with education, ranging from 2.88 in Romania (in the 28<sup>th</sup> rank) to 6.06 in Finland (in the 1<sup>st</sup> rank). This finding reflected also in the Programme for International Student Assessment (PISA) benchmarking, an assessment including 34 OECD countries and 31 partner countries, representing 80% of the world economy.



## 2 Clusters for competitiveness

### 2.1 Definition of clusters

The cluster-based approach is a new way of organizing and dividing the economy. **There is no real adequate definition on what a cluster is.** The two famous examples of cluster are the US Silicon Valley with high-tech electronics and the Italian Emilia Romagna industrial district specialised in light industry (textile, shoes, machine tools etc.). Both clusters differ in nature, orientation, markets, and members.

**A cluster is a system of interconnection between private and public sector entities (firms, institutions). It usually comprises a group of companies, suppliers, service providers, associated institutions like testing and quality standard institutions, education institutions, vocational training schools, trade companies/distributors/associations in a particular field, linked by externalities and complementarities. Often include financial institutions and various government entities.**

**Industrial cluster is an agglomeration of companies, suppliers, service providers, and associated institutions in a particular field.**

**Looking at the cluster literature and carrying out discussion with practitioners clusters have the following main characteristic marks:**

- **Geographically concentration of the interconnected firms.** These **entities** are linked by externalities and complementarities of different types and are usually located near each other. Although location remains fundamental for clusters, its role today is different from a generation ago. An example would be a country's auto industry, with its manufacturers and all their supporting services, such as parts and equipment suppliers, transportation companies, retail distributors, educational institutions and R&D firms, public relations and advertising agencies, etc.
- **Critical mass of members both resources as well as competences.** Members of the clusters need to have considerable capabilities to achieve the overall goal and resounding success.
- **There is a need and capability to have existing interaction and cooperation among the firms.**

In our economy competitiveness depends on productivity. Productivity means how the firms compete on particular fields. Companies can be highly productive in

their industrial branch if they use sophisticated technology, production methods, and offer unique products and services.

According to **Michael Porter** clusters affect competition in three ways: [6]

- 1 First, by increasing the competitiveness of companies based in the area;
- 2 Second, by driving the direction and pace of innovation, which underpins future productivity growth and
- 3 Third, by stimulating the formation of new businesses, which expands and strengthen the cluster itself.

Being part of a cluster companies could operate more productive in obtaining information, learning and obtaining technology, in accession to sourcing inputs. This includes the following options:

- Better access to employees and suppliers;
- Access to specialized information;
- Creation of complementarities;
- Access to institutions and public goods;
- Better motivation and measurement.

CLUSTERS DO NOT BORN OVERNIGHT. THEY CAN DEVELOP SLOWLY  
OVER TIME!

## 2.2 The World Bank Export Competitiveness Initiative

The World Bank Group's Export Competitiveness Initiative aims to develop synergies among practitioners working on economic growth, trade and private sector development, has underscored several

Of the above issues. It draws on a myriad of policy tools and approaches. Economic policy, customs and logistics, and direct enterprise support. The policy agenda that typically emerges from a competitiveness analysis relates to three core areas, and collectively they offer a platform on which necessary policy dialogues can be developed:

- *Macro fundamentals* (e.g., economic biases due to tariff and nontariff trade barriers, real exchange rate misalignment, tax distortions, overall fiscal health of the economy)

- *Hard and soft infrastructure* (e.g., infrastructure, customs and trade logistics, the costs of doing business)
- *Supply-side measures* (e.g., technology creation and adaptation, product standards and certification, export promotion, human resource development)

The figure below is a model of an agribusiness cluster. The entities of the cluster geographically are near to each other and their activities are interlinked, those the cluster members enjoy economic benefit and synergies. Such benefits include access to specified human resources, marketing tools, suppliers and subcontractors, R&D resources, quality and testing services. It creates both national and international economic power with strong competitiveness in all markets. Clusters can foster commercialization of new products, start-ups and spinoff companies.

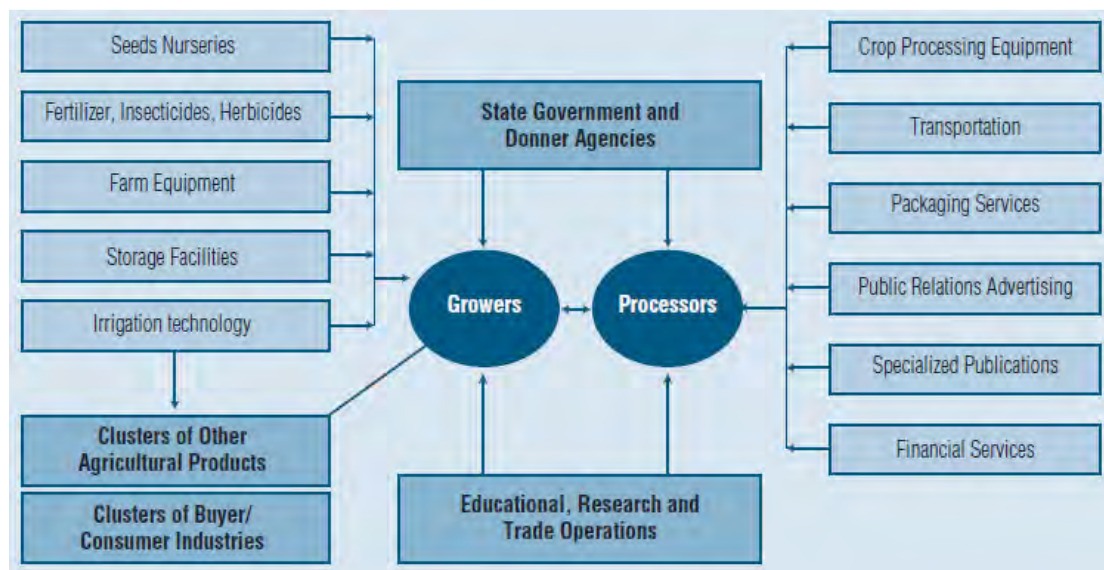


Figure 2  
Model of an agribusiness cluster  
Source: World Bank, 2009

### 2.3 European cluster panorama

With scarce natural and energy resources and ambitious social and environmental goals, EU companies cannot compete on low price and low quality products. They must turn to innovation, productivity, resource-efficiency and high value-added to

compete in global markets. Europe's comparative advantage in the world economy will continue to lie in high value-added goods and services, the effective management of value chains and access to markets throughout the world. Thus, innovation and technological advancement will remain the main source of competitiveness for EU industry. For this reason, further efforts are needed to achieve the Europe 2020 target of spending 3% of GDP on research and development (R&D). [7]

The European Commission has launched a range of initiatives to foster innovation and growth, and to strengthen the underlying competitiveness of the European economy. A key area of interest is the development of emerging industries and their role in driving economic dynamism. One of the new driving forces in entrepreneurship development is the cluster policy. SMEs working together could be more innovative, create more jobs and register more international trademarks and patents than they would alone. The EU Cluster Portal provides tools and information on key European initiatives, actions and events for clusters and their SMEs with the aim of creating more world-class clusters across the EU.

Clusters today operate basically in regional markets. 38% of European jobs are based in such regional strongholds and SME participation in clusters leads to more innovation and growth.

**There are about 2000 statistical clusters in Europe, of which 150 are considered to be world-class** in terms of employment, size, focus and specialisation.

Why the EU elaborated a cluster policy? The 2014 Communication on "For a European Industrial Renaissance" [8] highlighted clusters as being able to facilitate cross-sectoral and cross-border collaboration, helping SMEs to grow and internationalise. The Commission is launching several initiatives under **COSME** and **Horizon 2020** to support SME innovation and growth through clusters.

**COSME** is the EU **programme for the Competitiveness of Enterprises and SMEs**, running from 2014 to 2020, with a budget of €2.3billion. COSME will support SMEs in the following areas:

- Facilitating access to finance
- Supporting internationalisation and access to markets
- Creating an environment favourable to competitiveness
- Encouraging an entrepreneurial culture [9]

COSME promotes the development of world class clusters in the EU, fostering cluster excellence and internationalisation with an emphasis on cross-sectoral cooperation, notably in support of emerging industries. The programme also aims

at accelerating the digitalisation of the business community and promoting e-skills and e-leadership.

**Horizon 2020** is the biggest EU Research and Innovation Programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020). [10]

One of the key areas of interest is the **development of emerging industries** and their role in driving economic dynamism. Emerging industries can be understood as “the establishment of an entirely new industrial value chain, or the radical reconfiguration of an existing one, driven by a disruptive idea (or convergence of ideas), leading to turning these ideas/opportunities into new products/services with higher added value”. Therefore, emerging industries can but must not always be completely “new” industrial sectors.

### **2.3.1 Cluster in emerging industries**

**The EU Cluster policy includes** elaboration of The Cluster Policy Guide, **design and plan** cluster policy support initiatives, **establishment of an European Cluster Observatory**, **design** model demonstrator regions pilot projects, elaboration of a cluster stress test tool.

The European Commission has launched a range of initiatives to foster innovation and growth, and to strengthen the underlying competitiveness of the European economy. A **key area of interest is the development of emerging industries** and their role in driving economic transformations and growth.

<p><b>Emerging industries</b> can be understood as the establishment of an entirely new industrial value chain, or the radical reconfiguration of an existing one, driven by a disruptive idea (or convergence of ideas), leading to turning these ideas/opportunities into new products/services with higher added value.</p>
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Therefore, emerging industries can but must not always be “completely new industrial sectors”. They are new combinations of narrowly defined activities that can also comprise existing industrial sectors that are evolving into emerging industries in response to new technologies, market demands, and value chain configurations. [11]

The following fields were selected as **Emerging industries**:

- **Advanced Packaging** is an increasingly important input to many other activities, from food processing to automotive supply chains.
- **Biopharmaceuticals** form the scientific basis of the Life Science industries and employ some of the most educated and productive employees.
- **Blue Growth Industries** has been the focus of European policy in the last several years and is an area where interesting new islands of activity might emerge.
- **Creative Industries** is the key sector in future European economy and has been growing faster than any emerging industry in the past two decades.
- **Digital Industries** cover the key parts of the ICT economy: computer hardware, software, ecommerce and wireless services.
- **Environmental Industries** cut through all sectors of the economy as the need for more sustainable operations is realised increasingly more and thus have a high growth potential
- **Experience Industries** cover creation and consumption of “experiences” and are composed of millions of SMEs at the intersection of arts and business.
- **Logistical Services** are a key service sector in the modern economy and are among the leaders in job creation.
- **Medical Devices** are another core part of the Life Sciences industry and are also connected to large and growing employment in local health care services.
- **Mobility Technologies** are a core part of the European manufacturing industry and despite suffering during the recent crisis they are a clear focus for Europe’s strategy to re-industrialize.

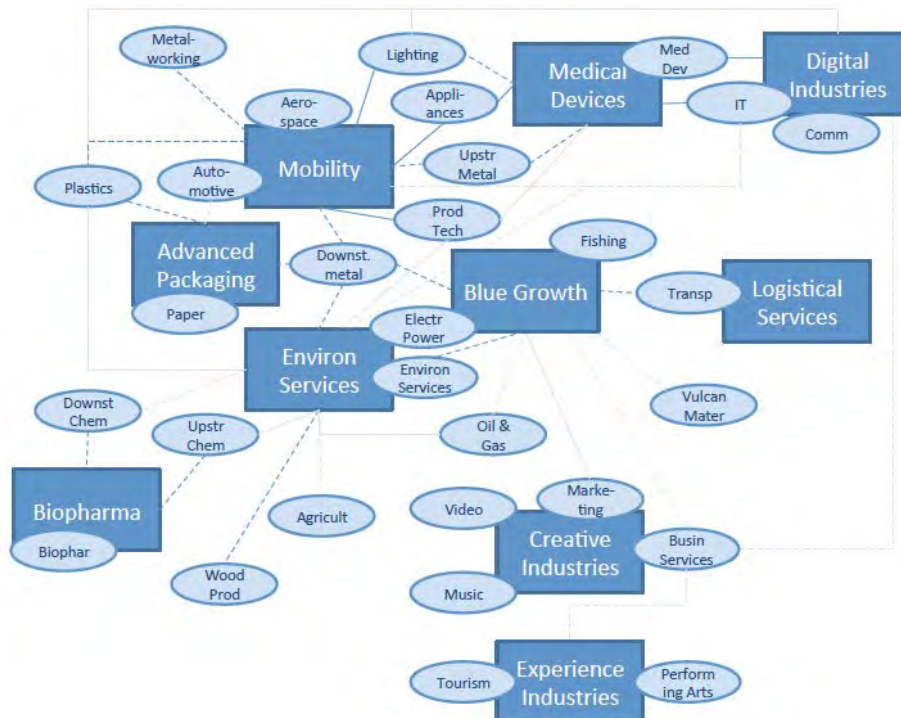


Figure 3

Linkages between clusters and emerging industries

Source: *European Cluster Panorama, 2014* [12]

## 2.4 European clusters excellence

In 2006, the European Commission launched a project on **Central and Eastern European Cluster and Network Area** [13]. It focuses on linking the eleven partner regions/countries whose innovation policies focus on cluster and network policy. The main objective is to find coherences in the different regional cluster policy implementation methodologies and to shape a common policy in by defining common strategic issues, strategies and programmes. The project aims for a coherent development of innovation and cluster policies in the strongest sectors of each regional economy at three levels: policy; administrative; and regional development agencies and cluster initiatives.

In 2007, the CEE Cluster Agreement was signed and later an operative Cluster Action Plan [14] was elaborated. The CEE-Cluster Network project involved eleven neighbouring cluster regions in Central and Eastern Europe who are keen to mobilise and support national and regional innovation policy actors to carry out

and design co-operation activities together with other competent public authorities.

## 4 Conclusion

On 8-9 October 2015, the Organization of the Black Sea Economics Cooperation – BSEC -Permanent International Secretariat and the Konrad Adenauer Foundation in Turkey organized a Workshop on „SME Clustering: How to Find the Right Business Partners / Improving the Business Environment for SMEs” in Crete (Hellenic Republic). As host, two prominent Greek institutions: PRAXI/FORTH and Centre for Technological Research of Crete made presentation of the national best practices and future programmes. The program of the Workshop and selection of candidates making national presentation from the BSEC countries was made by the Scientific Director of the ERENET Network.

At the end of the Workshop, conclusions and recommendations were formulated, which is the most important tangible output of the event. These conclusions and recommendations were submitted to the BSEC Working Group on SMEs and following the discussions, they were submitted to the BSEC Committee of Senior Officials and the BSEC Council of Ministers of Foreign Affairs. Finally they were forwarded to relevant National Ministries and other national authorities. The main finding we formulate is following:

- The concept of competitiveness has numerous interpretations of its core issues. It competitiveness includes static and dynamic components. Many factors influence and drive productivity and competitiveness. Investment in physical capital and infrastructure alone is not sufficient today. In more recent years the good governance, macroeconomic stability, education and training, R&D become as important as the capital and infrastructure investment.
- Innovation, talent development and institutional strength continue to play a defining role in determining world’s most competitive economies. The Global Competitiveness Index calculated by the World Economic Forum present the current achievement of the countries during the last few years.
- Entrepreneurship activities, SMEs and cluster development are three important “ingredients” of the economy.
- The cluster-based approach is a new way of organizing and dividing the economy. Clusters are important economic policy tools, which can help



enterprises, particularly SMEs, to stay competitive in an increasing global competition. The clusters have a significant potential for technology transfer, dissemination of innovations, resource sharing, marketing, market expansion, which makes them useful instrument for enterprise development.

- Successful clusters are characterised by the following three main pillars:
  - (i) Geographically concentration of the interconnected firms.
  - (ii) The number of participating partners must reach the critical mass both in resources as well in competences; and
  - (iii) There is a need and capability to have existing interaction and cooperation among the firms.
- Clusters play an important role in regional development, because they contribute to improvement of competitiveness of participating firms, creates job and promote marketing of the local products and services.
- Key elements necessary to foster the development of dynamic and fast growing SMEs and clusters should base on
  - A favourable tax environment;
  - A sound and stable macroeconomic environment;
  - A favourable legal environment based on a strict application of the rule of law and right of contracts;
  - Large and easy access to financing;
  - Few bureaucratic interference allowing easy entry and exit in the market
- National Policies must follow priorities such as: creating a favourable business environment for growth and innovation, diffusion of the knowledge, enlargement of the innovation support, mission oriented strategies, upgrading human resources, access to skills and competencies, abilities to learn, promotion of organizational change, technological change, productivity and competitiveness.
- To increase economic competitiveness, the development of the innovation infrastructure and the dissemination methods of research results for industrial and commercial applications shall be encouraged

- Cluster initiative should be part of the national economic development programme. Countries need short and long term strategies, policies must encourage the main drivers of innovation.

### References

- [1] [http://www3.weforum.org/docs/gcr/2015-2016/Global\\_Competitiveness\\_Report\\_2015-2016.pdf](http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf)
- [2] ibid
- [3] Communication for the Commission: EUROPE 2020 – A strategy for smart, sustainable and inclusive growth, COM (2010) 2020, Brussels 3.3.2010.
- [4] See [http://www3.weforum.org/docs/WEF\\_Europe2020\\_CompetitivenessReport\\_2014.pdf](http://www3.weforum.org/docs/WEF_Europe2020_CompetitivenessReport_2014.pdf) at
- [5] World Economic Forum: The Europe Competitiveness Report, 2014 edition, Geneva, <http://www.weforum.org/Europe2020>
- [6] Michael Porter: Clusters and the New Economics of Competition, Harvard Business Review. November-December 1998.
- [7] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: For a European Industrial Renaissance, COM/2014/014 final, <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0014>
- [8] ibid
- [9] European Commission: COSME. Europe's Programme for small and medium/sized enterprises. [http://ec.europa.eu/growth/smes/cosme/index\\_en.htm](http://ec.europa.eu/growth/smes/cosme/index_en.htm)
- [10] European Commission: What is Horizon 2020? <http://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020>
- [11] European Cluster Panorama 2014, Center for Strategy and Competitiveness, Stockholm School of Economics, October 2014
- [12] European Cluster Panorama 2014, Center for Strategy and Competitiveness, Stockholm School of Economics, October 2014
- [13] <http://www.eca-tactics.eu/project/cee-clusternetwork>
- [14] European Cluster Alliance: Identifying the main Objectives and Activities of Cluster Programme. Oberösterreichische Technologie - und Marketinggesellschaft m.b.H., Austria, June 2010.

**Management, Enterprise and Benchmarking in the 21<sup>st</sup> Century**  
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# **Financial Decisions of Micro-Enterprises in Albania and Hungary**

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*Abstract: This paper examines the characteristics of Small and Medium Enterprises, specially the financial behaviours of micro-enterprises in Hungary based on the SME Competitiveness Research (Kadocsa, 2015). In the second part of the article the authors examine Albanian micro-enterprises. Further this article provides evidence regarding the main characteristics of SME-s in Albania and Hungary. The aim of the paper is to explore, whether there are any differences between thinking and behaviour of the two countries?*

*Keywords: Albania, Hungary, micro-enterprises, financing, decision*

## **1 Overview**

This paper examines the characteristics of Small and Medium Sized Enterprises (later referred as SME) especially the financial behaviour of micro-enterprises in Hungary based on the SME Competitiveness Research (Kadocsa, 2015). The article aims to present micro-enterprises in Albania and Hungary based on a parallel analysis approach using the same questionnaire.

The reason why the comparison is considered for these two countries is related to their similar experience. Both of these countries have been through a communist era, which strongly affected the countries not only into a socio and political perspective, but also into the economic perspective. The main questions arising in this article are related to the difference between the thinking and behaviour of the two countries. In this article authors are going to examine the differences in SMEs' characteristics.

This article aims to describe the main characteristic of Hungarian SMEs especially the micro-enterprises in line with the literature review; secondly it aims to analyse the financial culture of micro-enterprises in Hungary; thirdly the paper aims to examine the characteristics of Albanian micro-enterprises on the basis of responses that were given to the same questionnaire used with Hungarian SMEs. As a result the authors point out some interesting differences and similarities which turn out to be in line with the literature and present primary research and case-studies.

## **2 Literature Review**

The economic importance of small and medium-sized enterprises<sup>1</sup> (SMEs) in Albania and Hungary is unquestionable (Lazányi, 2014a) (Lazányi, 2014b). To emphasise this importance this analysis is conducted. In this section a theoretical background is provided.

### **2.1 Number of SMEs**

Although Hungary and Albania have very different characteristics, they have the same proportions of SME sector (Figure 1.) An interesting indicator, found in this analysis is the number of active SMEs operating in both countries. For instance, Albania has a population of approximately 3.2 million and the ratio of SME divided by population is 0,035. Meanwhile in Hungary this ratio is considered to be 0,06 SMEs per person. (KSH, 2015b), (Musta and Meka, 2015)

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1 Small and medium-sized enterprise: According to paragraph 3. § (1) of law XXXIV., 2004. an enterprise may be qualified as an SME if:

- a) the total number of its employees is less than 250 people and
- b) its annual revenue is maximum 50 million Euros or its equivalent in HUF, or its bottom line maximum 43 million Euros or its HUF equivalent.

(2) Within the SME category an enterprise may be qualified as a small enterprise if

- a) the total number of its employees is less than 50 people and
- b) its annual revenue or its bottom line is maximum 10 million Euros or its equivalent in HUF,

(3) Within the SME category an enterprise may be qualified as a micro enterprise if

- a) the total number of its employees is less than 10 people and
- b) its annual revenue or bottom line is maximum 2 million Euros or its equivalent in HUF.



Figure 1.

The size of SMEs according to their number of employees.

(KSH, 2015b), Musta and Meka (2015)

## 2.2 Hungary

According to the data of the Hungarian Central Statistical Office published in 2015 the proportion of the SME sector is 99.8%, within which 94.8% of all the enterprises are micro enterprises in Hungary (KSH, 2015a); 66,9% of the labour force are employed by the SME sector. (SBA, 2015). The competitiveness of SMEs has an impact on whole of country (Varga-Csizsárik-Kocsir, 2015).

According to the SBA report (SBA, 2015) access to finance is one of two SBA areas where Hungary is above the EU average. Hungarian enterprises access easier the public financial support, and the banks have more willingness to provide a loan to them. Cost of borrowing for small loans is cheaper and total amount of time it takes to get paid is a bit shorter in Hungary than in an average EU country. However there are more rejected loan applications in Hungary than EU average. (SBA, 2015.)

There are several possibilities for Hungarian SMEs to solve their financial problems. The New Széchenyi Plan has been as an efficient support system. It's based on the EU sources, and it provides new tenders for SMEs. Széchenyi Kártya - SME Credit Card Programme has been extended, it combines different loan product for the SME not only to finance current assets and temporary liquidity problems, but to finance their investment. (Kavosz, 2016). Seed capital, business angels and venture capital were invigorated by EUR 700 million under the JEREMIE Holding Fund until 2011, but these solutions weren't popular among the SMEs. (Borbás, 2013). There are lots of opportunities for tender due to the operative programmes of EU multiannual budget for 2014-2020 which includes Programme for the competitiveness of enterprises and SMEs (COSME), and Horizon 2020 - Framework Programme for Research and Innovation. The tenders provide several financial way to reach SME's goals like non-repayable grants, reduced rate loans, and their combination.

The different forms of finance don't substitute each other equally: the choice depends on the laws of tax or liquidation. There can be some rules which motivates

the SMEs to get bank loan (eg some reduced rate tax because of the company's loan), or the bank not to give loan. (Antal-Pomázi, 2011)

Ágnes Csiszárík-Kocsir made a research about the financial strategy of SMEs, and it turned out that the small and medium enterprises haven't got enough capacity and financial knowledge to think about the enterprise with finance-consciousness. They use own capital at first, and if they need, try to use bank loan, but they had very weak relationship with the participation of the financial market (Csiszárík-Kocsir, 2015).

### **2.3 Albania**

According to Musta and Meka (2015), micro enterprises (1 to 9 employees) in Albania constitute the dominant part of the SMEs, up to 95% per cent, 4 per cent is constituted by companies with 10 to 49 employees and only 1 per cent is constituted by companies with more than 50 employees.

According to the Institute of Statistics in Albania there has been an increasing trend of overall active enterprises in Albania from 2010 until 2014. The same trend stands for new entry companies.

During 2015, due to the implementation of the formalisation reform, many of the SMEs which were working under informality conditions, could not support the pressure so they are now closed. This accounts for a considerable number of SMEs. For instance Bedalli (2016) states that 4.918 SMEs were suspended. According to Bedalli (2016), the number of SME being run or managed by foreign owners has increased substantially. There has been a 12 per cent increase of the foreign SMEs in 2015, compared to 2014. Meanwhile according to ECR Report (2013a) financing for small firms is less floating compared to financing for large firms.

Another factor affecting SME financing needs is the development stage. Firms do not have the same funding necessity at every stage. Felkana et.al (2001) states that firms at the starting stage usually rely on their own saving or borrowings from family or relatives, while during the maturity and later more established stages, they usually rely on loan financing.

Musta and Meka (2015) and Abdulsaleh (2013), state that the financial behaviour of firm is determined by many factors such as size (which can be measured as the asset size), age (for how long has the firm been into the market), ownership type, legal form, location, financial structure, industry sector and the ability to provide collateral in support of the loan request. Meanwhile it is also found that even though bank financing is more expensive, it generates a higher profitability for firms, due to the fact they - because of being monitored by banks, - will use their funds in a more efficient way (Keasey and McGuinness (1990).

Falkena (2004) states that SMEs tend to seek finance for relatively small amounts. The cost of credit assessment and loan and investment monitoring leads to a high cost of providing funds for the SME.

Based on this literature review and different academic perspectives of the main authors, the main research question posed in this article is: How do the micro-enterprises make their financial decisions according to a primary research in Hungary and several case-studies of Albanian companies? Based on this research question, this study hypothesizes that: *The main source of financing for the SME in Hungary and parallel to that in Albania (from a certain size onwards?), is bank loan.*

### 3 Data and Methodology

In this section the data design and methodological approach are discussed. This article is a parallel analysis approach based on primary data, collected from small and medium enterprises in Albania and Hungary.

#### 3.1 Data Design

In Hungary there is a total number 578.708 active SMEs operating within the country; 94,8% of them are operating as micro enterprises, which means that their total number of employees is less than 10. (KSH, 2015a) The data for SMEs operating in Hungary is provided by the Research Workshop for Research and Development of Small and Medium-sized Enterprises (Kadooca, 2015), which generates a total number of questionnaire response 407, which is about 0,07% of the total SMEs. While in Albania, according to the official data from 2014, the total number of SMEs actively operating into Republic of Albanians 112.537. Due to the unbalanced data sample, this study is mainly focused on studying the financing features of small medium enterprises in both countries.

#### 3.2 Methodology

The instrument used to generate the primary data is a questionnaire. The same questionnaire is used for SME-s interviewed in Albania and in Hungary. It is divided into three main sections. The first section is related to the general profile of a company, such as the sector where the company operates, the year it was established, number of employees. The second part of the questionnaire analyses the financial indicators such as revenues, loan support etc. The third section is related to access to tender. The authors have decided to use the first two part of the research for this paper.



## 4 Main Findings

### 4.1 Hungary

The main findings of the Research of Competitiveness of SMEs are presented in this part of the paper. There are 242 micro-enterprises who have answered the research questions, which makes up 59% of all items.

The graph below (Figure 2.) shows the role of planning in the SMEs' strategic management. Hungarian managers seem to know about the importance of planning, but they usually don't write their plans down, and don't discuss it with their colleagues (together is 41,7%). More than 30% just improvise. 21,5% use and write down their Business Plan, but only 4,1% take action after any misbalances are noticed comparing the plan and the reality.

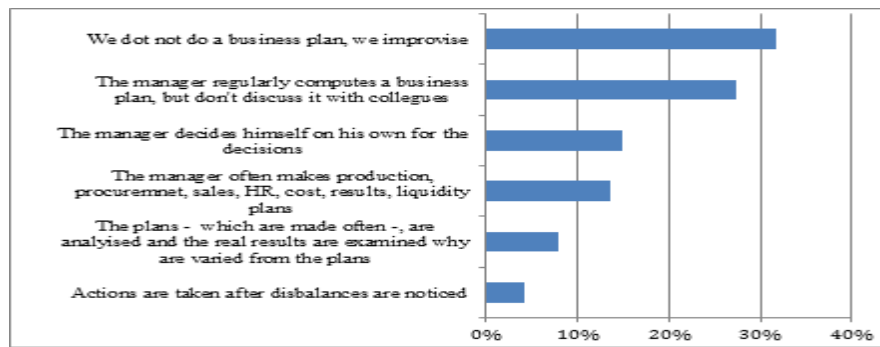


Figure 2.

Role of the Business Plan in terms of strategic management (Edited by the Authors)

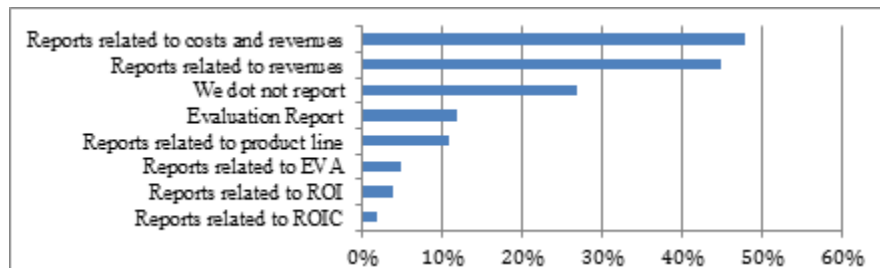


Figure 3.

Reporting with the Accounting Office (Edited by the Authors)

In Hungary Micro-enterprises use more reports at the same time as noticed on Figure 3, nearly a half of them (48%) require data about their revenue and costs, but less than 10% of them use EVA, ROI, ROIC rates as information to their decisions. However, 27% of micro-enterprises don't use any report. Figure 2 and 3 show that the micro enterprises make decision in a less conscious way compared to the bigger

companies according to this research.

As also stated in the literature review section, financing is a key issue in term of operational activity of the micro SMEs. Figure 4 shows the sources of financing for SMEs in Hungary. The most common source of financing is from revenues. Owners capital and bank loan are listed thereafter, 79% indicated only one source in the questionnaire.

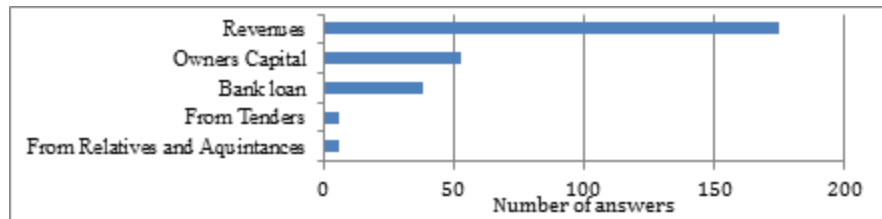


Figure 4.

Financing sources (Edited by the Authors)

Hungarian SMEs are cautious about their financial decision, especially after the economic crisis (Csiszárík-Kocsir, 2015). Most of them never ask for short-term and long-term loan (75%, 80%), and only 8% answered that getting short term loan, and 5% who said that getting long-term loan is a usual solution for their financial problems. (“Very often”, “Often” and “Depends” together).

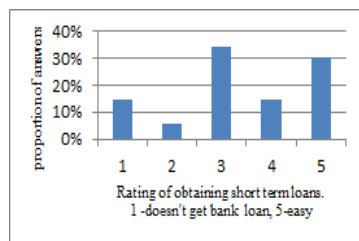


Figure 5.

Difficulty of obtaining a short term loan  
(Edited by the authors)

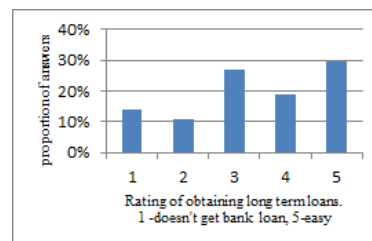


Figure 6.

Difficulty of obtaining a long term loan  
(Edited by the authors)

Figure 5 and 6 indicate the difficulties in obtaining a short term and a long term loan respectively. Obtaining loan from a bank is easy, supposedly due to the well-known Széchenyi Kártya – Credit Card Programme for SME which was extended in 2011 to the long-term loan products. (KAVOSZ, 2015) Meanwhile most of the SMEs responded that the reason why they do not apply for a loan is related to the fact that they do not find it necessary to apply for a loan. They use alternative financing sources.

## 4.2 Albania

As presented in the graph below, the majority of the SMEs operating in Albania do not conduct a Business Plan, but improvise instead. Nevertheless slightly more than 20% state that the manager conducts a business plan but does not discuss it with the colleagues.

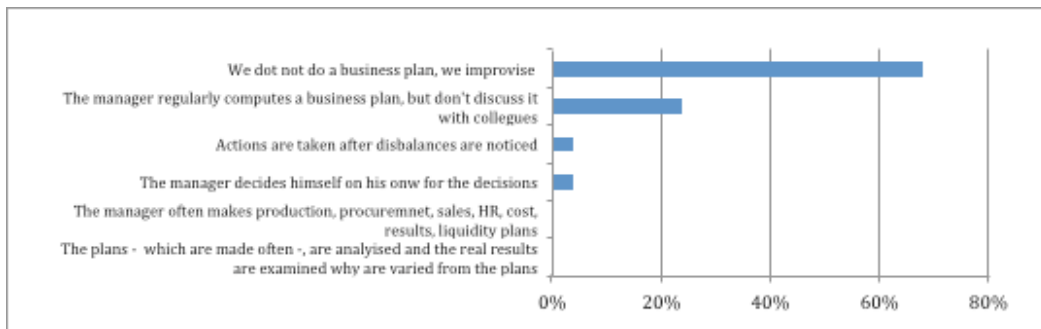


Figure 2a

Role of the Business Plan in terms of strategic management (Edited by the Authors)

Figure 3a indicates the frequency of the accountancy reporting. The graph shows that slightly less than 30% of the SMEs in Albania stated that they exchange regular reporting with the accounting office for reports related to revenues, and other 30% state that they get reports related to costs and revenues.

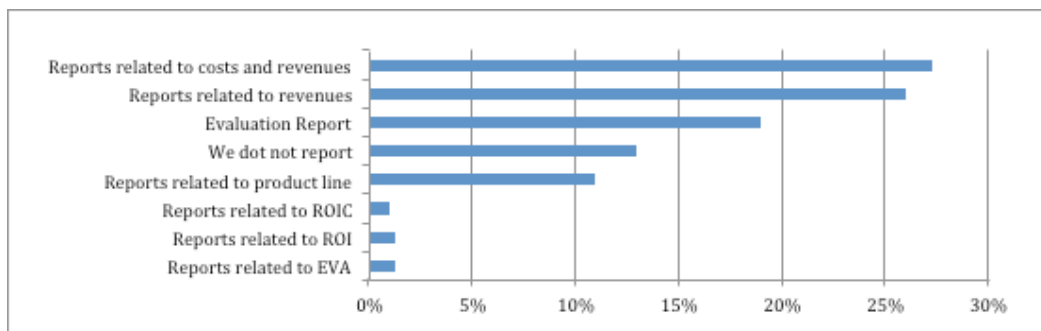
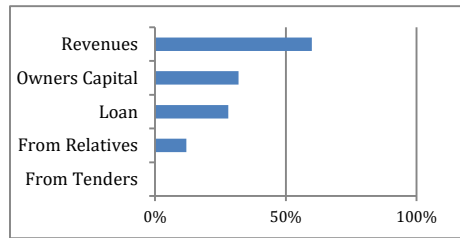


Figure 3a.

Reporting with the Accounting Office (Edited by the Authors)



A specific element is sources from relatives and acquaintances, which in the case of Albanian SME weights for slightly more than 10%. This may be explained due to the cultural fact that Albanian are very related and usually rely on each other (Hofstede, 2016.)

Figure 4a.

Financing sources (Edited by the Authors)

In terms of the frequency of requiring a short time loan the analysis indicates that approximately 70% of SME in Albania never or rarely ask for a short term loan. Only less than 30% answered that they often, or occasionally - depending on the situation - require a short term loan from a bank. In terms of long term loans the situation appears to be slightly different and very similar in both countries. More than 60% of the respondent SMEs in both countries answered that they never asked for a long term loan from a bank. Similar results are revealed for about 20% of the respondent SMEs in Albania and Hungary, stating that they rarely asked for a long term loan from a bank. The reason beyond the fact that more than 90% of the SME never or rarely ask for a long term loan may be related to the bank's procedures. The dominant part of the SME operating in Albania, find it very difficult to obtain a loan from a bank; and only 30% of them find these procedure easy.

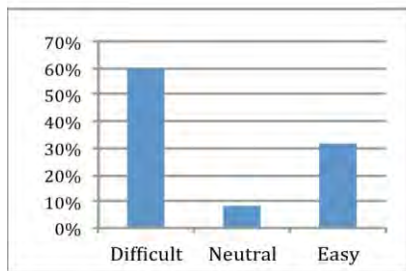


Figure 5a.

Difficulty of obtaining a short term loan

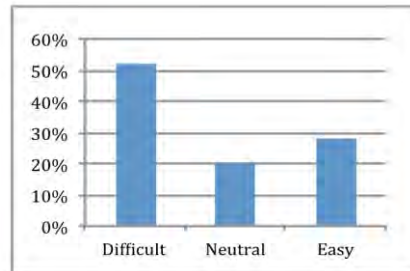


Figure 6a.

Difficulty of obtaining a long term loan

Nevertheless, there is also an explanation beyond the responses generated from the SMEs in Albania and in Hungary. The results are again similar, despite of financing source from relatives; here it is found that a considerable part of SMEs in Albania prefer borrowing from relatives because this source has a lower cost compared to other funding sources.

## Conclusions

According to the primary research and case-studies there are some similarities and several interesting differences between Albania and Hungary examining the micro-enterprises. Both researches indicate that micro-size means less conscious, planning in the financial decisions, and less liabilities in the financing. Most of the micro-enterprises in the two countries answered that they don't need loans, but while Hungarians access to finance easier, Albanians have a difficult administration process to get bank loan. Another interesting difference pointed out by the research data is that the Albanian companies in the study answered in bigger proportion that they ask money for their enterprise from acquaintances rather than the bank not only because it's cheaper and it has less administrative difficulties but due to their culture: They are much less individualistic (Hofstede, 2016) than the Hungarians.

## References

- [1] Lazányi, Kornélia: Entrepreneurs of the future. In: Serbian Journal of Management Volume 9. (2014) No. 2. 149-158. p.
- [2] Lazányi, Kornélia: Short Assessment of the Situation of Hungarian SMEs and the Potential Role of Higher Educational Institutes, In: Ivan Mihajlović (szerk.) Possibilities for development of business cluster network between SMEs from Visegrad countries and Serbia: - IMKSM2014. Bor: University of Belgrade. 2014. 55-64. p.
- [3] Varga, János – Csiszárík-Kocsir, Ágnes: Versenyképességi átrendeződés Közép-Kelet Európában, fókuszpontban a V4 országok, Kárpát-medencei versenyképesség. 6. Báthory – Brassai Konferencia. Budapest. Óbudai Egyetem. 2015. május 27.-28.
- [4] Központi Statisztikai Hivatal: Működő, valódi új, valódi megszűnt vállalkozások száma létszám-kategóriák szerint (1999–). 2015.06.18 [https://www.ksh.hu/docs/hun/xstadat/xstadat\\_eves/i\\_qpg001.html](https://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_qpg001.html) (downloaded: 01.03.2016)
- [5] Kadocsa, György: Kutatási program a kis- és közepes vállalkozások versenyképességéről – questionnaire and database. Research Workshop for research and development. Óbuda University Keleti Faculty of Business and Management. 2015.
- [6] Központi Statisztikai Hivatal: Népesség, népmozgalom (1941–). 2015.07.03. [https://www.ksh.hu/docs/hun/xstadat/xstadat\\_eves/i\\_wnt001b.html](https://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_wnt001b.html) (downloaded: 01.03.2016)
- [7] SBA Fact Sheet – Hungary. European Commission. 2015. <http://ec.europa.eu/growth/smes/business-friendly->

- environment/performance-review/files/countries-sheets/2015/hungary\_en.pdf (downloaded: 15.03.2016.)
- [8] SBA Fact Sheet – Albania. European Commission. 2015. [http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review/files/countries-sheets/2015/albania\\_en.pdf](http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review/files/countries-sheets/2015/albania_en.pdf) (downloaded: 15.03.2016.)
- [9] Csiszárík-Kocsir Ágnes: A hazai vállalkozások által alkalmazott finanszírozási stratégiák egy kérdőíves kutatás eredményeinek tükrébe. In: Vállalkozásfejlesztés a XXI. században V. (2015) Óbudai Egyetem Keleti Károly Gazdasági Kar. pp 33-56.
- [10] Antal-Pomázi, Krisztina: A finanszírozási források szerepe a kis- és középvállalkozások növekedésében. Közgazdasági Szemle, LVIII. évf. 2011. március pp 275–295.
- [11] Myers, S. [1984]: The Capital Structure Puzzle. *Journal of Finance*, 34. 575–592. o.
- [12] Musta, E. and Meka, E: Lack of Credit in Albania; Who is to “Blame” Analysing the Demand. *European Journal of Economics and Business Studies*, (2015), Vol.2, Nr.1, pg: 122 – 132. ISSN 2411-4073
- [13] Rahman, A. and Khatun, M: An Investigation of the Factors Affecting Small and Medium Enterprise Financing from the Formal Channel, (2012), *Jahangirnagar University Journal of Business Research*, Forthcoming. Available at SSRN: <http://ssrn.com/abstract=2093158>
- [14] Falkena, H. SME’ Access to Finance in South Africa—A Supply Side Regulatory Review (2004)
- [15] Bedalli, E. “Rreshtimi i Biznesit: Te gjitha shifrat e 2015-s”, *Revista Monitor*. Last seen 7 march 2016
- [16] Keasey, K. and McGuinness, P. (1990). Small Firms and the Return to Alternative Sources of Finance. *Small Business Economics*.
- [17] Hofstede, G: The Culture Compass™ Survey. Hungary in comparison with Albania. <http://geert-hofstede.com/hungary.html> (downloaded: 15.03.2016.)

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# Dependability Assessment of Supplier Performance based on the Fuzzy Sets Theory

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*Abstract: In the literature, considerable attention has been given to the role of suppliers, thus companies have been increasingly considering better supplier selection approaches in order to attain the competitive advantage in the demanding markets. The aim of this study is to provide an effective tool for decision makers (DMs) to help them with evaluation and prioritization of current suppliers. Moreover, the supplier prioritization is inherently multi-criteria decision-making problem (MCDM), with involved high degree of fuzziness. Hence, this paper introduces fuzzy decision-making model where dependability assessment of the suppliers could be done based on the fuzzy set theory and max-min composition. Furthermore, in order to determine supplier dependability, the typical influence indicators: Production facilities and capacities (PFC), Delivery (D) and Service (S), were analysed in an illustrative example, where proposed model used triangular fuzzy numbers (TFN) to establish linguistic description of these three indicators. At the practical level, the results and findings of this paper provide decision makers with a complete picture of those suppliers that have the highest dependability performance in their supplier network.*

*Keywords: Suppliers, fuzzy set theory, Suppliers evaluation*

## 1 Introduction

In today's competitive market proper management of the supply chain management is the key to success of every company, where they should know that for a company to remain competitive it is crucial to work with its supply chain partners [1]. Therefore, supplier evaluation and selection is one of the most important components of supply chain, which influence the long-term commitments and performance of the company [2]. Thus, supplier selection problem has been the focus of numerous studies both theoretical and empirical [3,4].

According to the Meoini, the supplier (vendor) selection problem is an unstructured, complicated and multi-criteria decision problem [5]. There have



been many analytical models proposed for the supplier selection problem in the extant literature [6-10]. Although, earlier studies on supplier selection emphasized the traditional approach to supplier selection, which has been to select suppliers solely based on price, companies have learned that the sole emphasis on price as a single criterion for supplier selection is not efficient. Hence, they have turned into to a more comprehensive multi-criteria approach. Recently, these criteria have become increasingly complex as: environmental, social, political, and customer satisfaction concerns have been added to the traditional factors of quality, delivery, cost, and service.

The idea of this paper is to establish the model for supplier dependability assessment according to the fuzzy set theory utilization. Moreover, the fuzzy sets were used to analyse several influence indicators on supplier performance. Since, this research is still going on, in this phase authors have decided to present the results for only three indicators of supplier dependability. Thereby, the proposed fuzzy model was used to analyse production facilities and capacities, delivery and service (as partial indicators of supplier's performance), as well as for their integration into supplier dependability evaluation.

This paper is organized as follows: research design and determination of the influence factors are discussed in Section 2. In Section 3, a brief overview of fuzzy set theory and evaluation methodology are provided. Section 4 covers numerical example with aim to demonstrate the application of the proposed fuzzy model. Finally, in the Section 5 this paper concludes with results summary and suggestions for future research.

## **2 Conceptual framework**

Conceptual model of this research is practically summarized in two phases:

1. Identification of supplier's dependability indicators,
2. Development of a research methodology that uses these influence indicators for evaluation and prioritization of the suppliers.

To indicate a set of influence indicators of supplier's performance dependability in supply chains, we surveyed supplier selection literature [5]. For example, even Dickson in 1966 found that seven factors, out of 23 analysed, were perceived as being the most important [11]. These seven factors, in descending order of importance, were: quality, delivery, performance history, warranties and claims policies, production facilities and capacity, price and technical capabilities. On the other hand, Webber with his associates identified six factors as being most used to make selection between suppliers, which varied somewhat from the previous

Dickson research, and they included: quality, delivery, price, facilities/capabilities, geographical location and technical capability [12].

Ordoobadi in his research concluded that factors considered in supplier selection are situation specific and each company should develop its own set of factors when facing with determining the appropriate suppliers [13].

In this study three influence indicators of supplier dependability were used, and there are shown in Table 1. Based on the past literature and expert opinions [1], each indicator was considered through the sets of sub-indicators, that are also explain in the following Table 1.

<b>Indicator</b>	<b>Sub-indicator</b>
1. Production facilities and capacities (PFC)	1. Process flexibility 2. Volume flexibility 3. Facilities for measurement, calibration and testing 4. Machine capacity and capability 5. Handling and packaging capability 6. Promotion of JIT concept 7. Training
2. Delivery (D)	1. Production lead time 2. Delivery reliability 3. Safety and security of components 4. Appropriateness of the packaging standards 5. Degree of product matching
3. Service (S)	1. After sales services 2. Spare parts availability 3. Technical support level 4. Sales representatives competencies

Table 1.  
 Influence indicators and sub-indicators of supplier dependability

### **3 Methodology framework**

In assessing the dependability of supplier's performance based on the partial influence indicators, the fuzzy model has been proposed in this study. Furthermore, to establish assessment of supplier's dependability (SD), a fuzzy composition of defined indicators and their synthesis into one fuzzy value was performed.

In order to develop proposed research model based on the fuzzy set theory, it was required to define:

1. Linguistic variables and their description through a membership function,
2. Establish rules of the fuzzy composition and appropriate models of integration and defuzzification.

The main advantage of the concept of fuzzy sets is ability to addresses uncertain and ambiguous information. Hence, in this research scale with five linguistic variables (1-poor, 2-adequate, 3-average, 4-good, 5-excellent) was used to express uncertainty and vagueness in the structure of input data. In addition, fuzzy sets can be presented by membership function, which usually takes triangular or trapezoidal shape. Whereby, membership function is a curve that defines how each point in the input space is mapped to a membership value between 0 and 1. In figure 1, trapezoidal membership function is shown, which represents linguistic variables used in this study. Numeric values  $j=1, \dots, 5$  represent measurement units for supplier's dependability, as well as for the influence indicators of supplier dependability: production facilities and capacities (PFC), delivery (D) and service (S).

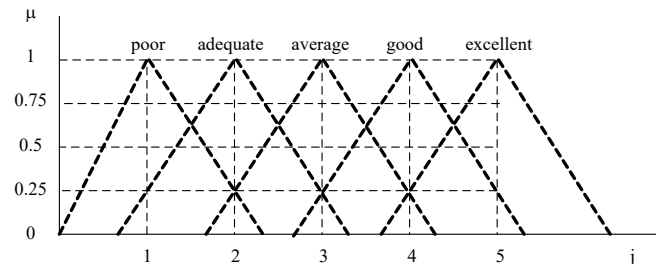


Figure 1  
 Fuzzy sets for linguistic variables

As a result, partial indicators of supplier's dependability can be expressed by following membership functions:

$$\mu_{PFC} = (\mu_{PFC}^1 \dots \mu_{PFC}^5), \mu_D = (\mu_D^1 \dots \mu_D^5), \mu_S = (\mu_S^1 \dots \mu_S^5), \quad (1)$$

Furthermore, mathematical analysis was realized with aim to determine the level of supplier's dependability, where determination of relations and synthesis of partially considered indicators PFC, D, S was completed based on the max-min composition concept [14-16]. Additionally, it can be stated that all influence indicators (PCF, D, S) that cause dependability of supplier's performance (SD), have equal influence on SD, so max-min composition followed by Best fit method

[14], will be used in this study to simultaneously treats the partial indicators onto composition indicator.

The following methodology is proposed to obtain overall supplier's dependability:

**Step 1.** Determining the maximum number of combinations of membership functions for the considered fuzzy sets of influence indicators in model, where  $C=j^3=5^3=125$ . That means, each of these combinations represents one possible synthesis of supplier's dependability:

$$SD = \left[ \mu_{PFC}^{j=1,\dots,5}, \mu_D^{j=1,\dots,5}, \mu_S^{j=1,\dots,5} \right] \text{ for all } c=1, \dots, C \quad (2)$$

However, to obtain outcomes  $o$  based on the defined combination, only non-zero values are taken into account:

$$\text{If } \mu_{PFC,D,S}^{j=1,\dots,5} \neq 0 \text{ it follows that } o=1, \dots, O, \text{ where } O \subseteq C \quad (3)$$

**Step 2.** Further, for each outcome its value  $\Omega_c$  is then calculated by following formula:

$$\Omega_c = \frac{\left[ \sum PFC, D, S^j \right]_c}{3} \quad (4)$$

where running variables in sum represent measurement values  $j=1, \dots, 5$  for the influence indicators of supplier dependability: production facilities and capacities (PFC), delivery (D) and service (S).

**Step 3.** In the next step, for each obtained combination the minimum value of  $\mu_{PFC,D,S}$  should be determined, where outcomes are grouped according to their  $\Omega_c$ , ie. by the size of  $j$  ( $j=1, \dots, 5$ ).

$$MIN_o = \min \{ \mu_{PFC}^{j=1,\dots,5}, \mu_D^{j=1,\dots,5}, \mu_S^{j=1,\dots,5} \}, \text{ for all } o=1, \dots, O \quad (5)$$

**Step 4.** For previously identified minimums of  $\mu_{PFC,D,S}$  for each group and outcome, maximum should be found between these values. Where maximums should be obtain for the each value of  $j$  ( $j=1, \dots, 5$ ) by using next formula:

$$MAX_j = \max \{ MIN_o \}, \text{ for every } j \quad (6)$$

As a result, dependability of supplier's performance (SD) is calculated:

$$\mu_{SD} = (MAX_{j=1, \dots, 5}) = (\mu_{SD}^1, \dots, \mu_{SD}^5) \quad (7)$$

**Step 5.** Additionally, the Best fit method is used to transform SD expression, obtained by formula 7, into a form that defines grade of membership to fuzzy sets presented in Figure 1 [14]. This methodology calculates distance  $d$  between  $\mu_{SD}$ , obtained by the previous steps, and each of the expressions (1-poor, 2-adequate, 3-average, 4-good, 5-excellent) according to the Figure 1. Hence, to represent the

degree to which SD is confirmed to each of fuzzy sets in Figure 1, next formula is used:

$$d_i(SD, H_i) = \sqrt{\sum_{j=1}^5 (\mu_{SD}^j - \mu_{H_i}^j)^2} \quad (8)$$

where:  $i=1 \dots 5$ ,  $H_i$  {excellent, good, average, adequate, poor}

and according to the Figure 1:

$$\begin{aligned} \mu_{\text{excellent}} &= (0,0,0,0.25,1), \mu_{\text{good}} = (0,0,0.25,1,0.25), \mu_{\text{average}} = (0,0.25,1,0.25,0) \\ \mu_{\text{adequate}} &= (0.25,1,0.25,0,0), \mu_{\text{poor}} = (1,0.25,0,0,0) \end{aligned} \quad (9)$$

It could be concluded that the closer the SD is to the  $i$ th linguistic variable, smaller is  $d_i$ . Also, if distance  $d_i$  is equal to zero, SD should not be compared to other expressions [15].

