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SURVEY AND RESEARCH STUDIES

THE LOCAL LEVEL OF SUSTAINABILITY – IN CASE OF HEVES COUNTY, HUNGARY

Hajnalka CSÁFOR – János SZLÁVIK

Abstract
In our paper we are going to focus on the presence of the criteria of sustainable territorial development in the local level, and we examine how strongly the objectives of the territorial plans are related to the key issues of transition to sustainability in Hungary.
The basic objective of the sustainable territorial planning is to develop and achieve a program which is based on the principle of sustainable development with the active collaboration of the local governments and support of population. With the assistance of sustainability in territorial planning a region is being organized (sub region, district, county) that is considered as a home by the population, in which they, their children and citizens living in towns and villages now and in the future feel to be at home. To achieve the above aim powerful and harmonic cooperation are needed to be planned consciously among the three dimensions of the sustainable development (natural, social, economic). In our paper we discuss the presence of aspects of above sustainability in the territorial plans of the counties, focusing on Heves county where we were active participants in concept creation.

Keywords:
regional development, regional development program, sustainability, social awareness, Heves county, Hungary

Introduction

The company which wants to be successful is focused on effectivity and flexibility of own activities and processes and their optimization (Serina, 2013). Cost management activities become part of the management tools that mining companies use to achieve economic efficiency and profit. The main idea of the cost management in companies is to direction, to evaluation and to improve of all processes. Costs create basic economic category. Costs are instrument of barriers to business, leading to bankruptcy or liquidation of business. Financial accounting is a system for evidence all costs of business. The main body of evidence is to prepare very effective system. Mann, Modrak, Grabara (2011) point out that the marginal costs are very important indicator for efficiency of production. Marginal costs are intimately connected with productivity optimum which is determined by the level of activity of the company where production achievement is done at the lowest medium cost, and both mathematical calculus and economic reasoning show that this optimum appears when medium cost is identical with marginal cost. It is very important mathematical formula for financial situation in companies.
The basic aim of the **sustainable territorial planning** is to develop and achieve such a program which is based on the principle of sustainable development with the active collaboration of the local governments and support of population. With the assistance **of sustainability in territorial planning a region is being organized (sub region, district, county) that is considered as a home by the**

population, in which they, their children and citizens living in towns and villages now and in the future feel to be at home. To achieve the above aim powerful and harmonic cooperation is needed to be planned consciously between the **three dimensions of sustainable development (natural, social, economic)**:

- Society **living in harmony with nature** has responsibility to act in saving the natural values (priority on the level of biodiversity). In Europe, including Hungary, nature, having its today's form, is a living system shaped by human, than can be survived on present level only by the result of the human's conscious actions. (e.g. A forest field or a country grassland can be weedy in case of not grazing or not mowing. In region of agricultural cultures invasive species – ragweed, acacia – diffuse in case of non-farming on it. Conservation and farming are not mutually exclusive definitions. If farming on valuable natural regions is done with environmentally friendly attitude (ecological farming, ecotourism, etc.) natural values will survive and even develop. Gardens being on habitations are also the part of the nature, its cultivation is an important task.
- Sustainability and **social awareness:** From the point of view of sustainable development man shall be understood not only a worker but also as a complex individual. On the other hand a region, county or habitation can live suitable way only if people living there have jobs (so their work power is also useful). Therefore a key objective in regional development concept is improving of the employment-intensive economy.
- Successful county sustainable territorial program: it can be realized only with the support of **business sector** responsible also for local society. This process is helped by an institutional system encouraging cooperation and functions properly, local and specific development of taxes and other economic regulators. Problematical to answer how the centralization effects to the local social activity of companies. (Szlávik – Csáfor, 2013)

1 Criteria of sustainable territorial development

Important practical issue is how the criteria of sustainability appear in each regional development concepts in Heves county besides the national developing concept, and in each elements of target system within the county concepts. Strategic Environmental Assessment (SEA) methodology helps the evaluation in sustainability of each plans, programs and concepts, it is also applied in territorial development. The aim of the survey is to correlate the surveyed document in an impact assessment matrix to sustainable criteria (value) developed to the surveyed object (Pálvölgyi T. and Csete M., 2011).

On the basis of Pálvölgyi T. and Csete M. (2011), the **criteria of sustainable territorial development** are the followings:

Table 1: Criteria of sustainable territorial development

Objectives and priorities	
Local and regional sustainability	Value storing economy with renewable resources
Global sustainability	Sectoral integration
Attractive rural world	Integrated product policy
Liveable towns	Decentralized developments
Value storing, diversified economy	„Produce locally, consume locally"
Diligence and altruism	„Work locally"
Ethical operation	Quality products, innovation
Conscious food-production and consumption	Production cooperation within the region
Nature conservative territorial development	Sparing with exhaustible values
Ecological developments	Social equity
Pollution prevention and minimise	Knowledge based territorial development
Minimising of multiplier effects	Social cohesion
Dematerialization	Solidarity, regional cohesion
Recycling and resource efficiency	Social participation
Justice and social equality between generations	Local ecosocial interest and social responsibility

Source: own compilation on Pálvölgyi T. and Csete M. 2011. pp. 471-472.

In our current study does not aim to carry out the SEA so we do not set up an effect-matrix but we will examine whether certain aims are presented in the target system of Heves county concept based on the central guide and if there are which aims are presented among the above mentioned criteria of regional jurisdiction. The county concept, on the basis of guideline, contains principles, a short vision related to the county and the target system which is built in every county concept as follows:

- Overall objectives
- Strategic objectives
- Horizontal objectives

We are also focusing on how appear the four key areas of road toward Hungarian sustainability in county concept. These key areas, determining as the operating conditions of sustainable development in the long term, are the following on the basis of Pálvölgyi T. and Csete M. (2011):

1. Investment in reproduction of **human capital**: individual- and family values, changes in approach and lifestyle.
2. Investment in reproduction of **social capital**: restoration of collective- and national values.
3. Investment in reproduction of **natural capital**: to conserve and to use the nation's natural resources

4. Investment in reproduction of **economic capital**: to handle the economic interdependence and to growth the national wealth.
   Sustainability with regional approach is a value storing economy that provides the growing of economy within the borders of ecological carrying capacity and not destroying the biological diversity and the quality of services given by natural environment. According to the explanation of strict sustainability, natural capital cannot be replaced to other capital goods, the value of the natural capital cannot decrease over time. (Szlávik J., Csete M. 2005, 2009)

2 Aspects of sustainability in territorial plan of Heves county

The North Hungarian region is one of the seven Hungarian statistical regions which includes three counties: Borsod-Abaúj-Zemplén, Heves and Nógrád. The region is one of the most underdeveloped regions in Hungary, according to the Hungarian Central Statistical Office (2013) the GDP per capita is under the 60 percent of the national average. The population of the Heves county is circa 306.000 in 2013.

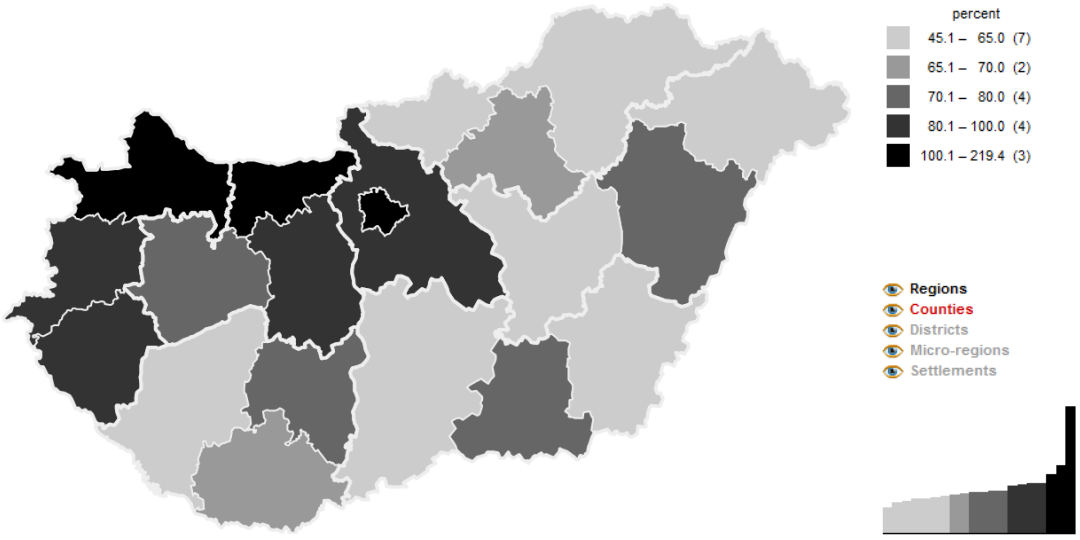

Figure 1: Gross domestic product as % of the national average, 2010

Source: own compilation on Hungarian Central Statistical Office (2013)

Heves county is focusing on, in its long-term territorial plan, a vision that is considered by social- and economic operators as a desirable, ambitious and realistic concept:

"By its innovation-oriented, competent and predictably developing economy based on properly trained and trainable human capital, by the sustainable use of its natural resources and the continuous improvement of its social resources, and by creating workplaces and its ever-improving public safety, Heves County will have become an important actor of the national economy by 2030. (HMTFK 2013, p. 4.)

During the implementation of this vision, the enforcement of the principles applied in the European Union are especially important which also define the feasibility of the development program and method of the implementation. These, especially sustainability, must be taken into account during the county planning. (HMTFK 2013):

- sustainable development: it can be sustainable only in the long term, it is balanced in case of social-economic-environmental criterion, it is able to self-financing in the long term period and developments can be aimed as well.
- equality: beneficiary of the implemented developments can be every group of the society, in order to have freedom in personal development, enrichment, social success and well-being of the citizens in the county and not to be limited in ethnical, gender, religious, political and income differences.
- partnership: the developing program is based on the collaboration of the county's operators, joint mobilization, related to common goals; cooperation basically is needed between central- and local institutions, organizations and private sector.
- additionality: the developing program includes its own power used in the county, because the long term goal mainly means the support of the programs where beneficiaries receive additional support to their own sources.

After defining the vision and principles a target system, was established to serve the implantation with containing three overall-, seven strategic- (four complex and three territorial strategic) and ten horizontal goals.

The development of the county has reached a new quality phase. In this phase infrastructural- and institutional services have to be enlarged continuously, improving factors, that can be improved the quality of the production and living conditions, are also needed. An increasingly large part has to be invested from resources to develop the population's living conditions; development of the education and the training quality, improvement of the state of the environment, storing the values of habitations and regions, renewing the factors that define the quality of the human housing areas. In the same time segregation of the regions and the social groups is required, settlement of the activities and organization supporting the propagation of innovation process and development of economic basis needs to be done. (HMTFK, 2013)

The county can be divided into three regional units with requiring different kind of development. The middle part of the county includes the most significant businesses (90% of capital investment, 89,7% of added value), the biggest part of the population lives here (69%), basically an urban region owning a significant innovation potential. The northern part of the county is a mountain region therefore it is more foreclosed and socially disadvantaged. The number of the settlements/habitations is high but the number of the population is rather low.

Nevertheless excellent touristic benefits of the natural landscape are available in the region. The southern part of the county is also disadvantaged but its availability is better and the effects of the climate change can be seen here. The region lost its former industry **but Lake Tisza, as a complex development area, shall break from this region.**

Examining the territorial plan of Heves county it can be seen that the overall- and strategic objectives integrated to the horizontal visions were defined in connection with the key areas of the transition toward sustainability. In our study we focus on the overall and strategic objectives first on the basis of the compliance of territorial sustainable criteria, to have a better view in the following table, after it we will survey the compliance of the horizontal objectives to the views of sustainability. We show the territorial sustainability of the criteria appearing in **overall goals** in Table 2:

Table 2: Criteria of sustainable territorial development in overall goals of HMTFK

1. overall goal: Complex, integrated employment-intensive **economy**
2. overall goal: Productive, qualified **society** living in harmony with its environment
3. overall goal: **Built- and natural environment** on high standard living accordance with each other

Source: own compilation on HMTFK (2013)

We can see that during drafting the overall goals economy, society and nature were taken into consideration and proposed to involve more territorial sustainable criterions. If reviewing the listed – tore from the details of description of each goal – elements related to sustainability and comparing to criteria found in table 1., it can be said that all of the criterions were paid attention by the experts made the paper of Heves county. There are only a few criterions that cannot be found (e.g. knowledge based regional development, sectoral integration), but these ones will be also found in the following strategic objectives.

