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Faculty of Economics**

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# **Liberec Economic Forum 2017**



**11<sup>th</sup> – 13<sup>th</sup> September 2017  
Liberec, Czech Republic, EU**



TECHNICAL UNIVERSITY OF LIBEREC  
Faculty of Economics



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Section I

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# **Economic Theory and Development**





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## Wages in the Czech Regions

### Abstract

The main aim of this paper consists in a comparison of wage level of fourteen regions in the Czech Republic. Clusters with the similar wage levels were created using the method of cluster analysis. Methods of the nearest neighbour and Euclidean distance metric were used within the cluster analysis. Capital Prague Region has definitely the highest level of wages, on the other hand Karlovy Vary Region is the lowest within the whole Czech Republic. One region with the highest and one region with the lowest wage levels were chosen. For these two regions, the model wage distribution was constructed to enable a comparison of wage development during the past seven years. Three-parametric lognormal curves present the basis of the theoretical wage distribution. Maximum likelihood method was used to estimate the parameters of these lognormal curves. Akaike and Bayesian information criterions were used to evaluate the accuracy of the obtained models of wage distribution. Probability models represent simple approximations of frequently complicated empirical distributions. Knowledge of probability models and knowledge of the developmental trends of their parameters form the basis for the construction of estimations of consumption in the future and for predictions of the impact of various social and economic arrangements.

### Key Words

*wage distribution, cluster analysis, method of the nearest neighbour, Euclidean distance metric, Akaike and Bayesian information criterions*

**JEL Classification: J31, D31, E24, C10**

## Introduction

Population wage levels are an object of research for economists of all developed countries, since they reflect the living standards. Knowledge of wage distribution of the population and its comparison from various socio-economic and time-spatial aspects is a precondition for assessing living standards, levels of social security and social equity in dividing material values produced by the society. Statistical analyses of the distribution of wages of the population also form the basis for decisions in the area of state budgets and social policies. Direct connection of wages with purchasing power of the population also puts monitoring the level, structure and development of the wage distribution to the forefront in identifying sales opportunities for products of long-term and short-term consumption.

For these reasons, the theme of labour market analysis and related wages and incomes of the population and the issue of gender wage gap are constantly current, and they are the subject of research of many domestic and foreign authors. For example, Albelda and Carr (2014) track the share of workers with low wages and low incomes and their approach to employee benefits and programs against poverty in the period 1979–2011 in the United States and they examine the changes according to gender and marital status of the worker. Bartošová and Želinský (2013) briefly describe the history of attempts to measure poverty before the split of Czechoslovakia. They focus further detailed analyses on monetary poverty, relative material deprivation and subjective perception of poverty already existing in these two divided countries on the basis of microdata from the EU-SILC statistical survey. Fehr and Ujhelyiova (2013) develop a model of general equilibrium of overlapping generations in Germany for purpose of studying the effect of public policy on labour supply of the households and decisions concerning the number of offspring. Fisher, Johnson and Smeeding (2015) examine the distributions of income and consumption in the United States using one set of data and acquire the characteristics of both, income and consumption from the same set of individuals. Garz (2013) researches how the deregulation of temporary work via agencies in Germany since 2004 affected employment and wages. Gobillon, Meurs and Roux (2015) propose a new measure to measure the differences between the sexes in access to employment on the basis of a model of assignment work. This rate is the ratio of the probability of gaining employment for women and men at each position of the wage ladder. Jakobsson and Kotsadam (2016) research whether a marriage will increase labour productivity among men, where they evaluate the relationship between marriage and the results of labour markets based on the use of EU panel data. Kolev and Robles (2015) analyse the wage disparity by gender in Peru in 2005–2011 using data from a national survey. Liberati (2015) describes the development of income and income inequality in the world from 1970 to 2009 using the Gini coefficient. Malá (2015) deals with the construction of multidimensional probabilistic models of income distribution of Czech households. Siah and Lee (2015) research the short and long-term relationships and causal connections between the female labour force, infant mortality and fertility in Malaysia.