Suppose  $d_{i_{min}}$  ( $i=1, \dots, 5$ ) is the smallest among the obtain distances for SD and let  $\alpha_i$  ( $i=1, \dots, 5$ ) represents the reciprocal of the relative distance, which is calculated as the ratio between corresponding distance  $d_i$  and  $d_{i_{min}}$ , then  $\alpha_i$  can be formulated as:

$$\alpha_i = \frac{1}{d_i / d_{i_{min}}}, \quad i=1 \dots 5 \quad (10)$$

If  $d_i=0$  it implies that  $\alpha_i=1$  and others are equal to zero. Thereby,  $\alpha_i$  can be normalized as follows:

$$\beta_i = \frac{\alpha_i}{\sum_{i=1}^5 \alpha_i}, \quad i=1 \dots 5, \quad \sum_{i=1}^5 \beta_i = 1 \quad (11)$$

Each  $\beta_i$  represents the extent to which SD belongs to the  $i$ th defined fuzzy sets expressions in Figure 1. Thus,  $\beta_i$  could be understood as a degree of the confidence that SD belongs to the  $i$ th SD expression. Finally, the expression for the dependability of supplier's performance could be obtained as [16]:

$$\begin{aligned} SD &= \{(\beta_{i=1}, \text{"poor"}), (\beta_{i=2}, \text{"adequate"}), (\beta_{i=3}, \text{"average"}), \\ &(\beta_{i=4}, \text{"good"}), (\beta_{i=5}, \text{"excellent"})\} \end{aligned} \quad (12)$$

**Step 6.** In the last step defuzzification is done. Where, defuzzification of obtained expressions for the dependability of supplier's performance SD is realized by center of mass point approach [17], according to following formula:

$$Z = \frac{\sum_{i=1}^5 \beta_i \cdot C_i}{\sum_{i=1}^5 \beta_i} \quad (13)$$

where C is numerical equivalent for linguistic variables (1-poor, 2-adequate, 3-average, 4-good, 5-excellent).

## 4 An illustrative example

As an illustrative example of evaluation of supplier dependability, comparative analysis of three suppliers is performed for company XYZ. This company is faced with a task of making analysis of its current suppliers, based on their past performance and cooperation.

The application of the proposed model in this study was initiated by collection of expert's judgements and estimations. Five experts (analysts) were interviewed and their task was to fill the questionnaires regarding influence sub-factors, presented in Table 1. Further, the obtained ratings were then averaged and rounded within each factor, in order to get discrete rates (1-poor, 2-adequate, 3-average, 4-good, 5-excellent) for considered influence indicators of supplier's dependability (production facilities and capacities (PFC), delivery (D) and service (S)). Hence, the results of experts evaluation of PFC, D, S are summarized in Table 2.

Expert	Linguistic variables								
	Supplier 1			Supplier 2			Supplier 3		
	PFC	D	S	PFC	D	S	PFC	D	S
Expert 1	<i>adequate</i>	<i>poor</i>	<i>poor</i>	<i>average</i>	<i>excellent</i>	<i>good</i>	<i>good</i>	<i>excellent</i>	<i>excellent</i>
Expert 2	<i>average</i>	<i>average</i>	<i>average</i>	<i>good</i>	<i>good</i>	<i>good</i>	<i>good</i>	<i>excellent</i>	<i>excellent</i>
Expert 3	<i>good</i>	<i>good</i>	<i>good</i>	<i>average</i>	<i>good</i>	<i>good</i>	<i>good</i>	<i>good</i>	<i>good</i>
Expert 4	<i>good</i>	<i>good</i>	<i>good</i>	<i>good</i>	<i>good</i>	<i>good</i>	<i>average</i>	<i>good</i>	<i>good</i>
Expert 5	<i>average</i>	<i>good</i>	<i>average</i>	<i>good</i>	<i>excellent</i>	<i>excellent</i>	<i>good</i>	<i>excellent</i>	<i>excellent</i>

Table 2.  
 Expert's evaluation of influence indicators PFC, D, S

First, the dependability of the first supplier's performance is calculated.

Based on the given rates of five experts it can be concluded that production facilities and capacities (PFC) was evaluated as good by two experts ( $2/5=0.4$ ), as average by two experts (0.4), and as adequate by one expert (0.2). Thereby, the assessment of PFC is obtained in the form:

$$PFC_1 = (0/\text{poor}, 0.2/\text{adequate}, 0.4/\text{average}, 0.4/\text{good}, 0/\text{excellent}) \quad (14)$$

Same, the assessments for  $D_1$  and  $S_1$  are obtained:

$$D_1 = (0.2/\text{poor}, 0/\text{adequate}, 0.2/\text{average}, 0.6/\text{good}, 0/\text{excellent}) \quad (15)$$

$$S_1 = (0.2/\text{poor}, 0/\text{adequate}, 0.4/\text{average}, 0.4/\text{good}, 0/\text{excellent}) \quad (16)$$

Further, these assessments are then mapped on fuzzy sets in the Figure 1 in order to obtain fuzzy membership function of each influence indicator based on the five linguistic variables  $j$  ( $j=1, \dots, 5$ ). In Table 3 (last row) result of fuzzy membership function for  $PFC_1$  was obtained, where each of expression in (9) is weighted by values from assessments in (14), for each linguistic variable respectively.

	1	2	3	4	5
<b>poor</b> $\times 0$	1 $\times 0$	0.25 $\times 0$	0 $\times 0$	0 $\times 0$	0 $\times 0$
<b>adequate</b> $\times 0.2$	0.25 $\times 0.2$	1 $\times 0.2$	0.25 $\times 0.2$	0 $\times 0.2$	0 $\times 0.2$
<b>average</b> $\times 0.4$	0 $\times 0.4$	0.25 $\times 0.4$	1 $\times 0.4$	0.25 $\times 0.4$	0 $\times 0.4$
<b>good</b> $\times 0.4$	0 $\times 0.4$	0 $\times 0.4$	0.25 $\times 0.4$	1 $\times 0.4$	0.25 $\times 0.4$
<b>excellent</b> $\times 0$	0 $\times 0$	0 $\times 0$	0 $\times 0$	0.25 $\times 0$	1 $\times 0$
<b><math>\Sigma PFC</math></b>	<b>0.05</b>	<b>0.30</b>	<b>0.55</b>	<b>0.50</b>	<b>0.10</b>

Table 3.  
Calculation of specific values of fuzzy sets for PFC

From the previous Table 3, it follows that:

$$\mu_{PFC_1} = (0.05, 0.3, 0.55, 0.5, 0.1) \quad (17)$$

Also, based on the assessments in (15) and (16) for the first supplier, specific fuzzy form for  $D_1$  and  $S_1$ , are calculated as:

$$\mu_{D_1} = (0.2, 0.1, 0.35, 0.65, 0.15) \quad (18)$$

$$\mu_{S_1} = (0.2, 0.15, 0.05, 0.5, 0.1) \quad (19)$$

These fuzzificated assessments (17), (18) and (19) are then used in the max-min composition in order to be synthesized into assessment of  $SD_1$ . Following the proposed methodology steps in this research, a number of possible combination with the values of membership functions in fuzzificated assessments (17), (18) and (19) different from zero, are only taken in analysis. In case of the first supplier's  $SD_1$  it is possible to make 125 combinations, since all values in fuzzificated assessments (17), (18) and (19) are different from zero, hence  $C=5^3=125$ . Further, the first outcome out of 125 outcomes in Table 4 would be for combination 1-1-1,

which means that  $SD_1=(0.05,0.2,0.2)$ , where based on the formula (4) outcome value is  $\Omega_{1-1-1}=(1+1+1)/3$ , as well as the minimum for this outcome value according to the formula (5) is 0.05. Other combinations, outcome values and their corresponding minimums are shown in Table 4.

No.	Combination				$\mu$			MIN				
	PFC	D	S	$\Omega$	PFC	D	S	1	2	3	4	5
1.	1	1	1	1	0.050	0.200	0.200	0.05	0	0	0	0
2.	1	1	2	1	0.050	0.200	0.150	0.05	0	0	0	0
3.	1	1	3	2	0.050	0.200	0.500	0	0.05	0	0	0
.	.	.	.	.	.	.	.	.	.	.	.	.
124.	5	5	4	5	0.100	0.150	0.500	0	0	0	0	0.1
125.	5	5	5	5	0.100	0.150	0.100	0	0	0	0	0.1
MAX								0.2	0.2	0.5	0.5	0.1

Table 4.  
 Structure of the max-min synthesis of the first supplier's SD

Finally, membership function of the first supplier's  $SD_1$  is obtained from the last row in Table 4, as follows:

$$\mu_{SD_1} = (0.2, 0.2, 0.05, 0.5, 0.1) \quad (20)$$

Based on the Step 5 in proposed methodology, Best fit method is further applied with aim to gives final assessment of SD for the first supplier.

Hence, distances  $di$  for the first supplier assessment, are calculated as:



$$\begin{aligned}
 d_1(\text{SD, poor}) &= \sqrt{\sum_{j=1}^5 (\mu_{\text{SD}}^j - \mu_{\text{poor}}^j)^2} = \\
 &= \sqrt{(0.2-1)^2 + (0.2-0.25)^2 + (0.5-0)^2 + (0.5-0)^2 + (0.1-0)^2} = 1.074 \\
 d_2(\text{SD, adequate}) &= \sqrt{\sum_{j=1}^5 (\mu_{\text{SD}}^j - \mu_{\text{adequate}}^j)^2} = \\
 &= \sqrt{(0.2-0.25)^2 + (0.2-1)^2 + (0.5-0.25)^2 + (0.5-0)^2 + (0.1-0)^2} = 0.982 \\
 d_3(\text{SD, average}) &= \sqrt{\sum_{j=1}^5 (\mu_{\text{SD}}^j - \mu_{\text{average}}^j)^2} = \\
 &= \sqrt{(0.2-0)^2 + (0.2-0.25)^2 + (0.5-1)^2 + (0.5-0.25)^2 + (0.1-0)^2} = 0.604 \\
 d_4(\text{SD, good}) &= \sqrt{\sum_{j=1}^5 (\mu_{\text{SD}}^j - \mu_{\text{good}}^j)^2} = \\
 &= \sqrt{(0.2-0)^2 + (0.2-0)^2 + (0.5-0.25)^2 + (0.5-1)^2 + (0.1-0.25)^2} = 0.644 \\
 d_5(\text{SD, excellent}) &= \sqrt{\sum_{j=1}^5 (\mu_{\text{SD}}^j - \mu_{\text{excellent}}^j)^2} = \\
 &= \sqrt{(0.2-0)^2 + (0.2-0.0)^2 + (0.5-0)^2 + (0.5-0.25)^2 + (0.1-1)^2} = 1.097
 \end{aligned} \tag{21}$$

where  $d_{\min}=d_3=0.604$ . Thereby, the reciprocals of the relative distances are then, based on the formula (10), as follows:

$$\begin{aligned}
 \alpha_1 &= \frac{1}{d_1/d_{\min}} = 0.563, \alpha_2 = \frac{1}{d_2/d_{\min}} = 0.615, \alpha_3 = \frac{1}{d_3/d_{\min}} = 1, \\
 \alpha_4 &= \frac{1}{d_4/d_{\min}} = 0.938, \alpha_5 = \frac{1}{d_5/d_{\min}} = 0.551
 \end{aligned} \tag{22}$$

and corresponding normalized values based on the formula (11) are then:

$$\begin{aligned}
 \beta_1 &= \frac{\alpha_1}{\sum_{i=1}^5 \alpha_i} = 0.153, \beta_2 = \frac{\alpha_2}{\sum_{i=1}^5 \alpha_i} = 0.168, \beta_3 = \frac{\alpha_3}{\sum_{i=1}^5 \alpha_i} = 0.273, \\
 \beta_4 &= \frac{\alpha_4}{\sum_{i=1}^5 \alpha_i} = 0.256, \beta_5 = \frac{\alpha_5}{\sum_{i=1}^5 \alpha_i} = 0.150
 \end{aligned} \tag{23}$$

Finally, assessment of dependability of the first supplier's performance is obtained in form (12):

$$SD_1 = \{(\beta_{i=1}, "poor"), (\beta_{i=2}, "adequate"), (\beta_{i=3}, "average"), (\beta_{i=4}, "good"), (\beta_{i=5}, "excellent")\} = \{(0.153, "poor"), (0.168, "adequate"), (0.273, "average"), (0.256, "good"), (0.150, "excellent")\} \quad (24)$$

In the same way, in this study we have assessed SD of other two suppliers:

$$SD_2 = \{(0.112, "poor"), (0.114, "adequate"), (0.144, "average"), (0.438, "good"), (0.192, "excellent")\} \quad (25)$$

$$SD_3 = \{(0.120, "poor"), (0.119, "adequate"), (0.136, "average"), (0.250, "good"), (0.375, "excellent")\}$$

At the end, if these SD assessments of considered suppliers are defuzzificated by center of mass point approach and formula (13), we can obtain the crisp values of SD's as:

$$Z_{SD1} = \frac{\sum_{i=1}^5 \beta_i \cdot C_i}{\sum_{i=1}^5 \beta_i} = \frac{0.153 \cdot 1 + 0.168 \cdot 2 + 0.273 \cdot 3 + 0.256 \cdot 4 + 0.150 \cdot 5}{0.153 + 0.168 + 0.273 + 0.256 + 0.150} = 3.082 \quad (26)$$

$$Z_{SD2} = 3.483 \quad Z_{SD3} = 3.642$$

From obtain results it can be concluded that the first supplier's dependability is mostly estimated as average in extent of 27.3%, the second supplier is in great extent assessed as good (43.8%), and the third supplier is in great extent assessed as excellent (37.5%). Therefore, it could be stated that third supplier has highest assessed dependability in comparison with other two suppliers. What more, calculated Z values (defuzzifiacted-crisp values) also confirm and complete this conclusion, which can be also seen based on the illustration in Figure 2.

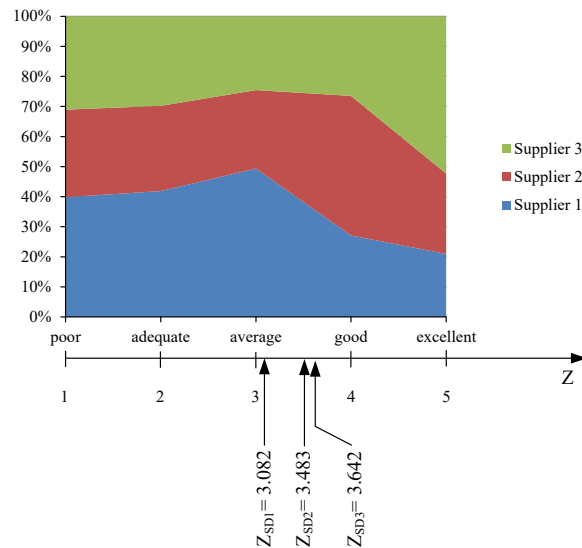


Figure 2  
 Results of suppliers dependability assessments

## Conclusions

In this study, fuzzy evaluation model has been introduced to help decision makers with their decisions regarding rating and prioritization of the suppliers in their organization. Therefore, the proposed methodology could be very useful to the current state of knowledge, since it initiates new unconventional approach to the supplier selection problem.

The results of illustrative example that have been presented in this study, confirmed applicability of the proposed model. Moreover, the advantages of this fuzzy logic approach are clearly explained and implemented. Where, the most of the issues regarding decision-making process are covered, starting with the elimination of imprecision and uncertainty in expert judgments by using linguistic rates (qualitative phase), and then followed by effective quantitative decision-making analysis such are max-min synthesis and the Best-fit method, in order to obtain the priority list of considered suppliers.

As it was stated, this paper gives the preliminary results of the author's research that is still in progress, and which is dealing with the supplier selection problem. This research continues with a focus on development of upgraded methodology, where additional influence factors will be added in the current fuzzy model, as

well as the importance of these indicators will be investigated and implemented in a future model.

### References

- [1] M. Punniyamorthy, P. Mathiyalagan, P. Parthiban, A strategic model using structural equation modeling and fuzzy logic in supplier selection, *Expert Systems with Applications*, 38, 2011, pp. 458-474.
- [2] D. Wu, L.D. Olson, Supply chain risk, simulation, and vendor selection. *International Journal of Production Economics*, 114 (2), 2008, pp. 646-655.
- [3] L. De Boer, E. Labro, P. Morlacchi, A review of methods supporting supplier selection, *European Journal of Purchasing & Supply Management*, 7, 2001, pp. 75-89.
- [4] M. Setak, S. Sharifi, A. Alimohammadian, Supplier Selection and Order Allocation Models in Supply Chain Management: A Review, *World Applied Sciences Journal*, 18 (1), 2012, pp. 55-72.
- [5] H. Moeini, Vendor Selection via Fuzzy Analytic Hierarchy Process: A Case Study, *International Journal of Social Science and Management*, 1 (1), 2014, pp.61-69.
- [6] J.Chai, J.N.K. Liu, , E.W.T. Ngai, Application of decision-making techniques in supplier selection: a systematic review of literature. *Expert Systems with Application*, 40 (10), 2013, 3872-3885.
- [7] C.A. Weber, J.R. Current, W.C. Benton, Vendor selection criteria and methods, *European Journal of Operational Research*, 50, 1991, pp. 2-18.
- [8] N. Aissaoui, M. Haouari, E. Hassini, Supplier selection and order lot sizing modeling: A review, *Computers & Operations Research*, 34, 2006, pp. 3516-3540.
- [9] F.Tahriri, M.R. Osman, A. Ali, R.M. Yusuff, A review of supplier selection methods in manufacturing industries. *Suranaree J. Sci. Technol.*, 15(3), 2008, pp. 201-208.
- [10] W. Ho, X. Xu, P.K. Dey, Multi-criteria decision making approaches for supplier evaluation and selection: A literature review, *European Journal of Operational Research*, 202 (1) 2009, pp. 16-24.
- [11] G.W. Dickson, An analysis of vendor selection systems and decisions, *Journal of Purchasing* 2 (1), 1966, pp. 5-17.
- [12] C.A. Weber, J.R. Current, W.C. Burton, Vendor Selection Criteria and Methods. *European Journal of Operational Research*, 50(1), 1991, pp. 2-19.

- [13] S.M. Ordoobadi, Development of a supplier selection model using fuzzy logic Supply Chain Management: An International Journal, 14(4), 2009, pp. 314-327.
- [14] J. Wang, B. Yang, P. Sen, Safety analysis and synthesis using fuzzy sets and evidential reasoning Reliability Engineering & System Safety, 47, 1995, pp. 103–118.
- [15] D. Ivezic, M.Tanasijevic, D. Ignjatovic, Fuzzy approach to dependability performance evaluation, Quality and Reliability Engineering International, 24 (7), 2008, pp. 779-792.
- [16] R. Miodragovic, M.Tanasijevic, Z. Mileusnic, P. Jovancic, Effectiveness assessment of agricultural machinery based on fuzzy sets theory, Expert Systems with Applications, 39, 2012, pp. 8940–8946.
- [17] J. B. Bowles, C. E. Pelaez, Fuzzy logic prioritization of failures in a system failure mode, effects and criticality analysis, Reliability Engineering & System Safety, 50(2),1995, pp. 203–213.

# Characteristics of Information Security Implementation Methods

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*Abstract: However information security is supported by national and international recommendations, standards and laws, their implementation fail to deliver the expected results in several cases. In our fast changing world information plays a central role in the operation of organisations. Implementation of information security it is a must for organisations in order to maintain and improve their competitiveness. Companies are working to attain information security by implementing the requirements of ISO/IEC 27001 standard. Governmental institutes follow the instructions of implementing regulations of the legislation in place. The failure of organisations in attaining information security may have several reasons. Our research in this topic reveals that several times the Information Security Management System (ISMS) implemented does not fit the operation of the organisation, its regulations are not applied or simply are not brought into force. There are several ways to implement information security. The most commonly adopted way of implementation is the development of an ISMS and building information security measures around it. Some organisations develop integrated management systems, others implement information security measures in their organisational processes. Applied methods have impact on the effectiveness of implemented information security systems. This study uncovers the most common deficiencies of ISMS. Analyses and compares the most commonly adopted implementation methods based on the acquired professional experience and scientific literature considered relevant by the author. Comparative analysis, uncovers the strengths and weaknesses of applicability and risk of these implementation methods in different operating environments. As a result organisations may use the outcomes in selecting implementation methods to attain information security and handle their risks successfully.*

*Keywords: information security, method, comparative analysis*

## **1 Introduction**

Nowadays most of the organisations depend on information processing services. These services can be delivered by the organisations themselves, partners or service providers. Sometimes organisations outsource some of their business as

well as management and operation processes. In this environment employees and partners process information in order to efficiently and effectively execute processes, improve and maintain the competitiveness of their organisation.

According to the international standard ISO/IEC 27001, information security means confidentiality, integrity and availability [1, 2]. The fact that we mention information security, means that this is not only a technological question. During its implementation all possible occurrences of information available in the organisation should be considered. Complex information protection measures should be placed in operations which support activities of organisation processes executed by employees and partners to enforce security, independently of whether they are supported or not by information systems. Security measures according to the threat types can be classified into physical, logical, organisational and life-cycle related categories.

Organisations depending on their sector and development level apply different types of information technology. The threats affecting the data stored and processed by information systems, depend on the applied technology. Security measures applied to protect information systems should align to their implemented infrastructure.

However, today the business data and information is stored and processed in information systems, printed and spoken versions may occur as well. According to this, there are significant information security threats beyond those, related to the information systems, so information should be protected not only in the information systems, but in every occurrence.

The most significant platform independent information security threat is the so called social engineering, which exploits the ignorance, gullibility and helpfulness of the users. Several research papers pay attention to the fact that the user is the weakest point in the protection of information assets. Amongst others [3, 4, 5] Jeimy J. Cano a The Challenge of Transferring Failure in a Digital, Globalized World mentions that the security of most valuable information of the organisation depends on the correct processing by the personnel accessing it [6].

The other common source of threat is the false sense of security awareness, which means that the organisation and its senior management believes, that the security of information is complete in the organisation and nothing threatens it, while there are gaps in the security measures and applied information security tools.

## **2 Data Protection and Data Protection Acts**

Most of the organisations uses, stores and processes personal data. Processing and management of personal data shall adhere to the national and international

legislation on data privacy. Governmental organisations process personal data, while respect local and international legal requirements of personal data protection as well as the principles of transparency. The Hungarian Act CXII of 2011 on information self-determination and freedom (ISDF) conditions which should be fulfilled by organisations handling personal information. The regulations of ISDF state that steps shall be taken to ensure that the confidentiality of personal information is protected. This Act requires the organisations handling personal information:

- to ask consent of the data subject to use the information for the given purpose;
- to announce the processing of personal information to the supervisory authorities;
- to keep records of personal information handling activities (forwarding and processing);
- to provide information to the data subjects upon their request, about their processed and forwarded data to the processing organizations;
- to ensure that personal data is not accessible by unauthorized persons [7].

The data protection requirements fulfill the principles of confidentiality, so it is closely related to information security. This means that organisations should use all of the available measures to guarantee the confidentiality of the personal data.

In the Hungarian public sector, the implementation of information security is enforced by the Act L of 2013 (ISA) [8] and its implementing regulations, mainly the Ministry of Interior decree 41/2015 (ISAIR) [9] which is based on NIST SP 800 53 [10] and ISO/IEC 27001:2013 [2] standards, but somewhat deviates from their requirements. The ISAIR of ISA focuses on the processed personal data amount when classifying information systems into security classes [9].

In the financial sector, in addition to the bank security and banking privacy legal requirements several standards and frameworks enhance information security. The most important of these are the EN ISO 9001:2015 and ISO/IEC 27001:2013, ISO/IEC 20000-1:2011, PCI DSS (Payment Card Industry Data Security Standard) standards, COBIT 5 developed by ISACA. Opposite to ISO/IEC 27001 standard the application of which is optional in the financial sector, the PCI DSS standard is publicly available and its application is mandatory for every organisation handling credit card data transactions [21].

On the other hand Omar Y. Sharkasi in the article entitled Addressing Cybersecurity Vulnerabilities draws attention to the fact that the legislation emerging all around the world to address information security, put the emphasis on the compliance, but neglect the advisory part. The author refers to the following improvements areas of information security [11]:



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- asset inventory and data classification;
- emerging technology risk;
- the effectiveness of risk assessment;
- data residency and cloud computing risk;
- handling of the internal threat;
- end point security;
- dealing with legacy systems;
- file sharing applications;
- maturity of security and remote access;
- cybersecurity test tools.

The national and international standards, legislation and best practices emphasize the risk based protection of information assets and promote the building of an ISMS. To attain this, all data handled by organisation should be collected. Business and operation processes should be analysed in order to identify risks affecting information security. Although the data and organisation processes drive the information security, attention should be paid to the process execution environment: size, location, business strategy, and financial situation of the organisation [12, 13]. The ISMS should be aligned to the business needs, should underpin business process execution, should have sufficient funding and provide adequate security to the organisation.

If the information security is over-regulated by the ISMS, the requirements fulfil the legal and organisational needs, but make expensive the implementation of security measures and execution of business processes.

If the information security regulation provided by the ISMS is weak, compliance with the regulation does not provide the necessary rules to enforce appropriate security for the information assets of the organisation.

The regulation environment of the organisation (legal environment and by-laws of the organisation) influences the boundary conditions of the developed ISMS. It determines the applicable information security classes, the classification rules for data and information systems and the minimum of security measures and assets [9] to be applied. For state and governmental organisations the ISA and ISAIR define the security requirements. For banks and insurance companies the information security requirements are determined by the legal environment of the financial sector.

### **3 Quality Assurance, Controls and Measures**

In several cases participation in tender procedures is limited to organisations having internationally recognized EN ISO 9001:2015 Quality Management Standard [14] certification. For organisations participating in NATO (North Atlantic Treaty Organisation) tender procedures, there are further quality management requirements under the name AQAP (Allied Quality Assurance Publications). This means that organisations having such certificates have a clear advantage compared to those which do not have. Recognizing this advantage, organisations implemented quality management systems and have certified their operations.

The implemented quality management systems usually support not only the business, but the operation processes of organisations too. This usually includes the implemented information systems life-cycle management processes in the organisation. This means proper information handling, to ensure integrity of data necessary for process execution, which is one of the most important components of information security.

COBIT 5 is the leading framework for the governance and management of enterprise IT developed by ISACA [15]. It is built around the idea that the role of IT systems is to enable business processes and generate value for organisations. It is based on the following principles:

- Meeting Stakeholder Needs;
- Covering the Enterprise End-to-end;
- Applying a Single, Integrated Framework;
- Enabling a Holistic Approach;
- Separating Governance from Management.

This framework groups IT governance processes in five domains:

- Evaluate Direct and Monitor (EDM);
- Align, Plan and Organise (APO);
- Build, Acquire and Implement (BAI);
- Deliver, Service and Support (DSS);
- Monitor, Evaluate and Assess (MEA).

The framework uses maturity model to measure the maturity of processes. This model enrolls processes in maturity levels:

- 0. incomplete process – no evidence of systematic achievement of the process purpose;
- 1. performed process – the implemented process achieves its purpose;
- 2. managed process – process implemented in managed mode (planned, monitored, adjusted);
- 3. established process – performed process implemented using a defined process;
- 4. predictable process – established process with defined limits to achieve its process outcomes;
- 5. optimizing process – predictable process continually improved to meet relevant and planned business goals.

The maturity level of executed processes reflects the maturity level of the operation and structure of the organisation, which determines the ability to defend itself against information security attacks.

COBIT 5 support information security with the following publications:

- COBIT 5 for Information Security – supports information security with best practices and methodologies regarding daily operations [16];
- COBIT 5 for Risk – helps implementations of risk analysis based on COBIT 5 [17];
- COBIT 5 for Assurance – provides detailed guidance to IT and internal auditors [18].

## **5 ISO/IEC 20000 standard and ITIL best practices**

In case of large organisations the important business processes and services are supported by several IT services. The design, procurement, implementation, operation, continual improvement and professional retirement of these IT services – functions, infrastructure and processes – play an important role in the delivery of supported business services.

The IT Information Library (ITIL) originally developed by the British Government is an internationally accepted collection of best practices regarding IT Service Management (ITSM). It focuses on optimized delivery of IT services, i.e. providing high quality IT services at best prices. Opposed to the standards and

COBIT which define requirements, ITIL provides best practices as implementation guidelines of ITSM, but the ISO/IEC 20000 standards family based on ITIL provides certification possibilities. The ISO/IEC 20000-1:2011 defines the requirements for a service management system [19]. The ISO/IEC 20000-2:2012 provides guidance on the application of service management systems, including best practices for service management processes [20] within the scope of ISO/IEC 20000-1:2011.

Large organisations operate several IT services and maintain a lot of IT assets. To facilitate their IT operation they need an IT asset database and incident tracking system. Several open source and commercial IT systems are available on the market, which support ITSM processes. The usage of these systems facilitate the availability of IT services and improves integrity of information processed by organisations.

## **7 Relationships of Information Security, Quality Assurance and IT Service Management**

In an increasing number of cases information security is regulated by the legal environment. However having ISO/IEC 27001:2011 standard certification it is not mandatory, organisations being certified have a clear business advantage. Because the value creation, high quality and cost-effectiveness of IT services is indispensable in supporting business services, the implementation of COBIT framework and ITIL best practices is straightforward.

Although the presented standards and best practice frameworks support different disciplines, they overlap, but complement each other as well. This interdependence promotes their integrated implementation. The International Standard Organisation recognizing organisations need to comply with more than one management standard, started to align standard structures to each other. To attain this, they proposed new management standard development guidelines and made proposal for common structure schema in the “High level structure, identical core text, common terms and core definitions” [22] published in the ISO/IEC Directives, Part 1, Consolidated ISO Supplement 6<sup>th</sup> edition 2015.

Regarding information security the following interdependence can be established between quality assurance (EN ISO 9001, AQAP) , ITSM (ISO/IEC 20000, ITIL) and information security (ISO/IEC 27001, COBIT5, ISA) management systems.

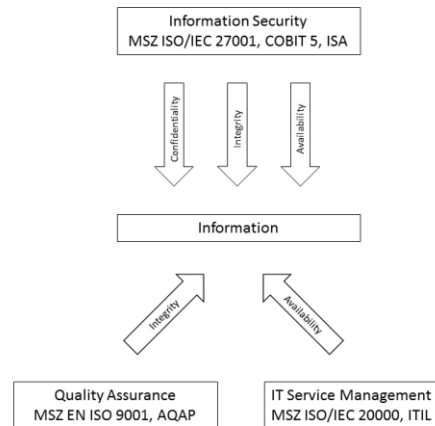


Figure 1.  
Interdependencies of information security, quality assurance and ITSM

## 8 Implementation of Information Security

Information security is a dynamic state. It depends on the ISMS and security measures implemented by the organisation. These security measures may consist of: security awareness of employees, implemented by laws, infrastructure, implemented information systems, etc. To ensure information security changes in business goals, local and international legislation should be taken into account as they affect the services, products, infrastructure and operation of organisations.

The information security is influenced by several factors. The continually changing technology and infrastructure, the daily emergence of new security holes in software, the usage of smart phones, mobile and cloud computing, the widespread of cyber-attacks and advanced persistent threats (APT) constitute serious ongoing risks and present challenges for organisations. Thus periodic analysis of security risks and implementation of security measures do not provide the necessary information security level. To ensure appropriate information security, organisation change management process should be implemented to detect emergence of new security risks and enable implementation of the necessary countermeasures.

Implementation of information security can be achieved using several methodologies. The following chapters describe the most common methods, then an analysis of them outlines their advantages and disadvantages.

## **8.1 Standalone Implementation of Information Security**

In case of standalone implementation of information security based on ISO/IEC 27001 / ISO/IEC 27002 standard, the development of appropriate ISMS plays a central role. To develop suitable ISMS organisations should analyse:

- the structure of the organisation;
- the by-laws of the organisation;
- the data processed by organisation;
- the business processes of the organisation;
- the business support operations processes of the organisation;
- the info-communication and IT infrastructure of the organisation

regarding compliance to the local and international legislation and standards. The ISMS consists of rules and procedures, require security measure implementation to enhance information security. If any non-compliance is found during the analysis, plans should be developed to eliminate the gaps. To develop appropriate ISMS, security measures and operating procedures, organisations should consider the requirements imposed by legislation and standards, technical and financial capabilities of the organisation. Security awareness plays a central role in the implementation of information security too. Beyond security awareness education, employees should be involved in the implementation of security measures, to improve their attitude to information security.

To attain a steady information security state, organisations should implement a cyclic information security planning process, consisting of the following tasks:

- analysis of current situation – gathering of data assets, identification of organisation processes, assessment of information infrastructure;
- threat analysis – identification of relevant threats regarding data, processes and infrastructure of the company;
- suggestions for immediate actions – if there exist threats, which can be handled with minimal resources and efforts;
- risk analysis – analysis of damages (economic, prestige, legal) caused by identified threats in case they realize, identification and ranking of risks, development of risk handling proposals;
- decision on risks to be handled – based on the risk analysis and handling proposals;
- Implementation of security improvement measures.

## **8.2 Integrated Implementation of Information Security**

In several cases organisations have implemented or plan to implement quality management and IT service management systems too. In these cases organisations should consider implementation of the ISMS integrated with these management systems.

ITIL as the best practice of ITSM covers the life-cycle of IT services from the service strategy through service design, service transition, service operation and continual service improvement until retiring them. Its recommendations consider information security and quality management, but does not cover them.

The organisations operating EN ISO 9001 standard based quality management system covering the whole organisation, have quality assurance processes in place for the management of business and operations processes. Their quality assurance activities ensure integrity of the information used in business activities to provide high quality products and services.

In case of organisations which operate quality management and ITSM systems, most of the requirements of ISO/IEC 27001 standard are available incorporated into business, management and operation processes. The requirements not already incorporated in organisation processes, can be easily identified using gap analysis, then implementation plans should be developed to integrate them into the management system of the organisation.

In case of parallel implementation of quality, information security and service management system, considering that International Standard Organisation developed a common management structure schema to support the integrated implementation, development of an integrated management system should be considered first, then filled in with the requirements of the standards.

As the requirements of these standards overlap partially and complement each other, their requirements should be compared and filtered to exclude the redundancy. To support this, correlation, tables were developed which help selection of the requirements which should be implemented. The implementation order of the requirements of standards may be influenced by the legal environment, but should be considered that information security measures are supported by quality and ITSM system processes.

## **8.3 Process Oriented Implementation of Information Security**

Because nowadays the operation of business, management and operation processes cannot be imagined without processing, storing and forwarding information, the employees executing organisation processes must protect the information they work with.

In case of process based information security implementation opposite to standalone and integrated implementation methods, the main focus is on information protection during process execution. This brings into the light the quality management tasks based on EN ISO 9001 standard too. During process based implementation it is need for:

- detailed assessment and modelling of business processes [27];
- risk assessment of business processes and ordering them by criticality [26];
- process execution analysis and for process activities [25]:
  - identification of the affected data;
  - determination of the criticality of processed data;
  - determination of the accessible/modifiable set of data for the execution roles [24];
- training data, process and application owners and participants in process execution to protect the processed data;
- preparation of the IT infrastructure and supporting processes to protect the processed data;
- training employees to the secure execution of IT systems supporting organisation processes;
- implementation of ISO/IEC 20000 standard or ITIL based ITSM processes complemented with ISO/IEC 27001 standard requirements;
- development and implementation of the missing ISMS regulations and procedures based on ISO/IEC 27001 or ISA and ISAIR;
- organisation change management process implementation to enable detection of information security risks;
- periodic review of organisation processes information security.

The process oriented implementation of information security, improves IT system security by enabling data protection by design technics [23].

An implemented EN ISO 9001 based quality management system facilitates the information security system process based implementation. It is indispensable the participation of professional process management and IT service management consultants in the implementation. Process management training to the data and application owners is critical to the process based implementation of information security.



## 9 Comparison of Information Security Implementation Methods

The following table compares the different kind of information security implementation methods advantages and disadvantages.

Method	Advantages	Disadvantages
Standalone	<ul style="list-style-type: none"> <li>• It is easy to identify the requirements of the standard or law chosen as basis for implementation.</li> <li>• Verification of materialization of the planned security measures is easy.</li> <li>• Lower initial cost.</li> </ul>	<ul style="list-style-type: none"> <li>• Risk that criteria formulated in the ISMS may not realise in practice.</li> <li>• The risk of too strict by-laws, which are:                             <ul style="list-style-type: none"> <li>○ unenforcable;</li> <li>○ obstruct the work;</li> <li>○ generate additional cost.</li> </ul> </li> <li>• Risk that affected employees who does not participate in the development of by-laws, will not comply with them.</li> <li>• Risk that implementation does not address the specific details of the business/ operating processes.</li> <li>• The standard and laws does not provide practical guidance on implementation of security measures.</li> <li>• IT may happen that the implemented security measures does not ensure the necessary protection.</li> </ul>
Integrated	<ul style="list-style-type: none"> <li>• ITIL best practices provide guidance on development and implementation of some security measures.</li> <li>• Verification of the</li> </ul>	<ul style="list-style-type: none"> <li>• The requirements to be applied have to be selected from the requirements of standards and laws selected for implementation.</li> <li>• The inadequately designed and</li> </ul>

Method	Advantages	Disadvantages
	<p>planned security measures materialization is easy.</p> <ul style="list-style-type: none"> <li>• The security measures designed and implemented according to the quality management system meet the expectations.</li> </ul>	<p>implemented ITSM processes obstruct the work.</p> <ul style="list-style-type: none"> <li>• The risk too strict by-laws, which are:               <ul style="list-style-type: none"> <li>○ unenforceable;</li> <li>○ obstruct the work;</li> <li>○ generate additional cost.</li> </ul> </li> <li>• Risk that affected employees who does not participate in the development of by-laws, will not comply with them.</li> <li>• Risk that implementation does not address the specific details of the business/ operating processes.</li> <li>• Higher initial cost.</li> </ul>
<p>Process based</p>	<ul style="list-style-type: none"> <li>• With detailed analysis of organisation processes, higher level security level can be attained.</li> <li>• IT is suitable for implementation in small organisations with few processes.</li> <li>• The implementation cost depends on the number of organisation processes.</li> </ul>	<ul style="list-style-type: none"> <li>• In case of large number of organisation processes, the implementation depends more on process owners and participants, so in some conditions it may fail.</li> <li>• The development and implementation of ITIL based support processes is indispensable for a successful implementation.</li> </ul>

Figure 2.

Comparison of information security implementation methods

## **Conclusions**

Whatever information security implementation method (standalone, integrated, process based) is selected:

- requirements of standards and laws should be fulfilled;
- management support is critical to achieve the goals;
- supporting stakeholder needs, facilitate implementation of information security;
- ITSM implementation support information security implementation.

Standalone implementation worth considering in the case when no other management standards are implemented nor planned.

The process based information security implementation method:

- uses a bottom-up approach, therefore facilitates realization of higher level security awareness;
- is straightforward to implement in organisations with small number of organisation processes;
- is more challenging to carry out in organisations with large number of organisation processes.

Integrated implementation of information security with ITSM and quality management, support practical IT service management and provides better quality business process support.

## **References**

- [1] Information Technology. Security Technics. Information security management systems. Requirements, ISO/IEC 27001:2005, 2005.
- [2] Information Technology. Security Technics. Information security management systems. Requirements, ISO/IEC 27001:2013, 2013.
- [3] Ernst & Young: Get ahead of cybercrime EY' Global Information Security Survey 2014 (p. 40); [http://www.ey.com/Publication/vwLUAssets/EY-global-information-security-survey-2014/\\$FILE/EY-global-information-security-survey-2014.pdf](http://www.ey.com/Publication/vwLUAssets/EY-global-information-security-survey-2014/$FILE/EY-global-information-security-survey-2014.pdf) (downloaded: 2015.02.27.)
- [4] PwC: Managing cyber risks in an interconnected world. Key findings from The Global State of Information Security® Survey 2015 (p.42);

- <http://www.pwc.com/gx/en/consulting-services/information-security-survey/index.jhtml#> (downloaded: 2015.02.27.)
- [5] A Frost & Sullivan Market Study in Partnership with ISC2: The 2013 (ISC)2 Global Information Security Workforce Study (p.28); [www.isc2cares.org/uploadedFiles/wwwisc2caresorg/Content/2013-ISC2-Global-Information-Security-Workforce-Study.pdf](http://www.isc2cares.org/uploadedFiles/wwwisc2caresorg/Content/2013-ISC2-Global-Information-Security-Workforce-Study.pdf) (downloaded: 2015.02.27.)
  - [6] Jeimy J. Cano: „The Challenge of Transferring Failure in a Digital, Globalized World,” *ISACA Journal.*, vol 5., pp. 37-42, Jun. 2015.
  - [7] 2011. évi CXII. törvény „Az információs önrendelkezési jogról és az információszabadságról,” *Magyar Közlöny.*, vol 88., pp. 25449- 25486, Jul. 2015.
  - [8] 2013. évi L. törvény „az állami és önkormányzati szervek elektronikus információbiztonságáról,” *Magyar közlöny.*, vol. 69, pp. 50241-50255, Apr. 2013.
  - [9] 41/2015. (VII. 15.) BM rendelet „az állami és önkormányzati szervek elektronikus információbiztonságáról szóló 2013. évi L. törvényben meghatározott technológiai biztonsági, valamint a biztonságos információs eszközökre, termékekre, továbbá a biztonsági osztályba és biztonsági szintbe sorolásra vonatkozó követelményekről,” *Magyar Közlöny.*, vol. 103. pp. 17700-17750. Jul. 2015.
  - [10] *Security and Privacy Controls for Federal Information Systems and Organizations*, NIST SP 800-53, 2013.
  - [11] Omar Y. Sharkasi: „Addressing Cybersecurity Vulnerabilities,” *ISACA Journal.*, vol 5., pp. 19-29, Jun. 2015.
  - [12] Alan Calder, „Scope definition,” in *Implementing Information Security based on ISO 27001/ISO 27002*, 2nd ed. Zaltbommer, Netherlands: Van Haren Publishing, 2009, ch. 11, pp. 35-38.
  - [13] Alan Calder: „Nine Steps to Success: An ISO 27001 Implementation Overview,” 2nd ed., *IT Governance*, UK, 2013.
  - [14] *Quality management systems. Requirements*, EN ISO 9001:2015, 2015.
  - [15] *COBIT 5*, ISACA, Rolling Meadows, IL, 2012.
  - [16] *COBIT 5 for Information Security*, ISACA, Rolling Meadows, IL, 2012.
  - [17] *COBIT 5 for Information Risk*, ISACA, Rolling Meadows, IL, 2013.
  - [18] *COBIT 5 for Assurance*, ISACA, Rolling Meadows, IL, 2013.
  - [19] *Information technology - Service management – Part1: Service management system requirements*, ISO/20000-1:2011, 2011.

**Management, Enterprise and Benchmarking in the 21<sup>st</sup> Century**  
Budapest, 2016

- [20] Information technology - Service management - Part2: Guidance on the application of service management systems, ISO/20000-2:2012, 2012.
- [21] Payment Card Industry (PCI) Data Security Standard v3.1 Requirements and Security Assessment Procedures, PCI SCC Standard PCI DSS v3.1, 2015.
- [22] ISO/IEC: "High level structure, identical core text, common terms and core definitions," in ISO/IEC Directives, Part 1, Consolidated ISO Supplement – Procedures specific to ISO, 6th edition, 2015.
- [23] George Danezis, Josep Domingo-Ferrer, Marit Hansen, Jaap-Henk Hoepman, Daniel Le Métayer, Rodica Tirtea, Stefan Schiffner: Privacy and Data Protection by Design, ENISA, 2014.
- [24] Haijo Roelcke, Gerhard Schimpf, Rupert Weidinger: Process-oriented approach for role-finding to implement role-based security administration in a large industrial organization, RBAC '00 Proceedings of the fifth ACM workshop on Role-based access control, 2000, pp.103-110.
- [25] Rodriguez, Alfonso Fernandez-Medina, Mario Eduardo Piattini: A BPMN Extension for the Modeling of Security Requirements in Business Processes, IEICE TRANSACTIONS on Information and Systems, Vol.E90-D. No.4. 2007. pp.745-752.
- [26] Risk management - Principles and guidelines, ISO 31000:2009
- [27] Arthur Tenner, Irving DeToro: BPR – Process Redesign. Prentice Hall, 1996.

## **Organisations in Digital Age – Information Security Aspects of Digital Workplaces**

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*Abstract: The digital age – although differently in each sector and area – is present in the life of all the companies. It means not only the IT support of planning, production, manufacturing, warehousing, trading, etc. processes, because they have already been applied for several decades and developed permanently. The digital age strongly affects the entire company, all the divisions, departments, sites, and all the employees and executives working there. The concept of digital workplace, however, goes beyond the traditional physical framework of the company, because teleworkers, suppliers and customers are also connected into the IT processes. The information has become a new type of economic commodity, acquiring, possessing or owning it, and the control above it has become an increasingly serious and complex aspect of the company's success. In spite of the fact, that the success of the business is the well-understood interest of the company's stakeholders (employees, employers, owners, suppliers, etc.), in a lot of cases the (not always) ethical hackers dealing with social engineering are able to find the weak points of the company's information system through the human side of information security, due often to human negligence and irresponsibility. Our own research – involving more than 400 people from the executive staff of Hungarian companies – has led to the conclusion that only a very few of them have appropriate information security awareness. Therefore a chapter of our study introduces some possible forms of human attacks against digital workplaces and the prevention of these attacks.*

*Keywords: information security, social engineering, digital age, organization, workplace, employee*

# **1 Our present age, the digital age**

## **1.1 Introduction**

The digital age first had existed parallel with, but later replaced the information age. The most typical feature of digital age [1] is that the phenomena, reaching us from the outside world and perceived (heard, seen, etc.) or not perceived by our senses, are digitalized at the earliest possible stage of information processing. These products can be shared with much more people and more quickly (contagious spreading) than conventional goods. When a digital date/information is entered in a network environment, it becomes practically undeletable. The digital age started in the first decade of the 21<sup>st</sup> century. Although its antecedents had been described earlier [2], the fundamental works were published later [3], and [4], as well as [5] and [6]. The digital age has brought some new economic and social models and some processes have begun in the information society with the help of which people (including all the aspects of the concept) have started to use IT devices and applications (hardware and software) on a daily level, and they have become connected with each other regardless of their distance in the physical world (wired world). In addition to money (and sometimes even overtaking it), information (the sacrifice made for obtaining it, the content, the analysis of its content, etc.) has been gaining weight.

## **1.2 Employees in the digital age**

At the moment the groups of veterans, baby-boomers, X, Y, Z and the alpha generations can be distinguished in the society. As employees, the veterans (born between 1925 and 1945) are mostly out of the labour market already, while the members of alpha generation (born after 2010) are not yet on the labour market.

Out of the generations, the baby-boom generation (born between 1946 and 1964) makes up a significant proportion of labour market, but many of them are preparing to retire now. They use the digital devices, but they first met these at the age of 30-40. The members of X generation (born between 1965 and 1979) form the backbone of the labour market (together with the members of baby-boom generation, they are mostly the employees aged above 45 years). They met digital devices as teenagers. The members of Y generation (born between 1980 and 1995) are the careerists, because most of them have several years of work experience or still study somewhere. For them the use of digital devices – since they have been using these from their early childhood – does not mean any problems. The Z generation (born between 1996 and 2009) was dripped into the world of internet, they are still studying or some of them are already employed. Those born in the last third of Z and Y generations (after 2004) are very interesting in regard to

workforce management, because they represent different set of values, and work differently than their predecessors. They are less in numbers, the labour market demand is increasing for them. It is a problem, that there is one pensioner per 2.4-3 members of Z generation in the developed countries which is going to pose serious challenges for the state care systems. Those who were born after 2004 have difficulties to tolerate the corporate regulations, they are harder to integrate into the business organisation. One of the reasons is that, as freeters, they have built personal brands and work towards self-realization. The realization of their own dreams is much more important for them than to achieve the objectives and represent the interests of the company. They long for freedom, and they usually achieve it due to their status on the labour market. They might be ready even for unemployment or atypical employment. Since they know and confidently use the latest digital devices, techniques, applications and services, it is not a problem for them to be engaged in teleworking, to understand teleworking processes and to actively participate in them. They punish, although not deliberately, the older employees (digital immigrants) because they move more comfortably in the (virtual) working environment built up by bits and bytes, and they are impatient and less tolerating with their older colleagues who have only shallower knowledge and make slower use of devices.

The members of the above mentioned young generation(s) pose new challenges to the organisations. Due to the increasing generation gaps (the basis of which is the seemingly irresolvable digital gaps), and the lack of understanding of the “special” functioning of younger employees, the knowledge, role plays and case analysis connected with Z generation have been included in the further training of the (senior) executives of companies and in the range of professional services (e.g. coaching) offered for them. Although the traditionally functioning HR of the companies know and, some of them, apply the atypical forms of employment for a smaller group of employees, but they are not prepared to change the employment policy of the company in order to include mostly freeters and teleworkers in it. In theory, there are many good reasons for atypical employment, but at the moment, - besides the members of Z and Y generations and disabled employees - neither the X generation and the baby-boomers, nor the employment side or the business organisation itself are able to provide work organisation, working conditions or to create value based on digital platforms (teleworking). The atypical employment is approved and frequent in case of project companies and startup enterprises, but their current contribution to the GNP is minimal.

### **1.3 Employers in the digital age**

The digital age is not simply a problem to solve for the company with a clear beginning and end, similarly to a project plan. The change-over to the digital age is a long-term decision which requires serious reorganization regarding the whole operation of the company, (internal) training, reconsideration of work processes,



more adequate measuring of performance, (hopefully) seamless connection to suppliers, (corporate) buyers, radical transformation of the content and platforms of internal-external communication – just to mention some of the main areas. The change-over concerning multiple areas is a lot easier for smaller or newly established enterprises, startups (the use of digital platforms from the beginning), while the larger companies, or those operating for a longer time, usually determine in multiple stages/milestones how to realize the transformation according to the requirements of the digital age e.g. in regard to employer and employee relations. Schillerwein [7] in his Infocentric study in 2013 distinguishes four steps of this process, as it is described in Table 1:

	<b>First step</b>	<b>Second step</b>	<b>Third step</b>	<b>Fourth step, and then...</b>
<b>Title</b>	Basic Intranet	Extended Intranet	Basic Digital Workplace	Full Digital Workplace
<b>Business focus</b>	Give information	Enable general interaction	Support actual work	Business transformation
<b>Focus of applied technology</b>	Ensure content	Cooperation	Portal and search	Other, specified by the company
<b>Main features</b>	(Internal) news Information libraries Self-service solutions for employees Simple applications	Basic social media and cooperation General process support Extended employee profiles Updated applications Personalization (customization)	Developed social cooperation Developed integration and applications Strong employee profiles Developed and more determined processes (eg.: project, innovation, frontline management) All kinds of information support and processing	Holistic process support in the whole organisation and beyond Meta-functionality (e.g.: social, cooperation) integration in all the areas Content- and intelligent filtering Almost smooth integration Universal inboxes Permanent transformation of the company Driving force: change, culture, commitment

Table 1  
 From the Intranets to the Digital Workplace

The employer side – especially the (top) executives in decision-making situations – should change employees, organisations and the tools/processes with the help of (reformed) way of thinking, considering the capabilities and abilities. McConnell [8] identifies nine areas which concern the company in the digital age and in the replies given to the challenges of the digital age:

- 1 Leadership: pays attention to all the parts and all the levels of the company which have impact on changes. If required, the furthestmost parts (e.g. subsidiaries, foreign branches) should be directly involved, monitored and directed.
- 2 Organisational culture: employee attitudes, expectations and behaviour in an open, receptive working environment. If required, the basic values forming the organisational culture should be changed.
- 3 Organisational processes: Launching new and updated organisational/business processes which integrate the social collaboration. If required, significantly more independent/freelancer developers, testers, test buyers, business partners should be involved even in the early phase of processes.
- 4 Organisational structure: virtual operational environment, where groups, communities and networks cooperate. If required (1) the operational environment should be extended to the social media (e.g. the Facebook page of the company where the customer/consumer reactions can be permanently tracked), (2) a new virtual operating environment should be developed which increasingly meets the comfort and communication requirements that have already been usual in the physical world.
- 5 Access: equal, relevant and interactive access for all the employees in the whole working process, so that they can connect to the (protected) IT resources of the company from anywhere, anytime with any type of communication device. If required, the IT department of the company should be supported with more funds in order to ensure the due implementation of all the developments which ensure the maximum protection of company databases and other resources against unauthorized hacking/break-in .
- 6 Company: cooperation in all directions, including the entire company. If required (1) the (digitalised) platforms of cooperation with suppliers, subcontractors and customers should be reconsidered and changed; (2) the seamless cooperation of colleagues should be supported with all kinds of (organisational development) tools, methods and possibilities (e.g. training, courses, joint programs, playful competitions).
- 7 Business: the clients, partners, users and buyers of the company's products and services should be served to the maximum. If required, new digital communication platforms – which meet their needs – should be introduced and regularly used (e.g. WEB 2.0).
- 8 Personal development: supporting programs which focus on creative, cooperative employees, who are glad to share their knowledge/expertise, permanently develop their knowledge, easily work in teams and easily adapt to the permanently changing environment. These programs aim to develop these types of competencies, skills/abilities. If required, the above qualities should be put in front of the actual professional knowledge (it is easier e.g. to train a

programmer than to find an employee with the above detailed parameters or to develop these abilities in the current ones).