In Table 3 the territorial sustainable criterions found in **strategic objectives** of HMTFK 2010-2020 will be shown:

Table 3: Criteria of sustainable territorial development in strategic objectives of HMTFK

1. Strategic (territorial) objective: **Hatvan-Gyöngyös-Eger** strengthening the „economic priority”
2. Strategic (territorial) goal: Development of the nature centred **Northern-Heves region**
3. Strategic (territorial) goal: development, built on local values, of regions **Southern-Heves** and **Lake Tisza**
4. Strategic goal: **economic development** based on openers
5. Strategic goal: **Rural development** based on local potentials, employment-centred **agri-verticum**
6. Strategic goal: Value- and health-conscious, solidarity-based **society opened** to receive innovation
7. Strategic goal: Strong towns, liveable rural regions, **sustainable environment** and spatial structure

Source: own compilation on HMTFK (2013)

It can be concluded that the amount of sub-targets - among the strategic-related targets the ones relating to sustainability - collected in the table above and their correlation with the regional sustainability criteria are complete. All of the criterions detailed in Table 1 can be found in the overall or strategic objectives of HMTFK 2014-2020, moreover in case of certain fields each criterion appears recurrently.

The mentioned ten strategic objectives are also supported by ten horizontal objectives, which- continously, increasingly harmonized with each other ensure economic-, human-, social- and natural capital needed for development.(HMTFK discussion, 2013)

We can say that the objective system of concept of Heves county is based on these horizontal theories, as it is stated well in Figure 2, showing the connections of the target system. In the following table (Table 4) we will discuss the content of the horizontal objectives, grouped according to the four key areas toward sustainability, and also the types of sub-targets in concepts of Heves county in planning period 2014-2020.

Table 4: Criteria of sustainable territorial development in horizontal objectives of HMTFK

Human capital	Talent promotion: ▪ offering high quality education in order to strength intellectual potential ▪ staying in the county after graduation ▪ attracting to Heves county talented young people out of the county ▪ development of career programme for talented young people
	Working culture: ▪ working culture is one of the basic terms of sustainable development ▪ fields must be improved: language knowledge, communication, risk-taking, responsibility cooperation, motivation and problem solving skill

Natural capital	Sustainable „green county”: ▪ society living in harmony with nature ▪ social awareness ▪ economic sector responsible for local society
	Quality of life: ▪ saving and careful development of environmental- and natural systems ▪ creation of liveable nature ▪ sustainable protection and development of resources, natural- and built environment ▪ realization of material- and energy efficiency
Economic capital	Innovation: ▪ innovations based on skills and knowledge ▪ development of IKT culture in SMEs sectors ▪ development of the cooperation between research units and business sectors ▪ social economy firstly for „low-tech”activities
	Competitiveness: ▪ utilization of possibilities in natural endowments ▪ ensuring work and living for less qualified employers ▪ utilization of bio energy ▪ education, integration of young people into formal education ▪ development of the county to retain their population ▪ reducing demographic processes
	Efficiency: ▪ time efficiency cost efficiency, sustainability ▪ professional and public publicity, more information both for the representative of the profession and public ▪ labour efficiency
Social capital	Cooperation: ▪ in social processes ▪ on the field of economy development ▪ on the field of tourism ▪ in external relationship of the county ▪ in agriculture ▪ in flood- and inland water protection ▪ in waste management ▪ in the education of human resources
	Equality: ▪ increasing the opportunities of the equality target groups. ▪ improvement of impoverished group ▪ social catching up and integration of minorities and disadvantaged groups ▪ strengthening the regional equality ▪ providing the access for information and knowledge
	Information society: ▪ compliance with quick technological development ▪ liquidation of digital gap and digital illiteracy ▪ strengthening innovative approach ▪ supporting the development of society able to renew

Source: own compilation on HMTFK (2013)

Further messages are also defined by HMTFK 2014-2020 for economic operators, citizens, families, villages, towns, churches, legislatives and law enforcement officials. These messages are not detailed but it can be stated that information included in them aimed at least 50% the realization of transition toward sustainability.

Summary

Finally, it should be laid down that there is no „only one" general sustainable value, criterions and views mentioned in the study represent a kind of approach helping the control and serve as a benchmark. In our study we only were able to examine the existence of views and their relations to each field must be developed. However, the question „where are we on this path?" can be examined after several years, not sure to have exact answer, whether the regional sustainable criterions involved to the territorial plan of the county could be planted to the programs, what effects will be and how the development of these objectives will contribute to the realization of the transition toward sustainability. One thing is surely can be said: if taking into consideration the sustainability criterions and our regional development objectives, and trying to reach these objectives on the basis these details, we are on the right track.

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RELATIONSHIP BETWEEN GDP AND ENERGY CONSUMPTION: SUR APPROACH

Michal TKÁČ – Peter REMIÁŠ

Abstract
It is the well known fact that most of the environmental issues people are facing today reach from exploitation of non-sustainable energy resources. It is incontrovertible that energy plays crucial role in the economy, whether on demand or on supply side. This study focuses on several types of energy sources and tries to discover most significant ones that can possibly affect the gross domestic product of a country. Based on the obtained results we can conclude that there is strong relationship between energy consumption and GDP of the country. For most of the countries is oil consumption the most significant variable, however negative relationship between investment expenditures into water power plants has also been discovered.

Keywords:
energy, GDP, seemingly unrelated regression

Introduction

The relationship between energy consumption and economic growth has been subject of research since Kraft and Kraft (1978) discovered evidence of causal relationship running from GNP to energy consumption in the US over 1947 to 1974 period. With a time series analysis development in recent decades, several studies were consequently published examining the causal relationship between these variables using Sims (Yu and Hwang, 1984) or Granger causality (Akarca and Long, 1980). Especially at the consumer´s side of the economy, the past trend was to pursue growth by turning the economy into one that was inefficient and wasteful (Norgard, 2006). These studies employed data for single country or countries with different findings. Particularly the latter causality type literature did prevail and became well established. But even with such an extensive literature applying Granger causality tests to the energy sector, results are due to differences in methodology used mixed or conflicting (Fatai, Oxley and Scrimgeour, 2004). Jumbe (2004) argued that if causality runs from the consumption of energy to GDP, the country is energy dependent and absence of energy sources might have negative impact on economic growth and employment. On the other hand, if causality runs from opposite direction the country is energetic independent and energy saving or accumulation policy can be applied without an effect on employment or growth. If there is no relationship in any of directions, the energy saving policy might be carried out without influencing income (Yu and Choi, 1985). Empirical study by Oh and Lee (2003) for Korea over the period 1970-1999 indicates long run birectional relationship between GDP and energy, while unidirectional causality from energy to GDP in the short run. Relationship between GDP and energy consumption in the six countries of the Gulf Cooperation Council is examined by Al-Iriani (2006). Author uses panel

cointegration and causality methods arguing that energy saving policies might be adopted without anxiety about their negative effect on economic growth, since his results do not support the hypothesis that energy consumption affects GDP growth in investigated countries.

The aim of this paper is to reexamine this relationship between GDP of the country and various types of energy resources consumed using seemingly unrelated regression estimation method.

Methodology

The data used in this study was obtained from BP Statistical Review of World Energy and consist of annual time series of real GDP per capita and average daily oil, natural gas, coal and hydroelectricity consumption for given years for Australia, Brazil, Mexico, Norway, USA and United Kingdom from 1969 to 2014. The real GDP is given in thousands of US dollars, oil consumption in thousands of barrels, natural gas and coal consumption in million tons of oil equivalent and hydroelectricity in terawatt-hours. Ton of oil equivalent is an amount of energy released by burning one tone of crude oil.

To explore the relationship between energy consumption of the six countries and their GDP per capita we consider following equation:

$$GDP\_C_{it} = \alpha + \beta_1 OILCON_{it} + \beta_2 GASCON_{it} + \beta_3 COALCON_{it} + \beta_4 HYDROCON_{it} + u_{it}$$

where GDP_C_{it} denotes annual GDP per capita for country *i* in year *t*, $OILCON_{it}$ is oil consumption, $GASCON_{it}$ stands for gas consumption, $COALCON_{it}$ denotes average coal consumption and $HYDROCON_{it}$ is hydroelectricity consumption. u_{it} ´s denominate error term and β_i´s are parameters to be estimated. For the estimation of β_i´s we firstly use simple and fast Ordinary Least Squares method, i.e.

$$\hat{\beta}_{OLS} = (X^T X)^1 X^T y$$

However, $\hat{\beta}_{OLS}$ is not best linear unbiased estimator (BLUE) whenever variance covariance matrix for disturbances is not diagonal. However the estimator still remains unbiased and consistent, its variance is not the smallest and other technique is more appropriate. That is the reason why we consequently test the diagonality of variance covariance matrix of disturbances. For testing the diagonality of the Σ matrix we decided to use the Breusch - Pagan Lagrange Multiplier test. This test uses the test statistics:

$$LM = T\Sigma_{i=2}^{M}\Sigma_{j=1}^{i-1} r_{ij}^2$$

where M denotes the number of equations and

$$r_{ij} = \frac{\hat{s}_{ij}}{\left(\hat{s}_{ii}\hat{s}_{jj}\right)^{\frac{1}{2}}}.$$

LM statistic is asymptotically distributed as $\chi^2_{\frac{M(M-1)}{2}}$, that in our case means χ^2_{15}. The null hypothesis of Breusch - Pagan Lagrange Multiplier test is the diagonality of Σ matrix. Rejection of the null hypothesis means that we need another estimator, in our case $\hat{\beta}_{SUR}$. Seemingly Unrelated Regression is a proper method where:

$$\hat{\beta}_{SUR} = (X^T \Omega^{-1} X)^1 X^T \Omega^{-1} y$$

and $\Omega^1 = (\sum^{-1} \otimes \mathrm{I})$.

If the extent of correlation between regression equations is large there we expect gain in efficiency in performing SUR rather than OLS (Baltagi, 2008). Seemingly Unrelated Regression estimation will be BLUE.

Results

For the computational purposes we used 1.9.1 version of Gretl software. The results for OLS estimates are in Tables 1 – 6.

Table 1 OLS, using observations 1969-2008 (T = 46), Dependent variable: AUS_GDP_PCAP

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	10747,1	1797,93	5,9775	<0,00001	***
AUS_OILCONSUMPT	20,7757	3,72379	5,5792	<0,00001	***
AUS_GASCONSUMPT	205,681	112,403	1,8299	0,07580	*
AUS_COALCONSUMP	206,179	84,3119	2,4454	0,01964	**
AUS_HYDROCONS	-666,348	122,734	-5,4292	<0,00001	***

Mean dependent var	25564,21	S.D. dependent var	5733,281
Sum squared resid	18773222	S.E. of regression	732,3782
R-squared	0,985356	Adjusted R-squared	0,983682
F(4, 35)	588,7533	P-value(F)	1,45e-31
Log-likelihood	-317,9388	Akaike criterion	645,8776
Schwarz criterion	654,3220	Hannan-Quinn	648,9308
rho	0,507560	Durbin-Watson	0,951950

Source: Own processing.

Table 2 OLS, using observations 1969-2008 (T = 46), Dependent variable: BRA_GDP_PCAP

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	2251,75	240,45	9,3647	<0,00001	***
BRA_OILCONSUMPT	1,71949	0,43793	3,9264	0,00039	***
BRA_GASCONSUMPT	8,59372	15,5941	0,5511	0,58507	
BRA_COALCONSUMP	71,2181	56,5445	1,2595	0,21618	
BRA_HYDROCONS	-5,34445	3,76746	-1,4186	0,16487	

Mean dependent var	4383,487	S.D. dependent var	715,5759
Sum squared resid	2616236	S.E. of regression	273,4037
R-squared	0,868991	Adjusted R-squared	0,854019
F(4, 35)	58,03934	P-value(F)	5,79e-15
Log-likelihood	-278,5249	Akaike criterion	567,0498
Schwarz criterion	575,4942	Hannan-Quinn	570,1030
rho	0,784658	Durbin-Watson	0,312864

Source: Own processing.

Table 3 OLS, using observations 1969-2008 (T = 46), Dependent variable: MEX_GDP_PCAP

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	3558,68	170,508	20,8711	<0,00001	***
MEX_OILCONSUMPT	1,06229	0,204854	5,1856	<0,00001	***
MEX_GASCONSUMPT	60,1838	9,20207	6,5402	<0,00001	***
MEX_COALCONSUMP	-136,023	48,6777	-2,7944	0,00838	***
MEX_HYDROCONS	-1,88909	12,4214	-0,1521	0,87999	

Mean dependent var	5945,697	S.D. dependent var	965,2080
Sum squared resid	2038896	S.E. of regression	241,3590
R-squared	0,943884	Adjusted R-squared	0,937470
F(4, 35)	147,1764	P-value(F)	2,25e-21
Log-likelihood	-273,5383	Akaike criterion	557,0767
Schwarz criterion	565,5211	Hannan-Quinn	560,1299
rho	0,708099	Durbin-Watson	0,542188

Source: Own processing.