Data for this research comes from the official website of the Czech Statistical Office (CSO). The database for this research represents the wage distribution in total, covering all employees of the Czech Republic divided into regions for the period 2009–2015. There are annual data related to gross monthly nominal wages in the year. For example, average wage then represents average gross monthly wage during the year. There are also data in the form of interval frequency distribution with unevenly wide intervals and open extreme intervals. More detailed data or individual data are not currently available. Because CSO only provides data regarding the nominal wage, the conversion of obtained average nominal wages to the average real wages was carried out using the rate of inflation. CSO provides data on the development of the inflation rate in the period. Because only data on nominal wages were taken from the website of the CSO, it was necessary to use inflation rates to recalculate it to a real wage that reflects the purchasing power of participants to allow a comparison of wage development for the period researched without the impact of inflation. The rate of inflation is based on the consumer price index, which is a Laspeyres price index. The real wage was calculated using the real

wage index, which is calculated as nominal wage index divided by the consumer price index (index of living costs). The data were processed using the SAS and Statgraphics statistical program packages and Microsoft Excel spreadsheets. Data for this research include employees in the business and non-business spheres in the Czech Republic. Wages include employees for work performed in the private (business) sphere and salaries in the budget (national, public, non-business) sector. In terms of the data presented on the website of CSO, the term wages includes both wages in the business sphere and salaries in the non-business sector.

The final 90s years of the last century were a period of transformation for the Czech economy to a market economy. Enterprises were privatized, price liberalization occurred and productive sectors of the national economy were restructured. These changes affected the appropriate methodology of the statistical survey, when it was necessary to change to a combination of exhaustive and sample surveys for the reason of growth of the number of small of entrepreneurial entities. We saw a high rate of inflation especially in 1996–1998, when it failed to fall below 8.5 % and even reached 10.7 % in 1998. On the contrary, in 2003, the rate of inflation reached only 0.1 %. In 2008, the subsequent sharp slowdown in real wages came in the context of economic recession, when the inflation rate reached 6.3 %. The inflation rate currently remains at a very low level (0.3 % in 2015 and 0.7 % in 2016). The impact of financial crisis and ensuing economic crisis, was clearly apparent in the Czech Republic. Although the onset of the global economic crisis can be traced back to the autumn of 2008, the impact of its accession economically became most apparent in 2009, when the Czech economy monitored a decline of 4.8 % as a consequence of the global economic recession. Then a brief revival came that lasted barely two years and during which GDP growth failed to exceed 2.3 %. So enterprises had insufficient time to recover and begin to invest. Other declines into recession followed. The Czech economy fell by 0.8 % in 2012 and in 2013 by 0.7 %. This resulted in what many analysts had already warned in 2010: a protracted recession that could result in a lost decade. Economists consider this a double recession even more severe than the slump in the economy in the period 1997–1998, when the economy fell by less than 1 % of GDP. While in 1999, the Czech economy could boast a GDP growth of 1.4 %, in 2014 we witnessed GDP growth of 2 % followed in 2015 by 4.3 %. For this reason, the period of research was chosen as the seven years of 2009–2015.

## 1. Methods of Research

Cluster analysis was used to allocate the Czech regions into relatively homogenous groups according to the level of gross monthly wages in these regions. Multivariate statistical data analysis, which are often used for processing economic data (see for example Malec (2016)), may include other multivariate methods of statistical data analysis, namely canonical correlation analysis. Řezanková and Löster (2013) deal with the special aspects of cluster analysis. One possibility of the utilization of the information contained in multidimensional observations is classification of the set of objects into several relatively homogenous clusters. We have a data matrix  $X$  of the type  $n \times p$ , where  $n$  is the number of objects and  $p$  is the number of variables. We consider various decompositions  $S^{(k)}$  of the

set of  $n$  objects into  $k$  clusters. We look for those decompositions considered the most appropriate. The goal consists in finding objects within the clusters that are similar as far as possible. We here concede only decompositions with disjunctive clusters. This method is described in detail in Everitt, Landau, Leese and Stahl (2011).

Theoretical aspect of lognormal distribution is amply processed in the statistical professional literature in terms of the course of lognormal curve, its characteristics, methods of point parameter estimation and construction of curve, see for example Johnson, Kotz and Balakrishnan (1994) or Kleiber and Kotz (2003). The importance of lognormal distribution as a model for sample distribution cannot be questioned. This model has found an application in various fields from astronomy, through technology, economics up to sociology. The characteristic features of the process captured using lognormal model are sequential effect of interdependent factors, the tendency to development in geometric sequence and overgrowth of random variability in systematic variability, i.e. differentiation. In the field of economics, wages and incomes of the population are among the many phenomena that the lognormal model allows to interpret. The substance of the maximum likelihood method of point parameter estimation is explained in detail in statistical literature, for example in Johnson, Kotz and Balakrishnan (1995). Simple descriptive measurements were used for characterizing wage distribution, see for example Barber (1988) or Triola (1989).