- 9 Resource-evaluation: the digital work environment/workplace is regarded as strategically important and inevitable resource which is a key to the future of the company. If required, the corporate values and resources should be reconsidered and even the basic charters (philosophy, mission, vision) re-defined.

## **2 Information security of digital workplaces**

### **2.1 Introduction**

In our opinion, the ideas about digital changeover [7] and [8] as well as the digital challenges concerning the organisations ignore a very important area, namely the information security. The data, information and the knowledge created from this, has become an asset, and it has resulted increasingly stronger cybercrimes [9], the victims of which – especially the victims of criminal groups – are not only individuals, but the company itself, including the staff, leaders and top executives. The attacks are not simply pranks, but crimes causing serious damages to the company. While at international, and thus at European level, the companies in almost all the countries address the protection and security of data from IT aspects [10], the human factor, as well as the social engineering focusing on it, is still a critical area in information security

### **2.2 The social engineer**

Social engineers – although they use some IT solutions – are rather special because they possess some practical psychological and communication knowledge, and - adapted to the given situation - apply it efficiently. The social-engineer-type attackers can be the staff, leaders, interns of the company, professionals dealing with the activities of the company, employees and leaders of suppliers, customers, as well as staff and leaders of corporate customers, clients, partners, visitors, staff of sub-contractors, practically anybody. According to a former survey done by Deloitte Touche Tohmatsu [11], 91% of company representatives think that their employees directly or indirectly can pose a threat in IT sense. More than three-fourth of them, however, do not enable their staff to collect knowledge or to update their current knowledge concerning information security. Although in the last eight years, information security awareness has moved in the right direction in Hungary (too) and part of the managers (especially

the members of Y and Z generations) are committed (or said to be committed) to information security, the daily practice proves that even a not-too-creatively elaborated social-engineering-type attack can succeed.

### **Empirical research**

The present study regards all the places as digital workplace where work is made with the help or with the use of info-communication devices, data are created, processed, stored, modified, handled, analysed, conclusions are drawn, then, after some time, these data are destroyed. Thus, besides the sites used for official working activities by the company and/or its partners, the concept is extended to the sites of meetings and talks (e.g. restaurant, tea rooms), the home offices of teleworkers and partners, as well as other places suitable for working. Due to the expanded interpretation of the concept, the employee who has appropriate info-communication devices (laptop, tablet, smart phone), applications, and usually permanent internet connection can work anywhere.

Our hypothesis are as follows:

- Hypothesis one: The majority of corporate executives and managers are very uninformed of new challenges of information security.
- Hypothesis two: While the company – in theory – can have stronger control of the information protection of fixed devices (e.g. desktop computer) of offices, workshops, etc. in its own or rented buildings, in case of portable devices, these regulations – which are usually available in written form as well - can be easily breached, either deliberately or by negligence and carelessness.

The opinion of Hungarian executives regarding digital age was surveyed with the help of an online questionnaire of multiple questions between December 2015 and January 2016. The title of the survey was: Organizations in the digital age. All those staff members were regarded as leaders who line-managed at least one employee and had decision-making competency in certain questions.

Altogether 406 people gave assessable responses to the questionnaire. Due to the limits of the study, it should be mentioned that regarding the acronyms which describe the digital age, the survey asked the concepts belonging to the acronym CAMSSA (cloud, analytics, mobile, social media, security and augmented reality) in open question.

It turned out from the analysis of more frequent and more interesting responses that some of the interviewed executives did not even know the information security risks of the mentioned areas. Regarding the security notion of digital age, we did not want to narrow down the response opportunities by asking the leaders to focus only on data, IT and information security. In spite of this, their replies

concerned, almost without exception, the data security, network security, IT system, access codes and antivirus protection. They did not mention the human aspects of information security or social engineering at all, although the digital workplaces can suffer from social engineering type attacks. The most frequent are as follows:

- Collecting information from the staff in places adjacent to the company (e.g. freely accessible places – courtyard, designated places for smoking, restaurants nearby). The most frequent methods of protection are:
  - preparing the staff for situations like these,
  - excluding those from the conversation who are strangers to the group,
  - the topics of the conversation are about e.g. the hobbies of the colleagues, and not about the company,
  - when it is not being used for entering or identification, the access cards of the staff (ID cards with names and photo) should be held in a way that the data on the card cannot be seen by others. If the card is lost, it should be reported immediately.
  - business lunches should not be held in places where the intimacy of the talks cannot be ensured (although technically a conversation can be easily tapped in any of the public places),
- Unauthorized intrusion in the protected/guarded areas of the company (sites, headquarters, warehouses, office buildings, including offices). The aim can be manifold: to steal info-communication devices, obtain access codes to devices, then, in the possession of these, to steal valuable data and/or uploading harmful applications on the devices. The most frequent methods of protection are:
  - strict admission control (e.g. recording personal identification documents),
  - short-spoken information to the visitor (the history of the company and the actual gossips should not be shared) ,
  - a phone call to the colleague who hosts the visitor in order to check if they expect visitors indeed,
  - providing the name of the expected visitors to the security guards prior to the visit,
  - locking the doors of offices when staff is not in,
  - shutting down the computers or switching to sleep mode with password protection when staff is not nearby or in the office ,
  - destroying all the office waste created in the office (e.g. contracts, drafts, reports) in a professional way.

- Unauthorized intrusion in the home or home office of teleworkers. Since they are the furthestmost from the focus of information security of the company, the implementation of protection is the most difficult in these cases. The company can do the following:
  - can make the employee aware of the possible attack,
  - can provide increased protection for the info-communication devices used by the employee for work (e.g. password entry, tracking in case of being stolen, remotely controlled switch of camera and/or microphone),
  - can ensure the protection of the working environment at home and provide financial support for the purchase of a shredder for the employee if necessary,
  - can regulate what platforms and which places are to be used for work by the teleworking employee.
- Attack from a partner (e.g. supplier, corporate buyer). These attacks can be ranked in two groups: (1) deliberate attack on behalf of the partner, (2) attack using the good faith or inattention of the partner. In these cases the intruder attacks not only the company, but the partners as well. The harmonization of this area is one of the most difficult corporate tasks because the companies should share their regulations concerning information security with each other, in order to develop an efficient and joint safety awareness.

## **Conclusions**

The first part of our study discusses digital age and the employees of digital age. By segmenting the employees according to generations we underlined that the members of the younger generation(s) pose new challenges to the organisations. There is not only a generation gap in regard to info-communication tools and applications used by the generations, but new types of management procedures and the increasing share of atypical employment forms should also be considered. The transition into the digital age is not a one-time job, the companies and the employees should permanently implement the solutions, services and developments offered by digital age, in order to maintain their market positions and competitiveness. The highest stage in this process is the Full Digital Workplace where business transformation is put in the focus of business. It has been concluded that although digital age concerns the companies in several fields (according to our references: in nine fields), the information security - especially the human information security – is not really discussed by the referred authors. Our theoretical statement has been examined empirically, too, by analysing the responses given to our survey by more than 400 employees working in executive status. Both of our hypotheses can be regarded confirmed because (1) the majority

of corporate executives and managers appeared to be uninformed concerning the new challenges of information security; (2) the majority of the surveyed companies know IT regulations only regarding the physical locations and equipment belonging to their own supervision, and beyond this, they handle the issues with a certain negligence. That is why, in the last chapter of our study, we consider it important to introduce the main social engineering type attacks on companies, as well as the frequent ways of protection against these attacks.

Finally it should be noted that there are more and more hacker attacks against companies which indicates that information security should be given much higher priority than before. The analysis and evaluation of attacks, as well as the honest and objective internal communication about attacks can be the basis of moving the security attitude of employees in positive direction.

## References

- [1] Kollár, Cs. (2014). *Communication in the digital age*. Budapest, HU: PREMA Consulting.
- [2] Dyson, E. (1998). *Release 2.0*. London, UK: Broadway.
- [3] Saphiro, C. & Varian, H. R. (1999). *Information Rules: A Strategic Guide to the Network Economy*. Boston, MA: Harvard Business School Press.
- [4] Levine, R., Locke, Ch., Searls, D., Weinberger, D., McKee, J., Rangaswami, J. P. & Gillmor, D. (2001). *The Cluetrain Manifesto: The End of Business as Usual*. New York, NY: Basic Books.
- [5] Kehal, H. S. & Singh, V. P. (2004). *Digital Economy: Impact, Influences and Challenges*. London, UK: Idea Group Publishing.
- [6] Lessig, L. (2004). *Free culture. How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity*. New York, NY: Penguin Group.
- [7] Schillerwein, S. (2013). *Digital Workplace Framework*. (electronic presentation): <http://www.slideshare.net/IntranetMatters/digital-workplace-framework?related=1>
- [8] McConnell, J. (2015). *The Workplace in the Digital Age*. (electronic presentation): <http://www.slideshare.net/NetJMC/e2-summit2015-netjmc>
- [9] Mitnick, K. D. & Simon, W. L. (2005). *The Art of Intrusion: The Real Stories Behind the Exploits of Hackers, Intruders and Deceivers*. Indianapolis, IN: Wiley Publishing.
- [10] Schneier, B. (2008). *Schneier on security*. Indianapolis, IN: Wiley Publishing.
- [11] Oroszi, E. D. (2008). *Social engineering*. Budapest, HU: BCE

# Misunderstanding how Passwords Work

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*It has always been an important security issue to prevent unauthorized access to our resources and it becomes more and more important as we go along in the digital era. Both possession based and biometric methods has been evolving fast and many experts say that the knowledge based methods, passwords, are not secure enough. In the present paper I prove that passwords in alone can be safe enough providing a publicly known case that shows that serious problems may occur if so-called experts give false advice to average users.*

*Keywords: user authentication, password*

EconLit subject descriptor: L860 - Information and Internet Services; Computer Software; JEL code: L860 - Information and Internet Services; Computer Software

## 1 Technical background

### 1.1 Authentication methods

Different kind of methods to authenticate users can be classified into three groups: knowledge based, possession based and biometric methods.

First of them relies on the supposition that there is something that is known only by the legitimate user. So if someone can provide that data element, a password or PIN usually, that person should be the legitimate user.



In case of possession based methods the situation is similar. The legitimate user is the only one who possess a particular thing, a cellphone SIM or an RSA token for example, so if someone can prove that they have that particular thing they should be considered the legitimate user.

In the third case an attribute of the human characteristics, physiological or behavioural, is used to identify the legitimate user, such as a fingerprint or the dynamics of handwriting.

Each of these methods has its advantages and disadvantages. Summarizing them in short we found especially the price and the complexity of these methods can differ very much.

Passwords are for free, or at least we have no clear method to calculate its cost. Obviously, when the users don't keep the basic rules attackers may have good chances and the same goes for the lazy and not up-to-date sysadmins.

In case of possession based methods there are, at least, two different situations. First situation is when you have to give a unique object, an RFID chip for example, to each of the users, and reader devices must be applied at each entry point, as many as the required throughput would need it. Both the readers and the objects given to the users have their prices. While an RFID chip is cheap an RSA token is quite expensive not to speak about the server side software. If users use their own devices, their cellphones for example to receive an SMS for a login passcode, this method may be cheaper.

If someone decides to use a biometric method only the reader devices should be purchased, at least one device for each entry point. These devices must not be too simple unless one needs an easily hackable system and that has no points. The reader device must be smart enough to distinguish whether a living human is standing in front of it or not. If the cheap and simple face recognition system can be hacked by a printed photo of the legitimate user that system is of no use. Matsumoto Tsutomu proved in 2002 that fingerprints can be transformed into artificial gummy fingers without difficulties. [1] Nowadays a photo machine, even a mobile phone with a builtin camera, may be enough to get the fingerprint of the target person, as at the Chaos Communication Congress it was demonstrated using some photos of the German Minister of Defense from a public event [2]

Complexity is also an interesting point. The knowledge and the possession based methods need a very simple programming procedure, the data element provided for identification by the user should be checked whether it can be found in the stored list of the data elements of the legitimate users or not. This needs a simple search algorithm that is usually taught on about the third programming lesson. The result of the checking is a definite true or false depending on the circumstance whether the data element, a password for example, provided by the user could or could not be found in the stored list.

Biometric methods are rather complex, needs significantly more sophisticated analysing methods than the simple search algorithm. The more complex a system is the more possibilities an attacker may have to hack it. In addition in case of biometric methods the answer is not a simple true or false, but rather a probability. Very important quality measures of biometric methods are the false positive (FAR) and false negative (FRR) rates.

So on the basis of the outlined comparison above passwords will not soon disappear so it is our interest to see how the password based authentication can be made secure enough.

## 1.2 What makes a good password

It can easily be acknowledged that there are two general axiom-like requirements related to passwords. First: users should be able to keep their password(s) in mind. The second is that it must not be guessable by others.

Most users won't keep passwords like *Shk17#4WLM!* in mind, but more likely they will write it down somewhere and that place is within an arm's length from the computer.

The guessing methods have developed a lot since the beginning.

The most easiest for the attacker is when users use a basic password from the top ten (or top hundred) list, such as *asdfgh*, *123456*, *password*, etc.

The next level when the users selects a password that is specific for themselves, such as the date of birth, the name of their favourite actors or pets. Barack Obama's twitter account was cracked because of using this kind of a password (see below).

Another not too lucky method is when there is a formal connection between the login name as a string and the password as another string, such as *admin – admin*, *admin – admin01*, for example.

Also not a clever choice when there is an obvious logical relationship exists between the login name and the password, for example *chuck – norris*, *jamesbond – 007*, etc.

Selecting any passwords according to the above mentioned bad practices is a serious irresponsibility of the users themselves. These kind of passwords could be guessed even online. From this point onwards the online guessing won't work unless the system administrator (or the security management) is too weak. The following methods usually used offline, when the shadow passwords could somehow be stolen from the system.

The next step for guessing someone else's password is the dictionary attack. In this case the attacker uses a list of probable passwords (top 100, top 1000 ones), at last

a long list of all the words from the dictionary of the given language and a program that tries out these words one by one. This means that users must not pick up any words that could be found in any dictionaries as passwords.

As there are a lot of real life password lists came into light in the past some years attackers have the possibility to make statistical analyses to decide the most frequent password structures. The author of this paper, too, made such an analyses on the password list of rockyou.com containing about 32 million passwords that shows that passwords containing only 6-9 lower case letters were 17.3%, and six lower case letters followed by two digits were nearly 3%. [3] Knowing the most common password structures dictionary based attacks can be optimized.

The last tool of an attacker is the brute force method, when an optimized software tries all the possible character combinations – it will *find* the password, the only question is that *when*. The efficiency of the brute force attack depends on the computational capacity the attacker has and the quality of the hash function used to calculate the shadow passwords.

Publicly known test results can be found in [4,5], in 2012 Jeremy Gosney published his device and software optimized for brute force password cracking. Since then nearly four years passed and there may be organizations with stronger financial background than Gosney could afford.

As an additional result we can conclude that not the complexity of the password that matters but rather its length looking at the fact that exponential functions increase significantly quicker than polynomial functions. It can easily be calculated how much time would it need to crack successfully a password of a given length and containing characters from a given char set. Let the number of the elements in the possible char set 80. Let the length be 16, it follows that the number of all the possible character combinations are  $80^{16} \sim 2.8 \cdot 10^{30}$ . Having a cracking speed of  $10^{12}$  tries per sec, we would need approximately  $10^{30}/10^{12} = 10^{18}$  secs, i.e.  $8.93 \cdot 10^{10}$  years.

Supposing that the hash function can be weak, unfortunately, I would suggest 16 characters as the minimum password length and that results in a time duration as long as the age of our universe to successfully crack the password.

### **1.3 Best practice at user side**

Understanding the guessing methods listed above and, what is more, keeping them in mind the best practices for choosing good passwords are rather simple. Do not choose anything that is in connection with you or your login name or for what Google would give any hints. The interesting point in this that you are supposed *not* to try Google to check your password. Looking at the possibilities (and limitations) of the advanced dictionary attacks I would suggest to concatenate two or three simple words with additional modifications at least at three positions to

form a long enough password that, because of its inner logic, can be remembered of. For example, as we know that William Shakespeare was born on 26 April 1564 in Stratford-on-Avon we could prepare a password like this: Stratford26on4Avon64 with a length of 20 characters and that seems to be enough.

Additionally, the old and well-known (?) rules ought to be kept: do not tell your password to anyone else, do not write it down, do not use it on a foreign device, etc.

Usually it is advised that a user is supposed (or obliged) to change his or her password regularly. It is of no use unless a security incident has occurred or you can think of a situation in which someone would like to use your account secretly in parallel with you (the case of keeping an eye on the mailbox of the ex or the boss).

#### **1.4 Best practice at sysadmin and/or management side**

It consists of coping with three different tasks. First, the sysadmin must use all the known countermeasures to prevent online password cracking and stealing the shadow passwords. Secondly, supposing that the shadow passwords could somehow be stolen, s/he must make the brute force attack as hard as possible for the attacker, i.e. should apply a strong hash function and salting.

Thirdly, he or she should make their users choose good enough passwords, so a newly selected password should be checked if they are long enough, then against the blacklist of the top passwords and their simple derivatives.

In addition system administrators and the security management are supposed to be competent in the field of security and not to give bad advices.

## **2 Misbelieves**

### **2.1 Human factor, examples for bad advices**

It is hard enough to deal with the human factor in case of the average (i.e. not enough security conscious) users. What is more serious that there is a lot of obviously false advices and methods can be found in the wild, many of them come from sources that seems to be authentic and expert.

In 2003 a guy at HP recommended a simple program [6] that could done some simple string transformations to produce strong, random-like passwords for

different sites taking the domain name and even a primitive password as input. The idea is good until an attacker does not know or suppose that it is used. If an attacker gets a clue about the usage of this program s/he could try the top ten passwords.

To use the initials of your favourite poem [7] as your password or to use the so-called leet alphabet [8] for character substituting might have been good methods until they were not advised publicly and widely.

It is advised nearly everywhere that a password should contain mixed type characters but the minimal required length does not get the necessary (if any) emphasis.

The Federal Trade Commission says “Make your password at least 10 to 12 characters long, and use a mix of letters, numbers, and special characters” [9]

Twitter also advises that “Do use use a mix of uppercase, lowercase, numbers, and symbols.” [10]

According to Gmail “Include punctuation marks and/or numbers. Mix capital and lowercase letters. Include similar looking substitutions, such as the number zero for the letter 'O' or '\$' for the letter 'S'.” [8]

“A password based on only small letters, capital letters or numbers has a small key-space. This makes it more easy for brute-force, just because it limits the possibilities.” [11]

## **2.2 Advice of Stanford University**

Examples could be continued in an infinite series. The most problematic source I found in the near past, is the infographics on passwords at Stanford University, which is in the top ten universities in all over the world in any rankings. The first Google hint for the search expression “stanford password policy” (without the exclamation marks) is the Password Requirements Quick Guide at Stanford University IT home page. [12]

First element in their infographics: “Which characters are required in my password? – HINT: It depends on password length!” And continues that if the length is 20 characters or more it is not important which character types are included (or not included) in your password. This is correct.

In the next section they recommend that your password should be at least 16 characters in length to resist a brute force attack.

Third section: “How on Earth can I come up with a password that long?”, and says “EASY! Select 4 random words.” And gives the example: “orange eagle key shoe” that ends up at 21 in length (spaces included). „Now go forth and create your own awesome passwords and keep your account secure!”

For the first glance it seems to be perfect. Supposing once again the computational speed  $10^{12}$  tries/sec and the fact that the password contains only lower case characters (and spaces) the result is: the  $1.14 \cdot 10^{30}$  combinations could be cracked with brute force in  $3.6 \cdot 10^{10}$  years, about the same as the age of our universe. Users are satisfied!

Another calculation follows, from the point of view of an attacker. Let us suppose that I would like to crack Stanford accounts. Stanford has nearly 16 thousand students and more than 2 thousand academic staff and more than 11 thousand administrative staff. Nearly 30 thousand people, at least the same amount of accounts. There are good chances that some people heed the official advice. Table 1. shows how much time would it need to crack these kind of passwords depending on the size of the vocabulary the user selects the four basic words.

vocabulary size in words	1000	2000	4000	10000
duration to crack	1 sec	16 sec	~4 min	~3 hrs

Table 1  
Duration to crack passwords consisting of four basic words

So the accounts of those people would fall very soon who kept the expert-like official advice while they would feel their passwords safe.

### 2.3 Importance of teaching and learning

The young generation or Z-generation is considered to be familiar with ICT, especially with the use of very different internet services. Though true it may be there are some disadvantages occur as well. If these pupils don't learn the theoretical background of the technology that is part of their everyday life they will be (are) in danger. Teaching them the basics and background is especially important in the security related fields if we want our kids to avoid serious dangers. We teach them, naturally, a lot of important rules as early as we can, such as they must not obey foreign people or should look around before crossing a street. The same goes for all the internet-related staff. There are foreign people and dangerous cross-roads can be found there, too.

“Similarly, in Israel last year, an officer from the Israeli army was arrested after allegedly forcing dozens of women and teenage girls to strip in front of their computer webcams under threat that he would attack their computers with a virus if they did not comply.” [13] This is a typical example what couldn't have happened should the victims have at least some basic IT knowledge.

Investigating the skills and knowledge of the young students here in Hungary related to the IT field, we find an alarming situation, their level is far from being

optimal. The situation is the same in Central Europe, too. [14, 15.] I, personally, think that the other parts of our world are not in a significantly better situation, especially not in the light of the above cited bullying case.

If we want to fulfill our duty to prepare our kids for a totally new era we will need give them not only technical knowledge but a new approach as well. Taking into consideration the fact, that the new generation, the Z-generation, is totally different from our generation due to the paradigm shift the widespread penetration of the internet it should be clear that we cannot teach them using only the old teaching methods and tools we have been accustomed to, we need new methods, perhaps new schools as well, as described in [16].

### **3 Summary**

As our dependency on the day-by-day increasing amount of data stored and processed in the digital network becomes stronger and stronger the need for security is also becomes more and more important. To protect our different accounts from unauthorized access the use of passwords has been and will remain the most effective and cheapest tool. This statement is true if, and only if we use passwords correctly. To decide what is the “correct way” won't need deep professional knowledge, only a little math from our memories from the secondary school and some natural mind-set.

To stay on the safe side an important rule is not to keep any advices without some basic critics even if it comes from an otherwise highly qualified source. We can improve ourselves and/or our colleagues with training, further training and practising. It is a task free benefit in kind – even today.

#### **References**

- [1] Matsumoto, T. et al. (2002). Impact of artificial "gummy" fingers on fingerprint systems, Proc. SPIE 4677, Optical Security and Counterfeit Deterrence Techniques IV, 275 (April 18, 2002); doi:10.1117/12.462719
- [2] 46halbe (2014). Fingerprint Biometrics hacked again, <http://www.ccc.de/en/updates/2014/ursel>, 27.12.2014.
- [3] Keszthelyi, A. (2013). ACTA POLYTECHNICA HUNGARICA 10:(6) pp. 99-118. (2013)
- [4] Update: New 25 GPU Monster Devours Passwords In Seconds, <http://securityledger.com/new-25-gpu-monster-devours-passwords-in-seconds/>, 04.12.2012.

- [5] New 25-GPU Monster Devours Strong Passwords In Minutes, <http://it.slashdot.org/story/12/12/05/0623215/new-25-gpu-monster-devours-strong-passwords-in-minutes>, 05.12.2012.
- [6] Karp, A. (2003). Site-Specific Passwords, Hewlett-Packard Company, <http://www.hpl.hp.com/techreports/2002/HPL-2002-39R1.pdf>, 26.03.2016.
- [7] Password statistics, <http://computersight.com/communicationnetworks/security/password-statistics/>, 16.02.2011.
- [8] <https://accounts.google.com>PasswordHelp>, no date of uploading, downloaded 26.03.2016.
- [9] Make Computer Security One of Your New Year's Resolutions, <http://www.consumer.ftc.gov/blog/make-computer-security-one-your-new-years-resolutions>, 26.03.2016.
- [10] Keeping Your Account Secure, <https://support.twitter.com/articles/76036-keeping-your-account-secure>, 26.03.2016.
- [11] Bakker – Jagt: GPU-based password cracking, University of Amsterdam, System and Network Engineering, 2010, p. 7.
- [12] Stanford (2015). Accounts and Passwords - Password Requirements Quick Guide, Last modified December 9, 2015, downloaded 26.03.2016.
- [13] Raeburn, S. (2013). Online bullying and Skype crime: Police face “new environment”, *The Drum*, <http://www.thedrum.com/news/2013/08/18/online-bullying-and-skype-crime-police-face-new-environment>, 18.08.2013.
- [14] Kiss, G.: Measuring Computer Science Knowledge Level of Hungarian Students specialized in Informatics with Romanian Students attending a Science Course or a Mathematics - Informatics Course / TOJET: The Turkish Online Journal of Education Technology, Volume 11, Issue 4, ISSN: 2146-7242, pp. 222-235.
- [15] Kiss, G.: Comparison of the Programming Knowledge of Slovakian and Hungarian Students / *Procedia of Social and Behavioral Science Journal különszám*, ISSN: 1877-0428, p. 10.
- [16] Karlovitz, J. (2015). Iskolarendszer-utópia vázlata In: Buda András, Kiss Endre (szerk.) *Interdiszciplináris Pedagógia és az oktatási rendszer újraformálása: IX. Kiss Árpád Emlékkonferencia: Tartalmi Összefoglalók*. 74 p. Konferencia helye, ideje: Debrecen, Magyarország, 2015.09.25-2015.09.26. Debrecen: Kiss Árpád Archivum Könyvtára - DE Neveléstudományok Intézete, 2015. p. 35. 1 p. (ISBN:978-963-473-841-1)



**Management, Enterprise and Benchmarking in the 21<sup>st</sup> Century**  
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# **Hire Smart: A Comparative Analysis on Hiring Erasmus Interns vs. Local Workforce in the Mediterranean**

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*Abstract: Currently, an estimated 100 million tourists visit the Mediterranean region annually. Due to the seasonally increasing demand of multilingual and cost effective workforce in the field of tourism, the employers have to deal with financial and HR planning challenges. Despite the serious effect of the economical difficulties and crisis of certain Southern countries such as Greece or Spain on the employment rate, the tourism sector still can indicate continuously increasing. This paper aims to find answers to the following questions: Which are the major benefits of participating in mobility programs and gain work experience in the field of tourism from the students' perspective? Is the employment of interns cost effective solution compared to hiring of local workforce? Is it sustainable on long term?*

*Keywords: international mobility, Mediterranean, seasonal labour, Erasmus+ work experience, HRM*

## **1 Relevance of the topic**

Despite of the continuously rising unemployment rates in the Mediterranean labour markets, the tourism sector shows significant growing in case of more countries such as Greece, Malta or France where guest night have been increased by more than 40% between 2005 and 2014 [1]. Unemployment is negatively related to tourism and the bigger employers of classic holiday destinations

survived the economical crises and still can produce positive numbers regarding the guest nights and its contribution to the GDP [2].

Rising the participants of the Erasmus+ international mobility programme contribute to the increasing seasonal workforce needs of employers and hotels in the Southern countries while guarantee cost effective and flexible solution to their strategic HR planning difficulties and due to the multilingual and qualified interns the general level of guest service can be developed as well.

This paper presents comparative analysis for hiring local workforce versus interns in the context of flexibility and cost effectiveness which are the keywords of Human Resource Management (HRM) strategies of the Mediterranean enterprises.

## **2 European Mobility programs**

### **2.1 EU Cohesion Policy, the origin of the mobility programs**

Europe is the world's most fragmented continent, especially considering the linguistic or cultural, economic or the geographical perspectives. Today we distinguish – on various level of independence- about three hundred subunits, mentioned most of the time as regions. The natural and cultural regionalization have a rich history in Europe, however the supra-national integration organizations have an important role in the development and strengthening of the European regionalism. To this comprehensive indirect process the EU institutions contribute enormous financial support on regional level.

The EU's main investment policy, the Cohesion Policy, targets all regions and cities in the Union in order to support business competitiveness, sustainable development, job creation, economic growth underpins solidarity and improve citizens' quality of life. It has also strong impact on several other sectors like the EU objectives education, energy, the environment, R&D and innovation.

Relating to the topic, the free movement of workers should be noted as one of the four freedoms enjoyed by EU citizens [3]. This includes the rights of movement and residence for workers, the rights of entry and residence for family members, and the right to work in another Member State and be treated on an equal footing with nationals of that Member State. Restrictions apply in some countries for citizens of Member States that have recently acceded to the EU. The rules on access to social benefits are currently shaped primarily by the case law of the Court of Justice [4].

In case of the higher education, training and the present research, the European Commission's key department should be pointed out: the Directorate General for Education and Culture. It is the executive of the EU and responsible for the guidance on education, culture, youth, languages, sport. The contentious points through a variety of projects and programmes, namely Creative Europe and Erasmus+ are supported and supervised by them. One of these parts, the Strategic

framework – Education & Training 2020 policy is conceived to support national action and common challenges. Some examples are ageing societies, skills deficits in the workforce, and global competition [5].

## 2.2 Erasmus+ and work experience

The Erasmus+ regulation was signed at the end of 2013. The new programme combines and supports (budget of €14.7 billion) all the EU's current schemes for education, training, youth and sport, including the Lifelong Learning, Youth in Action, moreover the 5 from the international cooperation sphere (Erasmus Mundus, Tempus, Alfa, Edulink).

Within the framework of the Erasmus+ Programme over 4 million Europeans have opportunities for mobility by transnational partnerships which are also highlighted among Education, Training, and Youth organisations to connect the world of Education and Work in practice [6].

In regard to the training/work experience abroad, Erasmus+ programme improves employability while provides opportunities for students to gain work experience in international environment, allowing them to practice languages and learn new skills. Preparation is an important part of the activity and can include cultural and practical preparation as well as language classes (via Erasmus+ Online Linguistic Support) [7].

## 2.3 Erasmus+ Traineeship opportunities in the Mediterranean

Within the framework of Erasmus+ Programme, students can study or gain working experience abroad for up to 12 months (during each cycle of tertiary education). Considerable proportion of placements concerns the field of tourism and hospitality for the following reasons:

1. Hotels provide significant number of open positions which do not require previous experience or relevant studies, but the increased needs cannot be fully covered based on local labour force.
2. The demand of hiring multilingual staff from abroad is growing in the field of tourism.
3. Many enterprises use services of recruitment agencies, cooperate with educational institutions or student organizations in order to simplify the recruitment procedure.

Erasmus+ programme provides different amount of scholarship for the participants according to the rating of the host country. In the case of Hungarian students this financial support is between 400 and 600 Euro per month. Moreover, interns might receive salary/“pocket money” and other allowances such as free accommodation or meals on duty.

Host Country	Scholarship
Countries with high living expenses: France, Italy, United Kingdom, Austria, Finland, Sweden, Denmark, Ireland, Norway, Liechtenstein, Switzerland	600 € / month
Countries with general living expenses: Spain, Germany, Turkey, The Netherlands, Belgium, Czech Republic, Portugal, Greece, Slovenia, Croatia, Luxembourg, Cyprus, Iceland	500 € / month
Countries with low living expenses: Poland, Romania, Hungary, Lithuania, Slovakia, Bulgaria, Latvia, Estonia, Malta, Macedonia	400 € / month

Table 1  
 Country categories according to the amount of  
 monthly Erasmus+ scholarship  
*Source: [8]*

If we compare profitability of traineeships from the point of view of a Hungarian student, the difference is significant. On the basis of 12 weeks long internship, Erasmus+ programme offers min. 400 Euro monthly scholarship, which is approximately net 125.000 Forint. If the hosting country is Hungary, the monthly salary of an intern is approximately net 63.000 Forint based on the current regulation [9].

In addition to the financial advantage, participating in Erasmus+ programmes expand the possibilities of acquiring experience abroad, offer excellent language practising opportunity and allows students to discover cultural differences.

### **3 The tourism sector and labour costs in the Mediterranean countries**

#### **3.1. Country profiles, share of the tourism sector**

Among the Mediterranean European Union member states, the present research reflects on Cyprus, France, Greece, Italy, Malta and Spain. In these countries the tourism and hospitality sector has large impact on the national economy and labour market.

The tourism market is one of the largest economic sectors in most of these countries, therefore governments are in an attempt to reduce the tourism seasonality effect, aims to extend the tourism season as much as possible.

Since Greece counts approximately 22 million visitors annually (2014), and the tourism employs almost the 10% of their workers, not to mention the 3 million related jobs in Italy, clear is that all the efforts should be taken to improve the sector and offer more along the Mediterranean coastline. Tourism to Malta is highly diversified with lower than average seasonality when compared to other Mediterranean destinations. The 16.0% of total employment worked directly in the travel & tourism, while a total of 77 550 students followed courses at local English language specialised schools [10].

	Tourism sector's direct contribution to the GDP	Tourism sector's direct contribution to the rate of employment	Change of youth unemployment rate (2005-2014)	Change of nights spent (2005-2014)	Minimum wage* (EUR)	Average international trainee salary** (EUR)
Spain	5,6%	5%	+33.6%	+0.3%	764,40	~300
Greece	7%	9,4%	+26.6%	+40.6%	683,76	510
Cyprus	7%	7,7%	+22.1%	-21.0%	~870	~500
Malta	14,7%	16%	-4.4%	+42.5%	728,04	~150
France	3,6%	4,1%	+3.9%	+44.6%	1 466,62	554
Italy	4,1%	4,8%	+18.6%	-7.6%	~1008	~400

Table 2

The tourism sector and labour costs in the Mediterranean countries

Sources: [11]; [12]; [13]; own data

\* Countries without defined minimum wage set by the government in European Union (these countries have some collective bargaining agreements), the minimal wage was calculated according to national statistics (in this case Cyprus and Italy)

\*\* Based on national statistics and own data

The most well known Mediterranean destinations are Spain and Greece, despite of the highest rising of unemployment rate during the last 10 years (+33.6% and +26.6%). While Greece could gain expressively the number of tourist (+40.6%), Spain products small change in numbers (+0.3%). The biggest winner of development of last ten years was France, which represents the lower rate change of unemployment (+3.9%), while could increase the number of guest nights by +44.6%.

In regard to the labour cost, Mediterranean countries shows significant differences, but supporting of employment of interns is common interest. Each country defines lower minimum wage in case of employment of students, which ensures that the younger generation can gain useful work experience while the companies benefit from the lower labour cost.

### 3.2 Seasonal labour in the tourism sector of Mediterranean

Based on the geographical differences of the Mediterranean, the seasonality of tourism shows notable differences compared to the Northern countries. Due to the weather conditions, most of the hotels operate only between April and November and close during the winter months. Effective Human Resources Management (HRM), especially recruitment strategy is a challenging task for the enterprises in the field of hospitality and critical for the success.

#### 3.2.1 Recruitment methods

Due to the seasonality, the staffing need of the hotels is not permanent. The high number of seasonal, temporary positions cannot be covered by local workforce easily. Studying the Greek labour market, the reasons can be attributed to the following [14]:

- Inflexibility of the labour market: hiring and firing practices, protective rules, and collective or individual dismissals are heavily regulated.
- The demand for individuals with high qualifications does not match with the supply, caused by two reasons: Firstly, the relation between the labour market and education is weak. Secondly, high percentage of student study abroad and individuals choose their studies according to their financial status not according to their employment perspectives [15].
- Training systems for the unemployed do not link to the needs of the labour market.
- Local workforce is less involved in manual labour, impact of immigrants on the labour market is beneficial.

The method of hotel chains for sourcing candidates can include many different channels. The method consists of practices such as holding job fairs abroad, online recruiting, cooperation with recruitment agencies, developing university relations and hosting internship programs. In many cases, hotels entrust employment or recruitment agencies as part of their strategy. An agency can save businesses the hassle involved with the initial screening of outside resumes, assessing qualifications and checking references. Establishing direct partnership with sending institutions (colleges and universities, vocational schools) can provide permanent supply of interns, which guarantees the most flexible cost effective solution for the seasonal labour needs of the hotels [16].

### 3.2.2 Need of more flexible working practices

High percentage of the positions in the hotel sector (except managerial level) does not require previous experience or relevant studies (assistant waiters, chambermaids and kitchen helpers).

According to the rapidly changing staffing needs during the season, based on the changes of the bookings, the key to maintaining a sufficient workforce is to recruit and retain young practitioners for these positions.

Without cost effective and flexible interns the necessary changes cannot be implemented in practice quickly. Recruiting local, full time workers can be a difficult and slow process, and collective or individual dismissals are heavily regulated.

## 4 Measure and Methods

The study is supported by primary and secondary data. Primary data was collected by an international student exchange agency coordinates Erasmus+ and different work experience placements to the Mediterranean area. The program participants filled in an online registration form which took approximately 5 minutes to complete. The database contains detailed information about gender, age, nationality, address, language skills, preferred position and location, salary expectation. The collected data indicates the final, completed placement information as well such as duration, position, host country, salary. Sensitive personal details of the participants (name, punctual address, date of birth, etc.) have been removed, the review and analysis were done anonymously.

Total number of applicants is 2225 (full-time students or fresh graduates), mostly (97.5%) from Hungary heading to one of the Mediterranean countries (Spain, France, Italy, Cyprus, Greece or Malta). The rest of the participants (2.5%) are from other countries of the EU. The average age is 24.55 years. There is significant difference on the basis of gender. 69.61% of the candidates are females, 30.38% are males, which means female applicants have about two times higher mobility potential regarding the Southern area.

## 5 Discussion of the Results

### 5.1 The students' benefits

The results revealed that mobility programs have positive impact on the students based on the following conclusions:



### 5.1.1 Higher, but established salary expectations

The 20-24 years old age group has the highest unemployment rate (29.4 %) in Hungary compared to other age groups [17]. The unemployment rate of males in the Hungarian population is 7.4% (with university degree) and 4.3 percent (with college degree). The same indicators in case of the female population are 11.4 and 5.0% which indicate major differences regarding finding an employment in Hungary [18]. The important differences between the employment possibilities of the two genders revealed based on the dissimilar monthly salary of the entrants – males earn approximately 55.000 Forint (~177 Euro) more than females [19]. In regard to the research of the database there was no correlation between the probable salary of the entrants in Hungary and the expected salary during the Erasmus+ placements.

Salary expectation of the male and female participants are almost equal and indicate realistic demand in regard to the scholarship amount of the most popular host countries such as Greece and Spain.

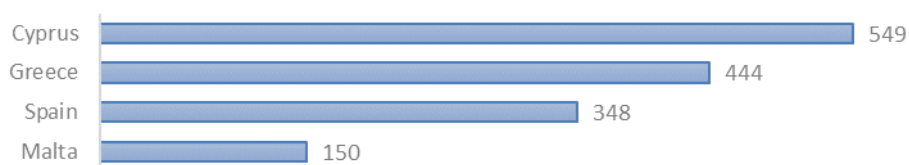


Figure 1  
Average monthly net salary of the placed students in different countries (€)

*Source: own data*

The average salary expectation of students is 393.03 Euro (per month) which is 65.37% higher than the net minimum wage in Hungary (80.000 Forint (~257 Euro) [20]. Total number of placements in the experimented period was 1151 which means 51.7% of the applicants have found traineeship position successfully. Based on the data about the placements, the average monthly salary of an intern is 394 Euro.

### 5.1.2 Higher earning potential compared to the Hungary

If the compulsory traineeship is hosted at a Hungarian company, the normative monthly wage is 60% of the national minimum wage, which points out the financial benefits of mobility programs from the aspects of student.

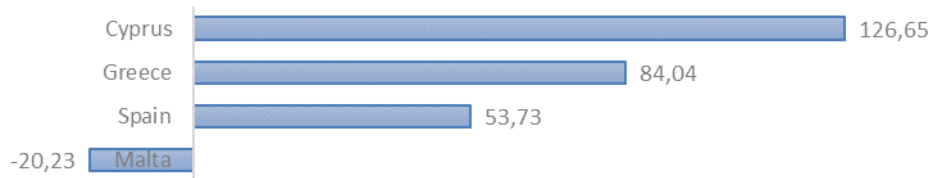


Figure 2

Percentage of general monthly salary of interns compared to the Hungarian minimum trainee wage.

Source: own data

The biggest demonstrable difference appears in case of the placements of Cyprus, where the average monthly salary is 527.50 Euro, which is 126.65 percent more than the available salary in Hungary. It is followed by Greece (84.04% higher internship salary) and Spain (52.7%). In case of Malta the difference has negative direction (-20.2%) due to the lower monthly salary. Practice shows that in case of Maltese placements, students are granted by their sending institution (Erasmus+ scholarship), which means monthly 400 Euro contribution to the traineeship program.

In regard to the country preference, 50% of the candidates applied to Greece, 44% to Spain, 4% to Cyprus and 2% to Malta, which indicates individual preferences as well beyond prospective salary.

### 5.1.3 Improvement of language and personal skills

The main reason of increasing the time gap between finishing the studies and the graduation is based on the lack of the proper language skills and necessary language certification required by the studies [21]. The findings of this research seem to indicate that there is correlation between increased number of participants in the age group 23-26 (61.85% of the candidates) and the need to improve language skills due to their studies.

While studies indicate that over-education cannot help individuals to find employment, participating in Erasmus+ programme in a foreign country can help develop the language and personal skills of the students due to the multilingual working environment [22]. Previous studies examined relationships among training, job satisfaction, and confidence of future career possibilities. The author found that students perceive their work experiences positively [23].

## 5.2 Perspective of hotels/enterprises

The results revealed that mobility programs have positive impact on the hotels based on the following conclusions:

### **5.2.1 Benefits of multilingual staff**

From the aspect of the employer, employment of multilingual students or fresh graduates can increase the quality of their service provided for the guest, and can reduce the difficulties of the integration of new employees due to the lack of language barriers, and can increase productivity due to more effective communication in the organization.

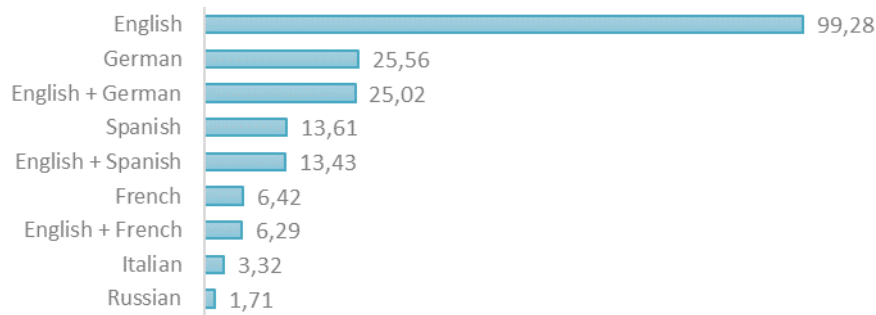


Figure 3

Percentage of applicants based on spoken language(s) (%).

Source: own data

99,28% of applicants speaks English, followed by 25,56% of German speakers which shows similar results as the survey of Tempus Public Foundation which demonstrates that 89.8% of fresh graduates speak English and 65.7% speak German [21], 57.9% of the students speaks just one language, 42.9% of them can use 2 or more foreign languages. The most remarkable combinations are English and German (25.02%), followed by English and Spanish (13.43%), and English and French (6.29%). The results show that rate of Russian speakers is very low, only 1.71% of the students can use it in daily interactions.

### 5.2.2 More flexible Human Resources Management (HRM) planning

Managerial positions have to be filled in before the hotel open (in case of seasonality) or number have to be stable if the hotel operates all year round. In regard to the positions which effected by the number of bookings, the margin is bigger. The recruitment strategy of the following positions has to be directly proportioned to the number of the guests in a particular period of the season: chambermaids, waiters, kitchen assistants.

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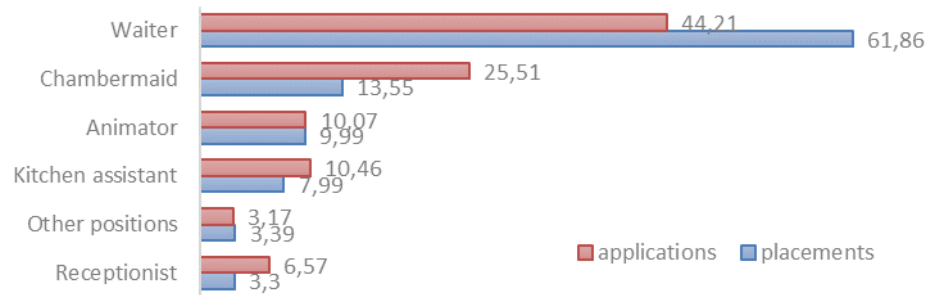


Figure 4

Comparison of percentage of applications and successful placements according to positions.

Source: own data

44,21% of the student applied for waiter position, 25,55% for chambermaid, 10,46% for kitchen assistant, 10,07% for animator, 6,57% for receptionist while the 3,17% preferred other positions. Animator and receptionist positions require previous experience and one extra language beyond English which confirms the lower application and placement percentages compared to the standard positions which requires just one spoken language and no previous experience. 83,32% of the student have been placed in waiter (61,86%), chambermaid (13,55%) or kitchen assistant (7,91%%) positions, while the jobs with higher requirements display 13.29%.

Experiment of the duration of the internship indicates that the average length of a traineeship in the Mediterranean is 3,8 months. These are approximately 15 weeks long short-term contracts can help the enterprises to cover their increased number of open positions in the peak season. If the number of scheduled reservations drops, the wage cost of untapped trainees is still competitive compared to the employment of local, permanent workforce.

### 5.2.1 Reduction on wage costs

The result of analysing the database regarding the placements indicates that the amount of attainable reduction of wage costs is significant.

To present the numerical differences, details of internship contract of a famous Spanish hotel chain have been highlighted. The concerned enterprise asked for anonymity. In 2015, 65 students have been placed at the enterprise as an intern during the year (hotels operate all year long). The average monthly salary was 335 Euro, while 46 students received 350 Euro/month, 19 interns earned 300 Euro/month. 32 of them worked as waiter, 13 as kitchen assistant, 11 as chambermaid, 6 as receptionist and 3 as animator. The average length of an

internship was 4.06 month. The total wage cost of the 65 students was 89.610 Euro in 2015. In this year, the minimal wage in Spain was 764.4 Euro. In case of employment of locals, the wage cost of 65 workers for the same working hours (which covers 263.4 months) would have been 203,050 Euro.

The result indicate that employment of interns reduced the wage costs of the Spanish enterprise by 55.9%, which saving rate can increase if we take into account further costs, such as tax and social security contributions have to be paid by the employer.

Based on the completion of the same calculations in case of the internship placements of other Mediterranean countries, the results indicate the following:

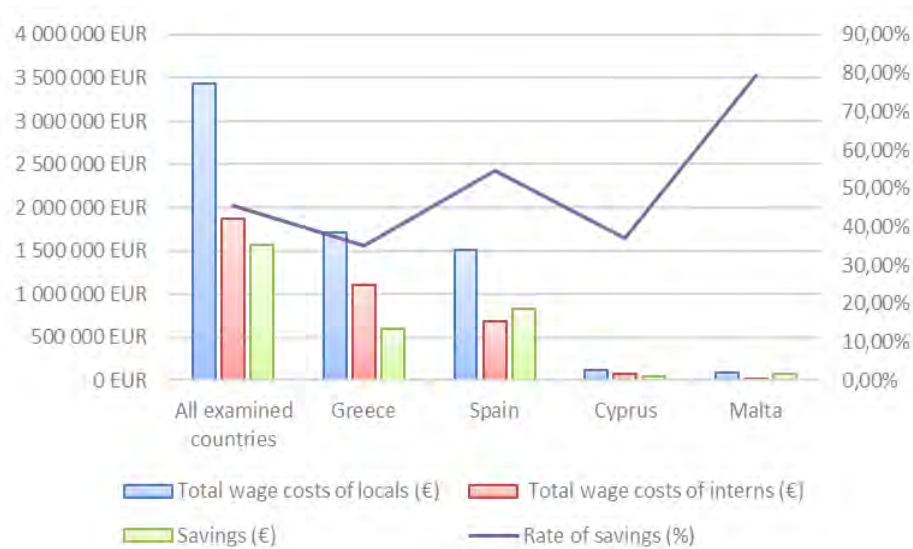


Figure 5

A comparative analysis on wage costs savings in case of Erasmus interns compared to. local workforce  
 Source: own data

In case of the Spanish hotels, the total saving is 823 623 Euro (54.54%), followed by Greek ones, where the amount is 599 283 Euro (35.12%). Enterprises of Malta could save 75 388 Euro, but this country indicate the highest percentage of saving, 79.40 % as most of the trainees are granted almost only by Erasmus+ scholarship. Hotels in Cyprus saved 45 190 Euro (36.94%).

In regard to the total number of placed participants the student exchange agency assisted to save 1 560 695 Euro for its clients in 2015, which indicates 45.46% saving on wage costs for the hotels.

## **Conclusion**

The results revealed that mobility programs have positive impact on the students and offer outstanding financial benefits over against a domestic placement. In case of gaining work experience in the Mediterranean, the average monthly benefit of a student from Hungary can be ~700 Euro, if the sending institution provides Erasmus+ scholarship beside the salary received from the local employer. Furthermore, the accommodation and meals are always provided for free by the hotels to their interns, which result excellent allowance compared to the placement options with no assured accommodation.

While the student can enjoy the numerous advantages of participating in a mobility program, the enterprises benefit from the possibilities of employing multilingual individuals and can save significant amount of wage costs due to the financial characteristic of internships. According to the presented research, 42 enterprises of the Mediterranean reduce their overall wage costs in 2015 by 1 560 695 Euro, which indicates 45.46% savings as an impressive result of internship programmes.

To maximize the benefits and to be able to cover their seasonal employment needs, hotels tend to establish cooperation with sending institutions and develop HRM strategies for the employment of interns in the future.