Table 4 OLS, using observations 1969-2014 (T = 46), Dependent variable: NOR_GDP_PCAP

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	2067,44	6162,6	0,3355	0,73926	
NOR_OILCONSUMPT	129,596	28,6818	4,5184	0,00007	***
NOR_GASCONSUMPT	6660,86	499,204	13,3429	<0,00001	***
NOR_COALCONSUMP	-2587,71	2072,44	-1,2486	0,22009	
NOR_HYDROCONS	76,9796	26,7801	2,8745	0,00684	***

Mean dependent var	46775,88	S.D. dependent var	13260,37
Sum squared resid	98272587	S.E. of regression	1675,646
R-squared	0,985670	Adjusted R-squared	0,984032
F(4, 35)	601,8423	P-value(F)	9,90e-32
Log-likelihood	-351,0451	Akaike criterion	712,0901
Schwarz criterion	720,5345	Hannan-Quinn	715,1434
rho	0,432587	Durbin-Watson	1,112083

Source: Own processing.

Table 5 OLS, using observations 1969-2014 (T = 46), Dependent variable: UK_GDP_PCAP

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	-7754,9	7990,33	-0,9705	0,33844	
UK_OILCONSUMPT	3,8783	2,13436	1,8171	0,07778	*
UK_GASCONSUMPT	357,151	49,6051	7,1999	<0,00001	***
UK_COALCONSUMPT	118,98	62,7219	1,8970	0,06611	*
UK_HYDROCONS	209,994	347,933	0,6035	0,55004	

Mean dependent var	26659,49	S.D. dependent var	6559,916
Sum squared resid	1,17e+08	S.E. of regression	1826,234
R-squared	0,930446	Adjusted R-squared	0,922497
F(4, 35)	117,0523	P-value(F)	9,51e-20
Log-likelihood	-354,4874	Akaike criterion	718,9747
Schwarz criterion	727,4191	Hannan-Quinn	722,0279
rho	0,853900	Durbin-Watson	0,344216

Source: Own processing.

Table 6 OLS, using observations 1969-2014 (T = 46), Dependent variable: US_GDP_PCAP

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	-12408,2	2895,25	-4,2857	0,00014	***
US_OILCONSUMPT	0,786282	0,184928	4,2518	0,00015	***
US_GASCONSUMPT	9,22429	4,69476	1,9648	0,05741	*
US_COALCONSUMPT	61,6181	2,97425	20,7172	<0,00001	***
US_HYDROCONS	-10,224	5,82046	-1,7566	0,08774	*

Mean dependent var	31358,73	S.D. dependent var	7280,185
Sum squared resid	44726472	S.E. of regression	1130,442
R-squared	0,978362	Adjusted R-squared	0,975889
F(4, 35)	395,6330	P-value(F)	1,33e-28
Log-likelihood	-335,3015	Akaike criterion	680,6029
Schwarz criterion	689,0473	Hannan-Quinn	683,6562
rho	0,668766	Durbin-Watson	0,701696

Source: Own processing.

As we can observe from Tables 1 – 6 there are different relationships between energy consumption of several types of resources and GDP for examined countries. For most of countries the energy consumption is a significant explanatory variable of the economy power. Oil and gas consumptions seem to be most important regressors for all six economies.

In case of USA and Australia all variables show significance with equal signs of coefficients, but different size. Not surprisingly the largest influence on GDP have non-sustainable resources, i.e. oil, gas and coal. Hydroelectricity as a renewable resource is either has either not significant impact on GDP or has an impact but with negative sign. This has possible explanation in large investment cost required for environmental hydroelectric power plants and their relative low efficiency. Only exception is Norway which we can consider as highly developed country with environmental way of thinking. This statement is also supported by lack of significance and negative sign of coal consumption estimator in case of Norway.

Accordingly to very high adjustable R-squared of every equation (0, 86 – 0,98), models explain the data very well. Following step is to check the diagonality of variance covariance matrix of disturbances and results are presented in following table:

Table 7 Cross-equation VCV for residuals (correlations above the diagonal)

1,2165e+006	(-0,241)	(0,379)	(0,640)	(0,067)	(0,552)
-59955	50972	(-0,052)	(-0,585)	(0,230)	(-0,032)
6,5569e+005	-18337	2,4568e+006	(0,030)	(0,315)	(0,184)
1,2052e+006	-2,2577e+005	81559	2,9182e+006	(0,109)	(0,235)
17493	12343	1,1715e+005	44129	56285	(0,101)
4,1710e+005	-5015,2	1,9784e+005	2,7462e+005	16428	4,6933e+005

log determinant = 76,3505
Breusch-Pagan test for diagonal covariance matrix:
Chi-square(15) = 61,2372 [0,0000]

Source: Own processing.

The value of the Breusch – Pagan Lagrange Multiplier test statistic is 61, 2372 with p-value equal to 0,0000. Assuming the significance level $\alpha = 1\%$ the p-value $< \alpha$ in so far that we can reject the null hypothesis. The result of the test is non-diagonality of the Σ matrix. There is a correlation among equations and $\hat{\beta}_{OLS} \neq \hat{\beta}_{SUR}$.

The correlation could be present due to unobservable specific attributes that influence the consumption on energy resources. Since the variance covariance matrix of disturbances is not diagonal we use Seemingly Unrelated Regression method rather than OLS. The results for SUR for investigated countries are demonstrated in Tables 8 – 13.

Table 8 SUR, using observations 1969-2014 (T = 46), Dependent variable: AUS_GDP_PCAP

	coefficient	std. error	t-ratio	p-value	
const	8979,52	1479,83	6,068	6,28e-07	***
AUS_OILCONSUMPT	18,2983	3,06634	5,967	8,52e-07	***
AUS_GASCONSUMPT	111,385	89,3673	1,246	0,2209	
AUS_COALCONSUMP	263,298	66,8038	3,941	0,0004	***
AUS_HYDROCONS	-477,813	96,3204	-4,961	1,81e-05	***

Mean dependent var	25564,21	S.D. dependent var	5733,281
Sum squared resid	20178719	S.E. of regression	710,2591
R-squared	0,984418	Adjusted R-squared	0,982637

Source: Own processing.

Table 9SUR, using observations 1969-2014 (T = 46), Dependent variable: BRA_GDP_PCAP

	coefficient	std. error	t-ratio	p-value	
const	2251,52	195,872	11,49	1,96e-013	***
BRA_OILCONSUMPT	1,62704	0,329725	4,935	1,95e-05	***
BRA_GASCONSUMPT	3,85185	13,1600	0,2927	0,7715	
BRA_COALCONSUMP	95,4347	44,0622	2,166	0,0372	**
BRA_HYDROCONS	-5,35275	2,88806	-1,853	0,0723	*

Mean dependent var	4383,487	S.D. dependent var	715,5759
Sum squared resid	2663663	S.E. of regression	258,0534
R-squared	0,866653	Adjusted R-squared	0,851414

Source: Own processing.

Table 10 SUR, using observations 1969-2014 (T = 46), Dependent variable: MEX_GDP_PCAP

	coefficient	std. error	t-ratio	p-value	
const	3489,39	129,601	26,92	5,55e-025	***
MEX_OILCONSUMPT	0,914915	0,147340	6,210	4,09e-07	***
MEX_GASCONSUMPT	59,9991	6,22560	9,637	2,21e-011	***
MEX_COALCONSU	-100,819	35,1872	-2,865	0,0070	***
MEX_HYDROCONS	3,48009	7,81972	0,4450	0,6590	
Mean dependent var	5945,697	S.D. dependent var		965,2080	
Sum squared resid	2132061	S.E. of regression		230,8712	
R-squared	0,942357	Adjusted R-squared		0,935769	

Source: Own processing.

Table 11 SUR, using observations 1969-2014 (T = 46), Dependent variable: NOR_GDP_PCAP

	coefficient	std. error	t-ratio	p-value	
const	-4369,47	4967,55	-0,8796	0,3851	
NOR_OILCONSUMPT	159,211	22,6784	7,020	3,60e-08	***
NOR_GASCONSUMPT	6252,68	414,274	15,09	6,82e-017	***
NOR_COALCONSUMP	-794,450	1733,20	-0,4584	0,6495	
NOR_HYDROCONS	80,7813	22,1056	3,654	0,0008	***
Mean dependent var	46775,88	S.D. dependent var		13260,37	
Sum squared resid	1,02e+08	S.E. of regression		1596,998	
R-squared	0,985139	Adjusted R-squared		0,983441	

Source: Own processing.

Table 12 SUR, using observations 1969-2014 (T = 46), Dependent variable: UK_GDP_PCAP

	coefficient	std. error	t-ratio	p-value	
const	-1722,25	5073,65	-0,3394	0,7363	
UK_OILCONSUMPT	2,95540	1,45968	2,025	0,0506	*
UK_GASCONSUMPT	316,843	31,3751	10,10	6,56e-012	***
UK_COALCONSUMPT	74,5274	36,7442	2,028	0,0502	*
UK_HYDROCONS	279,721	200,576	1,395	0,1719	
Mean dependent var	26659,49	S.D. dependent var		6559,916	
Sum squared resid	1,19e+08	S.E. of regression		1726,692	
R-squared	0,929123	Adjusted R-squared		0,921023	

Source: Own processing.

Table 13 SUR, using observations 1969-2014 (T = 46), Dependent variable: US_GDP_PCAP

	coefficient	std. error	t-ratio	p-value	
const	-14937,2	2154,28	-6,934	4,65e-08	***
US_OILCONSUMPT	0,867609	0,122249	7,097	2,86e-08	***
US_GASCONSUMPT	7,59723	3,34414	2,272	0,0294	**
US_COALCONSUMPT	59,2260	2,24704	26,36	1,13e-024	***
US_HYDROCONS	0,488643	3,55454	0,1375	0,8914	
Mean dependent var	31358,73	S.D. dependent var		7280,185	
Sum squared resid	49897121	S.E. of regression		1116,883	
R-squared	0,976239	Adjusted R-squared		0,973524	

Source: Own processing.

Observing tables above it is possible to argue that employing SUR estimation resulted into several changes. In case of Australia is gas consumption no more important variable for GDP, but on the other hand coal consumption is in SUR estimate significant at 1% level of significance. Interesting is the strong negative relationship exhibited between hydro-electricity consumption variable and GDP of Australia. In fact, the negative sign of estimation coefficient indicates difficultness and excessive expenditures of renewable energy resources utilization providing the country does not have the proper natural conditions.

Change has occurred also in model of Brazil where emerged two new valuable regressors, i.e. coal consumption and hydroelectricity consumption both of which modified their signs.

There is no evident alternation in case of Mexico. Three explanatory variables are highly significant (on 1% significance level) and only hydroelectricity shows no importance. But this situation is understandable due to geographical character of Mexico land.

Contrary to Mexico, Norway has ideal natural specification, access to modern technologies and it is obvious that there exists a strong positive relationship between domestic product of Norway and investments into renewable energy resources. The oil and natural gas consumption are also highly significant variables in determining GDP of Norway.

In United Kingdom SUR estimation model showed up hydro-energy consumption as important variable much like the significance of oil and coal consumption impact on United Kingdom GDP increased. Also the significance of the US model gas consumption estimation coefficients increased moderately.

For all six sets of SUR coefficients estimators we can observe mild decrease of Adjusted R-squared.

Conclusions

In this study we examined a number of energy resources types and tried to investigate the fact whether the energy consumption influences GDP per capita of the country and if, then which sort of energy resources have a major impact.

To estimate the parameters of the model we used two types of estimation methods, i.e. OLS and SUR, respectively. Former one was easier to implement and yielded relative satisfactory results but due to non-diagonality of variance covariance matrix of the disturbances we employed SUR estimation technique. Based on the obtained results we can conclude that there is strong relationship between energy consumption and GDP of the country. For most of the countries is oil consumption the most significant variable, however, we can observe several interesting patterns in the data, like significant factor of renewable energy consumption in high-developed and environmental Norway or negative relationship between investment expenditures into water power plants in Australia.

For further research we could include larger sample of the countries and focus on the statement that utilization of renewable energy resources is exclusively concern of wealthy countries or vice versa the environmental approach to energy consumption is profitable for the economy of the state.

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TAKING UP TECHNOLOGICAL COOPERATION IN THE SME SECTOR - AN OVERVIEW OF THE EXPERIENCE IN THE ENTERPRISE EUROPE NETWORK

Janusz NESTERAK – Zofia GRÓDEK-SZOSTAK – Olga MALINOVSKA

Abstract
The basis of innovative activity in an enterprise is the existing scientific and technical knowledge. If this knowledge is not enough in a given case, research and development work needs to be undertaken in order to expand it. The innovation process starts with determining what new products, processes and technologies can be successfully implemented in business practice within a specified time, or what improvements can be introduced in existing products, processes or technologies. The support networks for innovation and international technological cooperation, such as the Enterprise Europe Network, play an important role in this stage.

Keywords:
cooperation, technology, innovation, SME

Introduction

In the process of implementing new technology solutions in enterprises, identification and selection of a solution vendor is crucial. Due to the fact that the purchased services and/or products are the source, determinant and medium of innovation, they impact innovation activities of all companies participating in their supply chain. The nature of technology transfer includes the transfer of specific technical knowledge, organizational and related skills (know-how) for the purpose of their economic (commercial) use. Therefore, technology transfer is the process of supplying the market with technologies, which is a special case of an interactive communication process (Matusiak, 2010). In it, various feedback loops occur between the sources and users of knowledge, and the new technological and organizational solutions.