Some statistical model of data is supposed. We involve  $L$  as the maximum value of the likelihood function for this model,  $k$  represents the number of parameters estimated and  $n$  is sample size. Akaike information criterion (AIC) has the form

$$AIC = 2k - 2 \ln L, \quad (1)$$

and Bayesian information criterion (BIC) is defined

$$BIC = k \ln n - 2 \ln L. \quad (2)$$

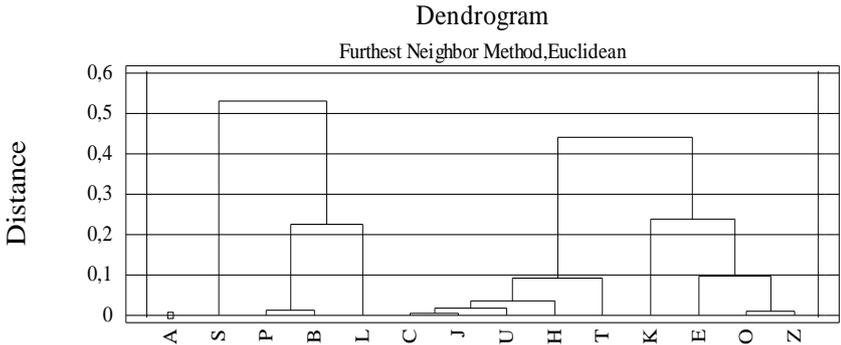
From a number possible models, the preferred model is that with minimal  $AIC$  or  $BIC$  values.  $AIC$  and  $BIC$  also include a penalty that is an increasing function of the number of estimated parameters.

## 2. Results of the Research

Figs. 1–2 provide an overview of the results of cluster analysis of the Czech regions (into three or five clusters) according to the average wage using method of the furthest neighbour and Euclidean distance metric. As for the average monthly wage (three or five clusters), the first cluster always contains only one element, namely the Capital Prague Region, which is due to markedly higher wage levels in this region than in other regions of the Czech Republic. In terms of the separation of regions of the Czech Republic into only three clusters by average wage, the second cluster has four-elements. There are Central

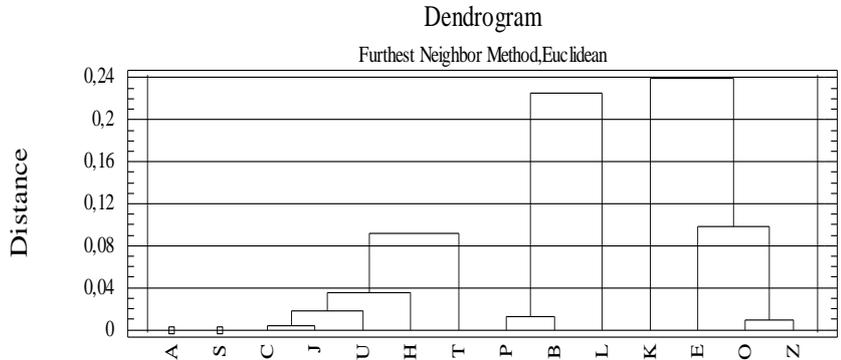
Bohemian Region, Pilsen Region, Liberec Region and South-Moravian Region. The third cluster then contains the remaining regions. According to the separation of regions of the Czech Republic into five clusters by average wage, the second cluster contains only one element, namely the Central Bohemian Region. The third cluster contains five elements. These are the South Bohemian Region, Usti Region, Hradec Kralove Region, Vysocina Region and Moravian-Silesian Region. The fourth cluster has only three elements. There are the Pilsen region, Liberec region and South Moravian Region. The fifth cluster contains the remaining four regions, see Figs. 1–2.