## **References**

- [1] European Commission, Eurostat, Nights spent at tourist accommodation establishments by residents/non-residents (Available online: <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tin00175> downloaded: 10.03.2016)
- [2] European Commission, Eurostat, Unemployment rates by sex, age and nationality (Available online: <http://appsso.eurostat.ec.europa.eu> downloaded: 24.02.2016)
- [3] Legal basis: Article 3(2) of the Treaty on European Union (TEU); Articles 4(2)(a), 20, 26 and 45-48 of the Treaty on the Functioning of the European Union (TFEU).
- [4] Legal basis: Directive 2004/38/EC on the right of citizens of the Union and their family members to move and reside freely within the territory of the Member States; Regulation (EU) No 492/2011 on freedom of movement for workers within the Union; Regulation (EC) No 883/2004 on the coordination of social security systems and its implementing Regulation (EC) No 987/2009.
- [5] European Commission, Regional Policy (Available online: [sources/docgener/informat/basic/basic\\_2014\\_en.pdf](sources/docgener/informat/basic/basic_2014_en.pdf) downloaded: 24.02.2016)

- [6] European Commission, Erasmus+, (Available online: [http://ec.europa.eu/programmes/erasmus-plus/index\\_en.htm](http://ec.europa.eu/programmes/erasmus-plus/index_en.htm) downloaded: 24.02.2016)
- [7] European Commission, Opportunities for students, trainees and apprentices (Available online: [http://ec.europa.eu/education/opportunities/vocational/students\\_en.htm](http://ec.europa.eu/education/opportunities/vocational/students_en.htm) downloaded: 24.02.2016)
- [8] Óbuda University, Erasmus+ grant table (Available online: <http://erasmus.uni-obuda.hu/hu/hallgatoknak/informaciok#2> downloaded: 10.03.2016)
- [9] Legal basis: Government Decree 230/2012. (VIII. 28.) on the practical work and vocational training as a part of the academic program in the higher education
- [10] World Travel & Tourism Council, Economic Impact Research 2015 (Available online: [http://www.wttc.org/-/media/files/reports/economic\\_impact\\_research](http://www.wttc.org/-/media/files/reports/economic_impact_research), downloaded: 14.03.2016)
- [11] Cyprus Tourism Market Report 2015 (Available online: <http://www.kpmg.com/CY>, downloaded: 14.03.2016)
- [12] Intelligenceunit.com, Monthly minimum wage for student interns (Available online: <http://www.iu.qs.com/2015/01/france-monthly-minimum-wage-for-student-interns-to-increase-to-554e/> downloaded: 14.03.2016)
- [13] European Commission, Eurostat, Unemployment rate (Available online: <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=teilm021&plugin=1> downloaded: 15.03.2016)
- [14] Katsanevas, Th. and I. Livanos (2006) Unemployment in Greece: trends and main causes', Volume of Essays in Honors of Professor Panayiotopoulos, University of Piraeus, pp 581-592.
- [15] Psacharopoulos, G (2003) Greek Education: A Contemporary Tragedy, Athens: Sideris, 2003
- [16] Legal basis: Greek Law regarding Student Training Program for students from abroad: number: 2122/192, 3198/1955, 1845/1989 and 2224/1994, Greek Law regarding the health and social insurance of the students: number 660-663
- [17] KSH, The number of unemployed people by age groups (available online: [https://www.ksh.hu/docs/hun/xstadat/xstadat\\_eves/i\\_qlf010.html](https://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_qlf010.html) downloaded: 15.03.2016)
- [18] KSH, Number of unemployed people according to their highest level of education (available online: )



- [https://www.ksh.hu/docs/hun/xstadat/xstadat\\_eves/i\\_qlf012.html](https://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_qlf012.html)  
downloaded: 15.03.2016)
- [19] Educatio Nonprofit, Tracking Study on Graduates in 2014 (available online:[http://www.felvi.hu/pub\\_bin/dload/DPR\\_tanulmanyok/frissdiplomasok\\_2014\\_zarotanutmany.pdf](http://www.felvi.hu/pub_bin/dload/DPR_tanulmanyok/frissdiplomasok_2014_zarotanutmany.pdf) downloaded: 15.03.2016)
- [20] KSH, Monthly net incomes of the white collar workers in the national economy (available online:[https://www.ksh.hu/docs/hun/xstadat/xstadat\\_eves/i\\_qli034.html](https://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_qli034.html) downloaded: 15.03.2016)
- [21] Tempus Public Foundation (2014), A felsőoktatási mobilitást akadályozó és ösztönző tényezők Magyarországon (available online:<http://www.tka.hu/konyv/1276/a-felsooktatasi-mobilitast-akadalyozo-es-osztonzo-tenyezok-magyarorszagon> downloaded: 15.03.2016)
- [22] Lazányi, K. (2012): Study for nothing? Literature overview of labour market opportunities for individuals with tertiary education In: Michelberger, P. (szerk.) FIKUSZ 2012: Symposium for young researchers: Proceedings. Konferencia helye, ideje: Budapest, Magyarország, 2012.11.16 Budapest: Óbudai Egyetem, 2012. pp. 37-46.
- [23] Ko, W. (2007). Training, satisfaction with internship programs, and confidence about future careers among hospitality students: A case study of universities in Taiwan. *Journal of Teaching in Travel & Tourism*, 7(4), 1-15.

## **Multivariate Statistical Analysis in Missing Skills Identification**

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*Abstract: The human capital development programs, partly financed by the means of European Social Fund, result in activities with the goal to equip students with skills not offered in traditional education and training system. Especially unique, so called soft skills seems to be necessary in contemporary professional careers and thus on the labour market. Courses developing skills such as team work ability, leadership, creativity, independent thinking and innovative approach to problem solving will be financed. Here, the university graduates are of special interest. For that purpose, a thorough analysis of needs is necessary. Existing databases describing the quality of human capital should be analysed in order to identify those competencies that graduates of universities are missing. Rich arsenal of multivariate statistical tools may be applicable for analyses. The list covers a wide range of techniques, from the simplest methods of descriptive statistics to advanced multivariate statistical clustering methods. Authors of the study examined and obtained results in an attempt to identify the missing soft competences using available statistical data. The list of specific results of the analysis includes identification of desired (by employers) competence profile. It has been confronted with the declared (by potential employees) possession level of soft skills. The level of compliance (convergence) of declared needs for soft competences (demand, employers' declarations) with the declared possession of soft competences (supply, potential employees' declarations) has been made. The credibility of respondents' declarations was assessed. Additionally, the conclusion that priority setting whether demand or supply side determines the directions of trainings has been drawn. It appeared that there is substantial consent on both sides. Nevertheless, decomposition (identification of) convergent and divergent indications have been made. Along with merit goals, the technical analysis of applicability of selected multivariate statistical analysis tools and techniques for the purpose of soft skills analysis has been made.*

*The policy recommendation coming from results of this analysis may be formulated on two observations: The improvement of the competences: Performing calculations and Working with computers and using the Internet should be accomplished, regardless the job type. The specialized competences should be improved depending on job type. The inference from results leads to the conclusion, that also employees see clearly the distinction between general competences, useful (necessary) of any job, and specific competences, needed for individual job.*

*Keywords: human capital, missing skills, multivariate statistical analysis*

## 1 Introduction

For the define definition of the education results, the terminology and definitions adopted in The European and National Qualification Frameworks are used. Key terms in education output description include knowledge, skills and personal attitudes. The analysis of the graduate description, although there is no direct indication on weights attributed to those three groups of teaching and learning results, leads to the conclusion, that one may expect some kind of equilibrium.

The analysis of the reality in the higher education, and analogously in other segments of education and training system, shows that effort and stress is attributed mainly to knowledge, in the second order to the skills, and in minimal degree, one cares for acquired personal attitudes, often referred to as soft skills.

On the labour market, the main player is employer. It is Obvious, that employers declare completely opposite hierarchy of expected employee characteristics. On the top of the hierarchy of expected employee characteristics soft skills are placed. On the second place are skills. The erudition, knowledge, although desirable, is considered by employer as additional, supplementary criterion.

In 2015 survey, 77% employers surveyed by CareerBuilder said they were seeking candidates with soft skills, and 16 percent of the respondents considered such qualities more crucial than hard skills<sup>1</sup>.

Appreciating this discrepancy, the Polish Ministry of Science and Higher Education has launched in mid-2015, the Competency Development Programme in form of additional financial means for activities to equip students with soft skills necessary on the labour market and in scientific careers. Analogous measures are planned in Operative Program<sup>2</sup> *Knowledge Education Development 2014–2020* (PO WER) partly financed with mean of European Social Fund. The task is to develop skills such as team work ability, leadership, creativity, independent thinking and innovative approach to problem solving.

Although the general list of soft skills desired by employers covers universal skills, there is significant diversification of expectations across workplace types and across professions groups<sup>3</sup>. To guarantee, the measures to improve soft skills are a success, there is necessity for thorough analysis of needs. Deep and competent assessment of compliance (convergence) of declared level (self–assessment) of possessed soft skills with the declared employers' needs (demand – supply analysis) is necessary<sup>4</sup>. Interesting possibility aroused with development of databases describing the quality of human capital. The most widespread mode of assessment of the level of soft skills possession is subjective approach. In this technique, the respondent declares to

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1 See for example The Ten Unique Soft Skills ... (2015), Why Attitude is more Important (2015). Similar results for Polish employers have been found in Dziechciarz et. al (2006), Kurkliński and Maszybrocki (2008), Maszybrocki (2010). Extensive literature review on the topic may be found in Getting Youth (2013).

2 The program description may be found in (Szczegółowy 2015).

3 Dziechciarz (2012 and 2016a) gives extensive discussion on education results quality.

4 For discussion see for example Dziechciarz (2015a) and Dziechciarz Duda, Przybysz (2014).

which extend she/he is able to use individual soft skill. The possible, alternative, approach to assess the level of soft skills is to measure it in tests. The goal is to prove, that a person is able to use individual skill. Additionally one may classify, on which level she/he is able to use individual soft skill. Such objective measurement is extremely expensive, time consuming, and requires frequent updating of results. This is the reason, why it is used extremely seldom. Multivariate statistical analysis framework provides arsenal of tools for purpose of looking into large database of self-assessment statements<sup>5</sup>. The list starts with basic descriptive statistics, along with correlation and dependence measures, factor and correspondence analysis, up to classification techniques.

## 2 The objective of the analysis

The demand – supply analysis comparing employees’ self-assessment side (supply) with employers’ statements concerning importance of individual skill for particular workplace type (demand side) has a task to assess compliance (convergence) of declared self-assessment of possessed soft competences with the declared employers’ needs<sup>6</sup>. The list of specific objectives of the analysis includes:

- Identifying desired (by employers) competence profile and its confrontation with the declared (by potential employees) possession level of soft skills.
- Assessment of compliance (convergence) of declared needs for soft competences (demand, employers’ declarations) with the declared possession of soft competences (supply, potential employees’ declarations).
- Credibility assessment of respondents’ declarations.  
And additionally:
- Priority setting whether demand or supply side determines the directions of trainings?
- Decomposition (identification of) convergent and divergent indications.
- Testing of applicability of selected multivariate statistical analysis tools and techniques for the purpose of soft skills analysis.

All databases on the topic, available in Poland should be analysed in order to identify those competencies that graduates of universities are missing. In the presented analysis, as main source of statistical data, the fifth edition of the Polish Study of Human Capital was chosen. The details of the study and the source data are availa-

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<sup>5</sup> Dziechciarz, Błazkowska and Grześkowiak (2009) discuss applicability of econometric approach for evaluation of education systems this analysis is further deepened in the article by Dziechciarz Duda, Król (2012) and Dziechciarz, Dziechciarz Duda, Król and Targaszewska (2014).

<sup>6</sup> Dziechciarz et al. (2012) give comprehensive analysis of erudite competences on the primary and secondary school level.

ble on the web page of the study (<http://en.bkl.parp.gov.pl>). The used database contains information coming from large number of respondents (*BKL2014 ...*, 2014). It covers over 64000 employers and 70890 of potential employees<sup>7</sup>. The database used for analysis in this article, was collected during the implementation of the 2014 edition of the Project *Study of Human Capital in Poland (Study of ... 2014)*. In further text, the database will be referred to as BKL2014.

### **3 Concepts, definitions and methods**

#### **3.1. The soft skills**

The classification of soft competencies, developed for the purposes of the Study of Human Capital in Poland, consists of twelve groups, both for employees<sup>8</sup> and for employers (see table 1).

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<sup>7</sup> Unfortunately, database contains variable description only in Polish language.

<sup>8</sup> The soft competencies for Employees are further classified into subcategories: C01\_1: quick summarizing large amounts of text; C01\_2: logical thinking, factual analysis; C01\_3: continuous learning new things; C03\_1: perform simple calculations; C03\_2: perform advanced mathematical calculations; C04\_1: basic command of MS Office; C04\_2: knowledge of specialized programs, writing programs, web pages; C04\_3: computer and internet literacy; C07\_1: making independent decisions; C07\_2: entrepreneurship and showing initiative; C07\_3: creativity; C07\_4: resilience to stress; C07\_5: timely completion of planned activities; C08\_1: group cooperation; C08\_2: ease in establishing contacts; C08\_3: communicativeness; C08\_4: solving conflicts between people; C10\_1: assigning tasks to other employees; C10\_2: coordinating the work of other staff; C10\_3: disciplining other staff; C11\_1: frequent trips; C11\_2: flexible working hours flexible working time.

Symbol		Soft competency description
C01	Z01	Seeking and analysis of information, and drawing conclusions
C02	Z02	Technical imagination, handling and repairing technical devices
C03	Z03	Performing calculations
C04	Z04	Working with computers and using the Internet
C05	Z05	Artistic and creative skills
C06	Z06	Physical fitness
C07	Z07	Self-organisation of work and showing initiative
C08	Z08	Contacts with other people
C09	Z09	Organisation and conducting office works
C10	Z10	Managerial skills and organisation of work
C11	Z11	Availability
C12	Z12	Fluent use of Polish language (linguistic correctness, wide vocabulary, ease of speaking)

Table 1

The classification of soft competencies, developed for the purposes of the Study of Human Capital in Poland

*Note: the symbols with description C and Z refers to Employees, and Employers, respectively.*

*Source. BKL <http://bkl.parp.gov.pl>.*

The basic hypothesis concerning required skills is that along with universally expected skills, each branch of the economy and administration requires unique, specific skills. In most cases, those specific skills, and the differences in the level of competencies possession is sought as fundamental. Describing industry relevant competence level is crucial both for education system as well as for labour market institution and their training and retraining policy. The list of universally desired skills covers honesty, cooperation, concern for quality, commitment, communication. Employers consider that those characteristics are additional to professional (technical) competences, which are veto type presupposition. General position is that employers trust the formal diploma, believing that education system is effective in forming knowledge and specific hard skills, different for different industries. Universities as part of education system are doing a much better job in training of specialized technical competence than soft skills. Universities positively react towards business and administration expectation on general responsibility of higher education for shaping good professional specialist equipped with required (hard) skills. Greater discrepancy between education side and employers exists, when responsibility in development of soft skills is discussed. Employers expect that education system will equip potential job applicants<sup>9</sup>. The university system represents the opinion that the employee's horizontal and vertical mobility on labour market makes it impossible to fit into each possible requirement. It seems obvious, that in

<sup>9</sup> Extensive discussion on the topic may be found in results of EURYDICE and MODERN projects; see Higher Education (2008) and De Boer and File (2009).

present time, the cooperation between business, administration and education is not working effectively. The governmental authorities encourage close cooperation with employers organisations and representatives, both in the construction and assessment of the teaching programs in order to optimise the use of education resources to improve graduate's labour market readiness. Companies that cooperate with universities declare greater ease in obtaining the competent employees. On the part of the deficits answer may be introducing elements of curriculum design and activities based on actual case studies, carried out in cooperation with business.

### 3.2. Descriptive analysis of competences

Simple plots have been used (box and whiskers) in order to demonstrate the basic characteristics of declared level of possessed soft competences.

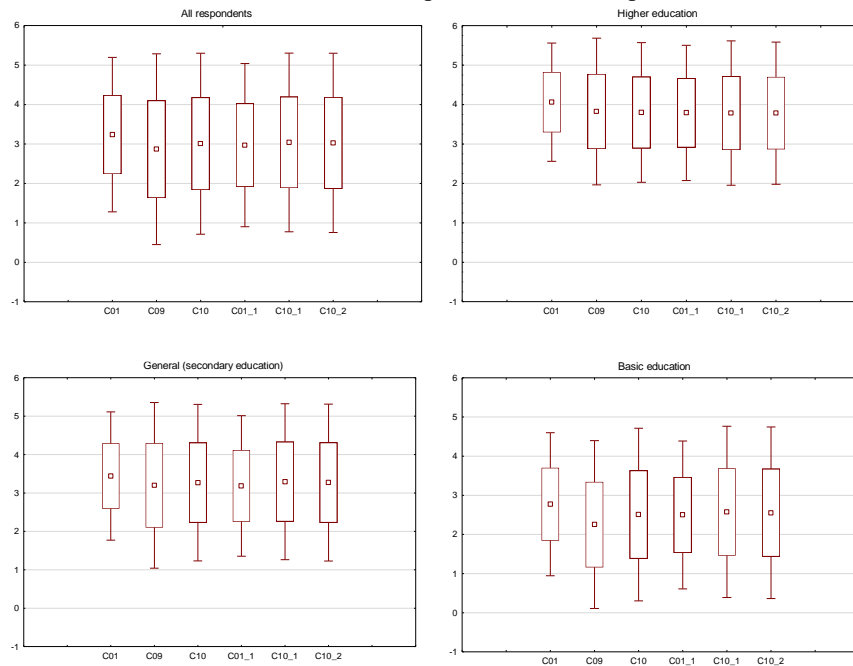


Figure 1

Box and whiskers plots, level of possessed soft competences, declaration of potential employees broken down by educational groups

Source: Own calculation on data from BKL2014.

The respondents (employees) with higher education diploma (least numerous group) manifest relatively high self-assessment with low variability. Respondents with basic education show much lower level of soft competences, accompanied with much higher variability (figure 1). The respondents with secondary education, in

accordance with expectation, show more optimistic picture of their soft competences than people with basic education and less favourable in comparison with those with higher education. Such statements give moderate, cautious ground to assess, that respondents carefully formulate their self-assessment, at least in accordance with the level of their education. It gives some reasoning for the use of subjective statements as a base of analysis. In our analysis, these are potential employers who represent the opposite (demand) side. They consider quite optimistic soft skills and the level of its possession by potential employees. The difference between the answers: *fully satisfactory* and *unsatisfactory, employees require additional training* differs only slightly. The message coming from the figure 2, may be understood as the situation, where employers accept, to large extent, that employees are lacking certain skills, but this may be improved by additional training. Over thousand respondents (1051, i.e. 25.0%) and almost three thousand respondents (2961, i.e. 70.4%) said that potential employee possess, respectively *fully satisfactory* and *satisfactory, but the employees need some additional training*. Only 196 respondents (4.7%) declare, the competences are *unsatisfactory, employees require training*. The worst assessment concerns competences Z2, Z5, Z9 and Z10.

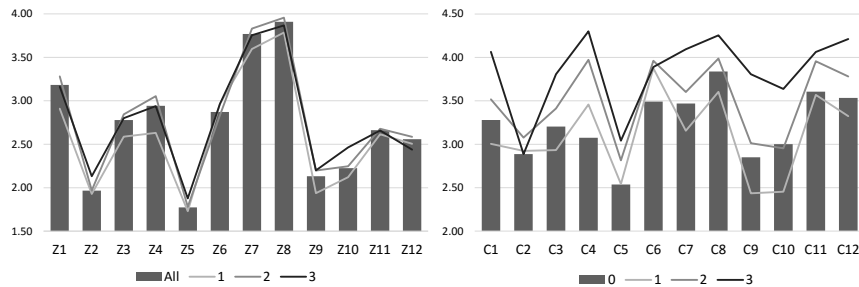


Figure 2  
Employers' assessment of soft competences of potential employees

Note: the employers' assessment of soft competences are broken down by the level of satisfaction with the skills of potential employees:  
1 – fully satisfactory,  
2 – satisfactory, but the employees need some additional training,  
3 – unsatisfactory, employees require training).

Source: Own calculation on data from BKL2014.

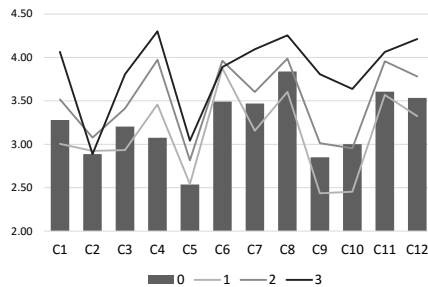


Figure 3.  
Employees' assessment of soft competences;

Note: the employees' assessment of soft competences are broken down by the level of education:  
1 – basic education graduates,  
2 – general (secondary) education graduates,  
3 – higher education graduates,  
0 – the rest of respondents.

Source: Own calculation on data from BKL2014.

Figure 3 demonstrates interesting phenomenon. Solid histograms show self assessment for respondents who finished education six or more years ago. The lines show



graduates<sup>10</sup> of certain level. It is striking, that in general, graduates overestimate their competences in comparison with more experienced employees. Especially those with higher education seems to be over optimistic in their opinions. Analogous with employers, the C5, C9 and C10 are seen as most problematic. General inference for whole sample of respondents may be used for general purposes only. Among the five most sought after professions in Poland in 2014 were, respectively, a truck driver, a sales representative, salesman, cook and accountant<sup>11</sup>. This substantiate the choice of sales representative and accountant as test cases for closer insight. An attempt to compare expectations on the employers' side with the employees' judgement gives interesting insight into differences on required skills. It is not surprising, that for employer, the ability of effective work goes first. Employee is seeking good working atmosphere. The striking difference may be seen in high importance of *working with computers and using the Internet* competence, in employers' hierarchy, and low in employee hierarchy. Analogously, the competence: *contacts with other people, either with colleagues or customers* is very high in employees' hierarchy, and low in employers.

### **3.3. Analysis for selected job type. Sales representative and Accountant**

The specific job type requires specific skills in general, and in particular, specific soft skills. In this particular situation, demand and supply of competencies necessary for accountancy job is analysed. Taking into consideration the knowledge on the differences between the nature of sales representative and accountant jobs<sup>12</sup>, it is not surprising, that appropriate differences are manifested in employers' declarations (figure 4). Analysis of similarities and differences in self-assessment of competencies for individual job gives insight into the way, employee consider ability to take responsibility to work on particular post.

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10 Graduates are defined as those, who finished education within last five years.

11 Dziechciarz (2015b and 2016b) extensively discusses the effectiveness and efficiency of training. On nonmonetary results see Dziechciarz Duda and Król (2013). Different point of view may be found in a book Górniak ed. (2015).

12 The number of respondents in the database consists of 164 for accountant jobs, and 420 for sales representative.

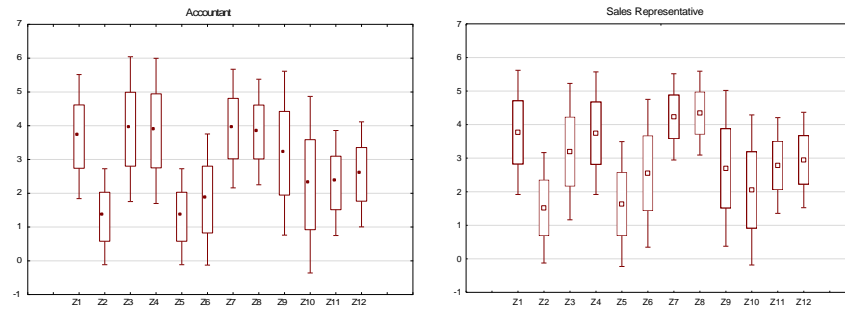


Figure 4  
Box and whiskers plots, employers' assessment of soft competences  
Source: Own calculation on data from BKL2014.

One may easily see groups of jobs with set of soft competencies. To large extend, sets shown are the same (similar), but some differences might be seen in assessment of job requirements with respect to soft skills.

For in depth insight, analytical technique of factor analysis<sup>13</sup> has been applied. For our purpose, one of the most popular variants of factor analysis, the main component method has been used. The technique variant with Equamax normalized rotation has been used. The method have been used for an attempt of the identification of main components in the employees declarations concerning importance of individual skills. The results are shown in the tables 2 and 3. An interesting insight may be drawn when comparing results contained in the table 2, where the results of an attempt of the identification of main components in the employers' declarations concerning importance of individual skills are shown with the table 3, where results of an attempt of the identification of main components in the employees' declarations concerning importance of individual skills are shown. Obtained results give indication for possible training effort direction and the most effective, or desirable education or training programs. In any case skills Z3 and Z4 (*Performing calculations* and *Working with computers and using the Internet*) should be included in all variants of training. Otherwise, the composition of factors differ for both jobs types (Accountant and Sales Representative).

13 The technicalities may be found, among others, in Garson (2013) and Osborne (2015).

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Factors Competence	All jobs types		Accountant		Sales Representative	
	I	II	I	II	I	II
1	2	3	4	5	6	7
Z1	0.790		–	–		
Z2		0.832	–	–	–	–
Z3	0.717		0.803			0.738
Z4	0.824		0.795			
Z6		0.723	–0.780		–	–
Z7	–	–	–	–	0.818	
Z8	–	–		0.790	0.749	
Z9	0.768		–	–		0.803
Z10	–	–	–	–		0.817
Z11	–	–		0.718		
Z12	–	–		0.825		
% of variance	42.821	20.880	38.894	26.324	39.61	16.60

Table 2

Results of factor analysis. Employers' assessment of skills importance, in general and for selected jobs

Note: in the table, factor loadings >0.700 are included. Empty cells contain (hidden) factor loadings that have values lower than 0.700. Symbol "–" denotes competence omitted in presented version of analysis.

Source. Own calculation with the help of STATISTICA and SPSS packages on data from BKL2014 database <http://bkl.parp.gov.pl>.

The policy recommendation coming from results of this analysis may be formulated on two observations:

- The improvement of the competences: *Performing calculations* and *Working with computers and using the Internet* should be accomplished, regardless the job type.
- The specialized competences should be improved depending on job type.

The inference from results shown in the table 3 leads to the conclusion, that also employees see clearly the distinction between general competences, useful (necessary) of any job, and specific competences, needed for individual job. The deeper division of competences types is necessary to identify commonalities. The description of employee's declaration on competences importance is more complex, and for individual job, three factors were necessary. The composition of individual factors is even more distinct for the job of Accountant and Sales representative. This statement, gives ground for optimism. Namely, it means that potential employees, analogously to the employers, manifest reasoned, intelligent assessment of needed

competences along with realistic statements describing the level, they possess competences in question. To some extent it is a surprising result. The common opinion is, that employees overestimate own abilities, and employers underestimate them. The careful analysis of data in BKL2014 database overthrows this opinion. Unlike the results of demand side (employers), and supply side for all employees, where two main components were identified. For specific jobs selected for in depth analysis, three main components were identified.

Factors Variable	All job types		Accountant			Sales Representative		
	I	II	I	II	III	I	II	III
1	2	3	4	5	6	7	8	9
C01		0.790		–	–	0.723	–	–
C01 1		0.810	–	–	–	–	–	–
C01 3		0.700	–	–	–	–	–	–
C03					0.854	–	–	–
C03 1	–	–			0.839	–	–	–
C04		0.729				0.872		
C04 2		0.755		–	–	–	–	–
C07			0.797					
C07 1	0.702							
C07 2			0.810				0.815	
C07 3			–	–	–		0.790	
C07 5	0.747							
C08	0.837			0.842		0.799		
C08 2	0.846			0.798		–	–	–
C08 3	0.818					–	–	–
C10	–	–	–	–	–		0.871	
C11	–	–	–	–	–			0.847
C11 1	–	–	–	–	–			0.883
C11 2	–	–	–	–	–			0.757
C12						0.811		
% variation	34.05	32.12	44.42	13.43	9.14	42.70	15.33	9.69

Table 3

Results of factor analysis, principal component variant, with Equamax normalized rotation.  
Employees' assessment of skills importance, in general and for selected jobs

Notes: In the table, factor loadings >0.700 are included. Empty cells contain (hidden) factor loadings that have values lower than 0.700. Symbol “–” denotes competence omitted in presented version of analysis.

The list of soft competencies for Employees are given in table 1.

*Source. Own calculation with the help of STATISTICA and SPSS packages on data from BKL2014 database <http://bkl.parp.gov.pl>.*

## Conclusions

Results of analysis of the reality in the higher education, and analogously in other segments of education and training system, shows that effort and stress is attributed mainly to knowledge, in the second order to the skills, and in minimal degree, teachers and education organisers care for personal attitudes, often referred to as soft skills acquired by students and trainee's. Obvious observation, that each job requires specific competences, may be quantified with the help of simple and more advanced statistical tool. The *sine qua non* condition is reliable data on what employers need, and what employee are capable to manage on individual, specific job type. Both educators and governmental agencies seem to appreciate the need to improve soft skills. Assuming, the erudition (knowledge), will be provided in formal education system, the Government effort goes in direction of improving skills and soft skills. As an example may serve Competency Development Programme launched by Ministry of Science and Higher Education and Operative Program *Knowledge Education Development 2014–2020* (PO WER) partly financed with mean of European Social Fund. The task is to develop skills such as *team work ability, leadership, creativity, independent thinking and innovative approach to problem solving*. Although the general list of soft skills desired by employers covers universal skills, there is significant diversification of expectations across workplace types and across professions groups. Comprehensive analysis of needs, deep and competent assessment of compliance (convergence) of declared level (self-assessment) of possessed skills with the declared employers' needs (demand – supply analysis) is necessary, to guarantee that the measures to improve soft skills are effective.

The confrontation of desired (by employers) competence profile with the declared (by potential employees) possession level of soft skills gave the measurement result for the level of compliance. It seems that the convergence of declared needs for soft competences (demand, employers' declarations) with the declared possession of soft competences (supply, potential employees' declarations) gives a possibility to rationalize the training plans. Important result is confirmation of the credibility of respondents' declarations, both on employers and employee side. It appeared that there is substantial consent on both sides. The latter leads to recommendations that it does not matter, whether demand or supply side determines the directions of trainings. On the other side, along with common skills, there are specific needs.

The policy recommendation coming from results of this analysis may be formulated on two observations: The improvement of the competences: *Performing calculations* and *Working with computers and using the Internet* should be accomplished, regardless the job type. The specialized competences should be improved depending on job type. The inference from results leads to the conclusion, that also employees see clearly the distinction between general competences, useful (necessary) of any job, and specific competences, needed for individual job.

Along with merit goals of the analysis, the applicability of selected multivariate statistical analysis tools and techniques for the purpose of soft skills analysis has been confirmed.

## References

- [1] *BKL2014*, <http://bkl.parp.gov.pl/bazy-danych14>), 2014.
- [2] Dziechciarz Duda M. Król A. *On the non-monetary benefits of tertiary education*, *Econometrics*, 3/41/2013, pp. 78–94.
- [3] Dziechciarz Duda M. Król A. *Próba zastosowania modelu Mincera do oceny wpływu wyższego wykształcenia na poziom wynagrodzeń*, *Ekonometria*, 3/37/2012, pp. 56–69.
- [4] Dziechciarz Duda M. Przybysz K. *Wykształcenie a potrzeby rynku pracy. Klasyfikacja absolwentów wyższych uczelni* in: Jajuga K. Walesiak M. (eds.) *Klasyfikacja i analiza danych – teoria i zastosowania* Taksonomia, 22/327/2014, pp. 303–312.
- [5] Dziechciarz J. Błaczowska A. Grześkowiak A. *Econometric Evaluation of Education Systems* in: Rinderu P. (ed.) *Creating an Observatory on Europe-wide Transparency of Academic Qualifications* Universitaria Craiova; Craiova, 2009, pp. 112–131.
- [6] Dziechciarz J. Dziechciarz Duda M. Król A. Targaszewska M. *Various Approaches to Measuring Effectiveness of Tertiary Education*, *Archives of Datascience*, 1/1/2014, pp. 1–25.
- [7] Dziechciarz J. Dittmann P. Hasińska Z. Tausz K. (eds.) *Rynek pracy aglomeracji wrocławskiej. Stan i perspektywy*, AE Wrocław, 2006.
- [8] Dziechciarz J. Błaczowska A. Grześkowiak A. Król A. Stanimir A. *Analiza wybranych aspektów wyników egzaminu gimnazjalnego*, UE Wrocław, 2012.
- [9] Dziechciarz J. *Mierzenie efektywności nakładów na edukację i szkolenia w przedsiębiorstwie*, *Folia Oeconomica*; 2016b, in print.
- [10] Dziechciarz J. *O pojęciu jakości w pomiarze efektów pracy uniwersytetu*, *Ekonometria*; 2016a, in print.
- [11] Dziechciarz J. *O pomiarze efektywności nakładów na edukację i szkolenia w kontekście kształcenia przez całe życie* in: Bernais J. Jędralska K. (eds.) *Uniwersytet w perspektywie kształcenia przez całe życie*, UE Katowice, 2015a, pp. 42–51.
- [12] Dziechciarz J. *Pomiar i wycena wiedzy, umiejętności i kompetencji nabytych w formalnych i nieformalnych formach kształcenia* in: Wdowiński P. (ed.) *Nauczyciel akademicki wobec nowych wyzwań edukacyjnych*; Uniwersytet Łódzki, 2015b.
- [13] Dziechciarz J. *System jakości kształcenia* in: Dziechciarz J. et.al. *Analiza wybranych aspektów wyników egzaminu gimnazjalnego*, UE Wrocław, 2012.
- [14] Garson G. *Factor Analysis*, SAP, Asheboro, 2013.

**Management, Enterprise and Benchmarking in the 21<sup>st</sup> Century**  
Budapest, 2016

- [15] *Getting Youth in the Door: Defining Soft Skills Requirements for Entry-level Service Sector Jobs* International Youth Foundation, Baltimore, 2013.
- [16] Górnjak J. (ed.) *(Nie)wykorzystany potencjał Szanse i bariery na polskim rynku pracy*, PARP, Warszawa, 2015.
- [17] *Higher Education Governance in Europe. Policies, structures funding and academic staff*, Eurydice, Brussels (2008).
- [18] De Boer H. File J. *Higher Education Governance Reforms across Europe*. The MODERN project, CHEPS, Enschede (2009)
- [19] Kurkliński L. Maszybrocki M. *Ocena kształcenia absolwentów studiów o kierunku ekonomia oraz finanse i rachunkowość a potrzeby rekrutacyjne instytucji finansowych*, Związek Banków Polskich, Warszawa, 2008.
- [20] Maszybrocki M. *Praktyki w bankach i zakładach ubezpieczeń dla studentów kierunków ekonomicznych (wyniki badań ankietowych)* Wiadomości Ubezpieczeniowe 1/2010, pp. 139–148.
- [21] Osborne J. *What is Rotating in Exploratory Factor Analysis?* Practical Assessment, Research & Evaluation, 20/2/2015, pp. 2–7.
- [22] *Study of Human Capital in Poland* Polish Agency for Entrepreneurship Development <http://bkl.parp.gov.pl/bazy-danych14>, 2014.
- [23] *Szczegółowy opis osi priorytetowych programu operacyjnego Wiedza Edukacja Rozwój 2014-2020* <https://www.power.gov.pl>, 2015.
- [24] *The Ten Unique Soft Skills Employers Desire in new Hires*, [entrepreneur.com/article/234864](http://entrepreneur.com/article/234864), 2015.
- [25] *Why Attitude is more Important than Intelligence* [entrepreneur.com/article/253095](http://entrepreneur.com/article/253095), 2015.

# **The Role of Human Resource Management Controlling in Organisational Safety**

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*Abstract: Safety and its corporate culture is becoming a key factor in the lives of technology-driven economic organisations. The development and maintenance of a strategy suitable for monitoring and managing external and internal risks is very important. However, not all organisations aim for perfection in this respect: few of them are aware that aiming for the minimally necessary and sufficient safety is not enough in these days. In order for an organisation to be able to detect and fully meet safety requirements, purpose-built support systems must be operated. Strategic and operative planning, implementation and decision support can be facilitated by area-specific controlling systems. This includes the application of human controlling as an important factor in shaping organisational safety culture. However, a number of result factors exist in human resource management and organisational behaviour, the quantification of which is impossible or very limited, therefore further extension of the traditional asset pool may be essential. The retention of human capital, along with the new controlling methods used for an efficient economy may also enable the examination of soft factors with difficult quantification, thus facilitate the smooth operation of corporate processes. This can also promote safety as a new aspect in the support system of human controlling.*

*Keywords: safety culture, controlling, human capital, organisational behaviour*

## **1 Introduction**

The global and organisational changes resulting from innovative technical solutions have led to a rethought of safety culture. The shift of accent within the theoretical framework of safety resulted in that the primacy of risk management was replaced by uncertainty management. (Krómer, 2011) As a result, organisations and purpose-built systems must be designed and effectively operated which, further to being safe, are capable of development and adaptation. The formation and the directions of development of safety culture may be influenced by human (behavioural) controlling, besides safety systems supporting technology-driven organisational processes. The view that these systems can contribute to, and even must be capable of reshaping safety control and culture, is



becoming stronger (Lazányi, 2010). In this respect, the justification and efficiency of systems supporting safety culture can be reinforced with suitable professional reports and analyses, both the quantifiable and non-quantifiable elements thereof facilitate safe operation.

This article aims to introduce human controlling from a safety point of view, in order to focus the attention to the significance of human factor in the reduction and management of risks in organisational processes. The empirical case analysis of the study also touches the questions of a new approach and examination of a controlling-focused way of thinking (Francsovcics, 1995), as well as of control.

## **2 A safety-focused approach of control**

In order to examine the possible connection of safety culture and controlling, the notion of control must be seen in a wider reading context. (Francsovcics, 1995) Control is a focal area of management studies, and one of the most important elements of safe operation. In order to achieve organisational objectives, all achievements in strategic fields must be continuously measured and controlled, so that the organisation can amend operations or review objectives on the basis of the feedback. (Millicz, 2010) The main areas of organisational safety-focused control are:

- internal/financial control,
- risk management (including identification and uncovering of risks),
- control mechanisms required by quality control standards.

The study of organisation and leadership is subject to development in multiple directions, on the basis of which the approaches of control are as follows:

- the basis of the area of controlling (management control), as often meant today (Horváth&Partners, 2003), has developed from the trinity of the establishment and planning of enterprise objectives, influence on behaviour, and reporting and feedback (Millicz, 2010),
- the financial and accounting aspects of controlling are: accounting controls, audits, independent internal control, quality assurance (audits, Institute of Internal Auditors: IIA Standards, INTOSAI, analysis of basic processes, production of tool systems for issue detection and feedback in accordance with product and service standards),
- the responsible, ethic organisational (including e.g. the topic of safety culture) behaviour is gaining focus,
- an approach based on the detection and prevention of wilful abuses, fraud management and anti-fraud strategy (CAFS).

Based on the above, the content elements of the financial and internal controlling can be summarised as follows (Millicz, 2010):

*Orientation:* the achievement of organisational objectives, key roles of managers

*Method:* compliance with standards, detection of risks

*Focus:* analysis of any non-compliance with regulations and requirements, identification of causes

*Consequences:* corrections, decision support, management actions.

We can conclude that internal organisational control is defined as the whole of all those processes, activities and actions that managers and employees carry out in order to achieve organisational objectives, and in order to reduce risks that jeopardise the achievement of such objectives.

### **3 Theories of safety culture and controlling**

Organisational culture is a system of common values and standards that influence the behaviour of members in an organisation. (O'Reilly, Chatman, 1991) (Bakacsi, 1996) This approach can similarly refer to safety culture as a subculture. (Lazányi, 2015)

According to the definition of Reason (1997), the safety culture of an organisation is the aggregate of individual and group values, attitudes, relationships, competences and behaviours, which is realised through the simultaneous presence of the four organisational features of "reporting" (including, among others, data and information gained by using controlling methods), "just", "flexible", and "learning" cultures.

One of the most important element in the establishment of safety culture is planning: the identification of hazards and vulnerabilities, the definition of safety systems and, in relation to this, the continuous development of safety-aware behaviour. Moreover, an important aspect is that constant side-factors of risk assessment and decision processes are uncertainties, which must be taken into account in a consequent way. (Krómer, 2011)

A focal matter in the budget of an organisation is the optimisation of expenses spent on the safe operation of corporate processes. Optimal costs mean that the efforts made to ensure safety are aligned with and proportionate to the risks possible. Expenses less than that can, at a particular level of production, lead to catastrophic circumstances. However, higher expenses are unjustified, as these can lead to bankruptcy. (Reason, 1994, 2001)

One major decision challenge is how to create balance between early predictions in order to reduce risks, along with the costs spent on such prevention, and the expenses spent on the recovery of any damages that have occurred. Decision makers are often reluctant to see that the costs of prevention are demonstrably, by

orders of magnitude, smaller than the cost of damage recovery. However, effective risk management and advanced safety culture does not only protect the company, but can, in the long term, increase its value. Safety culture is, therefore, an asset that can and must be taken into account, and should be handled as part of an economy. Some studies, which help decision-makers find the solutions, deal with the investigation of perceived and hidden dimensions of the investment management risks. (Szilágyi et al., 2013, 2015a, 2015b)

Westrum (2004) has set up the types of organisational culture on the basis of how enterprises handle safety-related information, and has classified cultures as pathological, bureaucratic or generative ones. The features above support that technology-driven organisations of today must belong to the generative category: they actively seek for safety-related information, they reward information “messengers”, they share responsibilities and the mistakes and failures they encounter result in far-reaching reforms. The decision support information needed for that can be provided by controlling<sup>1</sup>.

## **4 The main areas of safety and strategic human controlling**

The strategies developed for safety have a holistic view. The reason for this is partly because the analysis of hazards, vulnerabilities and risks must be carried out globally, regionally and locally. The other reason is that risk analysis implies the use of multiple disciplines simultaneously (due to e.g. economic, politic, cultural, sociological and psychological factors). Sustainable strategies include, among others, prevention, aversion and damage recovery. Based on this, the elements of systematic risk management culture are:

- early prediction methods,
- a review of hazards using modern tools and methods,
- the increase of efficacy of communication methods. (Krómer, 2011)

The elements mentioned are closely related to human factor. (Keszthelyi, 2014) For instance, it is much more difficult to justify prevention costs in decisions aiming risk reduction, than the costs spent on urgent damage recoveries in emergency situations, though planned prevention costs may be as low as one hundredth or thousandth of recovery costs. (Gardener, 2010) Controlling can support organisational processes and the attainment of modern safety strategies by providing analyses and suitable data and information. The main elements of these are:

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<sup>1</sup> In fact technology-driven organizations have gains from their controlling and reporting functions are being based on business information systems (Sasvári, 2013), from which the data recovery is much easier.

- 1) assessment of hazards and risks, and development of early predictions,
- 2) development of safety culture and of abilities to resist extreme conditions,
- 3) reduction of risk factors,
- 4) enforcement of catastrophe recovery capabilities.

In other approaches of safety, the toolset of human controlling (including HR audits, HR strategy, HR scorecards, benchmarking, process cost calculations, human cost planning methods, intellectual capital validation methods, use of competence measurements and maps, self-controlling, knowledge management, process management, performance measurement of processes etc.) and the significance of its support for EEM is especially important because a major proportion of costs is related to human capital, as it is very cost-sensitive without an economy of human resources. (Karoliny, Poór, 2013)

However, measurement of indicators related to intangible assets is practically never used in human controlling. Based on the research of IFUA Horváth&Partners international consulting agency, invisible (or “intangible”) assets are, with the exception of some Nordic countries, not measured, as they do not have a yield; companies prefer culture programmes and organisation development methods instead. This approach can also be efficient for the preparation of safety cultures. Therefore, an important aspect is to connect HR and safety strategy with human controlling, which can, through its services, support the smooth and balanced operation of organisational processes (e.g. recruitment, career, the identification of psychological and competence profiles, regular mental-hygienic assessments, targeted prevention programmes, overall programmes aiming at cultural goals, health and safety, identification of cultural factors etc.)<sup>2</sup>. (Karlovit, 2014) A critical question in this regard is which values shareholders and managers prioritise, and which values they support in order to ensure safety, in the organisational culture. The identification and testing of competences related to safety-awareness is a highlighted field in the human approach of organisational safety, which also includes the question whether the organisation needs brokers who are good at safety, or ones capable of doing precise and punctual work. It is probable though, that e.g. knowledge and information brokers support safety culture by predicting risk information. A powerful incentive can be if reporting of near-misses is rewarded. (IFUA, 2006)

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2 The key competencies had been examined in several articles, studies till now. Csiszárík-Kocsir et al examined the higher education's role and the most conveyed competencies in a primary resarch in 2009. The most useful competencies are: communication, foreign language and the communicational skills to reach a good position in a work.

	<b>operative human controlling (economy of operative processes)</b> (Körmendi, Tóth, 2003)	<b>strategic human controlling (safety)</b>
<b>time span, time horizon</b>	short	long
<b>Objective</b>	aims at capital return	economy of operative processes
<b>Indicators</b>	<ul style="list-style-type: none"> <li>• economic calculations, financial indicators</li> <li>• plan-fact comparisons</li> <li>• indicators of economy, performance, organisation (e.g. no. of employees, absences, work hour balance sheets, performance success rate, no. of accidents etc.)</li> <li>• process cost calculations</li> </ul>	<ul style="list-style-type: none"> <li>• non-financial indicators, intangible assets=non-material+invisible assets</li> <li>• HR audit (competence measurement)</li> <li>• strategic indicators: Balanced Scorecard (BSC), Performance Prism, Performance Pyramid System (PPS), Tableau de Board (TdB), Productivity Measurement and Enhancement System (ProMES), Intellectual Capital Statement, Wissensbilanz.</li> <li>• benchmarking</li> <li>• calculation of human capital value (elements: human capital, e.g. knowledge, competences, work ethic, attitudes, social capital, e.g. interpersonal connections, information databases, structural/organisational capital, e.g. intellectual property, brand names, organisational culture, management philosophy etc. ) (Laáb, 2006)</li> <li>• portfolio analyses</li> </ul>

Figure 1  
 Operative and strategic human controlling (own preparation)

The extension of the administrative and functional role of human controlling can also imply that it is not only the measurements supporting the area of HRM, but also the practical implementation of decisions that it focuses on. Human controlling, in this way, further to being the budget owner, practices a higher level of operation. A key element of the wider service provider catalogue of HR controlling may be the preparation of safety programmes at every level of corporate hierarchy (e.g. sensitizations, health and safety, trainings and education development of the application of purpose-built security systems, development of communication, burnout monitoring etc.).

The strategy-focused interpretation of organisations is also connected with the topic of quality and sustainability<sup>3</sup>. (Pató, 2015) Enterprises that focus on this aspect place a strong emphasis on the coordination of their human resources, business units and processes, information technology and financial resources, for a significant growth of productivity. (Michelberger, 2013) A shift in views took place in this regard recently: the focus on control has been replaced with a stronger focus on the support of strategy and organisational processes. (Wimmer, Szántó, 2006) In corporate practice it means that instead of the promotion of persistent reports and accounts, managerial and business decisions are supported, and organisational learning is being promoted. (Neely-Al Najjar, 2006)

Besides the aspects mentioned so far, the so-called non-market aspects have substantial influence on the output of the enterprise. Such aspects include, among others, the question of safety. Companies of our days are auditing sustainability in their sustainability reports on the basis of ISO standards, and are outlining specific, substantially well-defined safety aspects (e.g. psycho-social risks, work safety, risk management, trainings aiming at increasing safety, rules and systems to motivate reports on near-misses etc.).

In accordance with the above, it is a tendency that radical economic changes result in shorter time spans in strategic thinking, and accents are shifted from strategies to processes (IFUA, 2006), thus, besides process development and quality objectives, organisational safety is also presented in a new context. The shortening of strategic time spans and the development of information technology requires shorter response times. Also, the efficiency of organisational decisions may be largely affected by the quantity and quality of the information received (Szeghegyi, 2011), as too much or irrelevant information can slow down decision making, or can lead to wrong decisions<sup>4</sup>. Furthermore, a most focal aspect in the organisations, as seen in front of a socio-technical background, is that information is also available to customers and competitors, which also gives rise to safety concerns.

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3 A proven method for the strategic implementation of the sustainability aspects could be the so called Sustainability Balanced Scorecard. (Fülöp, Bereczk, 2015)

4 The appropriately chosen information systems can help to provide the information needed for organizational processes and decisions (Sasvári, 2012).

## **5 Human controlling in practice**

My field work was done at the Budapest premises of a strategically significant Hungarian pharmaceutical enterprise, in the human controlling organisational unit.

Basic data of the enterprise:

- legal form: private limited company, with nearly 85% of the shares being in foreign ownership.
- net turnover within the 2014/2015 business year: HUF 129.2 bn,
- the products of the company are sold in 60 countries; 75% of the turnover in 2014/2015 business year came from export sales, out of which
- the most important strategic markets were: Russia, CIS-countries (EUR 131.5 m), Middle and Eastern European region (EUR 134 m)
- number of employees: 4000.
- activities: production of pharmaceutical products, treatment and disposal of hazardous waste, recycling of waste, human health services, scientific and technical research and development, engineering, technical consulting etc.
- 9% of the turnover, i.e. nearly HUF 12 bn is spent on research and development.

For a safety-focused examination I analysed the deep interviews made with the human controlling manager, and I examined the practical operation of the HR controlling organisational unit. The below relevant aspects, features and risks can be mentioned in connection with safety and controlling, as results deduced from the empirical analysis.

The most important risk analysis policy elements of the organisation are:

- the enterprise considers that it is not full prevention of risks that leads to success, but a reasonable minimisation of adverse effects of risks on social objectives,
- the enterprise considers risk management as a tool of efficient enterprise management,
- their opinion is that as not all aspects of risks can be identified administratively and in advance, management should, in decision making regarding risks, rely on the competences, experience and judgement of employees in the course of work done in accordance with internal expectations and rules,
- area leaders are responsible for the identification and categorisation of risks pertaining to their own areas, as well as for the preparation of the relevant action plans,
- internal control analyses the full range of risks, and reports to executive management at least once a year about the operation of risk management, internal control mechanisms and the related company management functions,

- it examines independently and objectively, on the basis of the approved annual audit, whether the internal control systems established are capable of handling the risks discovered effectively.

The place and role of human controlling within the organisation:

- it is highly-positioned (taking company-specific aspects into account, human controlling has a highlighted position among controlling systems).
- the “secret weapon” of HR: executives understand hard data, i.e. they need cost and possible losses information (controllers convert “soft signals” into “hard numbers” for decision makers),
- It is not only on the level of costs that HR controlling deals with human resources economy, but it also establishes operative principles, continuously monitoring and following up on them, while further develops them, and interposes at decision points, whenever needed (these principles could as well include the support of advanced implementation of safety),
- as controlling is capable of providing more and more professional support materials to executives and managers, often there’s no need for economic intervention of controlling.

Areas of human controlling and safety:

- 1) employee competences,
- 2) economy of human resources,
- 3) data security.

Aspects and characteristics in connection with competences:

- competences are among the most focused areas (application of psychological tests, especially for executives),
- the purpose of testing is to pick the most loyal, safety-aware and contented colleague,
- proven version of practical testing, e.g. the application of the “principle of gradual access” (the most reliable colleagues successfully passing the “trials” get access to larger amounts of and more and more sensitive information),
- loyalty is a human aspect of highlighted importance, as smooth operation is ensured by contented employees,
- reliability is one of the most sensitive and critical competence continuously tested,
- in order to eliminate the risks resulted from human errors and faults, the principle of “every one is in control of another” is applied (however, there is a risk that overcontrol turns out to be a hindrance in open communication and trust) (Tóth Bordásné Marosi, Bencsik, 2012).

Characteristics of human resources economy and safety:



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- the accuracy of recruitment planning and the alignment to business processes thereof is especially important (the company employs a stretched number of staff just enough for a viable operation),
- One of the most sensitive organisational processes is the topic of reorganisation,
- the elimination of risks arising from the changing staff number is an important concern, **but**
- the HR controller is not aware of what is scheduled at HR strategic partners (risk: can cause discrepancies),
- the most critical one of all human risks is the loss of irreplaceable knowledge; the largest amounts of cost are taken up by the “war for talent”,
- there are no indicators related to training-return/yield or intangible indicators, or they are not applied.