Therefore, the essence of the transfer of innovation is finding new applications of the already known (i.e. previously invented, existing) manufacturing techniques, while the diffusion of innovation is associated with the gradual dissemination of new technologies, and thus its further applications (implementations), usually in other enterprises. The measure of the diffusion (popularization) range of innovation is usually the size (or value) or, more frequently, the percentage of production undertaken owing to the new method of production. Creating new technologies, as well as their improvement, implementation and diffusion, is a complex process carried out by a number of entities, including research institutions (universities, research institutes, research and development units), businesses (including small and medium), and support and intermediary institutions (Drucker, 1992). Enterprise Europe Network (EEN) is a network of support for innovation and technological cooperation of micro, small and medium-sized enterprises (SMEs).

The aim of this article is to identify the essence of technological cooperation in implementing innovations, including system support instruments for the cooperation of enterprises. Analysed was the experience of technological cooperation of enterprises in countries of the Visegrad Group in 2008-2014.

1 The essence of technological cooperation in the innovation process

Literature studies did not yield a definite interpretation of the term "technological cooperation." The Oslo Manual (OECD, 2005) indicates that the manifestation of technological cooperation could be: increasing the quality of the product/service as a result of interaction with suppliers or customers, or market research on demand or the potential applications of technology, or deriving information from works published by research institutes, or direct cooperation with scientists as part of an innovative project. Authors of most of the works focused on the benefits of technological cooperation, cooperation in the field of innovation, or the broadly understood connections (Majewska, Truskolaski, 2013). Technology providers play an important role in innovation processes for many companies. This is related to the extent of the knowledge and capabilities, which they possess in respect to the products and technologies they purchase (Nesterak, 2013). One of the advantages of the supplier's involvement is the increase of the probability of achieving a product or process innovation. This includes improving quality, reducing time-to-market, or product development costs (Clark, Fujimoto, 1991). Freel and Harrison (2006) point out that companies, which engage in cooperation are more likely to achieve innovation. Based on a survey of small businesses in Scotland and Northern England, the authors demonstrated a positive association between the probability of successful product innovation and the cooperation with customers and the public sector, as well as between the probability of a successful process innovation and cooperation with suppliers and universities (Majewska, Truskolaski, 2013).

2 Undertaking technological cooperation in the Enterprise Europe Network

Decisions about the acquisition and implementation of new technologies are an important element, increasing SMEs' innovativeness, yet one integrated with many others. As noted by Wyżnikiewicz (2009), it is also essential to shape the entrepreneurs' conscious desire to innovate, for the sake of improving competitiveness. A major conscious-raising role to play here is for economic organizations, such as chambers of commerce and business associations, but also public authorities at various levels (Маліновська, Матвіїв, 2013; Nesterak, Gródek-Szostak, 2016).

Acquiring technology from internal sources is related to the research and development (R&D) carried out by the company. This, however, requires providing appropriate resources and team expertise in the enterprise. The company's commitment in the ongoing work can be very different. From a single

specialist who understands the use of technology enough to independently carry out an R&D project, to a large, independent R&D department using modern equipment (Table 1). However, independent research in an enterprise is burdened with a significant risk of failure, and above all, requires high, and constantly updated, technical competence.

The Enterprise Europe Network (EEN) has been set up by the European Commission on 1 January 2008. It is the largest network providing expertise and services for enterprises in Europe. The main aim of the Enterprise Europe Network is to support small and medium-sized enterprises in developing their innovative potential and to search for partners for trade and technological cooperation. Currently there are nearly 600 EEN centres in Europe, the Middle East, Asia and America. The Enterprise Europe Network provides a free of charge search for foreign partners for any type of co-operation:

- According to the criteria set out by the entrepreneur (e.g. sales of products, transport brokerage, joint venture, merger, acquisition of shares, sale of all or part of the business, subcontracting, licenses)
- Technology transfer (e.g. sales/purchase of modern machinery and equipment, licenses), knowledge (know-how)
- Development of new technologies (e.g. research and implementation of new technologies/products).

Table 1. Comparison of selected characteristics of the main categories of the company's sources of technology and knowledge

Factor	**Internal sources of technology**	**The combination of internal and external technologies**	**External sources of technology**
The company's technological growth	The highest potential	The average potential	The lowest potential - needs to find other ways
Exclusive technology	The highest potential	A chance to maintain exclusivity	Most often technology is not unique
Technology as a competitive advantage	A unique process or product	Usually needs to be shared with partners	There is a chance of success in a specific market
The company's technological potential necessary to use the source	high	moderate	relatively low, important in the implementation of technology in the company
Obtaining period	The longest	Can be reduced through partners	The shortest
Risk of failure	The highest	Average	Low
The size of investment	The highest	Average	Low, but there is a danger of hidden costs

Source: IPTO, 2001

The process of establishing technological cooperation follows a logical sequence of successive operations (Figure 1). The first step is for an EEN consultant to visit the company, to investigate the company's expectations of innovative cooperation. During the visit, the direction of further actions is determined, depending on the enterprise's need: trade, technological or research cooperation. In the second stage, a cooperation profile is developed. This is the company's proposal, which identifies what the company can offer and what is expected from a potential partner in the field of trade, technology or research cooperation. The profile is then translated into English by the EEN consultant and included in the database of the European Commission. Next, the EC forwards it to the Enterprise Europe Network centres in the countries, in which the entrepreneur is interested.

Figure 1. The process of establishing technological cooperation within the EEN

Source: own research, based on the EEN.

In the third stage, EEN centres offer advisory support of high-class specialists in the field of finance, international law and intellectual property rights, or technical consultations in the preparation and implementation of new processes, products, technologies and methods of organization in enterprises. Particular emphasis is placed on the advisory support of the negotiation process of international technology transfer agreements.

It should be emphasized that all EEN centres operate based on a uniform service standard, and consultants have the appropriate competence, confirmed by certificates.

3 The experience of the Visegrad Group companies with the cooperation with the EEN network

Analysis of the level of innovation of the Visegrad Group countries (CEED, 2014) indicates that the most innovative ones in the region are Warsaw, Wroclaw and Budapest, employing the largest number of scientists and engineers (Figure 2). Through the EEN membership, the structure of scientific centres - and their affiliate entities, e.g. technology transfer centres - supports initiating and developing technological cooperation of enterprises.

Figure 2. Innovation leaders of the Visegrad Group.

Source: CEED, 2014

Technological cooperation related each time to seeking a solution vendor in a country different than that of the seeking company, and was carried out through the database of technology offers (Figure 3).

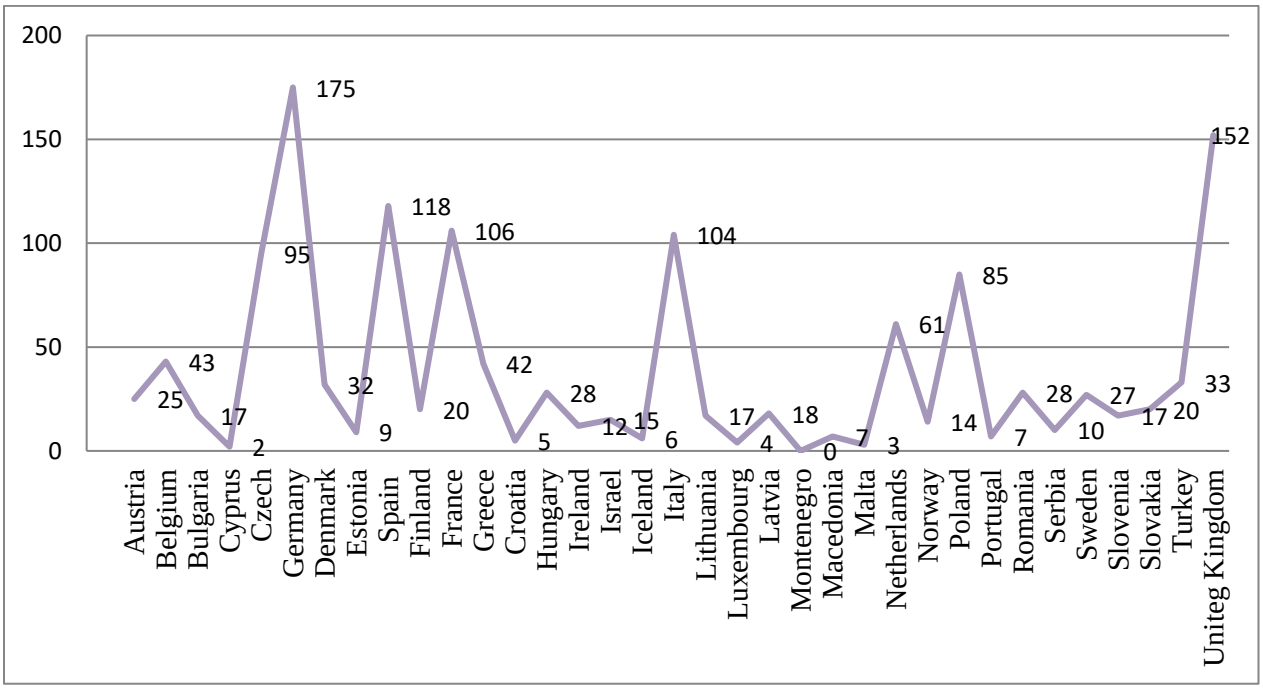

Figure 3. Technological cooperation of the EEN in the years 2008-2014

Source: own research, based on the EEN.

The structure of the undertaken technological cooperation, finalised with a technology transfer contract signed by the enterprises of the Visegrad Group in the years 2008-2014 (Figure 4) demonstrates the greatest interest among Polish and Czech entities.

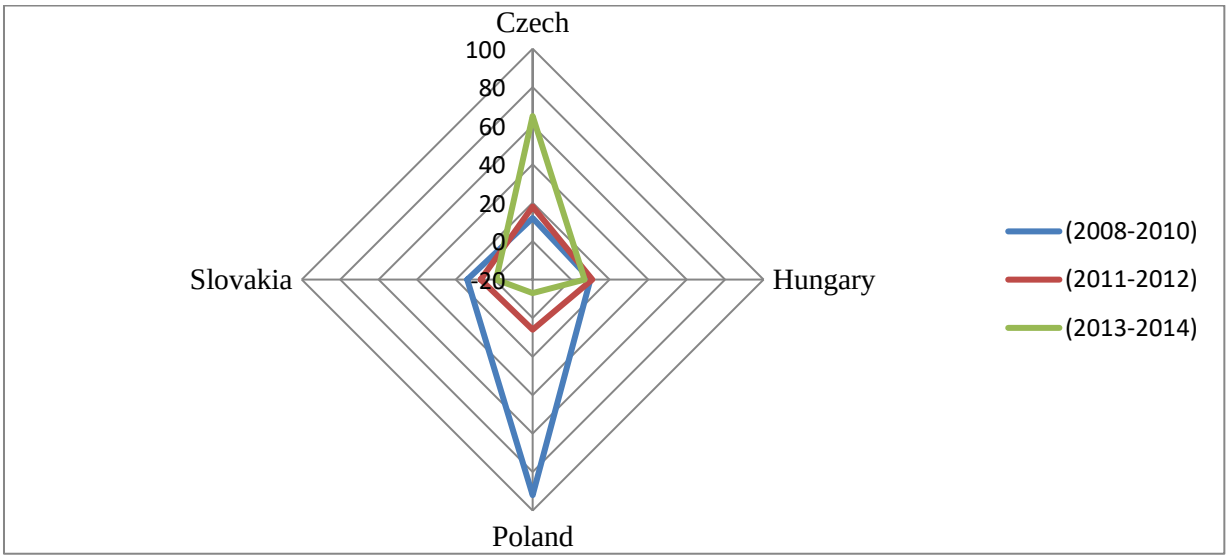

Figure 4. Transfer technology agreements 2008-2014

Source: own research, based on the EEN.

As part of international cooperation undertaken through the EEN, micro-, small and medium-sized enterprises establish business cooperation. This relates to seeking a foreign partner interested in buying/selling the product on the company's assortment offer. The quantitative structure of business cooperation in the years 2008-2014 is reflected in Figure 5.