**Fig. 1: Cluster analysis using three clusters, method of the furthest neighbour and Euclidean distance metric, average wage in 2015**



Source: own research

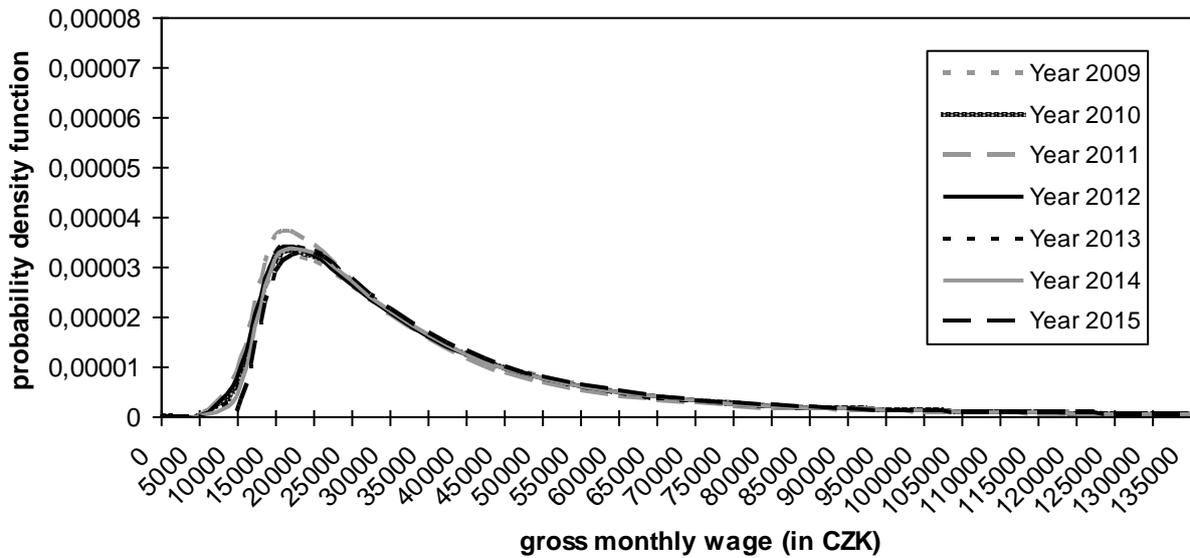
**Fig. 2: Cluster analysis using five clusters, method of the furthest neighbour and Euclidean distance metric, average wage in 2015**



Source: own research

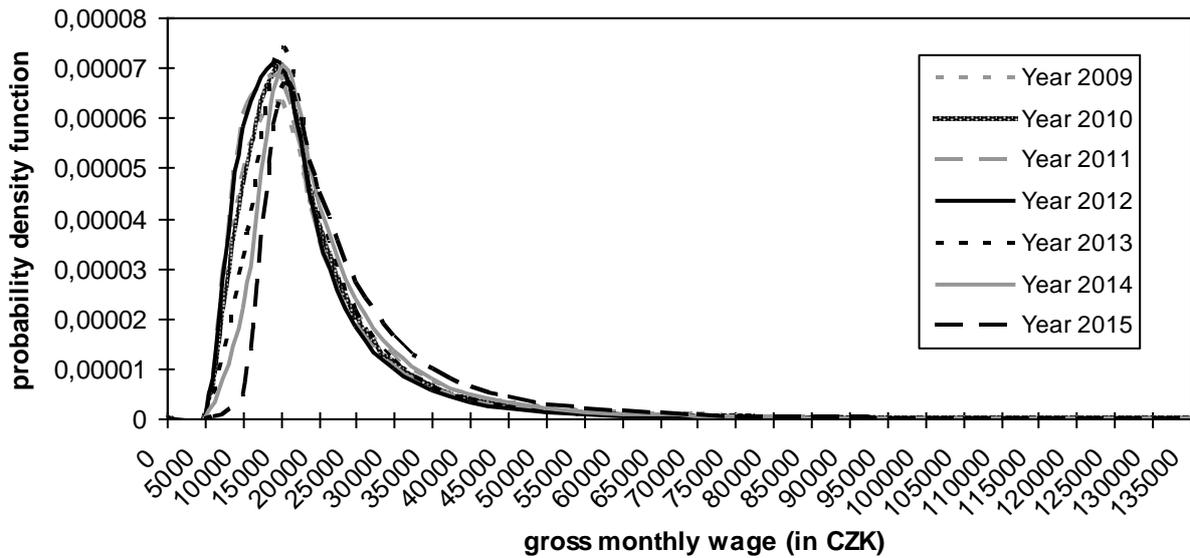
Theoretical wage models of one region with the highest wage level (Capital Prague Region) and one region with the lowest wage level (Karlovy Vary Region) are captured, using Figs. 3–4. These figures enable some comparison of the development of wage distribution of the regions with the highest wages on the one hand and with the lowest wages on other hand during the last seven years. We can see from these figures that wage distributions with higher wage level are also distinguished by higher variability than those with lower wage level. In addition, wage distributions with lower level of wage are more skewed and they have also higher kurtosis than those with higher wage level, see Figs. 3–4.