Characteristics of data security:

- there is no written security policy (the provisions of the Hungarian Labour Code and the internal organisational rules apply),
- a general principle is “to protect employees’ individual rights at any cost”, **but**
- top executives (CEO, HR director, senior financial manager) can get access to every sensitive data at any time without filtering,
- the complex information related to particular employees is only accessible for the HR director and the CEO,
- middle managers and employees can only access information which are not suitable for individual identification of employees,
- accurate, proactive and transparent communication is focal in reporting by controllers (an important concern is that colleagues think within the same interpretation framework at data exchange),
- controllers only have the opportunity to see data on the employee level, so that they can assess and find out which employee has caused any discrepancy between plan and fact data,
- IT policy: employees cannot, without authorization, send any data in emails; any mistakes are only found out afterwards, which is an indication of data security issues.

It can be concluded on the basis of the above that even adherence to the regulations and methods applied will not always guarantee full protection in organisational processes. Therefore, the development of organisational safety culture (standards, behavioural patterns, values etc.), including the enhancement of safety-awareness, must be continuously kept on the agenda.

## Conclusions

The methodology of controlling and the implementation of organisational safety using functional purpose-built systems have limited scope of interpretation using traditional approaches of plan-fact comparisons. In order to reduce risk factors of organisational processes, the tools of controlling have to be extended in the future, e.g. intangible indicators applicable as tools of human controlling can contribute to the establishment of organisational safety and to the enhancement of safety culture.

An academic approach of human controlling can facilitate the response of controlling methodology to the new challenges of the digital era, including problems and possible solutions of safety. It must be seen though that, in an age of corporate cultures less and less typeable, every normative approach can be counter-productive. (Amalberti, 2013) Accordingly, besides asset values measured by traditional accounting (e.g. funds, customer base, tangible and intangible assets etc.), the invisible assets of an organisation (e.g. patents, methods or the efficiency and quality of management) can also include such factors as client capital, employee competence and safety culture.

## References

- [1] Amalberti, R. (2013): Navigating Safety: Necessary Compromises and Trade-Offs-Theory and Practice, Springer
- [2] Bakacsi, Gy. (1996): Szervezeti magatartás és vezetés, Közgazdasági és Jogi Könyvkiadó, Budapest
- [3] Csiszárík-Kocsir, Á. – Fodor, M. – Szira, Z. – Varga, E. (2009): A kompetenciák mérése az emberi erőforrás-menedzsmentben és az oktatásban, Humánpolitikai Szemle, 2009. 7.-8. szám, 132.-140. old.
- [4] Francsovcics, A. (1995): Controlling Elmélet és Módszertan, Ligatúra Kiadó, Budapest
- [5] Fülöp, Gy.; Bereczk, Á. (2015): Sustainability Evidence from the Hungarian Chemical Industry, Proceedings of MAC-EMM 2015, Prága, Czech Republic, p. 7.
- [6] Gardener, N. J. L. (2010): Business continuity psychology – From Strategy to benefits? Continuity Magazine, Online: [www.bcifiles.com/papers/Gardener.pdf](http://www.bcifiles.com/papers/Gardener.pdf) (Download: 20 nov. 2014)
- [7] Horváth, P. (1991): Controlling: A sikeres vezetés eszköze, KJK, Budapest
- [8] Horváth, P. (2008): Partner Controlling, COMPLEX Kiadó, Budapest

- [9] IFUA Horvath & Partners (2008): Folyamatmenedzsment a gyakorlatban, IFUA Horváth & Partners Budapest
- [10] Karlovitz, J. T. (2014): Globalizmus és oktatásügy, In: Torgyik Judit (szerk.) Sokszínű pedagógiai kultúra: II. Neveléstudományi és szakmódszertani konferencia. 534 p. Konferencia helye, ideje: Nové Zámky, Szlovákia, 2014.01.09-2014.01.11., Komárno: International Research Institute, 2014. pp. 529-534. (ISBN:978-80-89691-05-0)
- [11] Karoliny Mártonné; Poór, J. (2013): Emberi erőforrás menedzsment kézikönyv (Rendszerek és alkalmazások), CompLex Kiadó, Budapest
- [12] Keszthelyi, A. (2014): Paradigmaváltás – Biztonság – Emberi Tényező, TAYLOR Gazdálkodás- és szervezéstudományi folyóirat
- [13] Körmendi, L.; Tóth, A. (2002): A controlling tudományos megközelítése és alkalmazása Perfekt Kiadó, Budapest
- [14] Krómer, I. (2011): Természeti katasztrófák: Kockázatok és Bizonytalanságok, Elektrotechnika, 11.sz.
- [15] Laáb, Á. (2006): Számviteli alapok, Elmélet és módszertan, Typotex Kiadó, Budapest
- [16] Lazányi, K. (2015): A biztonsági kultúra. TAYLOR. Gazdálkodás- és szervezéstudományi folyóirat, A Virtuális Intézet Közép-Európa Kutatására Közleményei, 7:(1-2) pp. 398-405.
- [17] Lazányi, K. (2015): Organisational Safety in Health-Care Setting – Literature Review. In: Michelberger Pál (szerk.) Management, Enterprise and Benchmarking in the 21st Century II. Budapest: Óbuda University, 2015. pp. 111-122.
- [18] Lazányi, K. (2015): Szervezeti biztonság és a stressz kapcsolata, TAYLOR: Gazdálkodás- és szervezéstudományi folyóirat, A Virtuális Intézet Közép-Európa Kutatására Közleményei (közlésre elfogadva)
- [19] Lazányi, K. (2015): Mire jó a biztonsági kultúra?, TAYLOR. Gazdálkodás- és szervezéstudományi folyóirat. A Virtuális Intézet Közép-Európa Kutatására Közleményei, közlésre elfogadva
- [20] Michelberger, P. (2013): Vállalatbiztonság. In: Nagy Imre Zoltán (szerk.): Vállalkozásfejlesztés a XXI. században: III. Óbudai Egyetem Keleti Károly Gazdasági Kar
- [21] Milicz, Á. (2010): Ellenőrzési aspektusok a vállalatok versenyképességének szemszögéből TM 15. sz. műhelytanulmány, TAMOP-4.2.1.B-09/1/KMR-2010-0005 azonosítójú projektje, A nemzetközi gazdasági folyamatok és a hazai üzleti szféra versenyképessége címet viselő alprojektjének kutatási tevékenysége eredményeként készült

- [22] Neely, A.; Al Najjar, M. (2006): Management Learning, Not Management Control: The True Role of Performance Measurement. *California Management Review*, University California of Berkeley, Spring 2006. Vol. 48. No. 3. pp. 100-114.
- [23] Pató, B. Sz. G. (2015): The 3D Job Description, *Journal of Management Development*, Vol. 34 Iss: 4, pp. 406 – 420
- [24] O'Reilly, C. A.; Chatman, J.; Caldwell, D. F. (1991): People and organizational culture: a profile comparison approach to assessing person – organization fit. *Academy of Management Journal*, 34(3), pp. 487-516.
- [25] Reason, J. (1994): *Human Error*, Cambridge University Press
- [26] Reason, J. T.; Carthey, J.; de Leval, M. R. (2001) Diagnosing vulnerable system syndrome: an essential prerequisite to effective risk management. *Qual Health Care*. 10(suppl 2). szám.
- [27] Sasvári, P. (2013): The Impacts of Using Business Information Systems on Operational Effectiveness in Hungary, *International Journal of Emerging Research in Management & Technology*, 2(9), pp. 1-5.
- [28] Sasvári, P. (2012): Adaptable Techniques for Making IT-Related Investment Decisions, *International Journal of Advanced Research in Computer Science and Software Engineering*, 2(2).
- [29] Szeghegyi, Á. (2011): A tudásmenedzsment stratégiai szerepe a vállalatoknál Óbudai Egyetem KGK Tanulmánykötet, Budapest
- [30] Szilágyi, T. P.; Medve, A.; Tóth, T. (2013): Beruházási folyamatvizsgálat a megrendelői döntéshozataltól a megvalósulásig, in: Nagy Imre Zoltán (szerk.): *Vállalkozásfejlesztés a XXI. században III*, Budapest, pp. 53-72.
- [31] Szilágyi, T. P.; Medve, A.; Tóth, T. (2013): Beruházási folyamatvizsgálat a megrendelői döntéshozataltól a megvalósulásig, in: Nagy Imre Zoltán (szerk.): *Vállalkozásfejlesztés a XXI. században III*, Budapest, pp. 53-72.
- [32] Szilágyi, T. P.; Almádi B. (2015a): Beruházási – projekt kozkázatok vizsgálata és feltárt dimenziói primer kutatási eredmények alapján In: Keresztes Gábor (szerk.) *Tavaszi Szél 2015 Konferenciakötet II*. 659 p., Eger, EKF Líceum Kiadó. pp. 601.
- [33] Szilágyi T.P.; Csiszárík-Kocsir Á. (2015b): Investment profitability measurements and their application based on the results of a primary research, In: *Mendel University in Brno (ed.) X. International Conference on Applied Business Research Proceedings in Madrid, Mendel University in Brno*, p. 1000-1007.
- [34] Tóth-Bordásné Marosi, I.; Bencsik, A. (2012): Szervezeti magatartás avagy a bizalom ereje, *Universitas-Győr Nonprofit Kft.*

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- [35] Westrum, R. (2004): A typology of organisational cultures, Qual Saf Health Care. 13.
- [36] Wimmer, Á. (2005): Teljesítménymérés és döntéstámogatás az üzleti szférában, Versenyben a világgal 2004 – 2006, Gazdasági versenyképességünk vállalati nézőpontból c. kutatásból: Teljesítménymérés és döntéstámogatás az üzleti szférában című tanulmány, a Versenyképesség kutatások műhelytanulmány-sorozat 10. sz. kötete., BCE, Vállalatgazdaságtan Intézet, Versenyképesség Kutató Központ

# Time Management in Context

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*Abstract: What is Time ?*

*Time is an important and scarce resource of which we never have enough. Unlike other resources, it cannot be substituted with anything else. Still, we do not seem to fully understand its nature. Even our numerous definitions of time are intangible.*

*Sensation of Time in Human History*

*Our sensation of time has changed enormously through our history. We keep trying to squeeze more and more tasks into a constant amount of time – in pursuit of more happiness.*

*Time Management Techniques*

*Lack of knowledge of this area causes a tremendous amount of struggle. While we are expected to be highly industrious at all times, many of us do not have sufficient level of knowledge of the basic time management technics. Let us briefly summarize these.*

*Deadlines*

*Deadline is a magic word in our lives. Deadlines drive our whole existence. What is a deadline? What are the typical types of deadlines?*

*Common fallacies*

*Not only we do not have decent definitions for time, not only do we lack knowledge in the field, there are also common fallacies that exacerbate our struggle for time.*

*Proposals*

*Do less. Do it better. Know the traps and avoid them.*

*Keywords: Time Management, Deadline, Fallacy*

## 1 Introduction

### 1.1 The ideal applicant for any job

From a bunch of job advertisement I created a generic job profile that describes the applicant who can fill any job. The profile:

- high- energy, dynamic
- passionate,
- flexible,
- positive disposition,
- multitasking,

- tight deadlines,
- experienced,
- inspiring,
- broad-minded,
- creative,
- capable of hard work, resilient,
- technically skilled,
- team player,
- covert (not PC, but smart HR managers know how to relate to this):  
 younger than 35.

## 1.2 Problem

Among middle-aged (and onward) employees burnout syndrome is frequent. This syndrome deprives people of many of their traits that are demanded by employers. (Glouberman, 2003)

<b>Required attributes, must haves</b>	<b>Burnout syndrome</b>
Dynamic, loadable, tight deadlines, high-energy	Exhausted
Resilient, positive disposition	Distressed
Problem solver, Can-do, Success person, Multitasking	Inability to cope, dysfunctional
Motivated	Disillusioned, bored
Team player	Antisocial, lonely

Table 1  
 Generally expected attitudes vs. Burn out

Permanent overload and stress result in burnout. (Maslach, Schaufeli and Leiter, 2001)

A major cause of stress: "I cannot meet the deadline!"

Typical cause for missing deadlines is bad time management.

In my experience, while workload seems to be ever increasing, many people - especially young employees - lack adequate skills in time management. This deficiency causes a lot of unnecessary stress and loss of efficiency. They continue their inefficient fight to meet exorbitant amount of deadlines until they gradually burn out. In this battle they waste a lot of their abundant energy and finally they may become liabilities for their employers. It is also important to understand the

covert nature of the problem: we generally start to be interested in time management only after we have burned out – this means we are regretfully, too late.

This is why I think it is imperative to deal with time management issues as major factors of burnout. In this article I will not focus on the “how”-s since many books describe them in detail. I find the “why”-s and “what not”-s more interesting and far less examined. This is why I will rather dwell now on these fields of questions predominantly.

## 2 The definition of Time

Passage of time is a major source of our fears. Time is a major source of our stress at work and also at home. The resource we never seem to have enough. This is the dimension that limits our being above anything else. The reason we do not travel to far planets is not distance but the fact that it takes too much time. Time cannot be substituted with any other resource. ‘Time is Money’ – people say. Still, time cannot be purchased for money.

Let us have an initial look at how we define time.

„**Time** is a measure in which events can be ordered from the past through the present into the future and also the measure of durations of events and the intervals between them. Time is often referred to as the **fourth dimension**, along with the three spatial dimensions.” (Wikipedia)

“A nonspatial continuum in which events occur in apparently irreversible succession from the past through the present to the future. The Free Dictionary” (The Free Dictionary)

“The measured or measurable period during which an action, process, or condition exists or continues” (Webster Dictionary)

„The part of existence that is measured in minutes, days, years, etc., or this process considered as a whole. Time is :

- the system of recording hours used in different parts of the world (e.g. GMT),
- an amount of time that you have available to do something,
- a particular period of time for which something has been happening, or that is needed for something,
- a particular point in the day, as expressed in hours and minutes or shown on a clock, or a particular point in time...” (Cambridge English Dictionary)

In comparison, I also show you definitions for other dimensions:

Distance: „the amount of space between two places or things „, (Merriam-Webster)



Temperature: a measurement that indicates how hot or cold something is : a measurement in degrees showing the heat of something (such as air or water). (Wikipedia)

The above examples show how difficult it is for us to relate to time compared to other dimensions. I think this is a precursor of our problems with time. We can rather describe than define time.

## **3 Man and Time**

### **3.1 Time and Human History**

Men's time concept has gone through fundamental changes over history. Let us browse through these historic ages.

#### **3.1.1. Prehistoric age**

Our prehistoric ancestors lived in hunter-gatherer societies. They did not produce food at all. They only collected what naturally grew or bred in their way. They lived by the day. Whatever they managed to acquire was likely to be consumed instantly. They could not store up food due to numerous reasons like scarcity, or perishability. They lived in a quick feedback world: they experienced the result of every action within a very short time span. The amount of work to be done in a day: just enough for the survival of that very day.

For them time meant a single day. Their timetable was very basic:

- rise when the sun rises,
- lie down when it sets,
- find something to eat in between and above all,
- not get eaten in the meantime.

Goal: survival. Survival is happiness.

Time schedule: airy.

#### **3.1.2. The Dawn of Agriculture**

The invention of agricultural production brought about enormous changes in human life. People discovered how to produce food. When you breed animals you do not have to eat them immediately. You can use them as live food stores. In addition animal husbandry produces a lot of useful side products too – like milk or wool.

When you grow grain, you can harvest it and store it for later use. Domesticated breeds also produce more food than their wild counterparts.

With the appearance of food storage, days became busier. Doing extra work became worthwhile. In order to be able to manage the busier daily agenda you needed more accurate measurement of time. The first clocks were invented for measuring the passage of time within the day: sundial, hourglass. The action-feedback cycle became longer. It was not enough anymore to measure time within a single day. Therefore, calendars were also developed for the measurement of longer periods of time.

The new goal: not to starve. Happiness is being well fed.

Time schedule: tight.

### **3.1.3. Industrial Age**

Machines were invented. The power of beasts of burden and that of humans were substituted with new sources of energy: steam, oil, electricity, nuclear power.

Productivity multiplied. People became even busier so they needed even more time measurement devices. Spring driven mechanical clock became widespread. Later on electric clock was introduced. Then atomic clock was invented - a clock that misses a second only in a couple of million years. We became time freaks. By now we do not have a single moment in our life when we have no clock in our eyesight.

Goal: produce more than yesterday. Economy has to grow endlessly. Produce more than you need. Rush! You are late.

Concept: dehumanization (loss of identity, loss of community).

Consumption is happiness.

Time schedule: over tensed

### **3.1.4. Post-industrial society**

This is a futuristic scenario. Consumption of goods is not everything. Let machines produce and people create. What we need is not more production but a sustainable one. Prevalence of quality over quantity.

New concept: rehumanization. (Rediehs 2014)

Goal: Sustainable happiness.(Boehm, Lyubomirsky 2009)

Time schedule: sustainable, balanced.

## **Time illusions**

If our natural time perception was accurate, we did not need clocks. However, our minds trick us by distorting our perception of time (West). Just a few examples.

### **3.1.5. Children vs adults**

Adults tend to underestimate the length of certain period of time while children overestimate it. This is because we learn to perceive time empirically: an adult compares any time period with the length of his age and so does a child.

### **3.1.6. Vierordt's law**

The root cause of many defaults. Long periods of time are often underestimated while short ones are overestimated. The time demand of simple tasks is frequently overestimated whereas complex tasks are underestimated.

### **3.1.7. Kappa effect**

In case of a sequence of consecutive stimuli, we tend to overestimate the time length between two stimuli if they are distant, while underestimate it provided they are close.

### **3.1.8. Emotional state effect**

Our emotions also impact our otherwise fragile time perception. Time flies when we are happy but seems to freeze when we have a hard time. The time perception of a dentist is likely to differ from that of his patient in the chair.

## **4 Deadlines**

### **Origins.**

Deadline is another word that has a meaningful etymology. The word originally referred to demarcation line in prisons. No one was allowed to approach or cross this line. If anyone did, the guards had to shoot immediately.

The original message of this word can also mislead us:

- modern deadlines are not constant. They can be changed for a better outcome.
- we often miss deadlines with minor or no consequences,
- we use many different types of deadlines instead of the single do-not-cross-me type.

### **4.1 Different types of deadlines**

When trying to accomplish anything, we generally have to face:

- Time constraints (do we have enough time?)

- Sequencing constraints (what should I do first, second, etc.)
- Resource constraints (do we have enough money, machines, workers, space, materials, etc.)

Success depends on the tasks executed in face of all constraints. More specifically: we wish to reach one very specific goal within the boundaries of all constraints. We tend to consider only one outcome as success, any other result will probably mean failure – the chance of full success therefore, mathematically tiny.

This difficult task in these not less difficult circumstances has led to the sophistication of deadlines. Some industries like construction industry have to cope with a complex network of different deadlines in difficult circumstances (e.g. the construction of huge railways, highways - lots of deadlines, long lead time, complicated network of interdependencies among tasks). These industries always use various deadline types besides the standard one. Serious projects are always backed by project time schedules that contain very complex structures of deadlines.

Let us quickly revise these through simple examples.

#### **4.1.1. Default: Finish no later than**

This is the classical and most common type. Its behaviour is the same as prison deadlines: an activity must be carried out not later or earlier than a specified time. Example: you want to watch a movie in the cinema. The movie commences at 8 p.m. You can arrive any time earlier than 8.00.

#### **4.1.2. Finish no earlier than**

Ageing Hungarian Tokaj dessert wine takes at least 3 years. Longer periods are also fine, but any period shorter than 3 years results in semi-finished wine with heavily reduced quality and value.

#### **4.1.3. On time (must finish on)**

If you travel by bus, you have to get off when the vehicle is exactly at the right bus stop. Acting later or earlier equally give bad results.

#### **4.1.4. Rush Deadlines (ASAP)**

In case of leakage in a nuclear plant this type of deadline is advisable for up keeping maintenance.

#### **4.1.5. As late as possible**

Software development projects generally postpone the costly phase of the work until the client has committed. Actual programming work does not take place until contract is signed and the first invoice (generally for the specification of requirements) is issued.

**4.1.6. Must start on**

Harvest must start exactly when the crops are ripe. Any delay and any earlier start lead to serious losses or extra cost.

**4.1.7. Start no earlier than**

In road construction, earthworks need at least 3 months of consolidation. Placing asphalt on an unconsolidated base will cause grand deficiencies.

**4.1.8. Start no later than**

Piano accordion valves are mounted to the corpus by molten beeswax. Wax solidifies in 10 minutes, so the technician has 10 minutes only to work on the valves and then he has to remelt the wax.

**4.1.9. Standby deadlines**

Preheating steel plates is optional in outdoor welding. Depending on the steel quality, dimensions and weather circumstances you may experience reduction in the quality of your welding stitches. If this happens you must insert a preheating phase in the welding process in order to improve welding quality to normal level.

**4.1.10. Phased Deadlines**

This type is predominantly used in case of lengthy activities as a risk management tool. The longer time a task takes the riskier it tends to be. By splitting up a time consuming task into smaller parts, you can increase your insight during its execution and thus allow yourself an opportunity to manage properly.

**4.1.11. Milestones: not attached to activities, not flexible – generally externally determined**

Milestones are special deadlines. They are typically externally determined, therefore rarely flexible. Their time span is generally zero – whereas other deadlines are mostly attached to some activity that has a time span.

The beginning of the heating season in Hungary is 15 September. A project that targets the reconstruction of heating systems for housing estates must be operational before that date. The date cannot be postponed, obviously. This is a typical milestone.

## 5 Time Management

The very first thing: Time management does not exist. None can manage time. However, everyone can manage his/her own schedule. Viewing it from this angle may change our vision of time.

There are many good books on time management. My observation is that they have a lot in common:

- they focus on the technics of time management (prefer the “how”-s to the “why”-s),
- they use similar techniques.

With due respect to the great authors of these books, let me make a faint attempt to summarize the very essence of time management technics I learned from works I had been fortunate enough to read.

### 5.1 Sequencing tasks:

- make a list of your tasks,
- order them into the sequence of precedence,
- eliminate the bottom 20%,
- execute the rest in the sequence you have set above,
- update regularly.

#### 5.1.1. The ABC sequencing method

Categorize you tasks as follows:

- Category A: crucial
- Category B: must be done
- Category C: unimportant

Once you have categorized all, you only have to focus on A-s, do B-s when you have some free time and omit C-s.

#### 5.1.2. The Eisenhower sequencing method

This method was devised by general Eisenhower He was a pragmatic, hands-on man. He realized that people like to pressurize their bosses by telling them some task is very urgent. He realized that the most important things are rarely urgent. He classified his tasks into a 2x2 matrix. The two dimensions of the matrix:

- urgency,
- importance.

Figure 1



## 5.2 Eliminating tasks

Pareto rule: 20% of our efforts is responsible for 80% of our achievements.  
Conclusion: focus on the imperative few and forget the rest.

## 5.3 Balanced time schedule

Would you like to maintain a time schedule that helps you not only in the short run but also leads you somewhere in the long run? This is what you need to do:

- take the list of your activities that you have prepared and categorize them into one of the following categories: meeting, paperwork, communication, think tanking, interruptions, etc.
- add up the time demand of each category,
- get surprised by the numbers,
- set a goal for a better distribution,
- reach your goal,
- here you have a balanced timetable.

# 6 Common fallacies

## 6.1 Ignoring time management

When I left school I was not equipped with time management skills and I paid a heavy price for it. I can see young professionals suffering from the same ailment too often. Many of them did not learn about the concept of Time Management. Others learned it but neglect it. The result is failures and loss of efficiency.

## 6.2 Erroneous sequencing

Sequencing all tasks into the order of importance is easier said than done. What makes a task more important and others less ?

Every task's importance can be measured on multiple concurring scales. The importance of a task is likely be different for

- the company,
- you,
- your boss,
- your colleague,
- moral obligation (this category is rarely emphasized).

Finding the proper ranking requires a lot of experience (in other words: "earlier mistakes"). The chosen sequencing criteria are often oversimplified or fundamentally improper. This leads to a bad sequence which is likely to cause harm. For a proper sequence you need to understand the context (the "why"-s).

A piece of advice: it might be a good idea to give high priority to those activities that are important for your boss.

## 6.3 Bad communication

The moment when you miss a deadline is not when its due date passes but a lot earlier. Sometimes you are late at the beginning, sometimes it goes astray at some point during its execution. You have to bear in mind: deadlines are ideally not a l'art-pour-l'art game. Properly managed deadlines keep your organization operational and this is the major motive behind them - which should drive you actions too.

People frequently miss serious deadlines without any preliminary warning cause scores of unnecessary stress for the rest of the organization. The reason why they keep silent is sometimes lack of skills, sometimes ignorance, sometimes fear of consequences.

For those who fear: there is only one thing worse than revealing problems and it is being caught in the red. It not only makes people twice as irritated but you may also destroy trust. Losing trustworthiness is like losing a hundred dollar banknote: you are unlikely to ever find it again.

Develop a sense to foresee the likely miss of upcoming deadlines of yours and notify everybody concerned well before the deadline – so they have time to prepare.

## 6.4 Rigidity

Nothing is more dynamic than time so time schedules should also be dynamic. Do not hesitate to reorganize your timetable when circumstances demand it. That means that you have to keep a finger on the pulse of the circumstances. Awareness is key.



You initial task sequence can be perfect today but a kamikaze tomorrow. So it may need revision.

When you are about to miss a deadline, preliminary notification of colleagues is a must but far from enough. You also have to increase your efforts (do overtime), and give the problem area proper focus (set aside other activities).

## **6.5 Distractions**

Open plan office became popular in the XX. century. The official reasoning behind it is better communication. My experience is that the real reason was to exert more control over employees.

There are jobs that should never be mixed in the same room. It is a pain for an analyst to hear the sales guy phoning all day long. The intended improved communication backfires: it produces a never-ending noise that destroys productivity.

Cell phones: real beasts. They can ring any time and when they do you immediately suspend whatever you do in order to answer them.

Emails: whenever you receive an email a small pop-up message is likely to let you know. Many people interrupt his/her current task to read it right away, and reply.

You better find a way to minimize these distractions if you want to be efficient.

## **6.6 Meetings**

Many company cultures love meetings too much. The more people attend, the more important the participants are and the longer the meeting lasts the more productive it is considered.

In fact:

- too many participants (above 5-10, depending on the topic) kill any meeting,
- too long meetings exceed people's attention span (60 minutes) and generally are fruitless,
- too many meetings distract people from their other tasks and unnecessarily exhaust them.

Some companies use meetings as governing devices. Here is how:

- employ people flexitime (no overtime pay)
- organize them a mandatory meeting for every 8:00 a.m. and 19:00.

## 6.7 Unbalanced schedule

Even a seemingly good timetable may lead you in the bad direction on the long run if it is unbalanced. This is the controversy between long term and short term goals. If you do not categorize your time into categories that are important for you then your timetable will probably be spontaneously unbalanced. In unbalanced schedules time consuming humdrum work tend to be overweight while value added activities and your personal development will lose.

## 6.8 Lack of foresight

I have seen many people who never started any task before it was too late. This lack of proactivity generates untold amount of stress when the deadline is suddenly closing in on us.

## 6.9 Excessive self-confidence

For decades psychologists saw the roots of all problems in too little self-esteem. People attended lots of courses to increase their self-esteem. Decades later researches prove that the self-esteem of the population has significantly grown. As a result problems caused by too low self-esteem have been replaced by problems driven by too much of self-esteem.

Exaggerated self-assurance causes many people overestimate their capacities and at the same time underestimate the difficulties they are supposed to overcome. Result: defaults.

## 6.10 Busy bees

Some people confuse business with busy-ness.

How you can recognize people suffering from this disease:

- They always seem extremely busy, therefore they do not have time for anything.
- They are always running.
- They have at least two mobile phones that are constantly ringing.
- They attend two meetings simultaneously, meanwhile they are constantly on the phone.
- They rarely show up at meetings to which they are invited as key participants.
- When they show up, they are late.

- They do not listen to anybody at the meeting. Once they show up, they quickly express their opinions and rush out before anyone could say “John Robinson”.
- At the first glance they seem very-very productive. Real heroes.
- Their time schedule is random, very badly organised if at all.
- Practically, they live in the office 24/7. This includes all banking holidays too. They are likely to be in a private life crisis.

My experience is that these colleagues are rarely top performers – despite all the fuss. On the contrary, they are prone to miss all deadlines, they cannot properly cooperate with anyone and their performance is shallow.

Often, these colleagues try to hide incompetence: they are always too “busy” with simple tasks to think about serious, non-piecemeal issues. Looking busy is looking precious.

If they are glorified, for this misleading appearance, then this behaviour model easily become company culture and soon enough you will see many new disciples acting the same way.

If the above description fits

- you: stop and think,
- your colleague: be careful,
- your boss: you are in trouble,
- your company culture: it is unlikely to change.

### **6.11 Semi-finished tasks, poor quality**

One of Murphy’s laws: some never have time to do a thing properly but somehow always find time to do it twice. Many tasks –especially big, complex ones – are never fully finished. Unfortunately, a 99% finished parachute jump is considered a failure.

### **6.12 Human games**

People love playing games with one another on the cost of the other party (Berne 1996). Shifting the blame for defaults or coercing are old time favourites. Some of them are related to time management.

Some people intentionally forward you a task in the most inconvenient times like

- Christmas Eve,
- at the beginning of your holiday,
- at the beginning of their holiday,
- last day of the year, month, week
- at night.

Some people learned that they can coerce quick positive decisions if they sit on a task until the last moment and then they come to you and say: “We are in the last moment. If you do not sign this off now, the company will lose 100 000 billion dollars”.

My advice is that you should minimize the games you agree to take part in. Every human game needs at least two people. If you stay away from it, the other player will not be able to play with you.

### **6.13 Victim**

There are situations in life when even the best time management cannot save us from trouble. There can be over tensed time schedules, unrealistic expectations, badly managed organizations with constant firefighting. If you are trapped in this for a long time and even the best time management attitude does not help you out - you become a victim. Do not be a victim.

This problem is typical in mature industries where competition is fierce and sales margins are too low, therefore, exploitation of employees is unescapable.

Another typical place to experience this atmosphere is at mismanaged companies.

## **Conclusions**

Be an essentialist (Greg McKeown: Essentialism) : be selective about what you choose to spend time on. Do less, do only what matters.

Do it better.

Know and avoid fallacies.

Whoever you are, your life is a treasure box which is full of time diamonds at the moment of your birth. You have to pay a diamond for every single day of your life until your treasury runs empty. A good day costs one diamond, a bad one often costs more. Think about time and you also have thought about your life.

## **References**

- [1] Maslach, Schaufeli and Leiter (February 2001): Job Burnout Annual Review of Psychology, Retrieved from <http://www.annualreviews.org/doi/full/10.1146/annurev.psych.52.1.397>
- [2] Dr. Dina Glouberman (2003): The Joy of Burnout (pp 1-5) USA, Inner Oceans Publishing
- [3] Wikipedia, Retrieved from <https://en.wikipedia.org/wiki/Time>

**Management, Enterprise and Benchmarking in the 21<sup>st</sup> Century**  
Budapest, 2016

- [4] Webster English Dictionary, Retrieved from <http://www.merriam-webster.com/dictionary/time>
- [5] The Free Dictionary, Retrieved from <http://www.thefreedictionary.com/time>
- [6] Merriam-Webster Dictionary, Retrieved from <http://www.merriam-webster.com/dictionary/distance>
- [7] Laura Rediehs (2014): From Dehumanization to Rehumanization
- [8] [http://www.carnegiecouncil.org/publications/ethics\\_online/0090](http://www.carnegiecouncil.org/publications/ethics_online/0090)
- [9] Boehm and Lyubomirsky (2009): The Promise of Sustainable Happiness (pp 667-677) Oxford, UK Oxford University Press
- [10] Louis Jolyon West: Time Perception Encyclopedia Britannica, Retrieved from <http://www.britannica.com/topic/time-perception>
- [11] Eric Berne (1996): Games People Play (pp. 19-24) Ballantine Books, New York USA

# Difference among Personality Types in Comment-Writing Behaviour

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*Abstract: The higher penetration of internet usage in the society makes it more important to understand how and why people are ready to generate information on the net and what the common features are of those who are ready to post comments. Here special focus is on the members of Y generation, who are adults now and get used to use internet on a daily basis. This study tries to find relationship between personality types and frequency of comment-writing activity. According to our hypothesis, among Keirsej's personality types, the intuiting Rationals and Idealists are supposed to write more comments than their Artisan and Guardian counterparts. Social attitude of the respondents is also examined: we would like to know whether the extravert people write more comments or the introvert ones. It is also expected that Rationals show the most positive attitude toward expressing their opinion and they are also ready to express negative opinion in a higher proportion than other temperament types. The analysis of the 992 usable questionnaire of university students supports the hypotheses.*

*Keywords: eWOM, comment-writing, Keirsej temperament types, MBTI, opinion-expressing attitude*

## 1 Introduction

In the Internet Age people have an easy way to get information almost whenever and on whatever they want. However, people cannot only use this information but can also generate them – especially when they evaluate products and services. There are different platforms to share opinions and post their comments: weblogs, discussion forums, social networking sites, and review and retail websites.

Comparing efficiency of mass media advertisements with classical word of mouth communication, literature found the latter significantly better, as the credibility of the information-source and its personal and non-commercial form makes it more

reliable. However, eWOM<sup>1</sup> shows some significant differences from traditional word of mouth communication. First, the internet communication is not limited in time or space, so eWOM spread can happen in asynchronous mode [5]. Moreover, it is persistent and more accessible than its traditional counterparts [6]. That feature makes it possible to measure it - but not only its quantity. Different sites insist on using specified rating scales beside giving text-based information about the product or service (e.g. booking.com), just to make independent evaluations comparable and make decision-making easier for the consumers.

## **2 Research background**

### **2.1 Literature review and hypotheses**

It is necessary to understand motivations behind comment-posting behaviour, which can also contribute to recognise customer competences in case of product/service development [2] [8]. Henning-Thurau et al. (2004) found that (1) focus-related utility (helping others), (2) consumption utility (post-purchase advice-seeking) (3) approval utility (self-enhancement and economic rewards), (4) moderator-related utility (problem-solving support) and (5) homeostase utility (expressing positive emotions and venting negative feelings) are in the background of positive eWOM [5].

Cheung and Lee (2012) designed a research model to understand factors influencing consumers' eWOM intention (precisely: intention to spread positive eWOM). Their study found support for their hypothesis which highlighted the relationship between reputation, sense of belonging and enjoyment of helping and eWOM intention. However they could not accept the role of reciprocity, moral obligation and knowledge self-efficacy as antecedents of eWOM intention.[1]

Ridings et al (2006) also wanted to understand motivations behind posting behaviour by comparing attitudes of active and infrequent posters and lurkers ("virtual community members who visit and use the community but who do not post messages" p. 330) They included trust in others' abilities, trust in others' benevolence, trust in others' integrity and desire to participate in the exchange of information/social support/shopping information as variables which should differ among the free behavioural groups. Lurkers "are different qualitatively not only in a gradual quantitative way, but also in their desire for more social distance, less

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<sup>1</sup> eWOM: electronic Word of Mouth refers to any statement consumers share via internet about a product, service, brand or company. WOM (Word of Mouth) communication is oral communication which passes information from person to person.

social bonding and their reluctance to rely on information provided by others” p.343. Lurker showed significantly less trust in others’ benevolence and integrity than infrequent or frequent posters. [12]

The above mentioned results show that different personality traits influence motivation of posting behaviour. Therefore in this study the relationship between personality/temperament and comment-writing behaviour is in the focus.

Based on Jung theory, personality can be described by mental functions (information gathering/perception and based on these information-decision making process) and by energizing attitude: how people “charge their batteries”. Briggs-Myers (1980) added the fourth dimension: the lifestyle preference to the former ones – that is how the MBTI can identify personality types. [17] [11] Table 1 shows the main features of the four personality types.

According to David Keirsey’s view, his typology is not completely similar to the Myers-Briggs Type Indicator- although they definitely show parallelism. For example he explains that extravert-introvert dichotomy should reflect to social address and social attitude instead of how people energizing themselves [7].

	<b>Rationals</b>	<b>Guardians</b>	<b>Idealists</b>	<b>Artisans</b>
Common preferences	Abstract Utilitarians Intuiting + Thinking (NT)	Concrete Cooperators Sensing + Judging (SJ)	Abstract Cooperators Intuiting + Feeling (NF)	Concrete Utilitarians Sensing + Perceiving (SP)
Typical features	pragmatic, focus on problem-solving, independent, strategic leader	dependable, hard-working, responsible parents, seek security	enthusiastic, kind-hearted, spiritual, trust their intuition	optimistic, creative, prize freedom, love working with their hands, live for today
Proportion in the population	5-10%	40-45%	15-20%	30-35%

Table 1

Main features of personality types by Keirsey

Source: <http://www.keirsey.com/4temps>, own construction

Probably information taking preference can influence most the comment-generating behaviour of personality types. In Keirsey’s method the two dimensions used for identifying the four personality types are (1) communication and (2) action. [7]

Communication can be concrete (facts and figures are in the centre) or abstract (beliefs, theories and understanding in the centre), while actions can be utilitarian



(good for themselves) or cooperative (meet the rules, what is correct). Web makes it possible to gather different kinds of information easily. For example before making a purchase decision, we can visit different sites to gather information on product variety, prices, objective product features, and we can also check the product reviews of former consumers. Although one of the main intention of the operators of these sites is to transform these reviews into a more formal, comparable form – via using scales for the evaluation, these evaluations are still personal and subjective. Therefore comments can be viewed mainly as abstract way of communication.

Moreover, the previous results from this study [9] - focusing on comment reading behaviour only - showed that Rationals and Idealists read significantly more public comments than the other two personality types. Therefore the first hypothesis is the following:

**H1: Rationals and Idealists generate more comments than Artisans and Guardians.**

Using Internet may also seem to be a modern form of communication – mainly via e-mail and social network sites. Taking into consideration the other dimensions of the personality, extroversion/introversion dichotomy may have a definite connection to comment writing activity. Extravert people are those who like talk to others, who are open to meet new people; they are interested in others and concerned with external reality. Supposedly, they are more active in virtual life as well than their introvert counterparts, so it is expected they generate significantly more comments than introvert people.

However, we can find extrovert people in each bigger personality types (e.g. ENTJ and ENTP among Rationals), it is worth to examine our sample through this dimension. Therefore our second hypothesis is, that:

**H2: Extravert people write more comments online than Introvert people.**

However, that can be seen as a threat for marketing managers because Extraverts typically speak before think, and if their comment is negative on the product or service that is a real threat. So, it is worth examining the proportion of positive and negative comments of different personality types and attributes.

Via Internet, users are relatively free to choose the contents they want to get, so probably they spend their time on sites which are interesting for them. Moreover, as people use forums, online chatrooms and comment-writing activity also for meeting new people and for building and cultivating relationships, it is expected that majority of comments are positive.

Yun and Park (2011) examined selective message posting behaviour if the opinion of the poster is a minority opinion. They found that people's perceptions about their position as being in the majority or the minority in the cyberspace influenced their willingness to speak out measured by the message posting behaviour: if their

opinion was a minority opinion, they posted a message less likely. [15] They also wanted to highlight the role of anonymity when they supposed that people would be less likely to speak out on an online forum when they have to register before posting a message. However, they found not support for this hypothesis. It is also important to mention that anonymity can lead to absurd or false behaviour, which should be taken into consideration at the analysis of product evaluations [8].

Based on the structure used by Keirsej typology, only Rationals are defined alongside Thinking aspect – this temperament type concentrates more on facts and figures when making a decision – combining it with intuitions. And for them it is associated with strong will and independence so they feel less pressure for assimilation in their opinion. That is why here it is hypothesised that this group of people is more ready to express relatively higher proportion of negative opinions in their comments.

**H3: Rationals generate more negative comments than other personality types.**

The aim of this study was not only testing the amount and valence of comment writing, but partly it wanted to understand the reason behind the differences of these numbers. It is supposed that besides of infrastructural conditions of comment writing activity (such as internet access and penetration of notebooks and smart-phones), differences in opinion-expressing attitude may play a significant role in comment writing. There are people who feel expressing their opinion difficult and some people don't want to share their opinion at all – especially not with unknown people in the cyberspace. On the other hand, expressing opinion sometimes means confrontation with others, and representing the opinion of minority may lead to the rejection of the majority. Hypotheses 4 party relies on the background what was mentioned for H3.

**H4: Rationals show more positive attitude toward expressing their opinion than other personality types.**

## 2.2 The questionnaire

For analysing comment writing activity of Y generation, a pen-and-paper questionnaire has been designed. University students were asked in their classes to fill in the questionnaires.

In the first part of the questionnaire, comment writing activity was in the focus. To improve reliability of the study, comment writing activity was measured on two ways. First, the respondent had to evoke how many comments (s)he wrote previous week on different sites (social network, news portals, forums, video sharing sites and so on). This question helps to detect the pattern of comment writing activity on the internet and perhaps is not difficult to bring a memory into the mind if interval is so short. Beside the former question, respondent had to give

the average number of comments (s)he wrote usually in a month. That was a great chance to control the reliability of the numbers given for the former question and also helped us to handle if there was an outstanding event or personal circumstance which could generate significantly higher or lower frequency in comment writing behaviour (celebrations, outstanding moments or social events for the young generation which could generate larger amplitude in comment writing).

Valence of comments were measured as an average distribution of the comments written by the respondents: they needed to share 100% among positive, neutral and negative comment types.

The second part of the questionnaire was dedicated to identify the personality of the respondent. Although there are wide variety of different personality tests, for this study, the easiest and shortest test was used – borrowed from a Hungarian homepage: [lektanitipusok.hu/tesztek.html](http://lektanitipusok.hu/tesztek.html). Here respondents have to make only four decisions alongside the four personality attribute-dichotomies described in a few sentences (extravert/introvert, thinking/feeling, judging/perceiving, sensing/intuiting). This relatively short but reliable version of personality tests provided the chance for the respondent not to feel overwhelmed and bored by a longer list of statements – especially because there were other parts of the questionnaire waiting for him/her.

In the third part of the questionnaire, there was a list of 5 statements related to opinion-expressing attitude, and the respondent had to evaluate them on a 7 point Likert-scale, where -3 meant: totally disagree and 3 meant: totally agree with the statement.

## 2.2 Sample description

Undergraduate and/or graduate student samples have been used in lots of studies examining eWOM [4], [10], [13].

	<b>Rationals</b>	<b>Guardians</b>	<b>Idealists</b>	<b>Artisans</b>
Proportion in the sample	13,7%	46%	16,6%	23,7%
Male/Female proportion	82 / 18 %	72 / 28 %	67 / 33 %	72 / 28 %

Table 2

Personality types in the sample

*Source: own calculation, own construction*

Our aim was to ask the members of the Y generation, as they are those who were born between 1980-1999, therefore they are young adults now who get used to using internet in their everyday life, and who have experienced the changing ways of contact patterns, and who have new definitions of group membership and social experience in the cyberspace [14]. So university student sample is definitely appropriate for that – even though their level of education will be higher in the near future than for the average population.

However, at the time of the fieldwork they didn't have a degree, only a high-school diploma. According to KSH database, in 2011 58,8% of the 20-24 year old population has graduated in high-school in Hungary, and only 28,0 % of the 25-29 year old population had a bachelor or master degree. [16] That means that education level of our sample is definitely higher than of the Hungarian Y generation population.

After finalizing the questionnaire based on the results of a pilot test, pen-and-paper study has been conducted in February, 2014 at Obuda University, Budapest. Students from faculty of business administration and management, mechanical and safety engineering, electrical engineering, informatics, light industry and environmental protection engineering took part in the survey. After data cleaning process, we have got 992 usable questionnaire. SPSS 19 was used to analyse the database.

Three quarter of our respondents were male (72%), the average age is 23,9 with a standard deviation of 5,3 years.

### **3 Results**

#### **3.1 Quantity of comments written by personality types**

Number of comments written on previous week was 8,36 in the total sample – comparing that with the average comments written in a month, which was 25, it seems that the monthly average is lower than what can be expected based on the number of comments previous week. (Expected value would be  $4 \times 8,36 = 33,4$ ).

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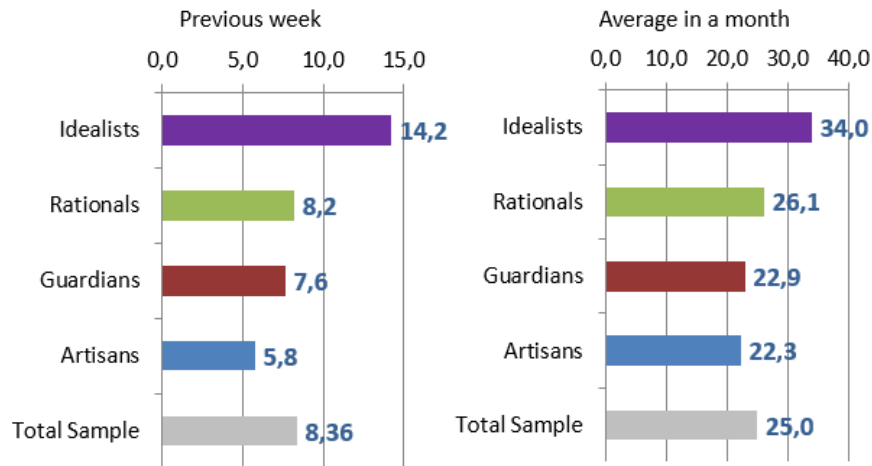


Figure 1

Number of comments by personality types – self-reported data (Total sample N=966, Idealists n=160, Rationals n=132, Guardians n=446, Artisans n=228)

*Source: own calculation*

Analysing the data carefully, it was found that the abstract category (average in a month) and the rounding behaviour of respondents could be the reason for the difference. For example, 10 comment per month was mentioned by 113 respondents, but 9 or 11 was mentioned only by 4-4 persons. So typical answers were rounded to the nearest multiple of 5 and perhaps they rounded down more than up.

Another potential explanation can be that for some of the respondents Valentine's Day was included in the previous week of the fieldwork. So that can also explain the higher number of comments written previous week than in an average month.

Focusing on the differences among personality types, number of comments previous week is significantly higher for the Idealists ( $F(3,962)=4,229, p=0,006$ ). However, no significant difference was found in the average number of comments written in a month ( $F(3,962)=2,024, p=0,109$ ). Rounding behaviour may explain also this difference, however the tendency of the number of comments very similar for this question to the previous one – Idealists generate the most comments in a month and Artisans generate the lowest number of comments.

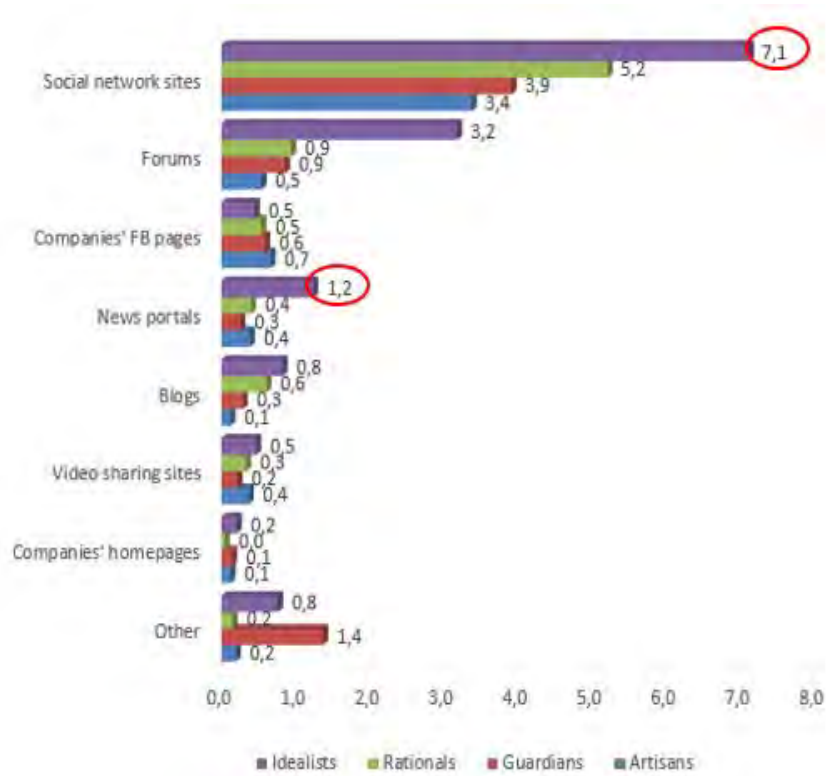


Figure 2  
Number of comments on different sites on a given week by personality types – self-reported data  
(Idealists n=160, Rationals n=132, Guardians n=446, Artisans n=228)  
*Source: own calculation*

Examining closer the sites where students posted their comments, not surprisingly social network sites were the most popular. Idealists posted there 7,1 comments as average which was significantly higher than for the other personality types. This group also wrote an above average 1,2 comments on the given week on news portals. They also wrote slightly more comments on forums, blogs and video-sharing sites than the other personality types.

### 3.2. Quantity of comments written by personality attributes

Digging deeper in understanding difference in frequency of comment writing, it is worth to examine the four temperament-dimensions used to define personality types.

Testing of the second hypothesis, number of comments written by extravert respondents was significantly higher than for introvert students – with both dependent variables (on previous week:  $F(1,972)=5,681$   $p=0,017$ ; average per month:  $F(1,972)=13,934$   $p=0,000$ ). As it was expected, the more open and socializing the respondents are the more comment they write on the internet.

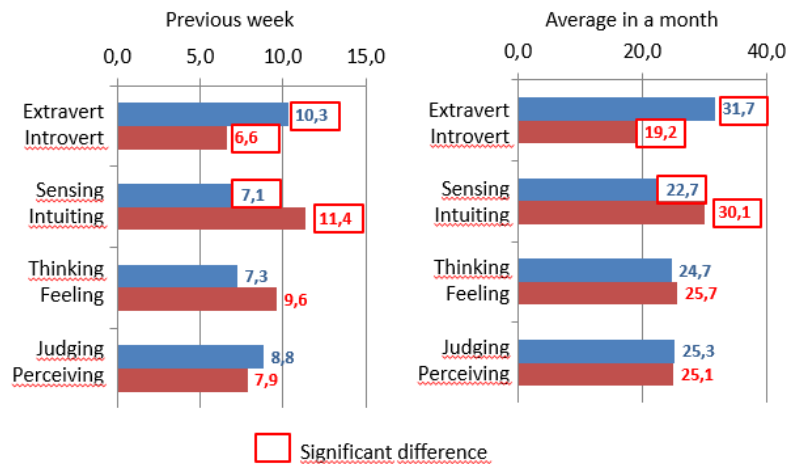


Figure 3  
 Number of comments by personality attributes – self-reported data (Total sample N=966) (red rectangle shows significant difference at  $p<0.05$ )  
 Source: own calculation

We could also find significant difference in average number of written comments alongside the perception preference. People, who focus on opportunities, connections and ambiguity in their perception (Intuiting) wrote significantly more comments than their Sensing counterparts on both time-period (previous week:  $F(1,971)=6,72$   $p=0,01$ ; in a month:  $F(1,971)=3,993$   $p=0,046$ ).

In the study, frequency of students’ comment-writing activity showed no significant difference in decision making preference and lifestyle preference - despite the slight advantage for people with Feeling preference.

### 3.3 Valence/polarity of comments written by personality types

In general, the predominance of positive comments is not surprising, as majority of the comments posted on social network sites which are mostly used for keeping/building contacts with friends, therefore mutual positive posts can serve this aim.