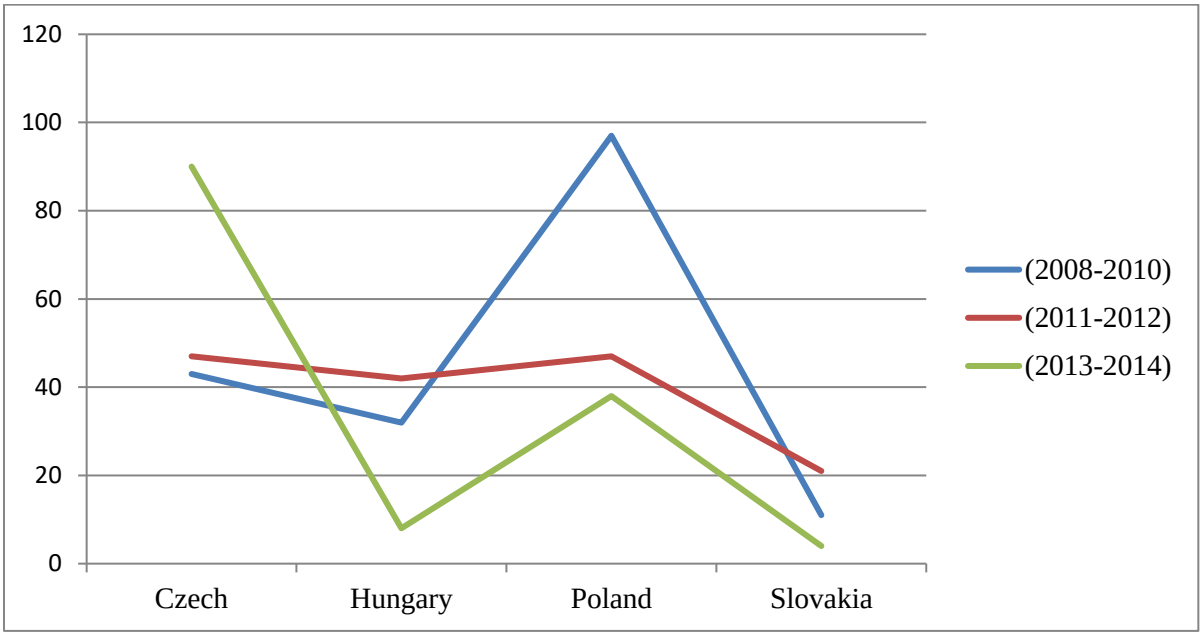

Figure 5. Business agreements 2008-2014

Author on the basis of EEN

Those figures and references to the experience of technological cooperation across the Enterprise Europe Network allow to conclude that the Visegrad Group enterprises are eager to use the available system instruments. The instruments used in the years 2008-2014 translate to the results evaluating the innovation and development potential of the region.

Conclusion

As many other characteristics of SMEs, the degree of modernity of technologies used is very diverse. The decisive factors are: the size of companies, their geographical location, period of operation, the sector or industry, and the general level of knowledge, experience and professional training of entrepreneurs. Therefore, a key factor in building a knowledge-based economy should be to intensify the efforts to enhance the cooperation between enterprises and R&D by way of a system (methodically). New technologies allow faster and cheaper manufacturing, and offering the products that are a result of a technical progress. The changing situation in the world markets means that companies should absorb the knowledge of new technology faster, and use it to improve their business.

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THE ROLE OF INVESTMENT AID IN ATTRACTING FOREIGN DIRECT INVESTMENTS

Aneta BOBENIČ HINTOŠOVÁ – Rastislav RUČINSKÝ

Abstract
The paper deals with a problem of the association between governmental instruments especially direct investment aid and foreign direct investment inflows. Based on theoretical background as well as previous empirical findings the role of investment aid in attracting foreign direct investment is rather disputable. Our research conducted in the period of 2003 – 2015 using correlation and regression analyses confirms positive and statistically significant relationship between given investment aid and foreign direct investment inflows in conditions of Slovak republic. Thus, we can conclude that direct governmental instruments play active however rather moderate role in attracting foreign direct investments and their effect needs to be complemented by other indirect tools connected with quality of business environment.

Keywords:
governmental instruments, investment aid, business friendly environment, foreign direct investment

Introduction

The gradual effort to increase foreign direct investment inflows into transition economies has encouraged governments of these countries to implement various tools to attract foreign direct investment (hereinafter also "FDI"). Besides creation of business friendly environment as one of indirect tools the governments use also direct instruments to attract FDI, especially in form of financial or fiscal investment aid. In many cases, governments compete in attracting foreign investors, especially in similarly developed regions. In this regard Drahokoupil (2008) has pointed out that while the competition state has become a major developmental strategy in the V4 region, its hegemony is far from unchallenged.

The role of governmental instruments, specifically direct investment aid is widely discussed topic in the academic literature (see e.g. Lim, 2008; Ginevičius, Šimelyté, 2011; Donaubauer, 2014; Arazmuradov, 2015). Besides other authors Demekas et al. (2007) emphasize that a country's investment policy is one of the main driving forces in attracting FDI. However, the effect of governmental instruments towards attracting FDI varies (Šimelyté, Liučvaitiené, 2012). From the theoretical point of view, the sign of the effect of investment aid on FDI inflows is not unambiguous.

One group of findings point to rather positive effects of investment aid on increase of FDI. Selaya and Sunesen (2012) state that aid raises the marginal productivity of capital when used to finance complementary inputs (like public infrastructure and human capital investments). In another study covering a large number of developing and emerging economies during the 1990s Harms and Lutz (2006) found robust positive effects of the aid on FDI in the countries with high

regulatory burden on firms. As reported by Thangamani, Xu and Zhong (2011), development aid has been found to drive FDI in South Asian countries. Similarly, key finding of the recent study of Arazmuradov (2015) conducted in Central Asian economies is that aggregate aid had a statistically significant influence on FDI inflows.

On the other hand, Economides et al. (2008) argue that investment aid can be negatively associated with FDI because it can distort individual incentives, and hence hurt growth, by encouraging rent seeking as opposed to productive activities. Beladi and Oladi (2006) pointed to crowding-out effect on FDI connected with investment aid. Subsequently, Donaubauer (2014) in his study analyzed relationship between aid and FDI in a large sample of developing countries using panel cointegration techniques. His results suggest that in the long run and on average, aid and FDI are negatively correlated. Thus, rent-seeking or crowding-out effects seem to dominate over other potentially FDI attracting effects of aid.

The third group of opinions indicate that an investment promotion policy of a host country has little or no impact on inward FDI. In this regard Burger, Jaklič and Rojec (2012) point out that the effectiveness of investment aid can only be assessed in terms of their potential scope to attract FDI. Empirical researches has shown that investment aid play only a secondary role in determining the international pattern of FDI. According to them aid is important only in case primary conditions of host country attractiveness have been deemed satisfactory. In addition, empirical studies for transition as well as developing countries confirmed limited effectiveness of investment aid. Antaloczy and Sass (2001) concluded that neither general nor econometric studies gave any proof about significance of impact of investment aid on the direction or size of FDI in the Czech republic, Estonia, Hungary, Poland, Slovakia and Slovenia. Similarly, Ruane (2008) argues that investment incentives must be complemented by favorable overall policy framework that focus on economic and political stability, provide physical, human and institutional infrastructure and reduce the cost of doing business in the host country, only in this case investment incentives appear to have a greater effect.

Going out from the overview presented above, the empirical findings on the investment aid – FDI relationship are mixed and inconclusive. Moreover, only a limited number of these studies were conducted in conditions of Central European countries. Thus, the aim of the present paper is to assess the role of investment aid in attracting foreign direct investment inflows into Slovak republic.

The rest of the paper is organized as follows: section 1 brings short overview of the amount of investment aid provided to companies incorporated in Slovak republic, section 2 explains the empirical methodology and introduces dataset structure including summary statistics of the used variables, section 3 brings own empirical results primarily on the investment aid – FDI inflows relationship and their discussion followed by concluding remarks.

1 Overview of Provided Investment Aid

The forms of investment aid, eligible projects and costs as well as other related issues are in conditions of Slovak republic regulated primarily by the Act on Investment Aid No. 561/2007 Coll. as amended. Generally, the Slovak investment aid program is focused on industry, high-tech sector, strategic services, tourism and it is oriented to promote economic development of certain disadvantaged areas to eliminate regional disparities and to target investments and job creation to most vulnerable regions. Thus, the type and the amount of the subsidy depends on the region. Typically, there are four applicable forms of investment aid, namely tax relief, cash grant, contributions for the newly created jobs and transfer of state/ municipal property for a discounted price. According to law, there is no entitlement to the granting of investment aid.

Based on the data published by the Ministry of Economy of a Slovak republic, the development of provided investment aid and its forms is obvious from the following figures.

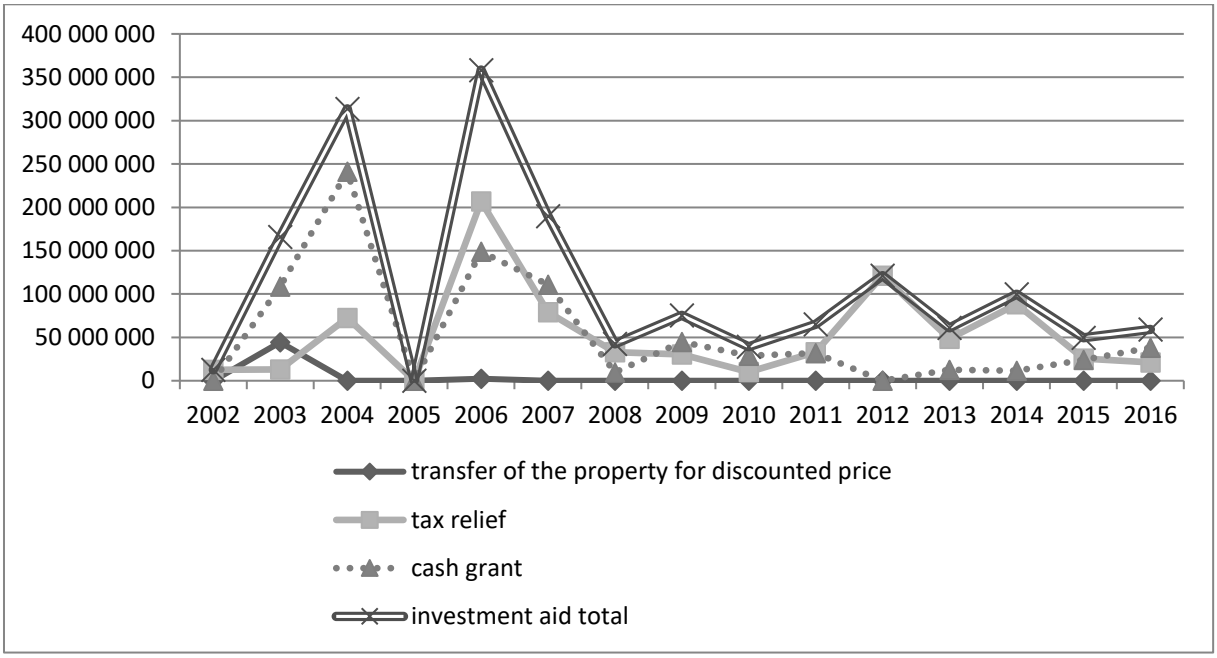

Figure 1 Overview of provided investment aid in Slovak republic in the period of 2002 – 2016

Source: own processing of data taken from www.economy.gov.sk

In the observed period, totally 176 applications for provision of investment aid were approved in the total amount of 1.653 billion EUR. Figure 1 shows that the highest amount of investment aid was provided in 2006. From that time, we can notice more stable investment politics from the amount of provided aid point of view. There are significant differences in portion of forms of aid on the total aid provided. Most frequently tax relief was used (48.15%), followed by cash grants (38.64%), contribution for newly created jobs (10.39%) and transfer of the state/ municipal property for a discounted price (2.82%).

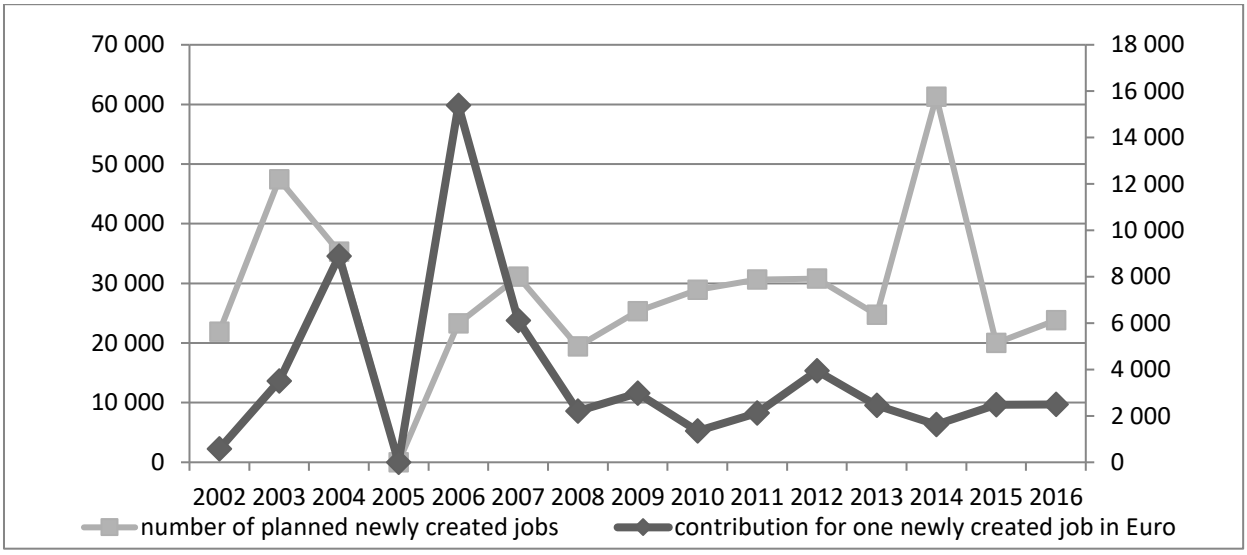

Figure 2 Overview of provided contributions for the newly created jobs and planned number of these jobs in Slovak republic in the period of 2002 – 2016

Source: own processing of data taken from www.economy.gov.sk

The amount of investment aid calculated on one planned created or maintained working place reached on average 29 467 EUR. Supported investments should contribute to creation of 54 578 new working places and to maintenance of 1 256 working places.