**Fig. 3: Development of model wage distributions – Capital Prague Region**



Source: own research

**Fig. 4: Development of model wage distributions – Karlovy Vary Region**



Source: own research

### 3. Discussion

Economic changes always lag behind political and other changes, so certain inertia can be seen in the development of wage distribution. Its changes begin to show up importantly till with elapsed time. For example, the impact of the financial crisis, which turned into economic crisis, became fully evident in Czech wages as late as 2011, although the beginning of the crisis can be dated to the autumn of 2008. In terms of development of

wage levels in the Czech Republic, the critical year was 2011. The financial and economic crisis then caused the slowdown in wage growth and its freezing.

Currently, the wage level is increasing in all regions of the Czech Republic, the wages of both men and women growing. Having slowed down between 2010 and 2013, the annual wage growth has accelerated in the whole of the Czech Republic since then, the average wage increasing by more than 2,300 CZK in most regions. The slowest growth was recorded in Moravian-Silesian and Usti regions (by 1,859 and 2,125 CZK, respectively), the fastest in the Central Bohemian region (by 3,260 CZK). The lowest wage level has long been reported in Karlovy Vary region – the average wage was a third lower than in the capital of Prague in 2015, the difference between the two regions gradually diminishing, the greatest one having been in 2011.

## **Conclusion**

The highest and lowest wages are reported in Prague and Karlovy Vary regions, respectively, the average gross monthly wage amounting to 36,371 CZK in the former, compared to only 24,119 CZK in the latter region in 2015. Residents of Central Bohemian, Pilsen and South Moravian regions receive relatively high wages, averaging 27,997, 27,013 and 27,051 CZK, respectively, in the same year. High-income regions, however, are also characterized by relatively wide gender wage gaps.

It follows from the results of the 2015 Living Conditions Survey that net household income per capita increased by 4,400 CZK on average in 2014 (latest data available), compared to the previous year. The annual fall in income occurred only in Vysocina region, the sharpest increase – more than 10 per cent – in Karlovy Vary region, representing an annual growth of more than 14,000 CZK per person in cash. Household income in individual regions varies considerably, depending on local economic conditions. Best-off households are in Prague region, while those in the Moravian-Silesian region report the lowest net income.

Purchasing power of the Czech population currently reaches less than 60 % of the European average. Purchasing power of the Central and Eastern Europeans annually rises by 5 %. However, division into Western European countries on the one hand and Eastern European countries on the other hand is still holding.

## **Acknowledgment**

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# Martina Hedvičáková and Alena Pozdílková

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## Regression Analysis of Mortgage Loans on the Czech Banking Market

### Abstract

The average interest rate fell below 2% in March 2016, and up to now (February 2017) has not been exceeded. The lowest interest rates were applied in November and December. These interest rates amounted to 1.77%, and hence began to rise slightly. High interest of clients in mortgage loans continues due to the low interest rates and the announced reduction in LTV from 95 to 90%. Total number of contracts and their volume still increases. This growing trend is not significantly affected by the rising price of real estate or the entry of the new Consumer Credit Act which deals with the early repayment of mortgage loans. Yet, banks and clients expect growth of average interest rates. The aim of the article is to analyse the development of average interest rate of mortgage loans with an emphasis on their development in individual regions. This paper aims to create a regression model for the amount of mortgage loans and interest rate including their analysis. Correlation analysis demonstrates the level of dependency of the amount of loans on the interest rate. According to the regression model, average mortgage amount is expected to grow; conversely, the average interest rate is expected to decrease.