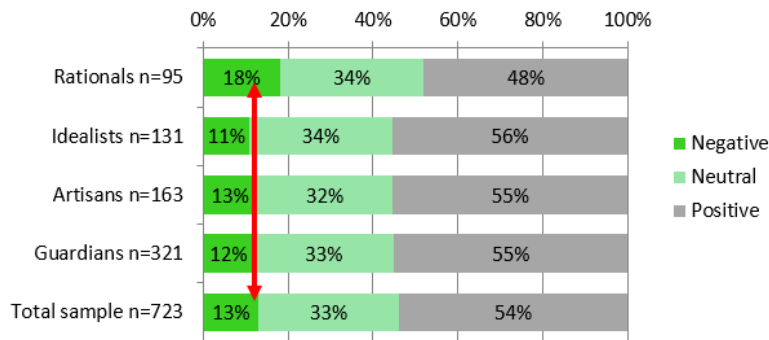


Figure 4

Distribution of valence of comments by personality types – self-reported data (Total sample: those who write at least one comment per month N=723) Red arrow shows significant difference at  $p < 0.05$

Source: own calculation

Examining valence of comments by personality types it was found that Rationals posted significantly more negative comments than other personality groups, which confirms H3. If we translate it into a practical issue, marketing managers dealing with eWOM should learn more precisely how to handle negative comments of the Rational type. Deeper understanding of the information-gathering and decision-making features of this personality may give a chance to influence the valence of their comment-writing activity

Analysing the proportion of negative and positive comments by personality attributes, people with extravert preference write significantly more positive comments (57,1%) than the introvert people (50,8 %), but this higher proportion doesn't mean the lower proportion of negative comments, so the proportion of neutral comments were lower for this group.

Valence of comments also shows significant difference alongside decision-making preference dichotomy. Those who concentrate more on their feelings when making a decision, write positive comments in 58,3 % and this higher proportion is also associated with the significantly lower proportion of negative comments (10,3%).



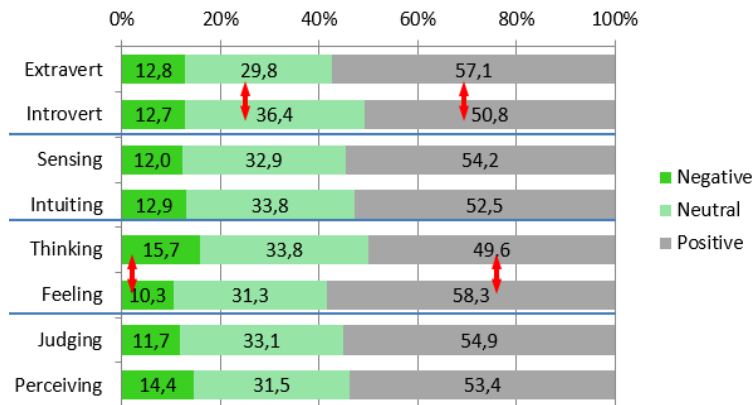


Figure 5

Distribution of valence of comments by personality attributes – self-reported data (Total sample: those who write at least one comment per month N=723) Red arrow shows significant difference at  $p < 0.05$

Source: own calculation

### 3.4 Difference of opinion-expressing attitude among personality types

For understanding the difference in comment-writing behaviour among personality types, opinion-expressing attitude statements has been used in the study. Each personality types prefers verbal communication over written communication and data show slight rejection of sharing opinion with people we don't know. However, one-way ANOVA test shows significant differences alongside the other three statements. As it was expected, Rationals have significantly more positive preference toward debating and Guardians show slight disagreement with this statement, what is also significantly different from the average in the total sample. The caring and helping attitude of this temperament type gives a good explanation for this result.

Rationals' positive attitude toward expressing their opinion is confirmed by the differences in the level of agreement with the two other, negatively formed statements. Rationals want to share their opinion the most and find no difficulty in the articulation of their own opinion.

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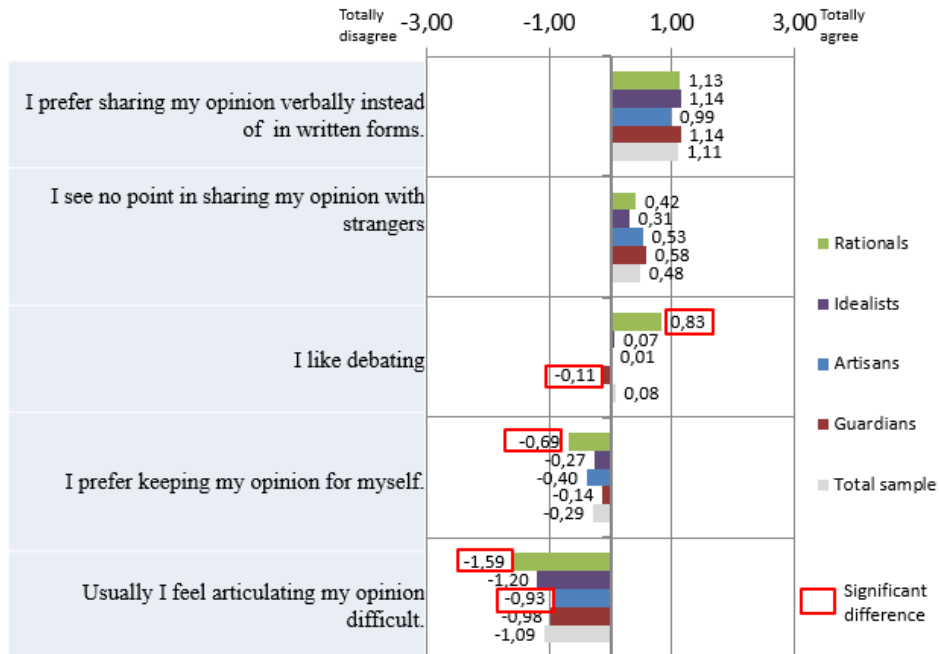


Figure 6  
Opinion-expressing attitude by personality types (means) – (Idealists n=160, Rationals n=132, Guardians n=446, Artisans n=228) Red rectangle shows significant difference at p<0.05

Source: own calculation

Although Artisans show slightly (but not significantly) higher intention to share their opinion than the total sample, they feel it relatively difficult how to say that.

For deeper understanding, it is worth to examine the level of agreement with the attitude statements alongside the four dimensions of temperament types. The extravert/introvert dichotomy, which reflects to the way of how a person energize himself (in MBTI) or to the social attitude of the person (in Keirsey’s theory) clearly distinguishes the different opinion-expressing attitude of the respondents. Significance test of mean differences shows that extravert people more ready to share their opinion – even with others they don’t know, and they like debating more than introvert people.

In the MBTI, alongside the decision making dimension, Thinking preference means that impersonal decisions based on logic and principles, while people with Feeling preference focus on human values and needs when making a decision. According to Keirsey, Thinking means that a person is tough minded, while Feeling people are friendly ones [7].

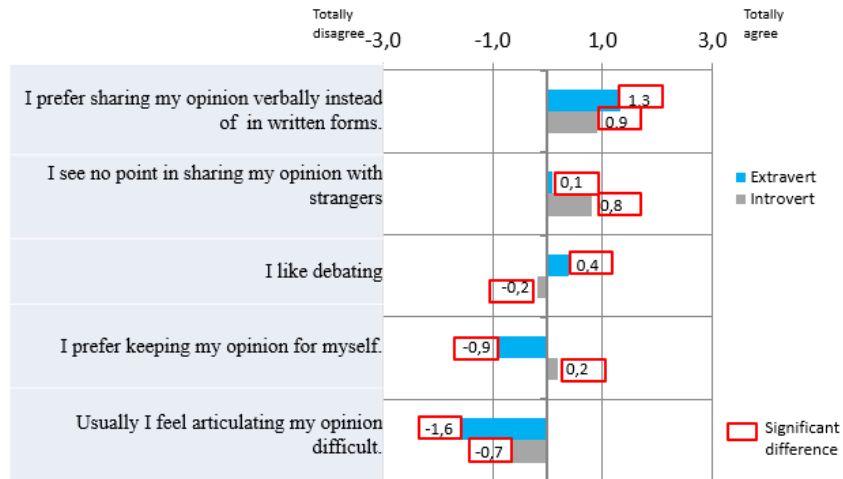


Figure 7

Opinion-expressing attitude of Extravert and Introvert respondents (means – (Extravert n=439, Introvert n=535) Red rectangle shows significant difference at p<0.05

Source: own calculation

Comparison of our respondents answers shows that people with Thinking preference like debating more than those who make decision based on human values and they experience less difficulty in expressing their opinion than people with Feeling preference.

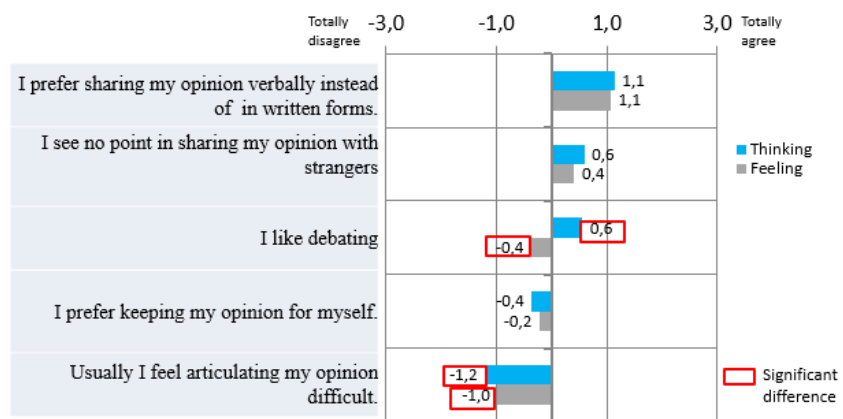


Figure 8

Opinion-expressing attitude of people with Thinking and Feeling preference (means -Thinking n=468, Feeling n=511) Red rectangle shows significant difference at p<0.05

Source: own calculation

Perhaps the latter group considers the potential reactions of the receiver of their communication more, so it is a bigger challenge (because of the higher level of discretion and precaution) to express their opinion in an appropriate form.

Based on day-to-day lifestyle preference, only one statement, the attitude toward debating showed significant difference: Perceiving people slightly more enjoy debating (mean: 0,248) than Judging people (mean: -0,016,  $F(1,957)=4,007$ ,  $p<0,05$ ).

Another finding is that people with Intuiting preference like debating significantly more than their Sensing counterparts (-0,059 vs. 0,4189  $F(1,957)=12,793$   $p<0,05$ ), and articulating their behaviour means less difficulty for them (-0,9675 vs. -1,365  $F(1,975)=10,503$   $p<0,05$ ).

## Conclusions

Results of this quantitative study underline the meaningful investigation of the relationship between comment-writing activity and personality types and attributes. Number of comments were significantly higher for Idealists than for the other personality groups. Taking into consideration that Idealists are enthusiastic people who trust their intuition, who are spiritual, and making decision based on feelings and values, comment writing (and reading) activity may be a reflection to the perceived world. Instead of facts and figures, they keep an eye on the “personally generated” world. They are more active than others both on social network sites and on news portals.

Data also supports that Rationals, who are broadly pragmatic, focus on problem-solving, independent, strategic leaders have the most positive attitude toward expressing their opinion, and they post the highest relative proportion of negative comments – although positive comments are still dominant.

Social attitude of respondents plays significant role in eWOM activity. The outwardly focused Extravert people show significantly more positive attitude toward sharing their opinion, therefore they post significantly more comments than people with introversion preference, and among these comments, and the positive ones dominate neutral and negative ones more than for the Introverts.

The results above are in line with experiences of social-media researchers. In the American society, more individuals with Extraversion preference reported using Facebook than individuals' preference for introversion and also more with preference for Intuition than for preference for Sensing. In connection with using LinkedIn, preference for Extraversion, Intuition and/or Thinking were detected as more relevant than their opposite in the related dichotomy. [18]

Practical implications of these results dedicated to online marketing managers. To get more realistic feedback on product or service evaluation sites, they have to

find out the way, how to motivate also Introvert people to express their satisfaction. On the other hand, as gathering eWOM information at the pre-purchase stage is more and more common behaviour, negative comments can ruin the reputation of the brand or the firm. Marketing managers may organize more efficient reactions to negative comments on product evaluation sites if they can understand the writer's personality deeper and giving the necessary type of information and the appropriate feedback to the poster.

Some limitations of the research should be considered. First, these data were self-reported, so they can still over- or underestimate the number of comments from one person. It was quite visible that respondents rounded up their answers to any multiple of 5 when the monthly average number of comments was asked, however this phenomenon cannot influence the relative differences among respondent groups.

Proportion of valence of comments also were self-reported, and here social desirability bias may occur. People would like to see themselves as nice persons, so perhaps they overestimate the proportion of positive comments.

## References

- [1] Cheung, C.M.K; Lee, M.K.O (2012): What drives consumers to spread electronic work of mouth in online consumer-opinion platforms, *Decision Support Systems* 53, pp.218-225.
- [2] Csiszárík-Kocsir, Á. – Fodor, M. (2008): The application of multiple variable methods in the segmentation of the domestic consumer market according to value system, *Acta Polytechnica Hungarica*, 2008/4, 109.-124. pp.
- [3] Erős, Ilona - Jobbágy, Mária (2001): A Myers-Briggs Típus Indikátor Magyarországon. *Alkalmazott Pszichológia*, [http://www.animacacio.hu/pdf/MBTI\\_mo.pdf](http://www.animacacio.hu/pdf/MBTI_mo.pdf)
- [4] Gupta, Pranjali and Judy Harris (2010): How eWOM recommendations influence products consideration and quality of choice: A motivation to process information perspective, *Journal of Business Research*, 63, pp. 1041-1049.
- [5] Henning-Thurau, Thorsten; Kevin P. Gwinner; Gianfranco Walsh and Dwayne D. Gremler (2004): Electronic Word of Mouth Via Consumer-opinion Platforms: What Motivates Consumers to Articulate Themselves on the Internet, *Journal of Interactive Marketing*, 18, 1, pp. 38-52
- [6] Hung, K.; Li, S. (2007): The influence of eWOM on virtual consumer communities: social capital, consumer learning, and behavioural outcomes, *Journal of Advertising Research*, 47 (4) 485.

- [7] Keirse, David (May 1, 1998) [1978]. Please Understand Me II: Temperament, Character, Intelligence (1st Ed. ed.). Prometheus Nemesis Book Co.
- [8] Kelemen-Erdős, A. (2015): Főszerepben a fogyasztó? A service-dominant logic elmélet kritikus megközelítése. In: Bíró-Szigeti, Sz., Petruska Ildikó, Szalkai Zsuzsanna, Kovács István, Magyar Mária (ed.) (2015): Marketing hálózaton innen és túl. EMOK XXI. Országos Konferenciája, BMGE, 2015. 08. 26-28., Budapest.
- [9] Majláth, M. (2014): Does Reading Comments Depend on Personality? – Results of an Empirical Study, Volume of Management, Enterprise and Benchmarking in the 21th century, (ed. Pál Michelberger) Óbuda University, Keleti Faculty of Business and Management.
- [10] Moldovan, Sarit; Jacob Goldenberg and Amitava Chattopadhyay (2011): The different roles of product originality and usefulness in generating word-of-mouth, International Journal of Research in Marketing, 28, pp. 109-119
- [11] Myers, Isabel Briggs (1980). Gifts Differing: Understanding Personality Type. Davies-Black Publishing; Reprint edition (May 1, 1995).
- [12] Ridings, C; Gefen, D.; Arinze, B (2006): Psychological Barriers: Lurker and Poster Motivation and Behavior in Online Communities, Communications of the Association for Information Systems, Vol 18, pp.329-354
- [13] Sen, Shahana and Dawn Lerman (2007): Why are you telling me this? An examination into negative consumer reviews on the web, Journal of Interactive Marketing, 21 (4) pp. 76-94. (Published online at [www.interscience.wiley.com](http://www.interscience.wiley.com))
- [14] Tari, Annamária (2010): Y generáció, Jaffa Kiadó
- [15] Yun, Gi Woong; Park, Sung-Yeon (2011): Selective Posting: Willingness to post a message online, Journal of Computer-Mediated Communication 16, pp. 201-227.
- [16] [http://www.ksh.hu/nepszamlalas/tablak\\_iskolazottsag](http://www.ksh.hu/nepszamlalas/tablak_iskolazottsag)
- [17] <http://lelektanitipusok.hu/alapismeretek.html>
- [18] <http://folkmedia.org/personality-type-social-media-from-mbti-myers-briggs-infographic/> Aaron Smith: Why Americans Use Social Media, Pew Internet and American Life Project Nov.15.2011

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# **Benchmarking in Management of the Electrical Energy Distribution**

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*Abstract: The report presents the methodology of benchmarking as one of the key tools in management of the sector of energy distribution. It enables better functioning of enterprises due to comparing their functioning in various profiles and drawing conclusions out of these comparisons. The methodology of benchmarking for distribution companies in Poland is used to a very limited extent. However, it is expected that its role in the decision making process in the energy sector will grow significantly. The report describes a method, which enables objective comparative analysis of distribution companies according to the efficiency of energy distribution, taking into account the specificity of each company. Benchmarking by stimulation to decreasing of costs leads to creation of competitiveness of a distribution company*

*Keywords: : benchmarking, decision making process, distribution efficiency*

## **1 Introduction**

The experience of the more developed energy markets proves that existence of market competition brings benefits to all of its participants. An example of success can be the British energy market, where liberalisation proved the theory that market mechanisms lead to decreased energy prices. The results of the introduction of competition in the Polish power energy sector could result only in maintaining prices at the lowest justified level (stable price level, attractive to the economy, enabling domestic and foreign competition), but also better allocation of funds, reduction of costs with improved state of energy safety, reduction of labour costs, optimisation of supply, rationalisation of demand and improved position of the consumer. So, the benefit would be the improved customer service, both for an enterprise and individual receiver. The implementation of the competitive mechanisms in the power energy sector will be the most effective way to force efficiency, where it is only possible. Where it is not possible, efficient regulation should be implemented.



## **2 Benchmarking in the energy distribution**

The benchmarking methodology is commonly used in the European Union and the USA, where it is used practically in all sectors of the economy. In the power energy sector, it is used intensively. Analyses with usage of this tool are aimed at comparison of functioning of the distribution companies. The concept of benchmarking in this field consists in measuring results in the situation where there is no price competition. Benchmarking may consist of simple ratio analysis (unit cost, the share of administrative expenses in total costs) or analysis of more complicated statistical models. The companies have different network and customer structure. Thus, the simple ratios like costs for one kWh or costs for one km of line are not valuable ratios for measuring of efficiency. The method „network size” developed by PA Consulting Group [1] is a method of evaluation of results of the distribution company through association of costs with the total size of the distribution network. Each element of the network is evaluated as a factor generating costs. These factors are converted through weights stemming from the average costs of distribution of the company. In this way one can compare total results of companies having different network structures.

In the model the following items are compared:

- Operating costs of the distribution and transit network up to 150 kV
- Costs of the network depreciation
- Costs of settlement of receivers and customer service

The Faculty of Electrical Engineering of the Technical University of Częstochowa has broad experience in conducting comparative analyses [3]. The methodology of taxonomy analysis based on the Prof. Hellwig method has been used, introducing so called objectivation of definite comparisons. This methodology laid the foundations of software MONITORING, implemented in a dozen of distribution companies in Poland. The software is a helpful tool for the management used for evaluation of the functioning of energy regions of a distribution company [2].

## **3 Multidimensional analysis of energy losses**

The efficiency of the functioning of the network of a distribution company is evaluated on the basis of analysis of percentage loss ratio. However, there are some doubts in case of necessity to compare different distribution companies basing on this ratio. Although it is a relative figure as losses relate to energy introduced to the distribution company, such ratio neglects some structural features, which have impact on its value [5,6, 8,9]. Certain objective correction of

the ratio for each distribution company is required. This is done by the following algorithm [4].

The starting point for analysis is the newly construed ratio – *the reaction ratio*, which was elaborated on the basis of research with usage of software EFEKTROZDZIAŁ – the most recent version of the existing software STRATY'96, commonly used in distribution companies. The reaction ratio defines to which extent energy losses will change if the energy increases by the same value for different network levels. Such ratios are comparable among distribution companies as they contain all attributes necessary for making comparisons. Calculations of the ratios for the representative distribution company had the following results ( it was result of large research investigationsral of author by several years – it is personally contribution to knowledge in area of distribution electricity):

- network of 110 kV ;  $w_{r110} = 1,073$
- network of medium voltage;  $w_{rSN} = 1,680$
- network of low voltage;  $w_{rnN} = 2,830$

Based on the analysis you can see the diverse impact of the flowing energy on the ultimate level of losses in the distribution network of a company. These ratios will be used for estimation of the corrected loss ratios for distribution companies, which can be used as a basis for comparison, because they possess all features required for such comparisons [7.8,9]. The data packages need the main information about electricity energy in all levels of network and technical infrastructures ( lenght of lines and numbers of substations).

As mentioned earlier, with usage of software STRATY'2002 PLUS one can conduct appropriate calculations and achieve ratios, which will enable comparisons among distribution companies. The following data constitutes an example of results from calculations:

A – Technical losses in low voltage network, [MWh]

B – Technical losses in medium voltage network, [MWh]

C – Technical losses in 110 kV network, [MWh]

D – Total technical losses, [MWh]

$\Delta E_{b\%}$  - Total balance sheet losses, [%]

Co-efficient  $\Delta E_{b\%}$  is an ultimate distinguishing feature of the functioning of the network of the distribution company

The corrected loss ratio for the distribution company is as follows:

$$W_{rs} = \left( \frac{C}{D} \cdot w_{r110} + \frac{B}{D} \cdot w_{rSN} + \frac{A}{D} \cdot w_{rnN} \right) \quad (1)$$

where :  $W_{rs}$  - the reaction ratio of the distribution company

$w_{r110}$  - reaction ratio of the 110 kV network

$w_{rSN}$  - reaction ratio of the medium voltage network

$w_{rnN}$  - reaction ratio of the low voltage network

$$\Delta E_{bs\%} = \Delta E_{b\%} \cdot \frac{W_{rsu}}{W_{rs}} \quad (2)$$

where :  $\Delta E_{bs\%}$  - the corrected energy loss ratio of the distribution company

$\Delta E_{b\%}$  - the original energy loss ratio of the distribution company

$W_{rsu}$  - the average energy loss ratio of the distribution company, calculated as:

$$W_{rsu} = \frac{\sum_{i=1}^K \sum_{k=1}^N W_{rsi}}{(N \cdot K)} \quad (3)$$

where:  $K$  – number of distribution companies being evaluated

$N$  - number of years of observations, assumed  $N = 5$

Below is the analysis of correction of losses in 5 distribution companies.  
 The original data is enclosed in Table 1.

Distribution company	$\Delta E_{b\%}$	$\frac{C}{D}$	$\frac{B}{D}$	$\frac{A}{D}$
SD1	14,5	0,15	0,42	0,43
SD2	8,9	0,45	0,35	0,20
SD3	12,1	0,25	0,35	0,40
SD4	10,2	0,30	0,40	0,30
SD5	6,5	0,55	0,30	0,15

Table 1  
 Original data for calculation of the corrected loss ratio

The necessity of corrections or objectivation of parameters used in the process of benchmarking has been also underlined by A. Auer [5] – only objects that fulfil requirements of comparisons can be compared.

Figure 1 depicts the results of the conducted research as well as original loss ratios of different distribution companies.

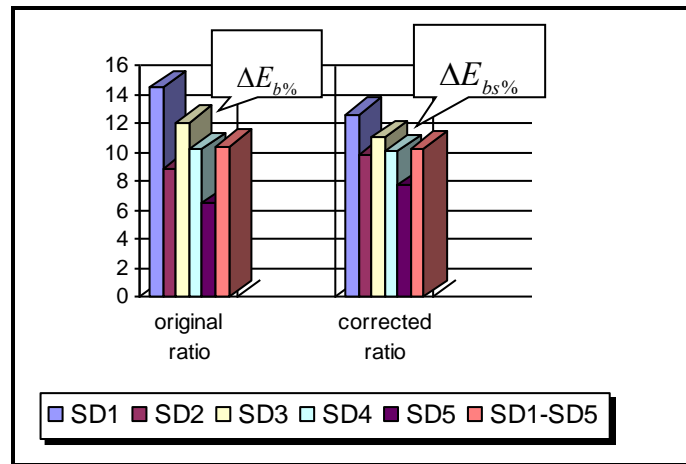


Figure 1  
 Original and corrected loss ratios of the distribution companies.

Based on the graph above, it can be stated that the corrected ratios have different values. Generally, correction results in smaller differences between companies characterised by the lowest and highest loss ratios i.e. SD1 and SD5, so:

- original value  $\delta = 8\%$
- corrected value  $\delta = 4,86\%$

Moreover, it is interesting that average values of the loss ratio before and after correction don't differ much (10,44% and 10,44%), which proves the correctness of the method used for objectivation of the loss ratio.

As presented above, it is possible to objectivate parameters of distribution companies related to general costs as well as costs at particular voltage levels, which leads to effective benchmarking.

However, correction must be preceded by the introduction of new ratios– cost creation ratios, which are defined as follows:

$$W_{kks} = \left( \frac{L_{110}}{L_c} \cdot w_{kk110} + \frac{L_{SN}}{L_c} \cdot w_{kkSN} + \frac{L_{nN}}{L_c} \cdot w_{kknN} \right) \quad (4)$$

where :  $W_{kks}$  - cost creation ratio of the distribution company

$w_{kk110}$  - cost creation ratio in the 110 kV network

$w_{kkSN}$  - cost creation ratio in the medium voltage network

$w_{kknN}$  - cost creation ratio in the low voltage network

$L_{110}$  - length of 110 kV network in the area of the distribution company

$L_{SN}$  - length of medium voltage network in the area of the distribution company

$L_{nN}$  - length of low voltage network in the area of the distribution company

$L_c$  - total length network in the area of the distribution company

Cost creation ratios are based on the following formulas:

$$w_{kk110} = \frac{k_{jL110}}{k_u} \quad (5)$$

$$w_{kkSN} = \frac{k_{ST110/SN} \cdot \frac{N_{ST110/SN}}{L_{SN}} + k_{jLSN}}{k_u} \quad (6)$$

$$w_{kknN} = \frac{k_{STSN/nN} \cdot \frac{N_{STSN/nN}}{L_{nN}} + k_{jLnN}}{k_u} \quad (7)$$

where:  $k_{jL110}$  - unit cost of construction of the 110 kV line [PLN/km]

$k_{jLSN}$  - unit cost of construction of the medium voltage line [PLN/km]

$k_{jLnN}$  - unit cost of construction of the low voltage line [PLN/km]

$k_{ST110/SN}$  - unit cost of construction of the station 110/medium voltage [PLN/station]

$k_{STSN/nN}$  - unit cost of construction of the station medium/low voltage [PLN/station]

$k_u$  - average unit cost of construction of the distribution network is:

$$k_u = \frac{(k_{jL110} + k_{ST110/SN} \cdot \frac{N_{ST110/SN}}{L_{SN}} + k_{jLSN} + k_{STSN/nN} \cdot \frac{N_{STSN/nN}}{L_{nN}} + k_{jLnN})}{3} \quad (8)$$

The objectivation of the corrected general operating costs is done with usage of the below formula:

$$K_{DSDs} = K_{DSD} \cdot \frac{W_{kks}}{W_{kksu}} \quad (9)$$

where :  $K_{DSDs}$  - corrected operating costs of the distribution company

$K_{DSD}$  - original operating costs of the distribution company

$W_{kksu}$  - average cost creation ratio is calculated as:

$$W_{kksu} = \frac{\sum_{i=1}^K W_{kksi}}{K} \quad (10)$$

where:  $K$  – number of distribution companies being evaluated

## Summary

The proposed objectivation methodology of input data for benchmarking analysis enables full reflection of differences among distribution companies. The method gives a possibility to convert the data, both technical and economic, into the comparable analytical platform. Further calculations may be done with usage of DEA methodology [5], Hellwig taxonomy method [3] or basic statistical tool incl. correlation analysis. The benchmarking of distribution companies conducted in such a way may constitute a basis for taking decisions related to both current and future activities of distribution companies. This methodology are used by numerous polish companies of distribution for really evaluation situation in this companies in efficiency area.

## References

- [1] Benchmarking is coming PA Consulting Group London 2002
- [2] J. Szkutnik Benchmarking w sektorze dystrybucji energii elektrycznej VI Konferencja PE 2002 Prognozowanie w Elektroenergetyce Prognozowanie, efektywność energetyczna Częstochowa September 2002
- [3] H. Auer .Deriving efficiency scores for the Austrian distribution utilities DistribuTech, EUROPE 2001 Berlin 6-8 November 2001
- [4] Szkutnik J., Benchmarking as one of elements of the creation of the competitiveness of distribution companies XI Międzynarodowa Konferencja Naukowa Aktualne Problemy w Elektroenergetyce, APE`2003 Gdańsk , 2003
- [5] European Energy and Transport Trends to 2030, European Commission, Directorate-General for Energy and Transport, Luxembourg: Office for Official Publications of the European Communities, 2003
- [6] Szkutnik J.: Innowacyjność w tworzeniu przewagi konkurencyjnej przedsiębiorstwa dystrybucji energii elektrycznej, w Uwarunkowania budowania konkurencyjności przedsiębiorstw w otoczeniu globalnym, praca zbiorowa pod redakcją Jerzego Bogdaniienki, Marcina Kuzela Iwony Sobczak, Wydawnictwo AdamMarszałek, Toruń 2007/2008, ISBN 978-83-7441-861-4
- [7] Szkutnik J.: Strategiczne cele i efekty zarządzania dystrybucją energii elektrycznej w przedsiębiorstwach energetycznych, Wydawnictwo Politechniki Częstochowskiej, Częstochowa 2006
- [8] Szkutnik J.: The energy efficiency as the necessary element of the planning in the sector of the electrical energy, Proceedings of the 9th International Scientific Conference ELECTRIC POWER ENGINEERING

2008, EPE`2008, May 13-15 2008, Hotel SANTON, Brno. Czech Republic, ISBN 978-80-214-3650-3, pp. 397-400

- [9] Szkutnik J.: Efficiency and Quality in Management of Energy Distribution. The Challenges for Reconversion Innovation – Sustainability-knowledge Management. Edited by Piotr Pachura, Institut Supérieur Industriel Pierrard HEC du Luxembourg VIRTON, Belgium 2006



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# **Changes in the Use of ERP Systems Supporting Enterprise Logistics in Poland – Sectoral Analysis**

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*Abstract: Markets globalization, consumer behaviour and fast development of products forced changes into running a business. Cooperation within supply chains, strengthening bonds with customers and optimal resource planning are fundamental to the functioning of businesses. The realization of these activities is possible through information technologies, especially those supporting businesses in terms of logistics. The level of complexity of logistic processes is connected with a particular sector. The goal of this work is to determine the scale of Enterprise Resource Planning (ERP) systems use in enterprises across individual sectors. The shift-share analysis is used. The analysis embraces the years 2012-2015. The number of companies using ERP systems acted as variables and the data were shown by sectors. The results of the shift share analysis point to the growing trends in the number of businesses using ERP systems. Relatively speaking, the biggest potential in terms of the analyzed variable was observed in the industrial processing and trade and repair sectors, although these sectors are at the same time less competitive than the others. We can conclude, therefore, that these sectors are not the domineering ones in terms of complexity and the intensity of the realization of processes supported by ERP systems.*

*Keywords: logistics, shift-share analysis, ERP systems*

## **1 Introduction**

The development of information technologies (IT) brought major changes into operating a business. The phrase information technologies denotes mechanisms whose goal is to improve the functioning of complex supply chains and the coordination of processes realized within them (Nativi and Lee, 2012, p. 366, Kott, 2013, p. 51). They are necessary in the management of supply chains (Li et al., 2009, p. 125) maintaining relations with clients (Strzelecka, 2012, pp. 286-286), and maximization of business benefits (Szajt, 2006). Information technologies have different influence on the activity of businesses as they can lead

to: Development of creativity, Corporation strategy support, Organization transformation, Creation of an organization or increase of its value, Shaping the planning process and other business processes, Knowledge integration, Organizational integration (Besson and Rowe, 2012, pp. 109-113).

Information technologies supporting the integration of logistics processes include Enterprise Resource Planning (ERP) systems which act as sources of up-to-date information in an enterprise management. And that is how the systems support the logistics of an enterprise. Investments into IT are often connected with the implementation of ERP systems (Thompson et al., 2014, p. 109). The systems are used in order to increase the effectiveness of an enterprise (Keramati et al., 2013, p. S29) which is possible through the roles the ERP systems play in an enterprise.

Enterprise resource planning system is an information system supporting and integrating the functioning of many business areas within an enterprise (Parthasarathy and Sharma, 2014, p. 1009, Ruivo et al., 2014, p. 167, Lepistö, 2014, p. 194, Madapusi and D'Souza, 2012, p. 24). The implementation of the system results in a better distribution of resources and the increase of effectiveness of enterprise management (Tasevska et al., 2014, p. 529). In contrast to classic enterprise management systems, ERP systems were designed to support business processes between multiple cooperating enterprises in the first place. The intensity of the cooperation and the need for ERP systems use often depends on a particular sector in which a company operates. Belonging to a given sector determines the type of processes realized in an enterprise.

The goal of the article is to determine the scale of enterprise resource planning systems use in enterprises across individual sectors. The article puts forward the following these: the nature of changes in the use of ERP systems is varied depending on belonging to a particular sector.

## **2 Research Methodology**

To examine the diversity across sectors we used the shift-share analysis. This method allows to analyze the level of economic development on a given area juxtaposed with a reference area in the context of the level of development of individual sectors and changes in that development (Suchecky, 2010). The method assumes a decompositional approach which allows to assess the influence of the individual components on the final assessment of the position of a given sector with reference to the whole area, and allows to diagnose the sources of change in sectors.

In order to carry out a shift-share analysis the following elements were specified:

1. Analyzed area potential (AAP) – national share – which determines the changes of the analyzed variable in sectors with the assumption that they develop in a tempo similar to the reference area.
2. Enterprises structure (ES) – industrial mix – which characterizes the portion of changes which comes from the general tendency with the analyzed feature, and where a positive value means a better structure in the examined area than in the reference area.
3. Analyzed area competitiveness (AAC) – regional shift – which describes changes in terms of the analyzed feature caused by a competitive position of enterprises in sectors and, thereby, indicates the difference between the increase index in the analyzed area compared to the reference area.

The following formulas were used (1)-(3) (Santarek and Szerenos, 2006):

$$AAP_{ib}^t = \sum E_{ib}^{t-1} \cdot \left( \frac{E_r^t}{E_r^{t-1}} - 1 \right) \quad (1), \quad ES_{ib}^t = \sum E_{ib}^{t-1} \cdot \left( \frac{E_{ir}^t}{E_{ir}^{t-1}} - \frac{E_r^t}{E_r^{t-1}} \right) \quad (2),$$

$$AAC_{ib}^t = \sum E_{ib}^{t-1} \cdot \left( \frac{E_{ib}^t}{E_{ib}^{t-1}} - \frac{E_{ir}^t}{E_{ir}^{t-1}} \right) \quad (3).$$

$E_r$  – number of enterprises using computers in their activity in the reference area  $r$  (Poland),  $E_{ir}$  – number of enterprises in terms of the analyzed variable in the reference area  $r$  in the group  $i$  according to the cross-sectional division,  $E_{ib}$  – number of enterprises in terms of the analyzed variable in the reference area  $b$  (individual sectors) in the group  $i$  according to the cross-sectional division,  $t-1$  – the first year in the analyzed period,  $t$  – the last year in the analyzed period.

The division is consistent with the classic shift-share model (Knudsen, 2000, Zaccomer, 2006). The sum of the components AAP, ES and AAC is the so called total shift (TS) which represents the actual change of a given variable in the year  $t$  compared to the year  $t-1$ .

The analysis embraced the years 2012-2015. The data come from the Polish Central Statistical Office (GUS, 2015). The analysis involves the number of companies using ERP software packages for transmitting information between different departments (e.g., accounting, marketing, production). The enterprises were divided according to different sections: S1 – industrial processing, S2 – production and the supply of electricity, gas, steam and hot water, S3 – water supply, sewerage and waste management, remediation, S4 – construction, S5 – trade and repair, S6 – transport and storage, S7 – accommodation and catering, S8 – information and communication, S9 – financial and insurance activities, S10 – real estate, S11 – professional, scientific and technical activities, S12 – administration and support service activities, S13 – repair and maintenance of computers and communication equipment, S14 – ICT sector.

### **3 Research findings**

As far as the number of enterprises using ERP systems for the decision making process support is concerned, in Poland we observe significant change dynamics. In the whole 2010-2015 period there was an annual average increase of the number of enterprises using ERP systems. The changes visible in the number of all companies using ERP software packages for transmitting information between different department (on annual average by 17.57%) were connected with changes in small enterprises (on annual average by 22.51%).

The scale of use of ERP systems in Poland is connected with the size of a business and a particular sector. ERP systems are most often used by big enterprises and least often by small ones. Profitability of using the systems in large businesses is connected with the greater scale of business activity, broad cooperation and the complexity of processes realized with the help of information technologies. In Poland, however, the use of ERP systems is generally limited as only 21% of enterprises. Leading sectors in terms of using ERP software packages for transmitting information between different departments (e.g., accounting, marketing, production) are industrial processing and trade and repair. 63.55% of all enterprises using ERP systems belong to these sectors.

Shift-share analysis allowed to cast some light on to what extent, if at all, the results of individual sectors in terms of using ERP and CRM systems are different, and if they also differ from general processes taking place in Polish businesses which use computers. The analysis covers the period of 2012-2015. The results are presented in table 1.

Sector	The level of components			Real change
	AAP	ES	AAC	TS
S1	388.26	2849.87	-152.17	<b>3085.97</b>
S2	13.70	100.59	-24.28	<b>90.01</b>
S3	19.00	139.47	158.26	<b>316.73</b>
S4	74.49	546.77	-279.18	<b>342.08</b>
S5	372.79	2736.32	-1028.20	<b>2080.91</b>
S6	45.91	336.95	150.39	<b>533.24</b>
S7	19.09	140.09	26.14	<b>185.31</b>
S8	35.06	257.34	729.33	<b>1021.73</b>
S9	16.23	119.10	-60.90	<b>74.43</b>
S10	18.50	135.77	285.54	<b>439.80</b>
S11	44.90	329.54	175.06	<b>549.50</b>
S12	27.83	204.27	112.77	<b>344.87</b>
S13	1.51	11.11	4.88	<b>17.50</b>
S14	45.15	331.39	430.37	<b>806.92</b>
<b>Total</b>	<b>1122.41</b>	<b>8238.59</b>	<b>528.01</b>	<b>9889.01</b>

Table 1

Components of shift-share analysis for the number of companies using ERP software packages for transmitting information between different departments (e.g., accounting, marketing, production) in Poland in the period 2012-2015

*Source: own elaboration.*

The results show an upward trend in the number of companies using ERP software packages for transmitting information between different departments (tab. 1.). In 2015 nationwide, the number was higher by 9889.01 than in 2012. Individual analysis components pertain to different change aspects. The first one reveals changes resulting from the general economic condition of the country and confirms the expected change (increase or decrease) in the number of enterprises using ERP systems with the assumption that the growth in this respect in individual sectors is comparable with the development of Polish enterprises using computers in general. AAP value exhibits a growing pace of the national increase in the number of companies using computers, but the growth is more than eight times smaller than the growth in the use of ERP systems. Positive AAP value in all sectors means that ERP systems use has a growing tendency.

Assuming a similar pace of change in the use of ERP systems in sectors and computers in the country in general, each sector should see an increase in the number of enterprises using ERP systems which was true with all analyzed sectors (positive TS value). Industrial processing and trade and repair sectors were relatively the most potent sectors in terms of the analyzed area. The number of enterprises could be potentially increased by 388.26 and 372.79 respectively (i.e. by 34.6% and 33.2%). No other sector came close to this kind of potential. Ranked

third, the construction sector, displayed a value five times smaller. The least desirable outcome was observed with the repair and maintenance of computers and communication equipment sector where the potential increase of the number of businesses using ERP systems was only 1.51.

The structural component (ES) of the total shift shows the changes in the number of enterprises using ERP systems in comparison to the reference area, i.e. the whole country. These changes come from the differences between the dynamics of the increase in the number of businesses using ERP systems in sectors and the dynamics of the increase in the number of Polish enterprises using computers in general. This shift-share analysis element had the biggest influence on the positive total shift. The component reached its highest value in the sectors: industrial processing and trade and repair, and its lowest value in the sectors: repair and maintenance of computers and communication equipment.

The third component (AAC) shows either a decrease or increase of the analyzed variable caused by a competitive position of enterprises in sectors, and for that reason it is treated as an indicator of the sector economy strength or weakness. Looking at the positive AAC value we can conclude that there is a stronger sector competitiveness among enterprises using ERP systems when compared to companies using computers in Poland. The same result repeated in nine sectors. Unfortunately the lowest AAC value occurred in the sectors with the biggest actual change (highest TS value) which means that the competitive position in these sectors in terms of the analyzed variable is weaker than in the case of the country. This is due to the fact that there are sectors where the use of ERP systems is more desirable because of some business processes, e.g. in the sectors: information and communication, transport and storage. These sectors realize typical logistic processes, and the subject literature often calls them the logistics sector.

## **Conclusions**

Implementing information technologies makes enterprises more responsive to the changing environment. And if applied to the supply chain, IT improve companies' resistance to malfunctioning of any of their partners and allow to control the level of resources at individual partners optimally.

The need for the implementation of ERP systems, which support the realization of logistic processes, results directly from the activity of an enterprise. The main activity of a business, which influences the complexity of logistic processes, is the key determiner of which sector it belongs to. In the 2010-2015 period there was a dynamic increase in the number of enterprises using ERP systems. The biggest annual average increase was observed in the case of small companies which are

the fastest developing entities in this respect. However, this significant increase in the use of ERP systems in small companies can be partly due to the annual average increase in the number of such enterprises in Poland in the years 2010-2015 and a simultaneous average annual drop in the number of medium and large enterprises. Yet still, in Poland it is medium and large sized enterprises that implement ERP systems most often because using advanced information technologies for logistic processes is profitable. The scale of these processes in medium and large sized enterprises is much bigger than in small ones.

The shift-share analysis results indicate growing trends in the number of companies using ERP software packages for transmitting information between different departments. Relatively, the biggest potential in terms of the analyzed data was observed in the industrial processing and trade and repair which is connected with the fact that these sectors contain the largest number of enterprises using ERP systems. At the same time, though, these sectors are characterized by a weak competitive position in comparison to the other sectors and the country. It means that they do not dominate in terms of the complexity and the intensity of the realization of processes supported by ERP systems. In Polish enterprises logistics is still thought of as connected with transport and warehousing. Yet markets globalization and competitiveness increase render customer service, automation and simplifying customer communication important which will result in customer's satisfaction and loyalty.

## References

- [1] Besson Patric, Rowe Frantz: Strategizing information systems-enabled organizational transformation: A transdisciplinary review and new directions, *Journal of Strategic Information Systems*, Vol. 21, 2012, pp. 103-124
- [2] Wykorzystanie technologii informacyjno-(tele)komunikacyjnych w przedsiębiorstwach i gospodarstwach domowych, <http://stat.gov.pl/obszary-tematyczne/nauka-i-technika-spoleczenstwo-informacyjne/spoleczenstwo-informacyjne/wykorzystanie-technologii-informacyjno-telekomunikacyjnych-w-przedsiębiorstwach-i-gospodarstwach-domowych-w-2012-r-,3,11.html>, GUS, Accessed: 10.06.2015
- [3] Keramati Abbas, Nazari-Shirkouhi Salman, Moshki H., Afshari-Mofrad Masoud, Berneti Eisa Maleki: A novel methodology for evaluating the risk of CRM projects in fuzzy environment, *Neural Computing and Applications*, Vol. 23, Suppl. 1, 2013, pp. S29–S53
- [4] Knudsen Daniel C.: Shift-share analysis: further examination of models for the description of economic change, *Socio-Economic Planning Sciences*, Vol. 34, 2000, pp. 177-198



- [5] Kott Iga: Application of modern IT technologies in logistics enterprises in Poland, *Advanced Logistic Systems*, Vol. 7 no. 1, 2013, pp. 51–56
- [6] Lepistö Lauri: Taking information technology seriously: on the legitimating discourses of enterprise resource planning system adoption, *Journal of Management Control*, Vol. 25, 2014, pp. 193–219
- [7] Li Gang, Yang Hongjiao, Sun Linyan, Sohal Amrik S.: The impact of IT implementation on supply chain integration and performance, *International Journal of Production Economics*, Vol. 120, 2009, pp. 125-138
- [8] Madapusi Arun, D’Souza Derrick: The influence of ERP system implementation on the operational performance of an organization, *International Journal of Information Management*, Vol. 32, 2012, pp. 24–34
- [9] Nativi Juan Jose, Lee Seokcheon: Impact of RFID information-sharing strategies on a decentralized supply chain with reverse logistics operations, *International Journal of Production Economics*, Vol. 136, 2012, pp. 366-377
- [10] Parthasarathy Sudhaman, Sharma Srinarayan: Determining ERP customization choices using nominal group technique and analytical hierarchy process, *Computers in Industry*, Vol. 65, 2014, pp. 1009–1017
- [11] Ruivo Pedro, Oliveira Tiago, Neto Miguel: Examine ERP post-implementation stages of use and value: Empirical evidence from Portuguese SMEs, *International Journal of Accounting Information Systems*, Vol. 15, 2014, pp. 166–184
- [12] Santarek Krzysztof, Szerenos Anna: Ocena funkcjonowania klastrów przemysłowych, *Ekonomika i Organizacja Przedsiębiorstwa*, No. 12, 2006, pp. 10-18
- [13] Strzelecka Agnieszka: Konceptyjne ramy zintegrowanego zarządzania w globalnym łańcuchu dostaw dla małych i średnich przedsiębiorstw, *Logistyka*, Vol. 6, CD nr 1, 2012, pp. 285-288
- [14] Suhecki Bodan: *Ekonometria przestrzenna*, C.H.Beck, Warszawa 2010, pp.163-167.
- [15] Szajt Marek: Wykorzystanie technologii informacyjnych w działalności przedsiębiorstw przemysłowych w Polsce, in: Kiełtyka Leszek, ed. *Integracja IT z systemami zarządzania w organizacjach gospodarczych*, Wydawnictwo P.H.U.SALUS, Toruń 2006, pp. 35-42
- [16] Tasevska Frosina, Damij Talib, Damij Nadja: Project planning practices based on enterprise resource planning systems in small and medium enterprises - A case study from the Republic of Macedonia, *International Journal of Project Management*, Vol. 32, 2014, pp. 529–539

- [17] Thompson Steven, Ekman Peter, Selby Daniel, Whitaker Jonathan: A model to support IT infrastructure planning and the allocation of IT governance authority, *Decision Support Systems*, Vol. 59, 2014, pp. 108–118
- [18] Zaccomer Gian Pietro: Shift-Share Analysis with Spatial Structure: an Application to Italian Industrial Districts, *Transition Studies Review*, Vol. 13 (1), 2006, pp. 213–227

**Management, Enterprise and Benchmarking in the 21<sup>st</sup> Century**  
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# Maturity Models of Shared Services in Theory and Practice

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*Abstract: all shared service center (SSC) has its own evolutionary path with stations from the formation to maturity. This study introduces the main theoretical models of this development, so Barbara Quinn's and Martin-Pérez's models. These models show what kind of development stations can a shared service center run through. However, it is also important to see that parent companies will only be able to effectively operate a shared service center only if all of business process are standardized and not only the processes of the SSC. The CMMI model helps the parent organization to find the optimal level of maturity to implement and operate an SSC. Janssen-Joha's model is also a good landmark because it shows how the parent company could implement SSCs organization-wide. Practical side of the research shows level of maturity of Hungarian SSCs based on the first two models.*

*Keywords: SSC, Shared Services, Business Services, Maturity model, CMMI*

## 1 Introduction

### 1.1 Business service sector

#### 1.1.1 Headway of business service sector

In recent decades, we are witnessing of continuously growth of business service sector which is one of the most important trends in the Central-Eastern European countries. Based on the declaration of European Commission in 2000 in Lisbon, the Business Related Services (BRS) which includes the business services as well is a key area for European Union because it contributes to the national employment, productivity growth and foreign trade with even greater scale. The special attention affecting the business services could be observable from the 1980s. The reason of this high attention is that, the growth of this area exceeds all other area's. Parallel with increasingly importance in the national economies, it got important role in the national employment as well. Since World War II, the share of service sector

workers has increased two and a half times. The dynamic of this growth was the highest in the period followed by the change of regime in 1990s. [1]

At the beginning of the 2000s, the total service sector gave more than 66% of the Hungarian GDP and within the business services was 17%. The weight of the services in the employment has been increased to 61% by 2003. [2]

Nowadays the business services are the fastest growing sector of the economy in the most developed countries. Hungary is still lagging with its about 8% of all employees working in the business services sector, which is half to two-thirds of the value comparing with the developed market economies. [3]

The business services are usually implemented in service centers that can operate independent as a market service provider or as an organizational unit within the parent company. This research deals with the shared service centers owned by the parent company.

#### **1.1.2 Shared service sector**

Within business services, the shared service model has particularly importance in Hungary. Over the past decade, the large international companies' service centers were increased from zero to about one hundred in Hungary. Approximately fifty thousand people work in this sector in Hungary. Therefore the sector has national economic significance as well.

The shared service center model appeared in the 1980s and since then it is in the focus of private and public sector as well. Today, 80% of the world's largest 2,000 companies use the shared service center model to support their activities. [4]

The shared services take place in specific service centers called shared service centers. The benefits (mostly the savings) available through this service center are differently from business to business. The biggest savings can be detected for those services in those companies that have high transaction volumes, because it can make the major impact on the economies of scale available. [5]

The main purpose of this model is to improve service quality and reduce costs, but the benefits are now significantly expanded and includes e.g. standardization of services and processes, reducing administrative costs; or grouping similar tasks and dismantling of redundant tasks; supporting corporate strategy.

The shared service centers provide a range of services primarily regional and sometimes global level, such as finance, accounting, procurement, logistics, IT and HR.

## **2 Aim and method of research**

The research seeks to answer that during what kind of changes the service centers go through their operation and to identify how major evolutionary-developmental models exist in the literature. The empirical research gives an overview of the maturity level situation with the Hungarian shared service centers, using the two most well-known evolutionary model.

The research is based on the database of a questionnaire research. The questionnaire was online, standardized, self-administered and available optional in English or Hungarian. The expected response rate was as large as possible, but at least a 50%. According to the database formerly compiled all shared service centers in Hungary were targeted. 80 service centers of 73 companies were involved in the research and 50 centers of 47 companies completed the questionnaire, so the response rate was 62.5%. At determination of research population, all shared service centers were involved, which were in the literature or a database of professional organizations included it as an SSC and fulfilled the following criteria:

- during the research it had a site in Hungary;
- independently of other corporate activities it had a separate service center;
- and the services of this center were shared at least for the other departments of the parent company.

## **3 Evolutionary models for shared service centers**

### **3.1 Quinn's model**

The most important model was created by Barbara Quinn. Quinn developed a model to categorize the different states of maturity in shared service model. [6] Quinn distinguished four archetypes: the first is the basic model that is followed by the market model and the developed market model and finally the independent model. The model describes those evolutionary steps that a shared service center could go through. In this model, the more market-based the operation of service center is, the more advanced the shared service center in maturity.

Quinn's model shows four evolutionary models as archetypes ranging from the simplest one where only the transaction process functions are centralized till the independent business model, which is operating as an independent business unit outside the organization.

In Quinn's model the first archetype is the basic model in which the service center is the level of initial consolidation where happens clarifying and merging of some

transactional background activities. The operational focus of the service center is primary on achieving economies of scale there. The target is the biggest possible cost savings and standardizing the service processes. The organization provides services to the parent company. The relationship between the service center and recipient side is market-based since there is charging of the total cost of the services.

The second archetype, the market model could be interpreted as a kind of moving forward from the basic model. Those service centers which are already at this level have broader and more professional portfolio of services. The goal is also the cost optimization of the background activities and development of service quality. In order to reach it, the service centers separates their control and service providing activities.