2 Methodology and Data

To examine the relationship between investment aid and FDI following regression model is used:

$$lnFDI_t = \beta_0 + \beta_1 lnIA_t + \beta_2 GDP_t + \beta_3 U_t + \beta_4 I_t + \varepsilon_t \quad (1)$$

As the dependent variable, the logarithm of FDI measured in thousands EUR is used ($lnFDI_t$). As the key independent variable, the logarithm of investment aid in thousands EUR ($lnIA_t$) is used. In addition, indirect incentive measures such as economic growth measured by change in GDP in percentage (GDP_t) and economic stability represented by unemployment rate in percentage (U_t), and CPI inflation rate in percentage (I_t) are used. β_0 represents the constant, while β_1 the coefficient of our main interest, and $\beta_2 - \beta_4$ the coefficients of other independent variables. Finally, $\varepsilon_t$represents the residuals of the model (1).

Data on FDI inflows, as well as data on GDP, unemployment rate and inflation rate are taken from the statistics published by National Bank of Slovakia. Data on provided investment aid are taken from the database published by Ministry of Economy of the Slovak republic. We use complete time series data over the period from 2003 to 2015.

Before we analyze the empirical results of the model, we present the summary statistics of all variables (Table 1). The FDI are on average in sum of 1 717 250 thousands EUR. The distribution of dependent variable is approximately symmetric, based on skewness, and platykurtic, based on excess kurtosis. The average investment aid is 122 620 thousands EUR, and the distribution of this main dependent variable is highly skewed to the right side, and slightly more peaked compared to normal distribution. The independent variable GDP is on average 4.14 %, and has moderately skewed distribution to the left side, with fatter tails (leptokurtic distribution). The average unemployment rate is 14.08 %, with approximately symmetric, less peaked (platykurtic) distribution. And the inflation rate is on average 3.21 %, with moderately skewed distribution to the right side, which is slightly platykurtic.

Table 1 Summary statistics of the variables

Variable	Mean	Median	Maximum	Minimum	St. dev.	Skewness	Kurtosis
FDI	1 717 250	2 320 630	3 741 390	-454 968	1 482 210	-0.42	-1.32
IA	122 620	75 271	358 310	12 746	107 650	1.19	0.18
GDP	4.14	4.80	10.80	-5.50	3.79	-0.80	1.45
U	14.08	13.80	18.50	9.60	2.68	0.22	-0.84
I	3.21	3.05	8.50	-0.30	2.56	0.62	-0.22

Source: own processing of data

The correlation matrix of model (1) is presented in table 2. Based on the Pearson correlation coefficients, we expect positive impact of investment aid, GDP, and inflation rate on FDI, and we do not suspect any collinearity problem in the model (1). In case of unemployment rate, there is no statistical significance of its correlation coefficient, however, the impact seems positive.

Table 2 Correlation matrix of model (1)

Pearson correlation coefficients	FDI	IA	GDP	U	I
FDI	1	0.60 ** (0.04)	0.64 ** (0.02)	0.15 (0.62)	0.71 *** (0.01)
IA		1	0.46 (0.12)	0.20 (0.52)	0.54 ** (0.05)
GDP			1	0.05 (0.86)	0.31 (0.28)
U				1	0.47 * (0.09)
I					1

Source: own processing of data

3 Results and Discussion

The empirical results of the model (1) obtained from OLS estimation are shown in the table 3. Based on R-squared, this model can explain 85 % of the dependent variable variance. The model shows no evidence on presence of heteroscedasticity, and residuals seem normally distributed. The independent variables show no indication of a collinearity problem.

Except for the constant, the statistically significant impact on the dependent variable have been detected in case of the variables investment aid and unemployment rate, while the variables GDP and inflation rate show no statistically significant impact. After removing the logarithms of variables, we can interpret the impact of variables as follows: the 10 % increase of the investment aid causes the FDI increase of almost 3 %, and the 1 % increase of the unemployment rate causes the FDI decrease of almost 11 %.

Table 3 Empirical results of model (1)

Variable	Coefficient	Std. error	t-ratio	p-value	VIF
The constant	12.65***	1.16	10.87	0.00	-
lnIA	0.30*	0.13	2.39	0.10	1.41
GDP	-0.03	0.03	-1.05	0.37	1.18
U	-0.11*	0.04	-3.12	0.05	1.49
I	0.08	0.04	1.94	0.15	1.98

Note: the asterisk denotes statistical significance - * on a level of 10 %, ** on a level of 5 %, and *** on a level of 1 %. The VIF value above 10.00 may indicate a collinearity problem.

R-squared	0.85	Adjusted R-squared	0.65
F-statistic	4.18	With p-value	0.13
LM statistic (test for heteroskedsticity)	1.16	With p-value	0.88
Chi-squared (test for normality of residuals)	4.30	With p-value	0.12

Source: own processing of data

In case of variable investment aid that is in the center of our interest we identified statistically significant; however rather moderate impact on inward FDI, similarly as in the work of Arazmudarov (2015). Thus, we suppose that in attracting FDI inflows also other indirect governmental instruments, such as creation of business friendly environment needs to be taken into account, as it results also from the work of Šimelyté and Liučvaitiené (2012). In case of other additional variables, we surprisingly detected statistically significant relationship only in case of unemployment rate. Despite generally believed association that higher labor availability leads to increase in FDI inflows (see e.g. Boudier-Bensebaa, 2005) our results show rather the opposite.

Conclusion

In the center of our interest within this paper was to examine investment aid – FDI nexus specifically in the conditions of Slovak republic. For this country, it is typical to provide rich scope of investment incentives primarily focusing on attracting inward foreign direct investment and to use this tool also as a mean of competition for foreign investor also with other countries in the region. Based on analysis covering 2003 – 2015 period we can conclude that provided investment aid has positive and statistically significant impact on FDI inflows however this effect is rather moderate. The effective pro-investment policy needs to be complemented by other indirect tools connected with creation of business friendly environment.

In our future research, we would like to study in more details what is the role of particular forms of investment aid in attracting inward FDI. To get more comprehensive picture we find it important to study investment aid – FDI relationship also within other countries on similar region and development level.

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SHARED ECONOMY

Miroslav KLIMEK

Abstract
Why is called shared economy as a phenomenon of the 21st century, when it is with us basically from the beginning of mankind? The answer is simple and to the Internet and advanced technology. Today, anyone and anywhere who have internet access, can participate in sharing. Speed journey information with the past can not be compared, in a split second you can know what is happening on the other side of the world, or even in space. Today we are indeed richer and a lot of things are much more accessible than in the past, but thanks to the Internet to share costs have fallen so much that individual use ordinary things seem to be unnecessary wastage.

Keywords:
shared economy, internet, technology, information, UBER

Introduction

Why is shared economics known as a phenomenon of the 21st century? Sharing product is as old as human society. In the history the people share the fire, shelter and prey. At the time of the first televisions the neighbors were met by the owner and watched broadcast together.

In human history we can follow the development of trade and human wealth, products you can afford are becoming more and more accessible, the cost of carrying out trade are reduced and it is easier to find a counterparty. This is why shared economy weakened in favor of individual ownership and consumption. Shared economy has shrunk only to those areas where the price of an individual is too high, a typical example is the insurance industry.

1 Shared economy

Why is called shared economy as a phenomenon of the 21st century, it is with us basically from the beginning of mankind? The answer is simple and that it is because of the Internet and advanced technology. Today, anyone and anywhere if have internet access, can participate in sharing.

Speed of the information can not be compared with the past, in a one second you can know what is happening on the other side of the world, or even in the space.

In the past, sharing rides, houses and other establishments have been very problematic. If a stranger came to you and wanted to share with you, your shelter, such a plan didn't work. Today, thanks to the internet we can check people and then save costs (Iness, 2016).

Among the first shared portals ordinary people certainly can include discount portals that operate in its early principles of consumer associations to negotiate better prices. What about price comparators? Why they are part of the shared

economy? Shared economy solves the problem of asymmetric information. What is valid if I know which product is cheapest, but I can not compare the quality of the products? Here they come to a number of user score as regulation of low-quality products.

Today, we are indeed richer and a lot of things are much more accessible than in the past, but thanks to the Internet to share costs have fallen so much that individual use ordinary things seem to be unnecessary wastage.

2 Current status

Size of the market of shared economy was estimated by Forbes Economy in 2013 to 110 billion dollars. In year 2014 the figure was 533 billion dollars. This shows big trend of sharing. Shared economy provides access to resources that are rare or limited. The thing that is owned by one person, may also benefit others interested and therefore some authors also speak about the access economy.

Two of the three most valuable start-ups are the biggest representatives shared economy. These start-ups are focused on goods that are in people´s lives the most expensive - housing and automobiles. These are the areas most people feel as the waste of the resources.

Uber company in year 2016 was the most valuable start-up. The value of the company is more than 40 billion dollars, while the formation of the company was only established in year 2009. It operates in more than 53 countries and represents competition for traditional taxis. It uses an application which connects customers with conventional car owners and allows them to make money by providing a drop-off (Dills - Mulholland, 2016).

Uber´s concurents:

- BlaBlaCar – 25 milions people registered
- Didi Kuaidi – operates in China
- Liftago – the biggest concurent of Uber in shared rides

Airnbnb - the third most valuable start-up, founded in year 2008. The value of website is around 10 billion dollars. With this website, people can share their property and provides guests with temporary shelter. This portal is also used by many hotels to increase sales. In the summer of 2015 it benefited from the application of 17 million people. During the busiest nights this portal was used one million guests worldwide (Trade-Off, 2016).

3 Regulations

This chapter compares the differences between the public regulator (which applies the power of the most common form of prohibitions, licensing, duties, excise tax and standards) and self-regulation of private platform that takes the form of a user score of the competition.

3.1 Motivation of regulator

Makers of regulation in the self-interest may be subject to pressure from interest groups and create regulations that are not in accordance with the general welfare, but allowed only narrow groups. Public regulator may impose costs of regulation to the masses, but yields to concentrate in the hands of a narrow interest group (http://iness.sk/stranka/11903-Samoregulacia-zdielanej-ekonomiky.html).

In self-regulation of private platforms are the creators of the rules of private owners platforms. In the interests of the owners it is to create an environment that ensures that the maximum number of transactions because of the profit depends on the platform. The creators of these platforms, so in addition to self-interest must take into account the interests of all participants, service providers and even customers.

3.2 Information problem

Public regulator also facing a knowledge of the problem and to identify and develop the right regulation. „Regulatory generate different costs and benefits to stakeholders and the public that the regulator faces a problem when the cost of regulation justified because they are offset by more revenue they bring in consumers“ (http://iness.sk/stranka/11903-Samoregulacia-zdielanej-ekonomiky .html).

Public regulator generally does not have the knowledge to properly evaluate the costs and benefits to stakeholders. Private controller has able to impose rules only to users platforms and not to all participants in the economy, thus leave room for competition (decentralized platform creators of new private platforms). Private controller also has access to the feedback in the form of inflows and churn.

3.3 Enforcement of regulations

Regulate public regulator requires an active and creates additional costs. For their enforcement is a need for controls, otherwise the one observed. Private regulators to use their platforms reputational mechanisms that allow peer review of the parties of the contract. These assessments put pressure on the parties to seek a counterparty, which behaved as expected, and during the contract shall be governed by the rules to avoid bad evaluation because it can bring bad expulsion from the party platform.

The pictures below shows the complexity of the regulation, if we wanted to rent a property in the Slovak Republic.