### Key Words

*mortgage loan, interest rate, LTV, correlation analysis, regression model*

**JEL Classification: C58, G21, C610**

## Introduction

Over the past year, the mortgage credit market has seen significant changes. In June 2016, the Chamber of Deputies approved the Consumer Credit Act No. 190/2004 Coll., (Including Act No. 137/1414 Coll.). Clients will be able to repay their mortgage loans prematurely without sanctions; banks can only charge for expenditure. From April 1, 2017, the maximum mortgage rate on LTV will drop from the current 95 percent to 90 percent on the basis of the CNB's recommendations. At the same time, banks will have to ensure that the proportion of newly negotiated mortgages in the LTV range from 80% to 90% exceeds 15%. (Hypindex, 2017).

# 1. Methodology and goal of the contribution

Mortgage loans are currently a very topical issue and there is extensive mortgage literature on the Czech market. This allows us to get a thorough insight into selected areas of mortgages from different sources that deepen or complement the analyzed issues. The development of mortgage loans in the Czech Republic is part of the overall situation on the Czech market. (Allen, Paligorova, 2015), (Leow, Mues, 2012). (Revenda, 2014), (Hedvičáková, Svobodová, 2016), (Palmroos, 2016), (Soukal, Draessler, 2015).

This article is based on the analysis of literature and professional publications. Important information is available on the official websites of individual banking institutions such as the Czech National Bank, the Czech Statistical Office and some financially oriented portals such as Hypoindex, GolemFinance, etc.

This article aims to analyze and create a regression model for individual mortgage loans and interest rates. The comparative analysis will show the degree of dependence on the amount of loans on the interest rate in 2015-2016. The partial aim of the article is to analyze the current situation on the Czech mortgage with an emphasis on the development in the last year 2016 and the situation in the summer months, these products. The situation will be outlined in the first quarter of 2017.

## 2. Development of Mortgage loans in the Czech Republic

### 2.1 The current situation in the mortgage market in the Czech Republic

Interest rates in the Czech Republic in 2016 reach record low levels, but interest in mortgages is beginning to decline. In July 2016, a mortgage loan of 7,615 people was negotiated in the Czech Republic (see Table 1), which is the second lowest number for the year after January. This is a decrease of 4,709 contracts compared to June 2016. By analyzing the previous 7 years, there is a decrease in the number of concluded contracts in July compared to June, but this year's decrease is considerable.

**Tab. 1: The number of mortgage loans over the past 5 years**

| Year | 2012 | 2013  | 2014 | 2015  | 2016  |
|------|------|-------|------|-------|-------|
| June | 7062 | 10613 | 8938 | 10794 | 12324 |
| July | 5636 | 8770  | 8352 | 9574  | 7615  |

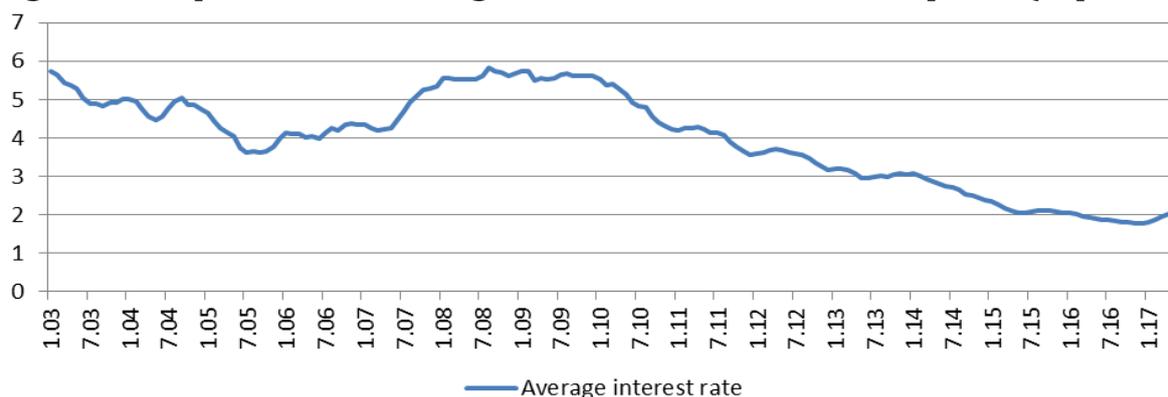
*Source: Hypoindex, (2016), own processing*

Compared to June 2016, the volume of mortgage loans is also lower. In July 2016, mortgage loans were negotiated for CZK 15.225 billion. Two years ago it would have been a great result, but in the current situation of record low interest rates, the volume of loans

is not so positive. On the other hand, volumes were better than the rest of the year. With the value of CZK 15.225 billion it is "only" the third lowest volume this year.