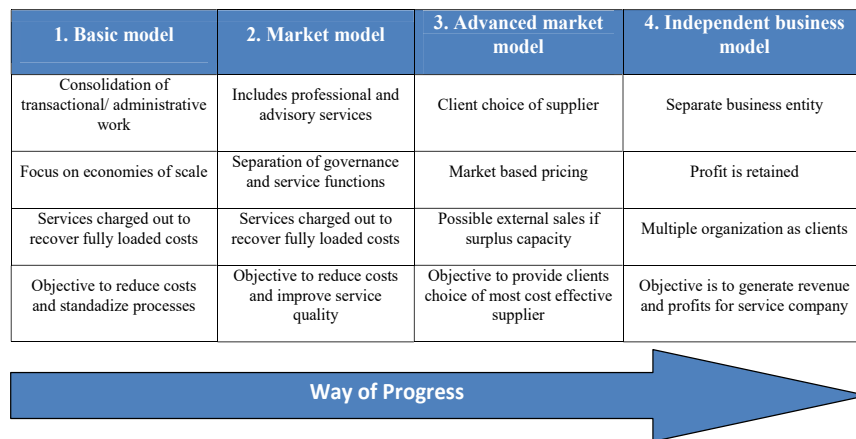


Figure 1  
 Quinn's modell. Source: own edited based [6]

The advanced market model is the third step of development, where the recipient can choose the service provider that means a market competition among the providers that could be internal shared service centers of the parent company or external service providers from the market. The aim is therefore to achieve the most cost-effective services. At this archetype the external customers also may appear. So here the service center could deliver its services not only the other units of parent company (internal customers) but to other external organizations as well. Of course, this is only possible if capacity permits and the service center can improve its capacity utilization by this. In this level the internal customers are still in majority and serving them should be the primary objective for the service center. [6]

The independent business model is the fourth and final step in Quinn's model. The service center can operate at this level as quasi-separated business units (divisions) and addition to the internal customers it has a number of external customers as well. Through the service delivery to the external clients the service center realizes profit which has its own and does not have to pay to the parent company. The target on

this level is the for-profit services which are together with world-class services and advanced cost calculation models. Service centers operating at this level often become targets for sales in the eyes of competitors. Sometimes for the parent organizations it means a chance to get return of its invest into the service center, since in this independent model the price of services have already reached the market price and it has roughly the same cost if the parent organization sources it from inside or outside. [7]

However the evolution of shared service centers could continue. According to Bangemann the next step from Quinn's model could be the virtual organizational operation. Its success depends on well-designed processes, advanced IT platform, trust, cooperation and personal competencies based on the existence of the network. [8]

### **3.2 Martin-Pérez's modell**

Quinn's model has been criticized that it is too theoretical. [7] The model describes a strictly development path on which all shared service center can go through. The focus of the model is on that how market-based will the service center become as times goes by. At the last, independent business model the question has been arisen that could it even called as a shared service center. Since the development of a shared service center may be influenced by a number of other factors and the parent company has the decision opportunity to determine what kind of shared service center is necessary to establish. According to Martin-Pérez it cannot be determined an exclusive way which is involved in Quinn's model. Based on their empirical research they revealed that Quinn's theoretical model only approaches the practice, in fact, the development of shared services is much more complex. [9]

Based on this research results they modified and expanded the model and placed the possible shapes in a matrix which has two dimensions as internal client-orientation and external competition-orientation. The high internal client-orientation is an essential requirement for the service capability in the shared service model. The external competition-orientation is important because it means a feedback how competitive the service delivery is. On the one hand it creates a competition, but on the other hand a positive incentive as well to spur the shared service center a higher value-creation. Martin-Pérez distinguished four types based on the development of shared service centers: pseudo-SSC, classical SSC, professional SSC and outsourced SSC.

It is typical for the pseudo-SSC that it has typically small internal client-orientation and small external competition-orientation. Almost each organization goes through this type when starts to establish a shared service center. Especially those companies where before it the services were too decentralized. Many times the parent organization has little interest to develop the whole concept, hence we can talk about a hidden but traditional centralized function, which is sometimes called SSC because of fashion, but there is a lack of internal client-orientation.



The classical SSC means a high internal client-orientation, but it is still characterized by low external competition-orientation. This level of development is typical for most young shared service centers. The provision of services within the company has already reached a high client-orientation and along with this the center could prepare to externalize its operation. Indeed, it is essential for long-term successfulness of the center. The shared service center uses at this level cost or market pricing, provides SLA or OLA and measure the client satisfaction. The internal client is in foreground, because generally they are much larger or exclusive.

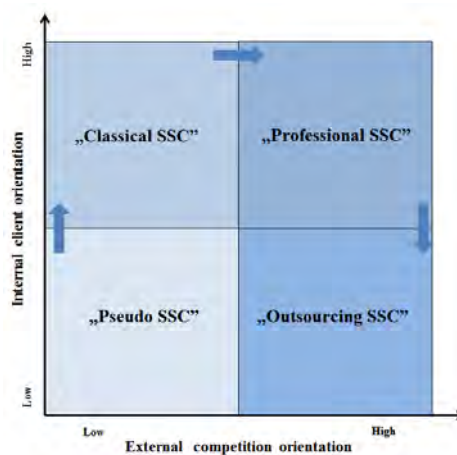


Figure 2

Martin-Pérez's model.

Source: own edited based [9]

Professional SSC has high internal client-orientation and external competition-orientation. A significant portion of its clients are external, so it is a professional level. It could be realized by implementation of continuous improvement and profit-orientation. The shared service center here occurs as an independent unit and is able to independently develop its activities. The parent company is the primary customer.

The outsourced SSC has small internal client-orientation but rather high external competition-orientation. The activities of shared service center are no longer completely dependent on the parent company's activities. The services themselves are marketable. This can occur if the SSC places particular emphasis on the acquisition of external clients, even when there is no requirement for the parent company. This position is typical right before the service center becoming independent (spin-off) or before a sale.

## 4 Maturity models of SSC parent companies

Today, more and more companies concentrate on the service-orientation and use internal or external service centers for service excellence. The service-orientation can bring many advantages for companies because it allows the creation of modular, accessible, well-defined, free-viable, interoperable services. [10]

### 4.1 Janssen-Joha' model

About Service-Oriented Enterprise (SOE), [10] states that establishing SSC means a solution of corporate consolidation in a situation with duplicate operations, previously organizational expansions and transformations. However, the development of the organizations does not stop at the level of creation of SSCs. Based on their study, they identified four levels of maturity. [10]

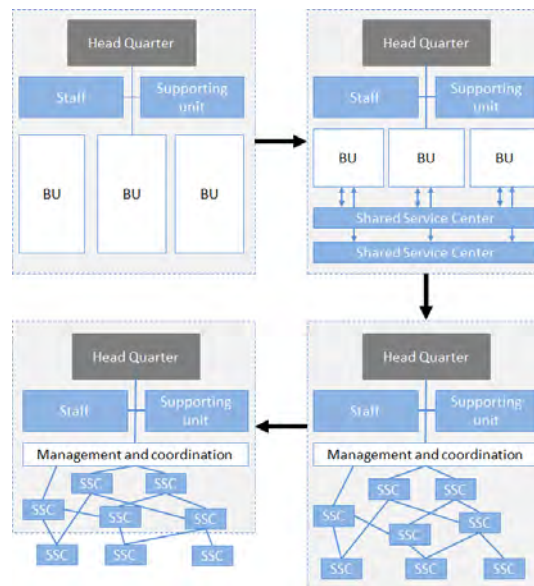


Figure 4  
Janssen-Joha model.

Source: [11]

The first is the traditional organization with functional organizational units and traditionally hierarchical structure of the organization. The second is the Shared Service Organization (SSO) which means a development compared to a traditional company structure because many service functions are restructured and organized to one or more SSCs. It means a combination of the traditional functional organization and the SSCs. The third is the Service-oriented enterprise (SOE) which includes separate management and coordination level in the body and the entire

organization is structured around the SSCs, and there is no longer a traditional functional structure. The last one is the retained SOE level when according to organizational performance the company sell some SSCs with outsourcing or bring new SSCs into the organization with acquisition .

## 4.2 CMMI model

It is important to see that a company is able to effectively operate a shared service center, if not only the service center has standardized and cleared processes, but the whole company as well. The input and output side of the service process should also be standard. It is worth to examine what level of development should be the parent organization in order to operate a shared service center. Capability Maturity Model Integration (CMMI) model could be a good tool for it. [12]



Figure 5  
CMMI-model.

Source: CMMI model

The CMMI model distinguishes five levels of organizational maturity. The first stage of maturity called as "initial" level when there is ad hoc operation and only the input and output is known and the organization is able to produce almost the same output twice. This level is typically for a creative agency. The second level is the "managed" state when over the knowledge of input and output, the organization has major milestones as well. Such an organization is university. The organizational responsibility is typical for this level. It is not defined how the employee should do the job, only the milestones are explicit and based on it, the organization could produce roughly the same output. The third level is called as "defined" state which means standardity and controlled operation. In this case, the organization has not only the input, output and milestones but the processes are already standard. At this level there is a bank or a majority of well-established companies. This is the first

stage that suitable to operate a shared service center but in fact this is still not a good maturity level.

The next level is "quantitatively managed" when besides of the milestones there are key performance indicators (KPIs) (i.e. processing time, error rate, etc.), and based on them, the organization has the ability to control its own actions. This is the first level where an SSC could emerge. On this level, the organization could make conscious sourcing decisions, could sign service level agreements (SLA, OLA), because it knows what needs to retain an operation, what means to outsource, or what brings to organize an SSC.

The fifth level is called as "optimizing" stage when there are not only KPIs, but they are actions linked to targets and which are built into the normal operation. This the level of operation which is completely suited to operate a shared service center. About the operation of the organizations, it is generally true that the maturity level of the core and the supporting activities could not be separated.

## **5 Characteristics of research participants**

47 data center of 44 companies were in the database, which eventually met a sampling rate of 59%. The survey examined the practices of the centers, however the respondents were natural persons of the centers. Except one person, the respondents were service center managers, most of them came from the middle or senior manager level.

At the time of analysis, 57% of the parent companies employed more than 10,000 employees and 51% of their annual sales were over 5 billion Euros. This result shows that the parent companies of service centers are traditionally large multinational companies came from sectors such as IT, telecommunications, automotive, energy service or area of banking and financial services.

Looking at the origin of service centers parent companies, in the Hungarian market it is surprisingly strong the positions of companies from the USA (47%), followed by companies from Great Brittan (13%), Hungarian companies (9%), Finland and Swiss companies (7% -7%). Interestingly, unlike the productive sector companies in the proportion of German descent, it was only 4%.

40% of the participants belonged to the category of small center (up to 150 people), but nearly 25% of them were large (minimum 500 people), the rest were medium-sized centers. The respondents are the most shared service centers established in Hungary in 2006, 2007 and 2010 years.

Analyzing of the organizational structure of them, almost third of the participants were at independent division level, 35.7% of them belonged to the divisional, while 31% of them operated under the control of the headquarter.

The vast majority of respondents were shared service centers in the capital, only 20.5% of them were located outside of Budapest.

Most of the respondents centers parent companies (78.6%) had a few (up to seven) shared service center globally, but in most cases (respondents over 26%) was that the parent organizations operate three pieces of such centers globally. However, 21.4% of respondents had serious global service network and had 12 or more center. In Hungary, the majority of respondent companies (83.3%) have only one center, and 14.3% of them operated two. Only one company had more than two, altogether five such centers.

The service portfolio of the respondents were mixed but the most important services were the following: finance (70%), accounting (66%), IT (55%), call center (55%), procurement (36%), HR (35), corporate administration (30%).

## **6 Maturity status of shared service centers in Hungary**

Based on the evolutionary models revealed in the literature review, the current maturity levels of shared service centers operating in the Hungarian market were examined in the practical research. According to Quinn's grouping, the Hungarian shared service centers were categorized taking into account four criteria (organizational independence, service orientation, settlement characteristics, the nature of the provision of services). Based on Quinn's model, the majority of the Hungarian shared service centers were matured, at the time of my investigation the largest proportion of Hungarian shared service centers (36%) were belonged to the "developed market model" category, which was followed by the "independent business model" category with its 29%.

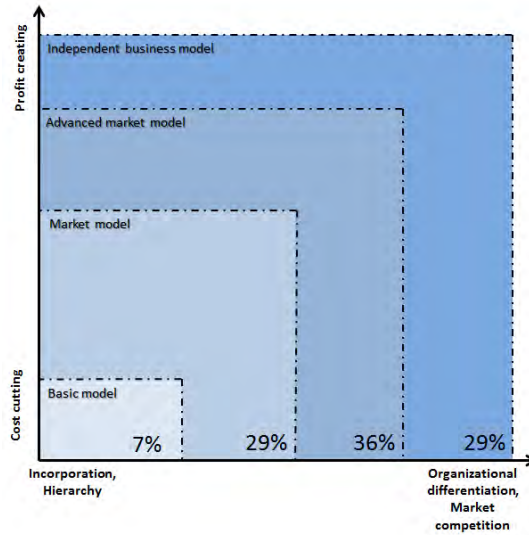


Figure 6

Maturity of Hungarian SSC based on Quinn's model.

Source: own edited

The research study examined the maturity levels of the shared service centers in Hungary based on Martin Pérez's model. The classification criteria were the existence of a service contract, customer satisfaction surveys, internal and external customer management, profit making and organizational hierarchy according to Martin-Perez's model. The following figure makes the Hungarian situation visible. During the investigation, the centers belonging to the category of "classical SSC" were the largest majority (64%) in Hungary, which was followed by the category of "professional SSC" by 27%.

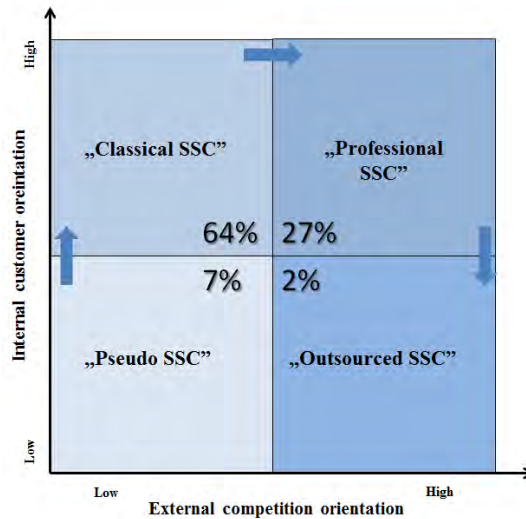


Figure 7

Maturity of Hungarian SSC based on Martin-Pérez's model.

Source: own edited

Looking at the results of the two evolutionary models, the majority of Hungarian shared service centers are operating with the matured organizational characteristics.

## Conclusions

Summarizing the research results, we can say that there are many theoretical models in the literature which are useful in categorizing of maturity levels of shared service centers. Quinn's model makes grouping into four categories according to their market orientation of service centers. Martin-Peréz's distinguished them along two dimensions, based on the empirical data. The Janssen-Joha and the CMMI models shows well the maturity of the parent company as well that is necessary if it want to operate an SSC. These models could be useful for the development of parent organization and exploring the opportunities for further improvement. Based on these information, the parent companies could create better sourcing strategies better manage their supporting operational activities.

There were more shared service researches in the last three years in Hungary conducted by the HOA or consulting firms but none of them analyzed the maturity stage of the Hungarian market players. The aim of this research was to fill this gap in the research practice.

**References**

- [1] G. Koncz, A szolgáltató szektor és a városhálózat kapcsolatának vizsgálata az Észak-alföldi régióban, Doktori értekezés szerk., Debreceni Egyetem: Debreceni Egyetem Természettudományi Doktori Tanács, 2010.
- [2] J. Hamar, „Üzleti szolgáltatások Magyarországon,” Közgazdasági Szemle, %1. kötetLII., %1. számNovember, pp. 881-904, 2005.
- [3] Z. Raffay, „Az üzleti szolgáltatások szerepe a regionális versenyképesség erősítésében,” in Versenyképesség és igazgatás: tanulmányok a regionális versenyképesség igazgatási feltételeiről, P. K. Ilona, Szerk., Pécs, MTA Regionális Kutatások Központja, 2004, pp. 69-90.
- [4] Zinnov, „Outsourcing info,” Shared Services Outsourcing Network, White paper, 2010.
- [5] V. Bodnár, Szerző, Régi-új kihívások a vállalati vezetők előtt: hogyan őrizhetjük meg stratégiai válaszképességünket és hatékonyságunkat egyszerre?. [Performance]. IFUA Horváth&Partners, 2002.
- [6] B. Quinn, R. Cook és A. Kris, Shared services: Mining for corporate gold, Harlow: Prentice Hall, 2000.
- [7] Z. Gast, Shared Service Center - Kontrolling Szolgáltató Központ - E.On Hungária Zrt., Budapest: Budapesti Corvinus Egyetem, 2010.
- [8] T. Bangemann, „Will the future of shared services be virtual?,” Shared Services News, %1. kötet3, %1. szám6, 2001.
- [9] N. Martin-Pérez, Shared Service Organisation, New York: Springer-Verlag New York, 2008.
- [10] M. Janssen és A. Joha, „Emerging Shared Service Organizations and the Service-Oriented Enterprise,” Strategic Outsourcing - An International Journal, %1. kötet1, %1. szám1, pp. 35-49, 2008.
- [11] M. Janssen és A. Joha, „Issues in Relationship Management for Obtaining the Benefits of a Shared Service Center,” Delft, 2004.
- [12] G. Vida, Interviewee, Interjú a magyar shared service piacról. [Interjú]. 2. augusztus 2012.



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# Application of the Theory of Constraints in Knowledge Management

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*Abstract: Organizations today are increasingly recognizing the effectiveness of knowledge management for the primary or at least one of the main sources of competitive advantage. At the same time need to process enormous amounts of information, and necessity to generate useful knowledge requires increasingly sophisticated tools with the enormous complexity of algorithms. Theory of constraints (TOC) is a philosophy of management that offers a set of tools that can be successfully applied in knowledge management. These tools are gathered in TOC Thinking process. The aim of the study is to present basic tools of TOC Thinking process and to explain how to use them.*

*Keywords: Theory of constraints, knowledge management*

## 1 The role of knowledge management in modern organization

Knowledge assets of organizations are on the one hand the sum of the knowledge of individual employees and teams, all intellectual assets in the database and the information that an organization uses to operate, however, on the other hand they incorporate tacit knowledge, such as operational processes and cultural values. Employees capable of converting data into information and that into knowledge and finally wisdom [1] using it for the benefit of the company is a key element of knowledge management in every organization. Nowadays the processes of information management, and in consequence knowledge management, cross all units, processes and management functions at strategic, tactical and operational level. Simultaneously the more accurate the information, the higher its quality is,

the more efficient and reliable and action and its effect will be [2]. However, higher quality of the information also increases the cost of obtaining it [3]. It is also important not to get lost in the volume of non-essential information that can obscure the true picture of the situation. Moreover, computers that were to bring streams of information are flooding us with a flood of data [4].

Good algorithms should support the process of assimilation of information (to facilitate understanding, accelerate the search for information), should not distort the source data, and should support the decision-making process; which means, it should support the ability of the audience to understand the data. Typical examples of the transformation process of information into knowledge are: aggregation of information, disaggregation, searching, selection, arithmetic operations (statistical methods), comparing, ranking, sorting [5]. Meanwhile, the data is not information, and information is not knowledge [6].

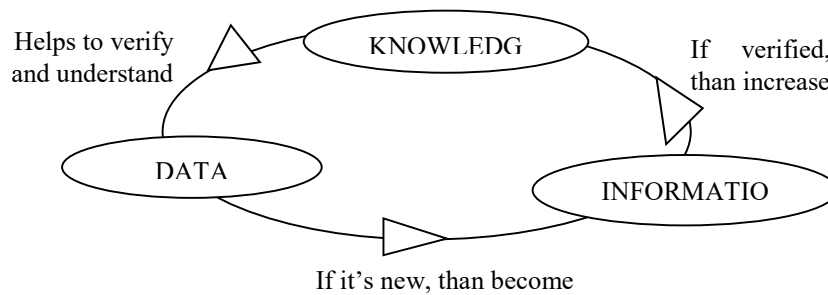


Figure 1

Knowledge, data, information

Data, if it is new, becomes information. If information is verified than it can increase knowledge. Knowledge helps to verify and understand data. Regarding knowledge, there are four main categories: to know "what"; to know "why"; to know "how", to know "who" [7]. You can also find the following categories: to know "when" and to know "where" [8].

There are four features that distinguish knowledge from traditional resources [9]. The first is domination. This feature gives knowledge a priority among other resources. It has a strategic importance for the functioning of modern enterprises. It also determines to a large extent, their position on the market. Often, its skillful use contributes to the effective management of other resources, and thus also to achieve the objectives of the organization.

The second is inexhaustibility. This feature indicates that knowledge is the only resource, which is not diminished as it is being used. At the same time the more you use the more its value is increasing. As the amount of available knowledge

increases, synergies appears. This phenomenon lies in the fact that during its transfer by any number of people it does not lose its value, but it is often developed with new elements created during this process.

The third feature that distinguishes knowledge from other resources is simultaneity. Due to this feature the same knowledge can be used by many entities at the same time and multiple locations simultaneously. Having knowledge does not ensure that an organization is the only entity that can use it. The essence of gaining and maintaining a competitive advantage is the use of knowledge before your competition does so.

The fourth specific feature of knowledge is non-linearity. There is no close relationship between the amount of knowledge and the benefits arising from its use. Large resources of knowledge does not predefine the position of the leading organizations in the market, but often contribute to its win. Decisive here is the ability to its appropriate use.

There is one more important feature of knowledge. It is viscosity. The viscosity of knowledge is its value as a source of competitive advantage and at the same time a huge problem when trying to share knowledge within the organization. Under viscosity a certain difficulty to transfer definite knowledge and solutions into new environment should be understood. Viscosity of knowledge may explain why it is so difficult to buy knowledge through buying people. People and their knowledge are merging in context and culture of the organization. The transfer to another location may cause that people are no longer able to use its knowledge so that they had done before.

The essence of knowledge management is determined by two very important aspects: good organization of information and its effective (relatively easy) search. Convenience and ease of use are seen as key determinants of the quality of knowledge management systems. The aim of the study is to present a potential algorithm of decision making based on the principles of the Theory of constraints.

## **2 Theory of constraints – basic assumptions**

Effective knowledge management combines four dimensions: 1) function - the relevance and usefulness of the information presented; 2) attractiveness - significant, new and / or interesting facts; 3) consistency - a true, accurate and reliable data; 4) form - that is the beauty of the structure and attractive appearance. Whether preparing to implement knowledge management or improving a current implementation, it's important to learn about best practices or leverage resources.

The Theory of constraints (TOC) is a philosophy [10] that implemented significant improvement in management through focusing on a constraint that prevents a system from achieving a higher level of performance. The Theory of constraints

(TOC) is a concept where the role of constraints in limiting the performance of an organization is emphasized. A constraint [11] is any element or factor that limits the system from doing more of what it was designed to accomplish (i.e., achieving its goal). A constraint can be capacity, market, time constraint or any other system limitation, like lack of knowledge.

The Theory of Constraints can be defined as an overall management philosophy founded on the idea that all systems; whether personal, interpersonal, or organizational; have at least one constraint: something that holds the system back from accomplishing more of its primary purpose, or goal. The rate of this accomplishment is called throughput. The principle of TOC consists of five steps [12]:

1. Identification of the system's constraint(s). It is important to identify these constraints and also necessary to prioritize them according to their impact on the goal(s) of the organization.
2. Decision on how to exploit the system's constraint(s). For example a managerial constraint should not be exploited but be eliminated and replaced with a policy which will support the increase of throughput.
3. Subordination of everything else to the above decisions.
4. Elevation of the system's constraint(s). If existing constraints are still the most critical in the system, rigorous improvement efforts on these constraints will improve their performance.
5. If in any of the previous steps a constraint is broken, the process has to be restarted from step 1. Organizations should not let inertia become their next constraint. TOC is a continuous process and no policy (or solution) will be appropriate (or correct) for all time or in every situation.

The five-step procedure presented above enables to plan the overall process / system or organization and focus attention on the resources with the greatest potential to be affected by changes of the system. These five steps correspond with typical knowledge management processes, where five steps are: collect, use, enrich, share, assess, sustain [13]. Moreover, in classical decision-making process, we can also distinguish several successive phases: 1) identification of the decision situation; 2) formulation of the decision problem; 3) building a model of the decision-making; 4) designation of decision limits and decision - sufficient or optimal decisions; 5) the final decision [14]. Typically the Theory of constraints is used to improve throughput in the process like in supply chain management [15]. But TOC offers also a set of tools that can be applied in knowledge management. These tools in general are gathered in the TOC Thinking process.

Theory of constraints offers a set of logical tools presented in an easy-to-follow form known as the "thinking process". Thinking process in the Theory of Constraints provides a set of holistic processes and rules, all based on a systemic

approach, that exploits the inherent simplicity within complex systems through focusing on the few "leverage points" as a way to synchronize the parts to achieve ongoing improvement in the performance of the system as a whole [16]. The philosophy of TOC is based on three simple assumptions [17]:

Basic Assumption 1: Everything within a system is connected by cause and effect relationships. Identification of the causes leads us to converge onto an apparent core problem/contradiction/conflict.

Basic Assumption 2: All contradictions can be resolved without compromise – our level of understanding and our assumptions hold the contradiction in place. A compromise is not usually a win-win solution.

Basic Assumption 3: There is no resistance to improvement – people embrace change because we have brought them to see the win for themselves.

These assumptions naturally fit into the process of knowledge management.

### **3 Theory of constraints – the strategical thinking process**

In the knowledge management process one should pay attention to the differences between efficiency and rationality of the decision-making process. Methodologically rational decisions are taken according to existing knowledge and suggestions, harvesting the information, through techniques, methods and tools developed by the ongoing improvement process, through experience and learning. Businesslike rationality of the decisions relates to its substantive content, it is synonymous with effectiveness and usefulness to the organization. Businesslike rationality is subjective, decisions should maximize the efficiency of the manager (which is assessed *ex ante*). The effectiveness of the decision however can be assessed *ex post*, always after the actual implementation and the gathering of information related to its effects.

Theory of constraints' thinking process is build on little-known tools and techniques that can be used to improve knowledge management. In general terms dealing with constraints during the implementation of the TOC, requires making three decisions [18]: decide what to change - identify the weakest link; decide what to change to - design a stronger link; decide how to cause the change - operationalize this stronger link into the chain. In details the technique is a bit more complicated.

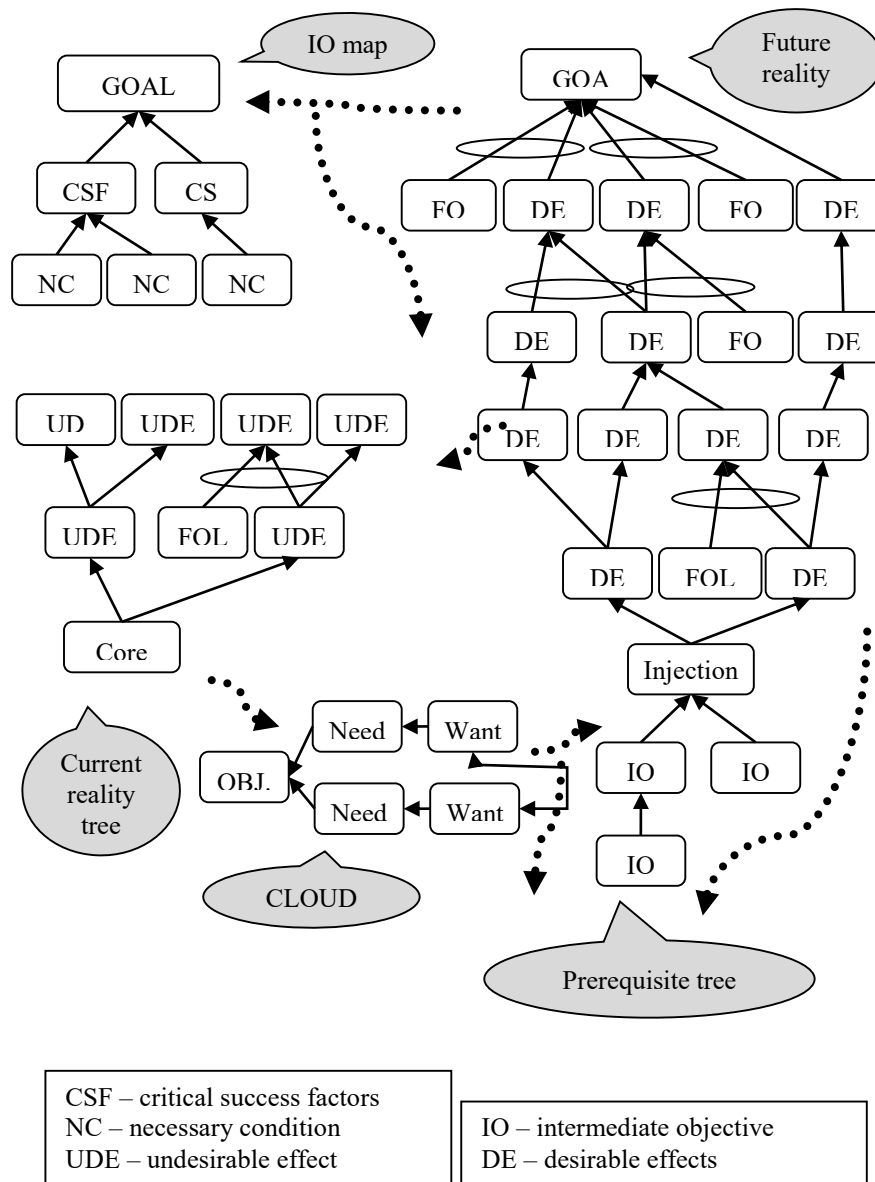


Figure 2  
 The TOC Thinking process

The Thinking Processes (Fig.2) is based on five visual tools - diagrams, (four trees and a "cloud") and a set of logical rules. The diagrams use two different types of logic to discuss the issue. Three of the trees (Current and Future Reality Trees and the Transition Tree) use cause - effect logic. They are built up by constructing connections between observed effects and causes on the basis of "sufficient cause". Sufficiency can be of three types: "A is sufficient to cause C" or "If both A and B occur together, then they will be sufficient to cause C" or "A and B (separately) both contribute to C, and either of them is sufficient to cause C". The Evaporating Cloud and the Prerequisite Tree both use necessary conditions thinking: "In order to achieve A one must have B". The general idea of TOC Thinking process (presented in fig.1) is described briefly in following sections.

### **Current Reality Tree (Why is the system sick?)**

Current Reality Tree (CRT) is the first diagram in TOC's thinking process. CST tries to find an answer to a question why the system is sick. CRT is a logical structure (if...then...) designed to depict the state of reality as it currently exists in a given system. It represents the most probable chain of cause and effect in a specific, fixed set of circumstances. Starting point for CRT is a set of undesirable symptoms, while end result is the core cause of the symptoms (constraint).

CRT is designed to achieve several objectives: provide the basis for understanding complex systems, identify undesirable effects (UDEs) exhibited by a system, relate UDEs through a logical chain of cause and effect to root causes, identify, where possible, a core problem that eventually produces 70% or more of the system's UDEs, determine at what points the root causes and/or core problem lie beyond one's span of control or sphere of influence, isolate those few causative factors (constraints) that must be addressed in order to realise the maximum improvement of the system, identify the one simplest change to make that will have the greatest positive impact on the system. It is essential to locate just one (or just few) key problems. It is a starting point to remove almost all of the most important problems, and this is the main goal of the management process. Often before one can move forward the core conflict must be solved. And for that "a cloud" is necessary.

### **Cloud (What conflict is preventing the cure?)**

This diagram is also known as a conflict cloud, a dilemma cloud, or a conflict resolution diagram. It helps to answer the question what conflict is preventing the cure. The Cloud provides a solvable verbalization of a conflicted situation where solvable is defined as "win-win." Starting point for this diagram is a conflict underlying a constraint, while end result should be a possible win-win solution. The cloud has one arm in the present and one arm in the future. The present contains things that one do have and do not want, the future contains things that one do not



have and do want. The conflict is between the present and the future. The cloud diagram is placed between the present problem and the future solution. To move forward one have to change the assumptions within the cloud: invalidate erroneous assumptions and overcome valid assumptions. Most often an “injection” must be created. Injection overcomes some current practices and creates a desired solution for the future. The injection must be transferred to future reality tree.

### **Future Reality Tree (Will the injection lead to all desired effects without creating new undesired effects?)**

The Future Reality Tree (FRT) is similar to the CRT in structure, but with new proposed actions, policies, and behaviors injected into it in order to create a new vision of the future reality of the system. FRT is trying to answer the question whether the injection leads to all desired effects without creating new undesired effects. For this diagram starting point is a proposed win-win solution, while end result should define necessary changes that should be implemented to process proposed solution and avoid new problems. Using FRT we ensure that all the undesirable effects (UDE's) of the CRT are changed by the injection into desirable effects (DE's). Sometimes one core injection is enough. Unfortunately usually there are prerequisites that must be actioned and often also some obstacles that must be overcome. One can describe this part of the process with a prerequisite tree.

### **Prerequisite Tree (What currently prevents the implementation of the injection?)**

The Prerequisite Tree (PRT) takes advantage of people's natural ability to point out why something can't get done. PRT focuses on the question what currently prevents the implementation of the injection. Starting points for this diagram are major objectives and the obstacles to overcome them. End results are milestones that overcome all obstacles. The first step in building a PRT (after identifying the team's ambitious objective) is to collect all the obstacles that the group can come up with. Then each individual identifies an "intermediate objective" (IO) that would overcome the obstacle. The PRT is important because it lists the individual major actions that must be undertaken in order to succeed. Prerequisite tree helps to set priorities. From this point of view the prerequisite tree can be called the execution plan.

### **IO Map (or Transition Tree: what actions one has to take to effectively implement the cure?)**

This tool supports the need to describe how to make the change happen. It tries to answer the question what actions have to be taken to implement the cure effectively. Starting point for this diagram is to define a set of goals, while end result brings

detailed actions to achieve the goals. The IO Map (Transition Tree) is built on “necessity-based” logic. It sets the goal, critical success factors, and necessary conditions for success. IO Map is necessary to move forward from predefined goal (or a short list of goals) to a set of defined critical actions that both: help to achieve the goals and at the same time deliberately avoid undesirable effects.

## Conclusions

The aim of the study is to present thinking methodology based on theory of constraints that can make an impact in knowledge management. The five stage thinking process in Theory of constraints starts with a Current Reality Tree (CRT). CRT shows what needs to be changed in the first place. Next tool, the Cloud, is used to understand and brake the conflict inside the system. The injection in the cloud breaks the constraint in the present and unlocks the future. It maximizes the leverage throughout the system. Third diagram, the Future Reality Tree (FRT) takes injection for change and ensures the new reality created would solve the unsatisfactory systems conditions and not cause new ones. Fourth diagram, the Prerequisite Tree (PRT) defines obstacles to implementation and presents ways to overcome them. Last tool, the Transition Tree (IO Map) is a graphical presentation of step-by-step implementation plan. The combination of five diagrams creates a complete, logical system supported by simple graphical presentation tools. Presented study proves that the thinking process included in the theory of constraints complies with all the requirements of a solution acceptable from the point of view of the knowledge management understood as a tool to support the process of acquiring and maintaining long-term competitive advantage.

## References

- [1] Ackoff, R. L., "From Data to Wisdom", Journal of Applied Systems Analysis, Volume 16, 1989 p 3-9.
- [2] Potocki A. (red.), Komunikacja w procesach zarządzania wiedzą, Fundacja Uniwersytetu Ekonomicznego w Krakowie, Kraków 2011, p.173
- [3] Shugan S.M., Price – Quality Relationships, NA – Advances in Consumer Research vol.11, eds. T.C.Kinnear, Provo UT, Association for Consumer Research 1984, p. 627-632
- [4] Hyerle D., Visual tools for transforming information into knowledge, 2<sup>nd</sup> ed., Corwin Press 2009, p.58
- [5] [www.mfiles.pl](http://www.mfiles.pl) (accessed at 13 March 2016)

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Budapest, 2016

- [6] El-Sayed Abou-Zeid, Knowledge Management and Business Strategies, Hershey 2008, p. 173
- [7] The Knowledge-based economy, OECD, Paris 1996, p. 12
- [8], [9] [www.uci.agh.edu.pl](http://www.uci.agh.edu.pl) (accessed at 13 March 2016)
- [10] Goldratt, E.M., Theory of Constraints, North River Press 1990, Croton-on-Hudson, NY, at all
- [11] Goldratt, E.M. and Cox, J., The Goal: A Process of Ongoing Improvement, North River Press 1992, Croton-on-Hudson, NY, at all
- [12] Goldratt, E.M., What is This Thing Called Theory of Constraints and How Should it be Implemented?, North River Press, New York 1990, NY, p.5
- [13] Mueen Uddin1, Roop Chand Hindu, Raed Alsaqour, Asadullah Shah, Adamu Abubakar, Tanzila Saba, Knowledge Management Framework using Green IT to Implement Sustainable Entrepreneur Ecosystem, Appl. Math. Inf. Sci. 9, No. 5, p.2710
- [14] [orms.pef.czu.cz](http://orms.pef.czu.cz) (accessed at 13 March 2016)
- [15] Theory of Constraints (TOC) Management System Fundamentals, IMA and Arthur Andersen LLP No. 99342, p. 6, at: [www.imanet.org](http://www.imanet.org) (accessed at 13 March 2016)
- [16], [17] [www.tocico.org](http://www.tocico.org) (accessed at 13 March 2016)
- [18] Jacob D.B., McClland W.T. Jr, Theory of Constraints Project Management. A brief Introduction into the Basics, The Goldratt Institute, New Haven, Connecticut 2001, p.3

## Entrepreneurial University as Contemporary Paradigm of 21<sup>st</sup> Century

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*Abstract: This manuscript is presenting some of the activities of University in Belgrade, as the largest academic institution in Serbia, in development of the adequate conditions for technology transfer and connections between research, industry and SMEs. The activities of the Center for technology transfer are additionally described by its representatives and introduced in the manuscript. Also, some activities of Technical faculty in Bor, in developing the entrepreneurial way of thinking of young population in the region of Eastern Serbia, are also discussed.*

*Keywords: Entrepreneurial University, Knowledge Transfer, Entrepreneurial skills*

## 1 Introduction

The mutual relationship between the university and industry through the exchange of knowledge has become a global trend recently [1]. Many European countries have introduced reforms and policy initiatives to encourage and improve university technology and knowledge transfer [2]. Following these trends, a number of universities have transformed themselves from a traditional research university to an entrepreneurial university with strong relations to industry and SMEs, thereby encouraging and promoting the entrepreneurial activities of their teaching staff [3].

In accordance to different authors, the role of the entrepreneurial university is not simply producing new knowledge, but also disseminating this new knowledge to industry and society [4]. The entrepreneurial university also tries to provide a culture and suitable atmosphere for encouraging academics to disseminate their

knowledge through traditional academic activities as well as through activities that are more entrepreneurial in nature [5]. Also, the entrepreneurial university as a concept, have to be based on many changes to university routines, culture and policies.

However, In spite of all the initiatives, educational policy modifications and changes and desire to create entrepreneurial universities, even today there is a question on how the entrepreneurial orientation within a university may influence academics' willingness for engagement in different new activities [4]. Meaning that transforming from classical to entrepreneurial university requires engagement of almost all teaching staff, wiling to adopt changes in their everyday educational practice. Also, actual involvement in entrepreneurial activities is largely associated with the environment surrounding academics. Namely, research of authors [6], which was conducted 20 year ago, has emphasized that the environment in which an individual works is likely to have a great influence on an individual's behavior. As stressed by D'Este and Patel [7], the environmental factors mainly influencing an academic's behavior are university culture, policies and routines. In many cases, even at universities operating in countries with highly developed market economies, this can be an obstacle. The lack of entrepreneurial role models, the absence of an entrepreneurial culture across the institution, and the reward system are some of the main barriers in increasing the entrepreneurial patterns of the universities, even in recent year as described in [4,5]. The obstacles in introducing the entrepreneurial university concept, in contemporary academia space of EU were also investigated and presented in [8]. This is even more evident in case of Serbian academic space, considering that limited resources can be dedicated to university development under the transitional economy.

The importance of the Entrepreneurial University concept in European Union is also evidenced by development of "A Guiding Framework for Entrepreneurial Universities" [9]. The Guiding Framework is aimed at those European universities looking for advice, ideas and inspiration for the effective management of institutional and cultural change. It is designed to help interested universities assess themselves against statements which are organized under the seven areas of Entrepreneurial universities concept, presented in Figure 1.

Having all above in mind, following text is describing some of the attempts of the University of Belgrade, as the largest academic institution in Serbia, in developing strong connections between research and teaching activities, on one side, and requirements of the industry and SMEs, on another. Also, some examples of activities targeting development entrepreneurial way of thinking, among young population in Eastern Serbia, facilitated by Technical faculty in Bor, are presented. The idea of this manuscript is to explore the possibility and applicability of the concept of entrepreneurial university and accordingly to draw attention on the importance of a new approach in higher education.

## 2 Initiative at university of Belgrade for developing the base for entrepreneurial university

The University of Belgrade (UB) is the oldest and the largest university in Serbia with over 89.000 students and 5.000 teachers and associates. According to the Shanghai list, it is ranked among the top 400 universities in the world. The UB comprises 31 faculties, 11 Institutes, 7 Centers and a University library, which all work together on achieving academic excellence. Although being a large academic institution with complex organizational structure can be a limiting factor in the attempt to reposition itself from its traditional role, the University of Belgrade is making continuous efforts in order to contribute to the development of a national innovation system and the creation of an economy and society based on knowledge, transfer of knowledge and entrepreneurial activities.

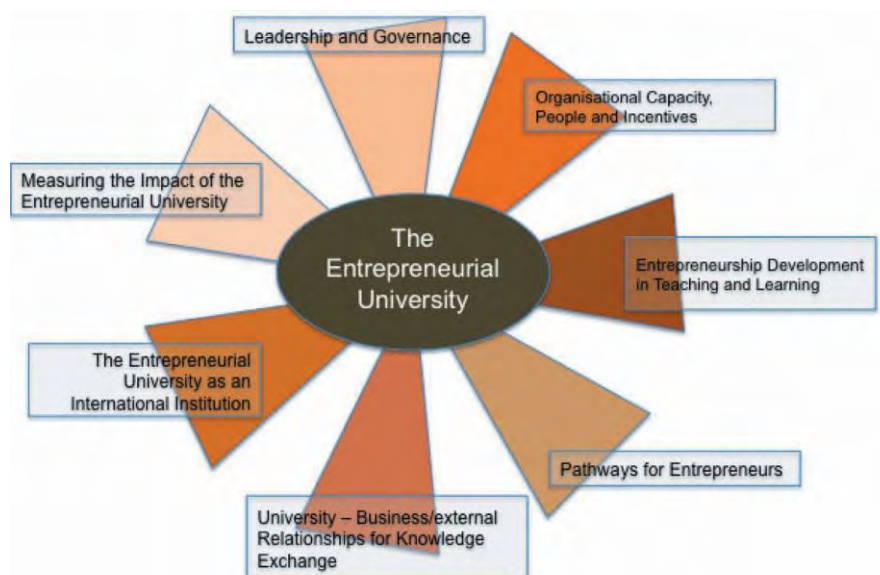


Figure 1

Seven factors for assessing the entrepreneurial activities of the universities as defined by EC-OECD

Considering that establishing, fostering and developing cooperation with other universities, organizations and enterprises all over the world, and strengthening the bonds between them, has been an everlasting commitment of the University of Belgrade, forming of the Center for Technology Transfer (CTT), primarily for the purpose of identification, protection and commercialization of UB's R&D results, was only the next logical step in the direction of preparing the base for evolving in to the entrepreneurial university.

Therefore, the importance of investment in intellectual potential, technology transfer and protection of scientific research results was acknowledged as one of

the foremost prerequisites for further successful development in the entrepreneurial direction.

The Center for Technology Transfer plays a supportive role through its promotional, educational and networking activities. It helps students and university employees to recognize the existence of innovation potential, to understand the relevance of its protection, possible ways of commercial exploitation and the complexity of the whole technology transfer process. Also, trainings, seminars, info days, and joint events with the industry representatives are being organized for the purpose of educating targeted groups in the area of entrepreneurship, commercialization and intellectual property rights. Considering that investments are indispensable precondition for further growth, Center endeavors to help young researchers to make an excellent pitch and present their idea in the best possible way in order to attract investors. In this respect, there is a permanent strive for creation of startup competitions and matchmaking events, as the opportunity for good ideas to find a way to the market.

The Center's Technology Transfer Managers are creating new and strengthening the existing connections with other universities, organizations and enterprises, through involvement with different associations which promote the Technology Transfer concept, as well as taking part in mentoring programmes with the aim to support future entrepreneurs during their path from the idea up to setting up business. Basically, they make maximum effort to create an ecosystem which is going to be beneficial for innovational initiative of students, researchers and teachers, simultaneously providing easy access to suitable staff, research projects, technical solutions, and portfolio of inventions needed by industry.

A part of this effort is embodied in the form of „Science2Business“ database, which was created as a response to increasing need for intensification of collaboration between academia and industry, and informing the broader audience about the scientific potential of University of Belgrade.

The process of technology transfer and the role of the Center are presented in Figure 2.

Technology transfer process

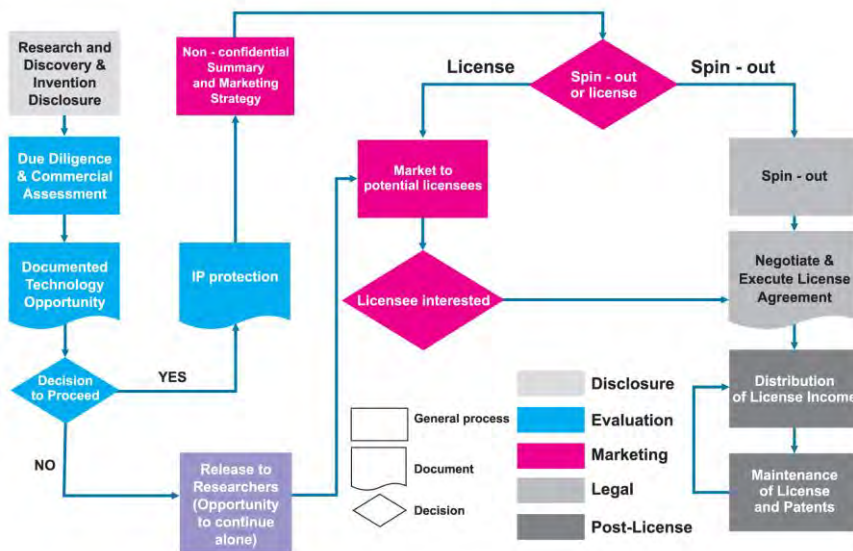


Figure 2

The process of technology transfer at the UB [10]

Database facilitates transfer and implementation of knowledge and technology in favor of prosperity of both sectors and indirectly of sustainable, knowledge based economic development of the country. It enables companies to get the information about new technologies and knowledge easy and efficiently, which is the best way to protect and enhance their competitive advantage in the era of turbulent technological progress.

As a modern communication channel, designed to be useful service for all involved parties, “Science2Business” contributes to generation of their economic benefits through joint research activities, development of new and improvement of the existing products, joint participation in national and international projects and business idea creation.

Although still in developing phase, establishing of Center for technology transfer in the scope of the University is clear indicator of its decisiveness to initiate and encourage entrepreneurial spirit within itself. Taking all the above into consideration, Center has made remarkable results creating entrepreneurial and innovation friendly environment through its numerous activities in that field and it is eager to continue in the same direction in the future.



## **2.1 Initiatives of Technical faculty in Bor in increasing the entrepreneurial spirit of youth in frame of the HE**

Technical Faculty (TF) in Bor was established in the year 1961 as a part of the University of Belgrade as a scientific-research organization in the area of technical-technological science. Main activities on TF Bor could be divided into two groups. The first is focused on providing a highest level of academic studies possible, in order to provide the students with the applicable knowledge, technical and managerial skills, which are required by business organizations. Academic studies are organized for approximately 1,400 students at BSc, MSc and PhD level. Second group of activities are projects in which our scientific staff is engaged.

Also, Technical faculty in Bor is active in publishing, being the publisher of two International Scientific Journals: Journal of Mining and Metallurgy, Section B: Metallurgy (indexed on Thompson Reuters List) [www.jmmab.com](http://www.jmmab.com) and Serbian Journal of Management (indexed by EBSCO Publishing and SCOPUS) [www.sjm06.com](http://www.sjm06.com).

There are four divisions at the Faculty, e.g.: The Division for management; The Division for Inorganic chemical technology; The Division for metallurgy and the division for mining. Technical faculty in Bor is a member of University of Belgrade (UB), together with 30 other faculties. However, TF Bor has one particularity. It is the only one of 31 UB faculties, which is located outside Belgrade, being located in Eastern Serbia, in city of Bor, which is 250 km away from Serbian capitol. There is a strong reason for this. The city of Bor is one of the largest copper producing centers in the Europe. For more than one century copper ore is mined and extracted there in the mining and metallurgical company RTB – Bor. Being as such, the TF Bor, is developed to sustain this industry and to educate engineers which will be employed in this large company.

Such situation has many positive, but also some negative, consequences. The positive consequences are in the fact that TF Bor is strangely connected with the industry since the beginning. There are lots of places for experimental work and practice of our students, which have direct links to industry of the RTB Bor Company. Also, development of the study programs at TF Bor was largely influenced by the requirement of the company. On the other hand, the negative consequences of this situation reflect the low development of entrepreneurial initiative in the region of the city of Bor. The reason for this should be found in the fact, that in the past, most of the high school and university graduates from this region were automatically employed in the RTB Bor Company. Sometimes, students were employed on their final years, because of expansions of the company. Accordingly, nobody even thought about possibility to start their own business in those days. However, during nineties, the economic situation in Serbia largely changed, leading to decrease of the RTB Bor Company capacities and resulting with downsizing. Instantly, the region faced large number of laid off employees and decrease of employability of newly graduated students. This was a

wakeup call to start thinking about entrepreneurial activities as the alternative to large industry of this region. Accordingly, TF Bor gain its primarily role again in responding to the needs of the region, and 13 years ago developed the Management department, with one of the goals to offer the entrepreneurial skills and knowledge to its management students. Entrepreneurial disciplines are among main courses included in the Engineering Management Department (EMD) curriculum (<http://menadzment.tf.bor.ac.rs/english/curriculum/>).

However, at TFB it was realized that it was not enough. It was realized that the most important issue is in development of “entrepreneurial spirit” among younger population (high school and elementary school students) of the region of Eastern Serbia, where TFB is located, which will lead to change toward entrepreneurial DNA [11]. Development of the entrepreneurial spirit, in the young population of the region, will at the same time lead to crating the new jobs by self-employment. Accordingly, Engineering Management Department (EMD) of TF Bor, UB, started its campaign and engagement in the projects dedicated to increase entrepreneurial potential among young people of the region.

One of the first action in this direction was connecting with Hewlett Packard (HP) LIFE program for promotion of entrepreneurial way of thinking among high school students and potential entrepreneurs, using the everyday ICT technology with which this target group is familiar. The goal of this program is achieved through development of entrepreneurial spirit, working on entrepreneurial ideas and sustaining the ideas with adequate knowledge from the field of business, as well as the field of informational communicational technologies (ICT). Education according the HP LIFE program is organized in 49 countries around the world. Technical faculty in Bor is the only accredited partner of this program in Serbia. The program was originally developed as the GET IT project, managed by Micro Enterprise Acceleration Institute - MEA I (Switzerland). Since the early beginning of this program was in 2008, when MEA-I and HP developed GET-IT project, Technical faculty in Bor was actively involved. As a participating organization, Technical faculty in Bor, received grant of HP equipment, the T-Tools Guidance course for their trainers and the T-Tools training materials.

The LIFE Program trainings are based on integration of Business Skills Courses and Technology Courses, this way resulting in Business Challenges and Technology Solutions, as presented in Figure 3 (<http://www.life-global.org/>). There is a reason for this attempt in development of entrepreneurial spirit among young population based on ICT. Today almost all high school and university students do have access to PCs, mobile phones and other ICT devices. Unfortunately in most cases, they use this equipment in personal entertainment. The Purpose of this education is to teach them to use the same technology in business and entrepreneurial activities [12].



Figure 3

Finding the solutions to business challenges based on technology

This means that none of the technology covered in the LIFE Curriculum is taught just for technology's sake. Rather, the technology covered here is applied to business to show how common, widely available ICT tools can help solve common, widely encountered business challenges – all with the goal of helping businesses run more smoothly and grow more quickly.