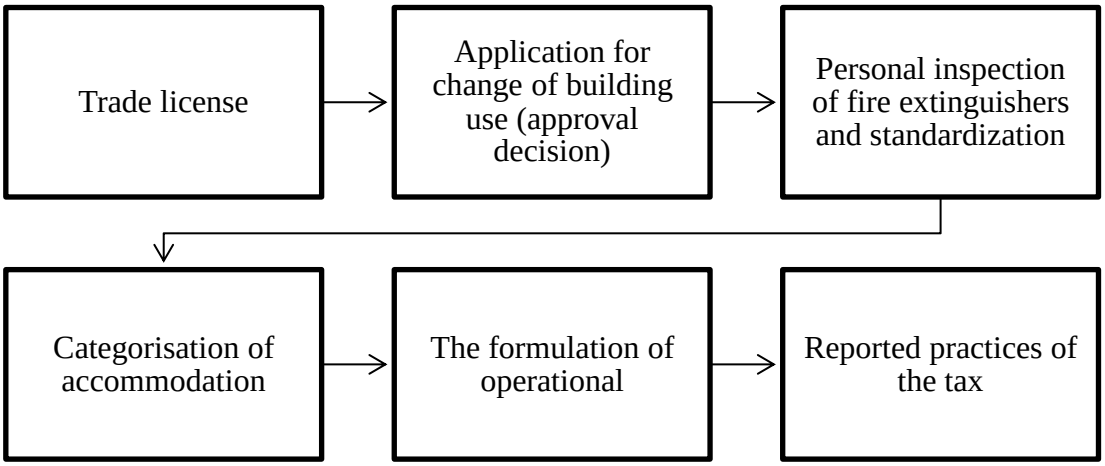

Figure 1 Public regulation

Source: Own processing

The whole process takes about six months and cost hundreds of euros and requires specific knowledge on the part of the candidate.

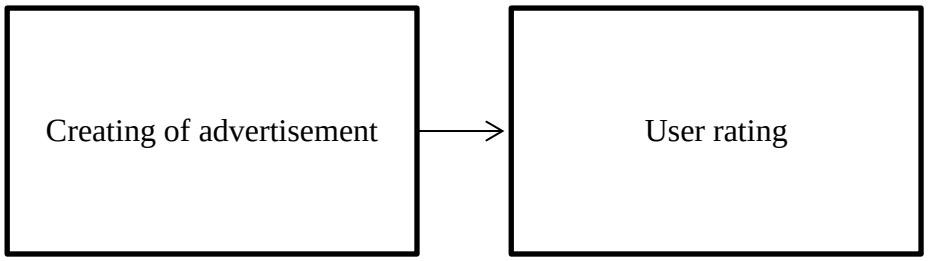

Figure 2 Private regulation at Airbnb

Source: Own processing

At Airbnb platform regulation works by the reputational mechanism. So far, 75 % of users leaving a review. Host having at least one positive evaluation has four times more likely to be chosen by the purchaser, as a host without a positive evaluation. The platform sends money to counterparty after 24 hours in the event that there is a problem. Well platform works non-stop customer service. Airbnb hosts insured property up to 1 million dollars. Also, participants are required to submit before the conclusion of the contract for themselves the most important information at a specific range.

4 Effects of shared economy

As the biggest benefits of the shared economy are mentioned higher volume of economic activity on the demand and the offer and said it is the pressure to improve service quality and faster adoption of new technological innovation. One of the most important analyzes comes from economist Scott Wallsten of the American Georgetown University.

In this study the author examines whether due to competitive pressure will improve service quality and reduce their cost (if they can be flexibly adjusted prices).

Results of New York: Wallsten used data from regulatory bodies on complaints about the taxis to get to know the quality of the taxi. New York institution The New York City Taxi and Limousine Commission has provided data over 1 billion taxi rides between years 2009 to 2014 and accurate data on how were complaints (Wallsten, 2015).

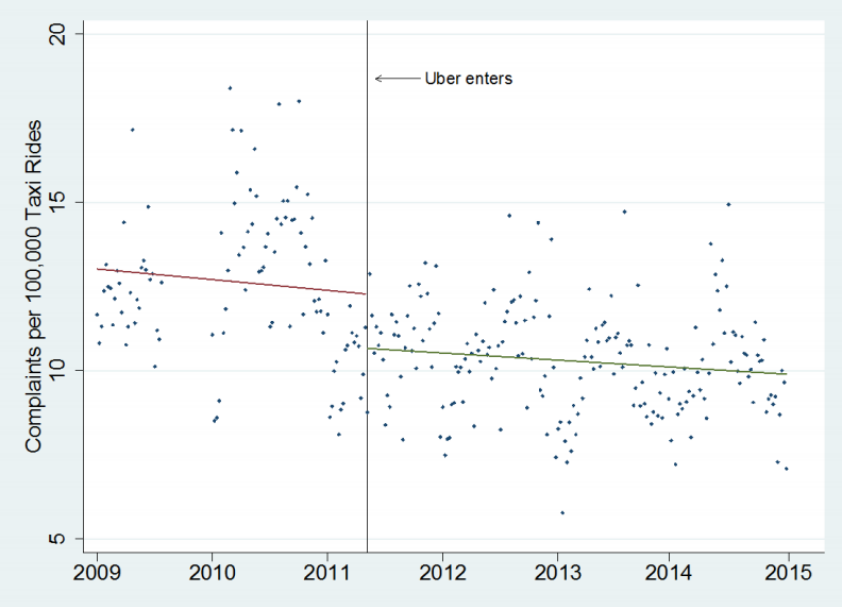

Figure 3 Complaints about 100 000 taxi rides in New York

Source: Wallsten, 2015.
https://www.ftc.gov/system/files/documents/public_comments/2015/06/01912-96334.pdf

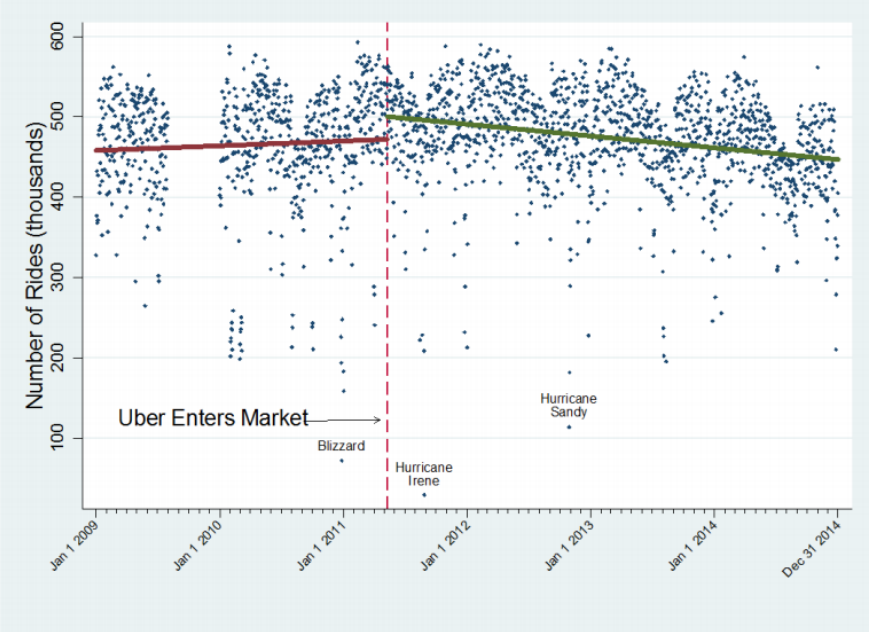

Figure 4 Daily driving a taxi in New York City (in thousands)

Source: Wallsten, 2015.
https://www.ftc.gov/system/files/documents/public_comments/2015/06/01912-96334.pdf

To capture the development of a shared economy, the author used a new data tool Google Trends. Google Trends is an online tool that allows you to display how often a phrase is searching the web with Google search. Statistics using this tool are even more accurate than traditional analysis. Uber index speaks about popularity of Uber services in New York.

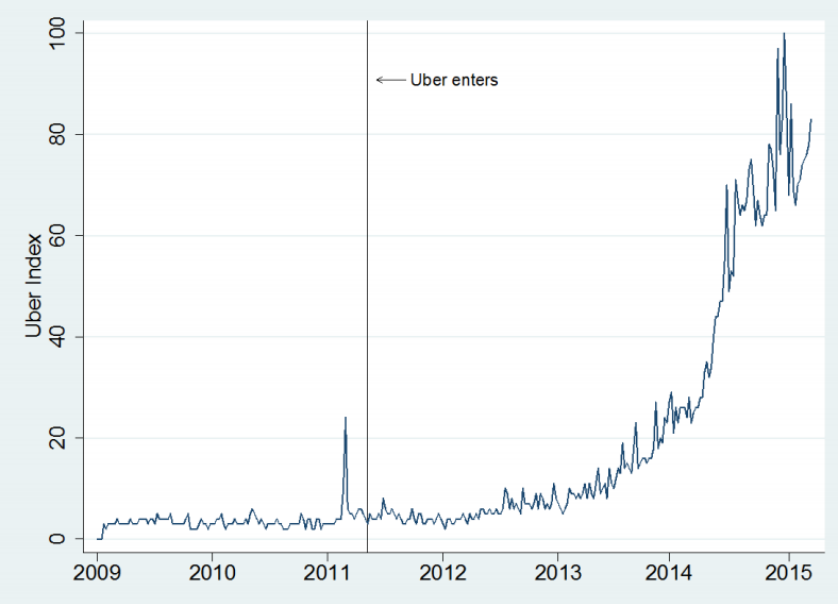

Figure 5 Uber index - Google trends search in New York

Source: Wallsten, 2015.
https://www.ftc.gov/system/files/documents/public_comments/2015/06/01912-96334.pdf

Results of the research say that the number of daily trips and taxi complaints per 100 thousand trips taxi after taking Uber systematically decreased. About 1 % growth Uber index reduce the number of taxi journeys by 0,1 % and the number of complaints decreased by 0,3 % and the number of complaints per run, by 0,1 – 0,2 %, taking into account other factors that could affect results (such as weather). Apparently there was a harmony of two effects. Of customers who were accustomed to complain they found other means of transport, for example, Uber and the advent of competition is forcing taxi drivers to improve service quality.

The results of other studies related to the shared economy in the transport sector: Angela K. Dills and Sean E. Mulholland in the study Ride-Sharing, Fatal Crashes, and Crime found, that:

- About 6 % average drop in the number of fatal accidents in the cities where it operates Uber.
- About 18 % decreased the number of nighttime accidents.
- About 50 % decreased crime of driving while intoxicated (Dills - Mulholland, 2016).

Rosanna Smart and Brad Rowe discovered in Study Faster and Cheaper: How Ride Sourcing Fills a Gap in Low-Income Neighborhoods in Los Angeles, that:

- 2 times faster drivers were able to arrive at Uber in poorer parts of Los Angeles.
- 2 times cheaper Uber drivers were in these parts of Los Angeles as a regular taxi (Smart - Rowe, 2015).

Judd Cramer and Alan Krueger carried out the study Disruptive Change in the Taxi Business: The Case of Uber, which found, that:

- 30 % more driving time drivers shared with the economy paying customers than a traditional taxi driver.
- 50 % more mileage drivers pass the shared economy cast as a classic taxi driver (Kramar - Krueger, 2016).

Also interesting study, which developed Uber at MIT (Massachusetts Institute of Technology), which found that thanks to the service pool, which is a service in Uber, where passengers can share the ride with other candidates and thereby reduce the cost of travel, in July 2015 has been spared in New York, San Francisco, Los Angeles, Austin and Paris car journeys 4,7 millions rides, 820 metric tons of CO2 and decreased driving a vehicle under the influence of alcohol. Furthermore, representatives of the Uber emphasize that the driver riding full time in New York can earn around 75 000 - 90 000 dollars per annum compared to traditional taxi driver, who is able to full-time earn only 30 thousand dollars a year (Halls - Krueger, 2015).

Conclusion

In the first part, we introduced a shared economy and the growing size of the market. Furthermore, we have been devoting comparison of traditional regulation and new regulation in a shared economy, which is largely made up of reputational mechanism. The biggest advantages are simplicity and the fact that this system does not burden the administrative members of the trade and use of new technologies and barrier-free entry of new competitors, the system is effective.

The shared effect of the economy, we focused on the area of taxi services, since this is where most studies have been created, which is due to the fact that the largest Uber representative and the most logical competitors. The results of specific studies are showing us more efficient use of resources. Shared economy using modern technology can more efficient use time. Another benefit of shared platforms, according to the results of studies can be more efficient redistribution of wealth. Thanks to the Uber platform drivers are able to supplement their basic income or work full-time for this platform and thus earn more as a driver in a taxi. Passengers can save transportation costs and thanks to modern technology drivers shared platforms are able to come to the customer faster. Based on the lessons learned can be shared platform economy partly address the issue of redistribution of wealth and especially help people with lower incomes to increase income and make more efficient use of your time.

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ISO STANDARDS, SIX SIGMA AND LEAN SIX SIGMA APPLICATION POSSIBILITIES IN HEALTHCARE MANAGEMENT

Zuzana HAJDUOVÁ – Roman LACKO

Abstract
This article deals with the newest trends in healthcare managements. It mentions most used methods for improving processes among the healthcare facilities, i.e. ISO 9000 standards, six sigma and lean six sigma. Article offers a summary of the newest foreign trends, which can be applicable also in CEE countries. We cannot prove there is one general solution for all the problems.