Volumes and numbers declined in July, but the average amount of the mortgage went up to two million crowns. On average, people lent 1999 405 crowns, the second highest amount this year. In July, the average interest rate declined to just 1.88 percent (see Figure 1). Most banks will launch their products in the autumn. For this reason, we can expect a slight recovery at the end of this year.

**Fig. 1: Development of the average interest rate in the Czech Republic (in percent)**



Source: Hypoindex, (2016), own processing

In 2016, the interest rate on mortgage loans declined. This trend should be halted in 2017, according to the forecasts of financial institutions, and from the second quarter the interest rates will rise. In addition, the availability of mortgage loans is expected to deteriorate. At the recommendation of the Czech National Bank it will be possible to borrow only up to 90 percent of the value of the property collateral. (Hypoindex, 2017). In order to eliminate the risk for the bank, banks themselves have lowered LTV limits. Some banks lend up to a maximum of 70% LTV or significantly increase interest rates with a rising LTV. In February 2017, the average interest rate on mortgages rose by 0.05% to current 1.87%, to June 2016 (see Figure 1).

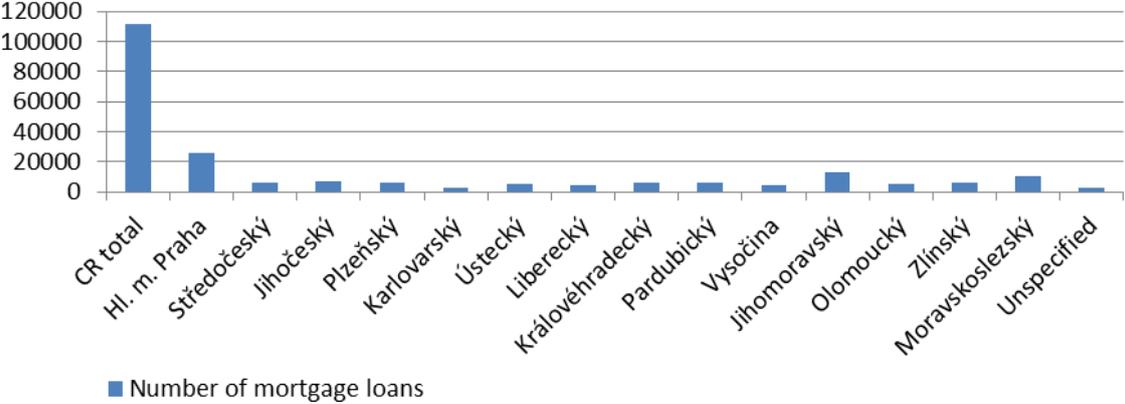
**Tab. 2: Summary data Fincentrum Hypoindex - February 2017**

| Change over previous period        |                    |
|------------------------------------|--------------------|
| Number of new mortgages            | 9413               |
| The volume of new mortgages        | 18.950 billion CZK |
| Average amount of the mortgage     | 2 013 220 CZK      |
| Monthly payment 1mil. for 20 years | 4 996 CZK          |
| Monthly payment 1mil. for 15 years | 6 374 CZK          |
| Loans effectiveness                |                    |
| Share of loans to purchase         | 60 %               |
| Share of loans for construction    | 20 %               |
| Share of other loans               | 20 %               |

Source: Hypoindex (2016), own processing

Table 2 shows that there is a growing interest in new mortgage loans. In February 2017, 9413 new loans were added (an increase of 748 clients more than in January 2017) in the total amount of CZK 18.950 billion, which is CZK 1.418 billion more than in January 2017. The average mortgage also rose to CZK 2,013,220.