The training is organized in the concept of workshops with interactive approach to presented subjects and using contemporary methodological concept. Four modules which are included in the training, according to HP LIFE program are: Marketing, Operations, Communication and Finance (Figure 4). Each of the modules is further developed in five segments: Imagine Plan, Start, Grow and Innovation. This way, curriculum includes  $4 \times 5 = 20$  subjects. Each subject is worked out separately through adequate methodological approach. Also, adequate modules levels are chosen for the level of prior knowledge of the high school or the faculty students. The training is organized for groups with 10 to 20 attendants in computer rooms equipped with at list 10 Personal computers (PCs). Software required for the trainings are provided by the HP LIFE program, however most of the applications are based on the open source and publicly available. Each modules subject is based on different ICT application. Trainings for one group of students are 5 days long (15 to 20 hours in total).

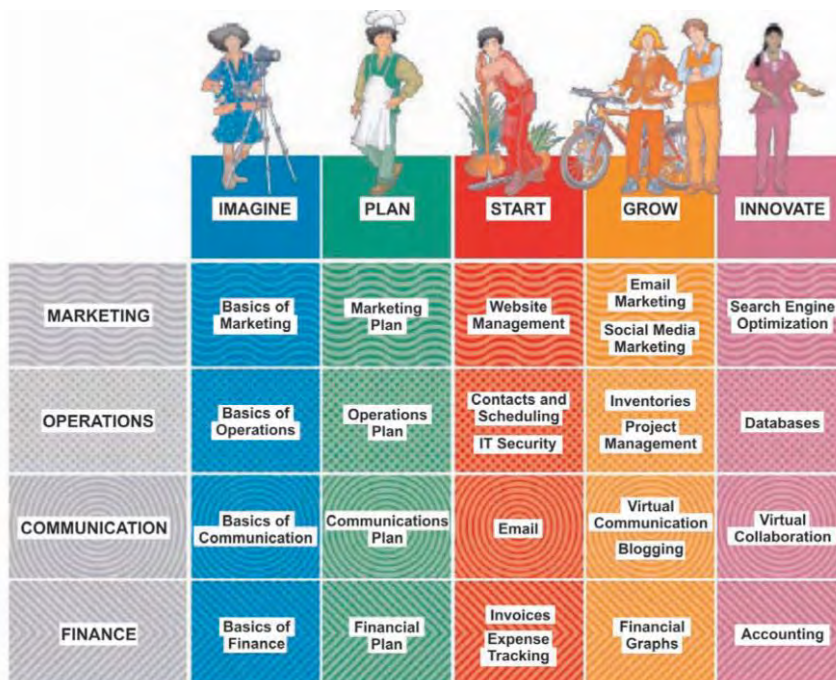


Figure 4

Modules of the HP LIFE program which are included in TFB curriculum

**IMAGINE** is the first level of the LIFE Curriculum. IMAGINE addresses people who have no background in business and who are still only dreaming of setting up their own enterprise. IMAGINE offers them training on business concepts, helping them build the foundations of their entrepreneurial thinking. IMAGINE teaches them different types of business analysis while at the same time introducing them to basic technologies that can be used to build these analyses in a professional manner.

**PLAN** is the second level of the LIFE Curriculum. PLAN addresses people who do not have their own company yet, but who have a good grasp on fundamental business concepts and an idea of the business they would like to start. It teaches them how to translate their idea into a well-researched and structured Business Plan. PLAN introduces further features of the same technological tools covered in the IMAGINE level, giving students the skills necessary to build a flexible and presentable Business Plan.

**START** is the third level of the LIFE Curriculum. START addresses potential beginners in business to help them develop their basic ICT skills so they can run their company as effectively as possible from the very beginning. The START level of the Curriculum is equally applicable to more established micro-enterprise owners who have considerable business experience but who are not in the habit of

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using information and communication technologies to manage and run their company.

**GROW** is the fourth level of the LIFE Curriculum. GROW focuses on more advanced technology for business skills and gives the advanced students the chance to learn about more complex technologies. The content of the GROW level of the Curriculum builds on the skills acquired in the START level, introducing more advanced features of certain technologies as well as entirely new solutions, many of which include Web 2.0 components.

**INNOVATE** is the fifth level of the LIFE Curriculum. INNOVATE addresses future entrepreneurs who are looking to optimize their operational tasks by undergoing training on more sophisticated technologies for business. INNOVATE builds on the technologies covered in the previous levels of the Curriculum to give potential entrepreneurs who are knowledgeable in business and skilled in technology the opportunity to learn how complex applications can be integrated to help them take their business one step further.

The LIFE Curriculum teaching methodology, was designed for business oriented young and adult learners. There are two key pedagogical concepts that underpin this methodology: the Experiential Learning Cycle (ELC) and the Business-Technology-Business (BTB) framework. Research has shown that adults learn best in a hands-on activity way. The ELC works as follows: Every topic in the LIFE Curriculum begins with students acquiring some new theoretical information. Then, students process that information through a practical exercise – in other words, a hands-on experience. After that, students reflect on what they learned and discuss how they might apply and consolidate their newly acquired knowledge. Then, they go into the real world and apply what they have learned. BTB means that every LIFE Curriculum topic begins with a common business challenge faced by a typical entrepreneur, anywhere in the world. By working on a business-related case study, students identify and discuss a particular business challenge. Then, the trainer introduces a technological solution to that challenge. The class is shown some of the benefits of the technological solution and taught how to use it through a hands-on exercise. Finally, the trainer guides the class back into the domain of business and encourages the students to discuss how to use the technological tool in the real business world.

Starting for the year 2009, the HP LIFE program was included in the curriculum of the Engineering Management Department, as the regular third year subject at the BSc level. Also, from 2012 this program is also offered to the high school students in the Bor region. Now, in 2016 there is additional attempt to further expand this program in the neighboring region of Vidin (Bulgaria), through IPA cross border cooperation projects.

## Conclusions

This manuscript is written in form of report, presenting some of the activities of University of Belgrade (UB) in creating the bases for enabling larger entrepreneurial activities of the academic institutions in Serbia, which are the part of UB. As presented in this manuscript, the final concept of Entrepreneurial University in Serbia is not established yet, however, there are concrete actions which are leading to development of basic conditions for introducing this concept in our academic environment in the future.

Also, second part of the manuscript is presenting the activities of Technical faculty in Bor (TF Bor), as part of UB located in Eastern Serbia, in developing the entrepreneurial spirit among young population of this region. Besides presenting activities facilitated in the past and present, some ideas for further action in this field are also elaborated.

## References

- [1] Arvanitis, S., Kubli, U., Woerter, M., 2008. University-industry knowledge and technology transfer in Switzerland: what university scientists think about co-operation with private enterprises. *Res. Policy* 37 (10), 1865–1883. <http://dx.doi.org/10.1016/j.respol.2008.07.005> .
- [2] Mihajlovic, I., Ljubenović, M., Čolić Milosavljević, T. Preparing the Base for Entrepreneurial University: Academic Activities and Directions of Knowledge Transfer at Technical Faculty in Bor – University of Belgrade – Serbia. *Journal of Entrepreneurship and Innovation*, Issue 7, 2015, accepted for publication.
- [3] Krabel, S., Mueller, P., 2009. What drives scientists to start their own company? An empirical investigation of Max Planck Society scientists. *Res. Policy* 38(6), 947–956. <http://dx.doi.org/10.1016/j.respol.2009.02.005> .
- [4] Kalar, B. Antoncic, B., The entrepreneurial university, academic activities and technology and knowledge transfer in four European countries, *Technovation*, 36-37 (2015) 1–11.
- [5] Philpott, K., Dooley, L., O'Reilly, C., Lupton, G., 2011. The entrepreneurial university: examining the underlying academic tensions. *Technovation* 31(4), 161–170. <http://dx.doi.org/10.1016/j.technovation.2010.12.003> .
- [6] Amabile, T.M., Conti, R., Coon, H., Lazenby, J., Herron, M., 1996. Assessing the work environment for creativity. *Acad. Manage.J.* 39(5), 1154–1184. <http://dx.doi.org/10.2307/256995> .
- [7] D'Este, P., Patel, P., 2007. University-industry linkages in the UK: what are the factors underlying the variety of interactions with industry? *Res. Policy* 36(9), 1295–1313. <http://dx.doi.org/10.1016/j.respol.2007.05.002> .

**Management, Enterprise and Benchmarking in the 21<sup>st</sup> Century**  
Budapest, 2016

- [8] Dabić, M., Gonzales-Loureiro, M., Daim, T., 2015. Unraveling the attitudes on entrepreneurial universities: The case of Croatian and Spanish universities. *Technology in Society* 42 (2015), 167-178.
- [9] EC-OECD, A Guiding Framework for Entrepreneurial Universities, European Commission, 2012, pp. 1-54.
- [10] Documentation of the Center for Technology Transfer: <http://www.ctt.bg.ac.rs/>
- [11] Abraham. J., *Entrepreneurial DNA: The Breakthrough Discovery that Aligns Your Business to Your Unique Strengths*, 2011., The McGraw – Hill, USA. ISBN: 978-0-07-175451-4.
- [12] Mihajlovic, I., Živković, Ž., Nikolić, Đ., 2012. Adaptation of the HP LIFE program for promotion of the entrepreneurship among young people, *Serbian Journal of Management* 7 (2), 321 – 325. [http://www.sjm06.com/SJM%20ISSN1452-4864/7\\_2\\_2012\\_171\\_325/7\\_2\\_321\\_325.pdf](http://www.sjm06.com/SJM%20ISSN1452-4864/7_2_2012_171_325/7_2_321_325.pdf)

**Web references:**

- [13] [www.jmmab.com](http://www.jmmab.com)
- [14] [www.sjm06.com](http://www.sjm06.com)
- [15] <http://menadzment.tf.bor.ac.rs/english/curriculum/>
- [16] <http://www.life-global.org/>

# **A New Approach in Higher Education: Social Entrepreneurship Education**

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*Abstract: Social entrepreneurship education is one of these approaches recently emergent. It is influenced by several factors at the environmental, organizational, and individual levels. However, through providing social entrepreneurship education in higher education institutions, it is possible to develop individual's abilities and enable them to produce innovative solutions to social problems. Social entrepreneurship education has many positive effects on person in terms of individualistic and society aspect. In this context, the aim of the study is to reveal the need of social entrepreneurship education. It is found out that social entrepreneurship education gives a chance to start up a social business. In addition to that, social entrepreneurship education supports individual's self-sufficiency, creativity, empathy, rational thinking, and entrepreneurship skills. It promotes the social problem solving in society and contribute to developing a sustainable national economy.*

*Keywords: social entrepreneurship, higher education, social entrepreneurship education*

## **1 Introduction**

The social entrepreneurship is quite new and complex phenomena, however, in the past decade it has gained recognition in scientific research, national policies, education, and the commercial sector. The policy makers and economists has labelled social entrepreneurship as one of the key factors to increase ethical and inclusive economic growth. It is important tool to tackle social challenges and to respond to them when the market and the public sector do not. Social enterprises and social entrepreneurs create innovative initiatives to unsolved social problems, putting social value creation at the heart of their mission in order to create benefit to different individuals and society [1]. In the wake of this development, social entrepreneurship as a field in academia is fast gaining popularity and attention due the realized need for trained professionals for social problem solving [2]. Social entrepreneurship education has become an effective key to shaping young people's attitudes, skills and the mindsets that are central to developing sustainable economic growth [3]. According to the study, conducted by Brock and



Kim, many universities, engineering faculties, business faculties, and high school institutions take part in giving social entrepreneurship education [4].

However, in Latvia only some higher education institutions include social entrepreneurship study course in curriculum. The only study programme in Latvia based on innovative concept of social economy promoted in EU countries is realized in Latvian Christian academy (master study programme „Social entrepreneurship”, licensed in 2013). The programme links principles and methods of social work and social entrepreneurship in interdisciplinary package with aim to reach social goals in entrepreneurship. It offers insight in both principles of organization and running of social business, deals with social and spiritual needs of socially marginalized people, promoting ensuring cohesion of society. However, researches show that social entrepreneurship and social entrepreneurship education is influenced by several factors at the environmental, organizational, and individual levels [1; 4].

Different scientists emphasize that social entrepreneurship education is needed in order to improve the quality of education and raise qualified individual [3; 5]. Giving social entrepreneurship education in the higher education institutions makes many things possible in terms of person development. Social entrepreneurship education is likely increase social awareness, make people sensitive to problems in their environment, help them to create innovative solutions for the problems and support their ability of giving an opinion about created solutions. In addition to these individual achievements, it is possible to say that social entrepreneurship education also has effects on society. Social entrepreneurship has come forward to find sustainable solutions for social problems and these solutions have significant role in social progress of the society. Hence, social entrepreneurship education has importance in terms of both individual and social effects. These considerable effects are one of the reason why social entrepreneurship and social entrepreneurship education gain popularity in recent years [5]. In this context, the aim of the study is to reveal the need of social entrepreneurship education. The research tasks are 1) to determine factors influencing social entrepreneurship education; 2) to identify individual benefits of social entrepreneurship education which can be applied in higher education institutions; 3) to identify benefits of social entrepreneurship education for society.

## **2 Social entrepreneurship education and its influencing factors**

One of the earliest discussions in entrepreneurship literature is whether to be an entrepreneur can be learned or not. This discussion reflects two extreme positions: in one side there are those who defend that “entrepreneurs are born”, on the other side there are those who believe that “entrepreneurs can be made” [6]. However, most accept that entrepreneurship, or certain facets on it, can be taught, or at least

encouraged, by entrepreneurship education [7]. The support for this view comes from a widely literature review of entrepreneurship and business creation, which suggest important links between entrepreneurship education, business creation and entrepreneurial performance [8; 9; 10]. Thus, entrepreneurship education arises as a crucial tool in the development of the competences needed to new business creation [11]. Similarly, Dees states that if individual wants to be entrepreneur, getting education is the first stage in order to acquire and develop entrepreneurial skills [12]. However, there is need for a new approach in entrepreneurship education. There is necessity to provide social entrepreneurship education in higher education institutions because it can give several benefits in addition to those provided by traditional entrepreneurship courses. However, putting social entrepreneurship education in university curriculum is quite new and developing event [13] and it is influenced by several factors at the environmental, organizational, and individual levels [14; 15; 16].

**Factors at the external environmental level.** Social entrepreneurship is affected by various macro-level factors. The influencing factors of social entrepreneurship education which are related to the external environment are classified according to PEST analysis.

Firstly, the lack of government support is mentioned as one of the key factors that hinder the development of social entrepreneurship [17]. The researchers point out that the government has to create an adequate legal framework for regulating social entrepreneurship and to introduce support instruments for fostering its development [18; 19]. For example, in the UK political climate is one which visibly supports the development of social enterprises but in Latvia the great obstacle is that social entrepreneurship is not legally introduced in legislation and is not accepted as the form of entrepreneurship. The fact that social entrepreneurship is not legally recognized doesn't contribute its development in higher education institutions. Martin and Osberg hold the view that the social and environmental issues should be given a political and academic priority [19].

Secondly, there are problems with access to finance for social entrepreneurship. Hynes research revealed that social entrepreneurs face with funding problems which prevent establishment and development of social enterprises [20]. Financing enables social entrepreneurs to hire talented employees, find a market, pursue pilot projects, and carry out other activities related to growing their enterprises. As social entrepreneurship has no financial support at the national level, it is not conducive to students' interest to address this kind of business.

Thirdly, there is a lack of understanding about social entrepreneurship as a term. According to Zagare research, only 37% of Latvia residents have heard the term 'social entrepreneurship' and have some understanding about it [21]. But the understanding of this term should be strengthened by the explanation of benefits that social enterprises fulfil in society and social entrepreneurship education can provide for individuals and society. The huge obstacle for development of social entrepreneurship in society is 'architecture of capitalism' where the main focus is on profit making. Very often the performance of business which is coordinated

alongside with society aims is not so attractive for students. Bornstein and Davis emphasize that thinking of society has to be moved from 'me' to 'us' and, eventually, to 'all of us' [22]. In order to build strong community, it is essential to respect others' rights and responsibilities because if people work only for their own benefit, it is difficult to reach social welfare and sustainable development. To achieve this aim collaboration skills between different parties are important. Without effective networks and intermediaries, it is very difficult to connect ideas, resources and people, which is a pre-condition for the development and growth of social entrepreneurship.

Fourthly, a study conducted by Hynes reveals that the Internet is an important factor affecting social entrepreneurship [20]. The advancement of technologies and communication facilitates the exchange of information and experiences. Developments in information and communications technologies have created exciting possibilities for introducing online study courses in social entrepreneurship.

**Factors at the organizational level.** Social entrepreneurship education influencing factors which are related to the organization are connected with managerial levers. There are defined several sub-categories for the identification of social entrepreneurship education barriers at the organizational level: strategy and management of the higher educational institution, management practice and organizational culture. It is proved that social entrepreneurship intentions and initiatives usually come from organizational norms and attitudes [23].

**Factors at the individual level.** The use of the micro-level perspective and a focus on different individual characteristics emphasize that social entrepreneurship education depends on the knowledge, abilities, skills, motivation and the attitudes of individuals [24]. It means that academics should take the initiative to develop social entrepreneurship study courses.

Fig. 1 summarizes the proposed model, which integrates and structures the three levels of analysis and the respective sub-categories.

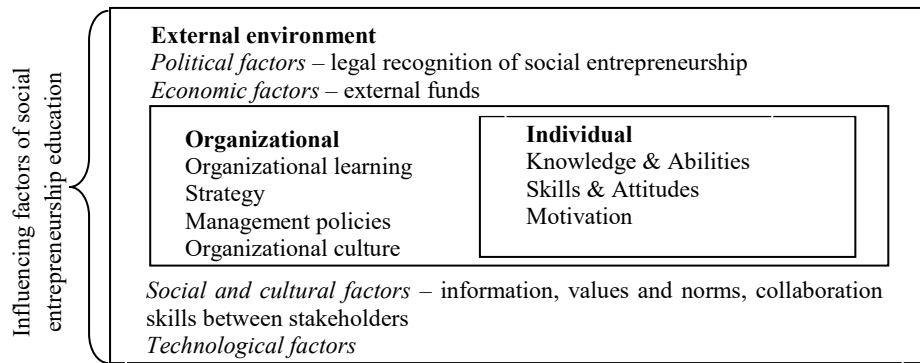


Figure 1

Social entrepreneurship education influencing factors at the environmental, organizational and individual levels

Source: Author's own study based on [17; 20; 21; 23; 24].

Despite the influencing factors, putting social entrepreneurship education in university curriculum is important as it can provide to individuals and society significant economic and social benefits.

## 2 Benefits of social entrepreneurship education

Scientists has proved that higher rates of education will lead to higher rates of entrepreneurship [25; 26; 27]. A study by Kolvereid and Moen has also confirmed that students who have learned entrepreneurship have greater interest to become entrepreneurs and have acted more entrepreneurial than other students to start a new business [28]. Walter and Block findings from 11,230 individuals in 32 countries support this notion [29]. It means the objective of social entrepreneurship education is to stimulate students to start up their own business and develop knowledge and competencies about how to do that. Hence, social entrepreneurship education can and should be offered to students for them to become social entrepreneurs and to develop their entrepreneurial skills.

Certain studies suggest that higher levels of education lead to better performance in entrepreneurial activities [30], it can provide the necessary cognitive skills so that the individual can better evaluate the opportunities as they arise [31], which leads to a greater potential for productivity and efficiency.

Moreover, once committed to a business activity, entrepreneurs with a higher level of education are better equipped to exploit those opportunities successfully [32]. Pache and Chowdhury developed social entrepreneurship education model. They

indicate that, firstly, social entrepreneurship education adds individual an ability to see entrepreneurship opportunities in any area and evaluate these opportunities. Secondly, social entrepreneurship education develops individual's ability to combine sources effectively. Lastly, network of social entrepreneurs keeps all social activities together and this contributes to sustaining actions of social entrepreneurs. Pache and Chowdhury's social entrepreneurship education model is attracted attention with the idea that by giving qualified social entrepreneurship education it is possible to contribute students' life positively and revolutionize their life and this give students a chance to attempt to enterprise, which will affect the life of wider society [13].

According to Bornstein, entrepreneurship is not only related with economy, productivity, or sustainability. Social entrepreneurship is related to getting all people together by overcoming the obstacles. By considering Bornstein's statement, it is possible to reach conclusion that social entrepreneurship is not only associated with economic terms, it changes the way of thinking, attitudes and culture [33]. In addition to that, social entrepreneurship education supports individual's self-sufficiency, creativity, empathy, rational thinking, and entrepreneurship skills [5; 34]. It can be concluded that the higher level of education can create the non-material advantages of entrepreneurship such as greater autonomy [35] and personal achievement [36]. Comparing with traditional entrepreneurship programmes social entrepreneurship education gives vision to entrepreneurs. Dees supports this idea and according to him, each entrepreneur should have social abilities and social entrepreneur needs to respect others, emphasize with others, and act modestly in order to work with their employees [12]. This will be possible with social entrepreneurship education. Fig. 2 presents the benefits from social entrepreneurship education.

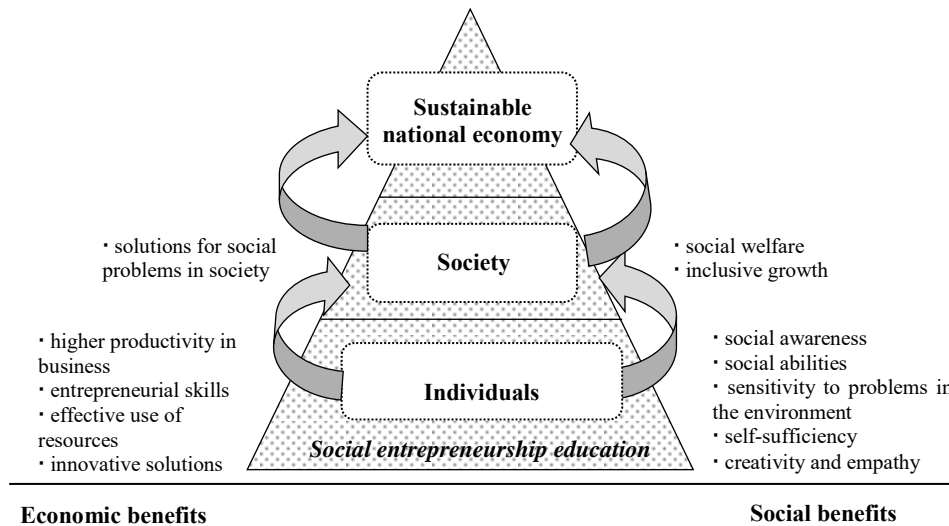


Figure 2

The benefits of social entrepreneurship education

Source: Author's own study based on [5; 12; 33; 34; 37].

Even if requirement of social entrepreneurship education is noticed newly, it has been essential for individuals' personal development as well as for strong social structure. In competitive society, in order to raise generation, who think others instead of themselves, with empathetic thinking it is needed to give social entrepreneurship education. In order to build strong community, it is essential to respect others' rights and responsibilities because if people work only for their own benefit, it is difficult to reach social welfare, inclusive growth and sustainable development. Social entrepreneurship education equips the individual, who is building block of community, with social characteristics and gives them an idea to develop the society. For this reason, benefiting from social entrepreneurship education is very significant for both individual and society level. It can be concluded that social entrepreneurship education result in a beneficial way for the society and strengthen social fabric. Increasing these benefits and raising new social entrepreneurs are even sufficient reasons for giving social entrepreneurship education. Dees indicates that main goal of social entrepreneurship education is understanding how social change can be made in a positive way and creating useful results [37].

Based on the mentioned benefits of social entrepreneurship education, one can conclude that it plays an essential role in shaping balanced and inclusive society development. Yet, by promoting the balanced development of the society, it is possible to contribute to developing a sustainable national economy [38].

## **Conclusions**

Social entrepreneurship in the past decade garnered particular attention from policy makers, academics and the general public and it is influenced by several factors at the environmental, organizational, and individual levels. Significant environmental factor influencing social entrepreneurship development is a lack of knowledge about it, as well as cultural values in society. The introduction of social entrepreneurship study courses in curriculum depend mainly on higher education institution strategy and academics initiative and motivation.

However, social entrepreneurship education plays an important role in the individuals and society development. Through providing social entrepreneurship education in higher education institutions, it is possible to develop individual's social awareness, creativity, and sensitivity to problems in the society. In addition to that, social entrepreneurship education improves individuals' entrepreneurial skills, adds individual an ability to see entrepreneurship opportunities in any area and evaluate these opportunities. Social entrepreneurship education develops individual's ability to combine resources effectively and to produce innovative solutions to social problems. As a result social entrepreneurship education promotes the social problem solving in society, increases social welfare, and contributes to developing a sustainable national economy.

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## **References**

- [1] Sekliuckiene J, Kisielius E.: Development of social entrepreneurship initiatives: a theoretical framework, *Procedia – Social and Behavioral Sciences*, Vol. 213, 2015, pp. 1015-1019.
- [2] Kummitha R.K.R., Majumdar S.: Dynamic curriculum development on social entrepreneurship – A case study of TISS, *The International Journal of Management Education*, Vol. 13, No. 3, November 2015, pp. 260-267.
- [3] Rosendahl L., Randolph H., Sloof M.V.: The effect of early entrepreneurship education: Evidence from a randomized field experiment, *Tinbergen Institute Discussion Papers*, 2012. p. 40.

- [4] Brock D.D., Kim M.: Social entrepreneurship education resource handbook, Ashoka U, the University Division of Ashoka: Innovators for the Public, 2011, p. 14.
- [5] Sarikaya M., Coskun E.: A New Approach in Preschool Education: Social Entrepreneurship Education, *Procedia – Social and Behavioral Sciences*, Vol. 195, 2015, pp. 888-894.
- [6] Rodrigues R.G., Dinis A., do Paço A., Ferreira J., Raposo M.: The Effect of an Entrepreneurial Training Programme on Entrepreneurial Traits and Intention of Secondary Students In Entrepreneurship – Born, Made and Educated, Rijeka, Croatia, 2012, pp. 77-93.
- [7] Kuratko D.F.: The emergence of entrepreneurship education: development, trends and challenges, *Entrepreneurship Theory and Practice*, Vol. 29, No. 5, September, 2005, pp. 577-597.
- [8] Peterman N.E., Kennedy J.: Enterprise education influencing students' perceptions of entrepreneurship, *Entrepreneurship Theory and Practice*, Winter, 2003, pp. 129-144.
- [9] Fayolle A.: Evaluation of entrepreneurship education: behaviour performing or intention increasing, *International Journal of Entrepreneurship and Small Business*, Vol. 2, No. 1, 2005, pp. 89-98.
- [10] Raposo M., Paço A., Ferreira J.: Entrepreneur's profile: a taxonomy of attributes and motivations of university students, *Journal of Small Business and Enterprise Development*, Vol. 15, No. 2, 2008, pp. 405-418.
- [11] Raposo M., Paço A.: Entrepreneurship education: relationship between education and entrepreneurial activity, *Psicothema*, Vol. 23, No. 3, 2011, pp. 453-457.
- [12] Dees G., Emerson J., Economy P.: *Enterprising nonprofits: A toolkit for social entrepreneurs*. John Wiley & Sons, Inc. New York, 2001, p. 321.
- [13] Pache A.C., Chowdhury I.: Social entrepreneurs as institutionally embedded entrepreneurs: Toward a new model of social entrepreneurship education, *Academy of Management Learning & Education*, Vol. 11, No. 3, 2012, pp. 494-510.
- [14] Damanpour F.: Organizational innovation: a meta-analysis of effects of determinants and moderators, *Academy of Management Journal*, Vol. 34, No 3, 1991, pp. 555-590.



- [15] Damanpour F.: Organizational complexity and innovation: developing and testing multiple contingency models, *Management Science*, Vol. 42, No. 5, 1996, pp. 693-716.
- [16] Damanpour F., Schneider M.: Phases of the adaption of the innovation in organisations: effects of environment, organization and top managers, *British Journal of Management*, Vol. 17, No. 3, 2006, pp. 215-236.
- [17] Adamson D.: Final Report to SEN/WDA: programme for community regeneration, University of Glamorgan, 2003, p. 32.
- [18] Mulgan G.: Cultivating the Other Invisible Hand of Social Entrepreneurship: Comparative Advantage, Public Policy, and Future Research Priorities. In: Nicholls A. *Social Entrepreneurship: New Models of Sustainable Social Change*. New York: Oxford University Press, 2006, pp. 74-95.
- [19] Martin R.L., Osberg S.: Social Entrepreneurship: The Case for Definition, *Stanford Social Innovation Review*, spring, 2007, p. 28 – 39.
- [20] Hynes B.: Growing the Social Enterprise – Issues and Challenges, *Social Enterprise Journal*, Vol. 5, No. 2, 2009, pp. 114-125.
- [21] Žagare E.: *Labdarbības veikala „Otrā elpa” kā sociālās uzņēmējdarbības formas attīstība Latvijā*: bachelor thesis, Riga, 2010, pp. 68.
- [22] Bornstein D., Davis S.: *Social Entrepreneurship: What Everyone Need to Know*, USA, Oxford University Press, 2010, p. 141.
- [23] Prieto L.C., Phipps S.A., Friedrich T.L.: Social entrepreneur development: an integration of critical pedagogy, the theory of planned behavior and the acs model, *Academy Of Entrepreneurship Journal*, Vol. 18, 2012, pp. 1-15.
- [24] Dufour S., Lessard D., Chamberland C.: Facilitators and barriers to implementation of the AIDES initiative, a social innovation for participative assessment of children in need and for coordination of services, *Evaluation and Programme Planning*, Vol. 47, 2014, pp. 64-70.
- [25] Bates T.: Self-employment entry across industry groups, *Journal of Business Venturing*, Vol. 10, No. 2, 1995, pp. 143-156.
- [26] Reynolds P.D.: Who starts new firms? Linear additive versus interaction based models, *Small Business Economics*, Vol. 9, No. 5, 1997, pp. 449-462.
- [27] Delmar F., Davidsson P.: Where do they come from? Prevalence and characteristics of nascent entrepreneurs, *Journal of Entrepreneurship and Regional Development*, Vol. 12, No. 1, 2000, pp. 1-23.

- [28] Kolvereid L., Moen O.: Entrepreneurship Among Business Graduates: Does A Major in Entrepreneurship Make a Difference? *Journal of European Industrial Training*, Vol. 21, No. 4, 1997, pp. 154-160.
- [29] Walter S.G., Block J.H.: Outcomes of entrepreneurship education: An institutional perspective, Original Research Article *Journal of Business Venturing*, Vol. 31, No. 2, March 2016, pp. 216-233.
- [30] Evans D.S., Leighton L.: Some empirical aspects of entrepreneurship. *The American Economic Review*, Vol. 79, 1989, pp. 519-535.
- [31] Schultz T.: Investments in man: an economist's view. *Social Service Review*, Vol. 33, No. 2, 1959, pp. 69-75.
- [32] Davidsson P., Honig B.: The role of social and human capital among nascent entrepreneurs, *Journal of Business Venturing*, Vol. 8, No. 3, 2003, pp. 301-331.
- [33] Bornstein D.: *How to Change the World: Social Entrepreneurs and the Power of New Ideas*, Oxford University Press, 2007, p. 341.
- [34] Jimenez A., Palmero-Camara C., Gonzalez-Santos M.J., Gonzalez-Bernal J., Jimenez-Eguizabal J.A.: The impact of educational levels on formal and informal entrepreneurship, *BRQ Business Research Quarterly*, Vol. 18, 2015, pp. 204-212.
- [35] Van Gelderen M., Jansen P.: Autonomy as a start-up motive, *Journal of Business Entrepreneurship and Development*, Vol. 13, No. 10, 2006, pp. 23-32.
- [36] McClelland D.C.: *Power: The Inner Experience*, Irvington, New York, 1975, p. 442.
- [37] Dees J.G.: Enterprising Non Profits: What do you do when Traditional Sources of Funding Fall Short? *Harvard Business Review*, January/February, 1998, pp. 55-67.
- [38] Shah D.: A UK Policy Perspective: Thought Piece From the UK Social Enterprise Coalition, *Social Enterprise Journal*, Vol. 5, No. 2, 2009, pp. 104-113.

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# The Role of E-learning

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*Abstract: The term E-learning refers to a novel teaching and learning in education. This educational high technology is an important part of today's world, which delivers, supports and enhance the quality of learning. E-learning involves the participation of instructors, and students and mentors who use this technology to update their work. This paper reports on the extent to which the effectiveness and students' attitudes towards e-learning impacts their learning styles.*

*Keywords: E-learning, Social support, Higher Education*

## 1 Introduction

Nowadays, in the rapidly changing world the education plays an important role. The primary, the secondary, and the tertiary education altogether is responsible for the human resources [10],[11],[14].. Over the past years, e-learning has become a vital source of expansion and studying in education. Due to the opportunities created by e-learning, teaching and learning can now happen at any time and in anywhere. The new media like the internet has become one of the vital ways to make available resources for research and learning for both teachers and students to share and acquire information. The explosive growth of the World Wide Web (WWW) has made information technology a popular platform for providing e-service, e-learning service.[18], [4]

E-learning is defined as acquisition of knowledge and skill using electronic technologies such as computer and Internet-based courseware at local and wide area networks. Technology-based e-learning encompasses the use of the internet and other important technologies to produce materials for learning and teaching in organization [6]. As a result Internet and Information technology in tutoring and studying has created a different necessity to modify how university students learn by using more modern, effective, and alternative such as e-learning system.[8]

Regarding to e-learning, many people are now attracted to training and education who previously would not have considered it as a relevant part of their lives. [4]

Tao et al. really thought that this new learning environment was centered on electronic networks had found a way for undergraduate to have learning schedules that is more suitable for them as well as separate from other students. [7]

With the developping of computer and Internet technologies, this technology has a high interaction and collaboration level between instructors or lectures and peers than traditional environment for learning. [19]

Hence, e-learning system might be able to deliver a broad array of solutions to enable learning and improve students' performance.

## **2 Literature Review**

There are three ways of classifying the models of e-learning. The first one is called synchronous, the second one is asynchronous and the third one is blended learning.

Synchronous training (at the same time):

Intrinsically synchronous training involves the collaboration of participants with E-mentor via the virtual platform in real time. In other words, synchronous training provides facilities to the participitians to discuss with the mentor and also among themselves via the e-classroom with the use/help of tools such as the videoconference and/or chat rooms. [12][15]

Asynchronous (not at the same time):

The asynchronous mode gives the opportunity to the participitians to discuss with the instructors or teachers/mentor as well as among themselves over the internet on his/her own pace without live interaction with the instructor. In this way students are able to learn at a time that suits them the most. However, immediate feedback from instructors, their colleague learners is not receivable. [15]

Blended learning (the mix of synchronous and asynchronous learning):

This kind of training combine aspects of online and face-to-face instruction, so the course materials and explanations is shared between traditional learning method and e-learning method in the classroom setting.

Blended learning allows for personalized education as a result students can work at their own pace, making sure they have mastered the curriculum before moving on.

Using e-learning at university classrooms give to instructors the multiplicity of their lectures, displaying more information, and enhancing student learning. Also e-learning system can helps lecturers to save time and allow for more attention to be paid to the content of course.

With e-learning system students don't have to come to class in person and feel uncomfortable answering their teacher's questions in class. Therefore, students can study at home, work or even on the street by using multi-electronic devices as computers, laptops, or smart phones. As follows, students can easily read or download the materials or reference books online when and wherever they want.

There are numbers of advantages for using this technology and learning materials in the university classroom: [20]

- More active learning class
- Diversified teaching method
- Better student attention and realization
- Effective time management for lecturers
- Visual stimulation

The major advantage of e-learning lies in its flexibility and ability to cover distances. The curriculum can be repeated until it is understood by the trainee. Hence full time and part time undergraduates can take part in their degree courses selected from any place or location so students can gain multiple learning ways depending on their needs. [1]

Just as a glass may be half full, it may also be half empty. There are also disadvantages for using e-learning.

despite the statements that e-Learning can improve the education quality, e-learning is still a support device for existing methods of learning. Also e-learning can not solves the problems created by the absence of vital personal interactions, not only between learners and instructors, but also among undergraduates.[9],[17]

Since e-learning is based on Internet technology and it creates a virtual "class room" for the students; therefore, it depends on Internet connection. Also this technology requires students to have a massive technical skills and Internet connection with high bandwidth to download the materials from the courses and upload their tasks or work with e-system.

Therefore the disadvantages of e-learning might be the followings:

- E-learning may possibly deteriorate institutions' role of socialization, and also the role of instructors as the directors of the process of education.
- Since tests for assessments in e-learning are possibly done with the use of proxy, it will be difficult to regulate bad activities like cheating.
- Equipment failures

All in all, e-learning could offer learning-on-demand opportunities for students in order to reduce costs and time, while improving their products (Kranz, 2008). On the other hand, we have to take notice of the reason why students would use this technology.

The purpose of the next part is to identify factors beyond the educator that support students' ability and motivation to learn in online courses.

Tsai and Weng's study pointed out that social support from mentors and peers (*usually a neglected factor*) has significant effect on students' learning satisfaction, also family support affects students' continuous intentions to participate online courses. [16]

## **2.1 Social support**

Social support covers the exchange of resources between at least two parties, with an intention of enhancing the well-being of the recipient. [5] The exchange of empathy, care, love or trust provides actual aid in time, money, advice, information and suggestions. [21]

Kim's study showed that social support from different sources is positively associated with learner's well-being and plays role in determining students satisfaction and decisions as to whether to participate in HEI's e-learning programs.[3]

The scientific literature distinguish several forms of social support. [2] These are Informational Support, Instrumental Support, Emotional Support and Affirmational Support.

Informational Support:

As the name implies, Informational support includes the provision of helpful information, advice, or suggestions on how to deal with certain issues. Support could come from different people. For example: sophomore students offer information to freshman on how best to deal with school concerns.

Although informations pertain to immaterial goods, on various occasions it can be expressed in monetary value, that is why it is rarely found in it's pure form.

Instrumental support:

All of tangible aid that provide practical help and resources falls into the category of instrumental support. For example, undergraduates received support in the form of guidance from classmates or instructors on how to find the informations which could help them solve their homework.

Emotional support:

This kind of social support usually manifests as expressions of love and caring, Providing emotional support can help individual know that he or she is valued.[13]

For example: Students share experiences and support each other through life events such as family illness, final examination, looking for work, or adjusting to new place, it leads individuals to a sense of community.

Appraisal support:

This kind of social support happen when individual offers information that allows someone to make an informed decision on their own.

For example: The compliance like "I trust your judgment" or "You are doing the right thing" could generate appraisal support.

According to the mentioned theories it can be said that e-learning concept is based on self-efficacy and belief that one can be successful in e-learning activities. However, social support is also needed to keep users' intentions to continue using a technology . in this case e-learning. With this object I'm wondering whether social support could influence students' evaluation of e-learning.

### **3 Methodology**

#### **3.1 Research participants and data collection**

For this study, online questionnaire was used to investigate students' opinions and evaluation of e-learning about using/ applying it in their own learning. The online survey has been initiated and circulated (via google drive) among students at Obuda University. The online quantitative survey consists of 24 questions on required fields.

231 students filled out the online questionnaire (161 males and 75 females), expressing their opinions of e-learning system under investigation.



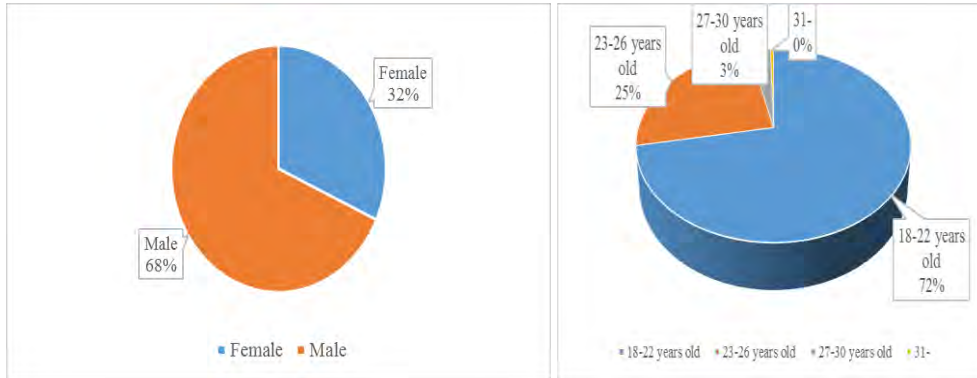


Figure 1  
 The respondent's distribution by gender and age  
 Source: Own data

The sample included 170 answers from 18-22 years-old students, 58 responses from students in the age group of 23-26, seven from the 27-30 years-old students and 1 from students' who are older than 31 years-old.

According to the collected data 75,4% of students used e-learning system and they would love to use it in the future during their academic years, 12,3% of them used it but if they can, they would not use it during their academic years.



Figure 2  
 The respondents' cognition of e-learning  
 Source: Own data

Mixed Replies were received to the question of which kind of didacticism do they prefer? The vast majority of the respondents 99 out of 231 chose blended training as a favorite didacticism, 45 of them selected lectures, 38 of them picked consultations, 16 of them chose Asynchronous training and 3 of them chose Synchronous training.

By this token I take it that blended training would be the most popular and welcomed training form at the examined institutes.

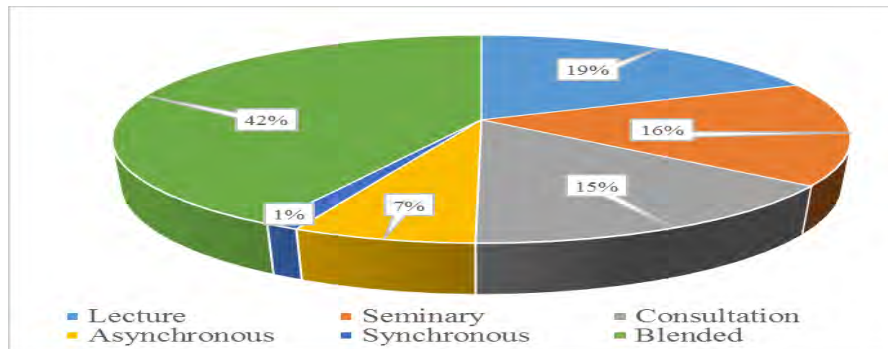


Figure 3

Students' opinion about different didacticism

Source: Own data

The collected data has been analyzed using SPSS 20 program. In addition, descriptive statistics, a cross table was run in order to explore the relationship/ correlation between the variables. Since the paper is presented with the preliminary results of an ongoing research, all relationships described below are seen as indicative, rather than evidential statements. Because of the quantity of elements this database cannot be considered representative of Obuda University's fellowship.

### 3.1.1 Data Analyses

The findings of this study showed that e-learning system would be a very profitable device for the students and the universities as well. Hence my primary goal with this study is investigating whether social support is needed or on the other hand is it even available via e-learning system? That's why my research questions are the following:

1. With the support of e-learning's materials students do not require real time contact with fellow students.
2. Regardless of e-learning's trainings and materials students do need help to fulfill the requirements

### 3.1.2 Research question 1

According to the students' opinions e-learning system (training and materials) is necessary (138 out of 191 thought that e-learning is necessary and 43 students thought that it is absolutely necessary) even for those (20 out of 28 thought that it is necessary) who have used e-learning system but would avoid it if there are any other options. However, there is no statistical relationship/ correlation between the examined variable (Pearson Chi-Square = ,062) (1 appendix) Despite the fact that there are no statistical correlation (Pearson Chi-

Square =0,231) between the student's willingness to use e-learning system and whether they need real time interaction with their mentor. The collected data show that most of them (141 out of 191 and 22 out of 28) do want to have conversation or real time contact with their mentor.

How comfortable for you to discuss about assignment and tasks with your mentor?	I do not want to discuss with anyone	I do not really want to but I could get used to it	I do not mind to discuss it	I could not imagine it in other way	Total
Do not want to use E-learning system	0	6	11	11	28
	0,0%	21,4%	39,3%	39,3%	100,0%
Do want to use E-learning system	17	30	86	58	191
	8,9%	15,7%	45,0%	30,4%	100,0%

Table 1  
 Students' opinion about real time connection with their mentor  
*source: own data*

The same result is showed between the student's willingness to use e-learning system and whether they need real time interaction with their fellowship. There were 88 out of 191 students who are favourably inclined toward e-learning, do need real time connection with companions and 27 out of 28 191 students who stand against e-learning felt that they do need social interaction with their mates.

How comfortable for you to discuss about assignment and tasks with your fellowship?	I do not want to discuss with anyone	I do not really want to but I could get used to it	I do not mind to discuss it	I could not imagine it in other way	Total
Do not want to use E-learning system	1	0	13	14	28
	3,6%	0,0%	46,4%	50,0%	100,0%
Do want to use E-learning system	6	19	78	88	191
	3,1%	9,9%	40,8%	46,1%	100,0%

Table 2  
 Students' opinion about real time connection with their mentor  
*source: own data*

### 3.1.2. Research question 2

According to the students' views of their academic years, students' comfort level of studying alone is quite high. 60,7% of students who are comfortable with using e-learning stated that studying alone is more preferred than in group. The same situation has found in the case of

those student who are not comfortable with using e-learning system. (Pearson Chi-Square = 0,040)

It suggests the idea that students have grown up in a global world of information. Thus, they have accustomed themselves to acquire information from the internet.

As a students I would rather studing alone	I'm absolutely disagree agree with it	I would rather disagree with it	Neutral	I would rather agree with it	I'm absolutely agree with it	Total
Do not want to use E-learning system	0	1	15	3	<b>2</b>	28
	0,0%	3,6%	53,6%	10,7%	32,1%	100,0%
Do want to use E-learning system	11	15	49	<b>55</b>	<b>61</b>	191
	5,8%	7,9%	25,7%	28,8%	31,9%	100,0%

Table 3  
Students' studing attitude  
*source: own data*

Despite the fact that with or with out the support of e-learning students would rather studing alone. But presumably that is not enough. Since, there are 46,6% of them who do need help from companions during their academic years. (Pearson Chi-Square =0,024)

As a student	I am able to meet all of requirements with out any help	I need help from companions to understand the curriculum and to meet the requirements	I need a lot of help from companions to understand the curriculum and to make all of my assigments ready	Total
Do not want to use E-learning system	11	<u>14</u>	3	28
	39,3%	50,0%	10,7%	100,0%
Do want to use E-learning system	102	<u>78</u>	11	191
	53,4%	40,8%	5,8%	100,0%

Table 4  
 Students' studing opinions about whether they help during their academic years  
*source: own data*

## Conclusion

E-learning could be an effective tool for transferring knowledge and it has a potential to overtake the traditional teaching method. Web-based training helps facilitate learners and instructors in educational environment. Nowadays, many universities, colleges implement e-learning system in their own training programs to satisfy their students needs. The survey results of the students' attitudes toward e-learning showed that they do need it. Since e-learning could match well students studing habits. It could be a very effective and practical learning method. However, the support of e-learning is not enough to ensure effective incentives for effective learning students do need social interaction with their mentors and fellowship during their academic years. As a result, there is a real need for a well-established e-learning environment which teachers and students can rely on. I am strongly think that with the complement of instructors, mentors, e-learning will become more popular in the future in order to make the users feel comfortable and secure

This study shows that students at Obuda University would rather studing alone then in group but when they experience high levels of academic press and expectations they need social support and social interaction to maintain their focus and performance.

*(I am agree that students need to be pressed hard to learn. But without supportive environments it will not lead to meaningful gains in academic achievement.)*

Which means if the university wants to improve their student achievement/performance by raising expectations or creating high stakes for academic performance-Scientific Student Conference) they should not ignore the social support, interaction that necessary for students to be successful.

## References

- [1] Aggarwal, D.: Role of e-Learning in A Developing Country Like India. Bharati Vidyapeeth's Institute of Computer Applications and Management, New Delhi, India, 2009.
- [2] Lazányi, K.: A társas támogatás szerepe és jelentősége a felsőoktatásban a diákszervezeti tagság kapcsán . Vállalkozásfejlesztés a XXI. században , pp. 155-170, (2011).
- [3] Kim Munich.: Social Support for Online Learning: Perspectives of Nursing Students. International Journal of E-learning & Distance Education vol 29 (2), 2014
- [4] Richard & Haya: Examining student decision to adopt web 2.0 technologies: theory and empirical tests. . Journal of computing in higher education, 21(3), 183-198, 2009
- [5] Shumaker, S. A., & Brownell, A.: Toward a theory of social support: Closing conceptual gaps. . Journal of Social Issues, 40(4), pp.11-36, 1984
- [6] Sloman, M.: The e-learning revolution: From propositions to action, London: Chartered Institute of Personnel and Development, 2001
- [7] Tao, Y. H., Yeh, C. R., & Sun, S. I.: Improving training needs assessment processes via the Internet: system design and qualitative study. . Internet Research, 16 (4), pp. 427-49, (2006)
- [8] Valentina Arkorful & Nelly Abaidoo. (2014). The role of e-learning, the advantages and disadvantages of its adoption in Higher Education. International Journal of Education and Research, 397-410.
- [9] Young, J. R.: Rethinking the Role of the Professor in an Age of High-Tech Tools, The Chronicle of Higher Education, pp. 44 (6), 1997
- [10] Csiszárík-Kocsir, Á. – Medve, A. (2009): Beszédes számok – avagy a hazai közoktatás finanszírozási és hatékonysági jellemzői a nemzetközi eredmények tükrében, Humánpolitikai Szemle, 2009. 5. szám 45.-58. old.,
- [11] Lazányi, K. (2015): What is the Role of Higher Educational Institutions in Managing their Students' Competencies? Science Journal of Business and Management 3:(1-1) pp. 46-52.
- [12] Algahtani, A.: Evaluating the Effectiveness of the E-learning Experience in Some Universities in Saudi Arabia from Male Students' Perceptions, Durham University, 2011
- [13] Lazányi, K. (2012): A társas támogatás szerepe egy individualista társadalomban, A Virtuális Intézet Közép-Európa Kutatására Közleményei 4:(2) pp. 51-58.
- [14] Pató, Beáta Sz. G. (2015): The Logistical Approach of Public Education, Studia Universitatis Babes-Bolyai, Oeconomica 2015. Vol. 30 Iss. 2. pp.22-41.

- [15] Almosa, A. & Almubarak, A.: E-learning Foundations and Applications, Saudi Arabia, Riyadh, 2005
- [16] Apollo Weng; Cathy Weng; Chin-Chung Tsai: Social support as a neglected e-learning motivator affecting trainee's decisions of continuous intentions of usage, Australasian Journal of Educational Technology, pp. 177-192, 2015
- [17] Burdman, P.: Cyber U, Anaheim (California) Orange County Register, September 13, sec. 1, p. 9, 1998.
- [18] Fry, K. (2001). E-learning markets and providers: some issues and prospects. Education Training, 233-239.
- [19] Giddens, A.:Sociology. 4th ed, Cambridge: Cambridge: Polity, 2001
- [20] Hassan, M. S.: Critical success factors for e-learning acceptance, Elsevier Computers & Education 49, pp. 396–413, 2007
- [21] House, J. S.: Work stress and social support, . Reading, Mass: Addison-Wesley Pub. Co., 1981

## Appendix 1.

		What is your opinion about E-learning (trainings, materials)				Total
		It is absolutely not necessary	Not necessary	Necessary	It is absolutely necessary	
Do not want to use E-learning system	Count	0 <sub>a,b</sub>	5 <sub>b</sub>	20 <sub>a</sub>	3 <sub>a</sub>	28
	% within Do not want to use E-learning system	0,0%	17,9%	71,4%	10,7%	100,0%
	Std. Residual	-,3	2,5	0,0	-1,3	
Do want to use E-learning system	Count	1 <sub>a</sub>	9 <sub>a</sub>	138 <sub>a</sub>	43 <sub>a</sub>	191
	% within Szereti_Nem_szereti	,5%	4,7%	72,3%	22,5%	100,0%
	Std. Residual	,2	-,8	,1	,1	
Total	Count	1	14	165	51	231
	% within Szereti_Nem_szereti	,4%	6,1%	71,4%	22,1%	100,0%