Key words:
ISO 9000, healthcare, six sigma, lean six sigma

Introduction

The internal part of healthcare is also the quality of provided services. The quality and satisfaction of customer are nowadays the key priorities of most successful organizations. In competitive market environment are present the significant pressures on efficiency and higher customer requirements. Their achievement requires a resolution and adequate management system. ,

1 ISO

International Organization for Standardization deals with quality management and has created the system of ISO 9000 standards. Organization defines the quality as "Degree to which a set of inherent characteristics fulfils requirements". Implementation of quality management system emphasizes the process management and process improvement. The standard ISO 9001 mentions that organizations without consideration where they belong, must identify and manage the processes, which create their quality management system (ISO 9001, 2008). We must say that the starting point for creation of ISO 9001 system is the definition of processes with aim to ensure the satisfaction of customers. Based on this fact is created the organizational structure and required resources (Carmignani, 2008).

ISO defines the process as the set of mutually related or mutually active operations transforming inputs to outputs. These activities need the allocation of some resources – human resources or material. As the main advantage of process approach defines ISO the management and control of interactions between processes and interface between the functional levels of organization. This process approach represents effective way of organization and management of activities with aim of creation of values for the customer and other interested groups. Process approach involves three steps:

1. Process implementation and measurement
2. Process analysis
3. Corrective actions for process improvement

The application of processes performance indicators needs the adherence of measurement principles. The frequency and correct timing of measurement is important and in some cases, can leads to distortion of data. The output of measurement should provide information for all employees, who must work with information. Therefore, is important to preserve the simplicity and intelligibility of presented results. The universal indicators can be used in wide range of processes and are linked with assessment of time, quality, costs etc. For example, the indicator of employee productivity measurement, number of days of stocks in production, the structure of process interim period. In next table, we indicate the overview of indicators according to ISO.

Table 1 The processes performance indicators

Universal indicators of processes performance	• Process interim period • Effective use of process period • Process total costs • Effective use of costs • Share of disagreements in process • Level of Sigma competencies • Number of registered deviations in process
Indicators of production processes performance	• Productivity of workers • Productivity of machines • Productivity of capital • Total effectiveness of equipment • Machines and processes capability index • Average profitability on worker
Indicators of nonproduction processes	• Organization profit to costs on design and development • User effect from new products • Cost-effectiveness on selection of appropriate suppliers • Assessment of suppliers • Speed of reaction to indicated customer mismatch • Share of planned and realized orders
Performance measurement according to deviations	• Late delivered material and information inputs • Tools defects • Incompetent worker
Performance measurement according performance index	• Measurement period • Titles of used indicators • Actual values of indicators • Weight of indicators • Values of 10 basic performance degrees

Source: own adaptation according to www.poling.sk

Within the category of performance measurement according to deviations is the main aim the definition of deviations from legislative and normative requirements. Performance index uses special forms. By the creation of forms is important to define the quality aims for individual processes and the selection of appropriate indicators, which can be used for monitoring of achieved target values. Important step is definition of starting point values for each indicator. This value should be defined based on at least three previous periods. On the other hand, is the definition of target values, which should correspond with in advance defined aims. The component is also the definition of partial performance aims. These are defined by experts according to experiences. The last value is minimum bearable performance level. This indication represents for society the least favorable circumstances and values. Within this method, the weights are also used. 100 points are divided between individual indicators. After the definition of form, it is possible to monitor certain process and to measure its performance. Necessity for monitoring and measurement is the frequency and regularity of intervals. Based on calculations is defined actual value index of performance and its development is monitored in time.

Organization must apply the appropriate methods for monitoring and measurement of quality and processes performance. These methods should declare the ability to achieve planned results. If the planned results are not reached, must be the corrective actions undertaken. By the selection of appropriate methods, organization should consider the type and extent of monitoring and measurement of each process, mainly in relationship with influence on fulfillment of goods requirements. Except of ISO standards also method Six Sigma is used in practice. Six Sigma is used not only in production organizations but also in organizations providing services, where we can find non-profit organizations in area of healthcare.

2 Six Sigma

The application of Six Sigma methodology is recommended also in healthcare. Some of healthcare institutions have implemented this methodology in their conditions (Heuvel et al., 2006; Christianson et al., 2005; Cagliano et al., 2011; Cima et al., 2011). With the aim to quantify the process performance, Six Sigma project begins with definition and implementation of relevant metrics and actions – quality critical characteristics.

Cima et al. (2011) and Taner et al. (2007) emphasize that process mapping, support of management, employees' engagement, key performance metrics sharing and high level of internal communication is key to achievement of healthcare processes improvement.

Taner et al. (2007) summarized that the shortage of financial investments, human resources, time, management, insufficient trainings, selection of projects and internal resistance are the key barriers for implementation of processes improvement in healthcare.

Arthur (2011) implemented the set of Lean and Six Sigma tools, widely used in healthcare improvement process.

They are:

- Value Stream Mapping (VSM),
- Ishikawa diagrams,
- Regulatory diagrams,
- Pareto´s diagrams and histograms.

In literature, we meet with three types of Lean and Six Sigma implementation within the healthcare institutions. The first type is single implementation of Lean (Teichgräber and Bucourt, 2012; Jenkins and Eckel, 2012), the second type is single implementation of Six Sigma (Kumar et al., 2009; Taner et al., 2007) and the last type is the combination of Lean and Six Sigma (Cima et al., 2011; Koning et al., 2006).

Table 2 The implementation of Lean, Six Sigma a Lean Six Sigma

Bearing	**Application**	**Methodology**	**Source**
Lean and Six Sigma			
Costs reduction with quality maintenance or improvement in hospital in Netherlands	Complexity reduction by the staff acquisition, the improvement of maintenance process system	The combination of Lean and Six Sigma DMAIC methodology	Koning et al. (2006)
The whole process of treatment within emergency in hospital in Netherlands	Emergency treatment time reduction	The usage of DMAIC approach for Lean Six Sigma and application Little's Law	Heuvel et al. (2006)
Lean			
The process of endovascular stents in intervention radiology	Waste elimination	The usage of Lean techniques to identify the waste, the analysis and process improvement with VSM and Kanban	Teichgräber and Bucourt (2012)
Medicaments issuing process in hospital in South Carolina	Time reduction of medicaments issuing	The application of Lean concept with aim to optimize the time of chemist in medicaments issuing process	Jenkins and Eckel (2012)
Six Sigma			
Main problems of healthcare, improvement of patients' life quality in healthcare sector	Reduction of unnecessary laboratory tests, shortening of waiting time before operation, shortening of hospital stay	The usage of Six Sigma and DMAIC structure	Tolga Taner et al. (2007)

Source: own adaptation

Feng and Manuel (2008) performed research within the healthcare organizations with help of online survey of Healthcare Information and Management Systems Society and the Society for Health Systems. They found that 15 from the whole amount of 56 organizations have implemented the Six Sigma methodology. Antony et al. (2007) have incorporated into the results also the summary of outputs and financial savings from 10 healthcare organizations, which have implemented Six Sigma. The improvement of CtQ and procedural metrics was present. From the whole amount of 10 firms were 6 able to estimate costs savings or incomes increasing. DelliFraine et al. (2010) studied Six Sigma and Lean management in healthcare. They stated that it does exist only poor proof, that Six Sigma and Lean improve the quality in area of healthcare institutions and that the latest opinions showed the restrictions linked with Six Sigma in healthcare and its performance, costs and incomes generation. Liberatore (2013) within the view of Six Sigma application in healthcare institutions identified 88 hospitals and providers of healthcare services, who in their conditions applied the concept SS/LSS (Six Sigma/LeanSix Sigma). From the whole amount represented 14 (16%) institutions from Netherlands, United Kingdom, South Korea, Italy, Finland, Taiwan and Thailand. The picture shows the implementation in time for these 88 institutions. Within these institutions were performed 171 implementations in different departments and units. From the whole amount, only one implementation represented DFSS and 9 introduced CAP (ChangeAccelerationProcess).

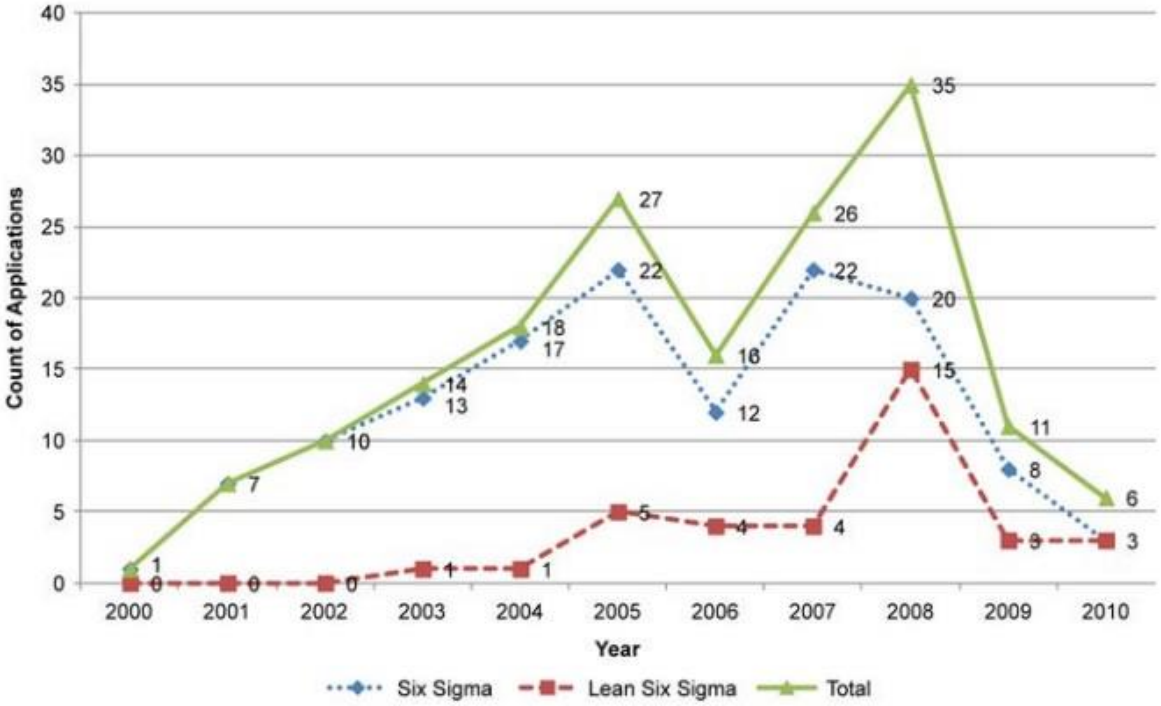

Fig. 1 The implementation of Six Sigma a Lean Six Sigma

Source: Liberatore (2013)

The improvement of processing time (38 %) and reductions of errors are the most often monitored factors, followed by productivity (19,9 %) and errors in

treatment (7,6 %). The primary process, which was monitored within the departments and units was different. Reduction of errors prevailed in administration (65 %). The productivity was priority in outpatients' departments and therapeutic support (35,7 % and 37,1 %), while the treatment time was the most important factor in emergency and institutional care (61,1 % and 41,7 %). From the whole number of monitored units, 67 % stated the improvement of key process, but only 9 % demonstrated permanent improvement. Only 28 % stated costs savings and only 8 % incomes increasing. Within the healthcare organizations has important position the human factor in comparison with equipment and devices, in which example is very hard to quantify the variability. Within the adaptation of Six Sigma is the challenge to find a way, how to utilize data from Six Sigma with aim to manage human behavior. Success is possible only when the technical aspect of Six Sigma methodology is linked with cultural aspect with aim to accelerate the change and operating mechanism (Lasarus, Ian and Neely, 2003). The literature defines four metrics (indicators), which can be used singly or in combination by the identification of performance level in healthcare institutions:

- Level of services
- Costs of services
- Satisfaction of customers
- Clinical excellence

Indicators can be used in healthcare organizations, but they are hardly applicable during the planning processes and the adjustment of healthcare. Despite of many problems linked with usage of Six Sigma in healthcare, many hospitals decided to implement the methodology Six Sigma mainly with aim to improve the satisfaction of patients (Lazarus and Neely, 2003).

Conclusion

According to authors, we mentioned, we cannot prove there is one general solution for all the problems. Methods, that we mentioned can offer significant solution for managerial deciding. But it is still manager, who is in charge to decide which solution is the best for hospital, where he works. There is big space to improve processes in Slovak Republic, and all these methods should be used with regard to other methods.

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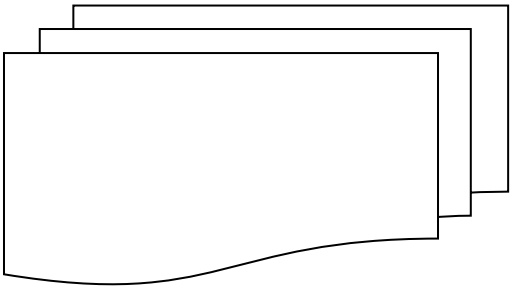

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