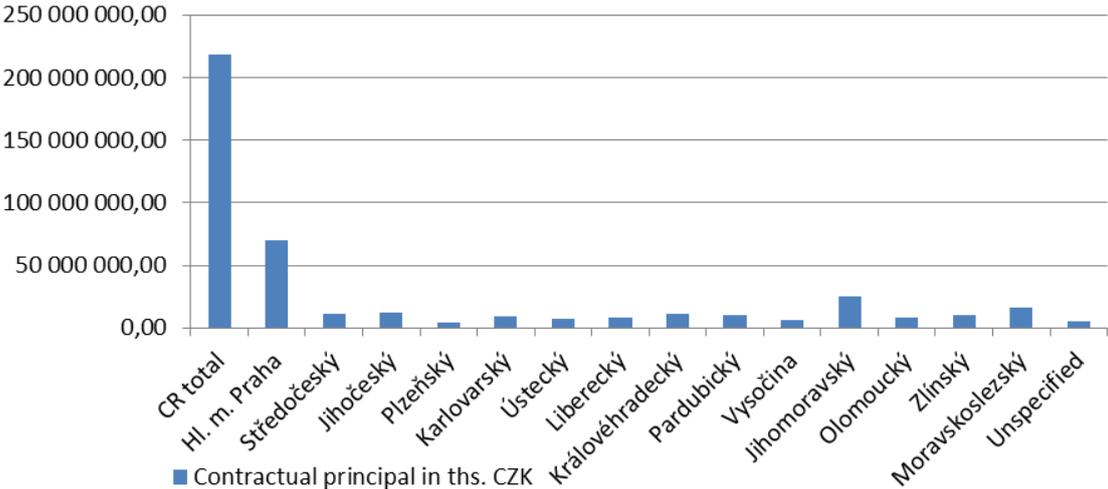
**Fig. 2: Number of mortgage loans in 2016 in pcs - citizens**



Source: MMR (2017), own processing

For the year 2016, 111,520 mortgage loans were closed in the Czech Republic. The largest part was concluded in Prague with 25,553 contracts. Most mortgage loans were also closed in the South Moravian Region with 12803 items and the Moravian-Silesian Region with 9998 items. The other regions did not exceed 7,000 mortgage loans (see Figure 2). Under 4,000 mortgage contracts and at the same time the region with the lowest number of contracts was Karlovarský with 2579 pieces.

**Fig. 3: Contractual principal in thousands, CZK in January - December 2016 - citizens**



Source: MMR (2017), own processing

The contractual principal in the Czech Republic was 218,290,717 thousand in 2016. CZK. CZK 69,540 million was the principal for Prague and the second highest in the South Moravian region was CZK 24,746 million. In the Moravian-Silesian Region, the contractual

principal was CZK 16,389 million. The Central Bohemian, South Bohemian, Hradec Králové, Zlín and Pardubice regions were the principal between CZK 12 and 10 billion. The lowest contractual principal was CZK 3,782 in the Pilsen Region (see Figure 3).

### 3. Regression analysis

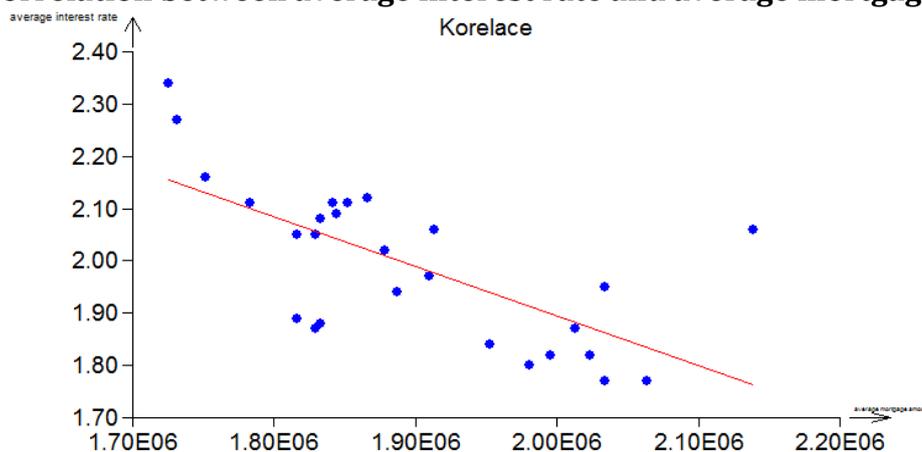
In this part regression models will be analyzed. (Hebák, 2007), (Romesburg, 2014). Regression models are properly assembled, the quality of the model is verified based on the p-values for the parameter beta b (the parameter is statistically significant at a level of 0.05, p-value is less than the significance level), the quality of the entire regression model is satisfied (p-value 0.0000), determination index is less than the statistic Durbin - Watson - it is not apparent regression. These statistics were applied to all models.

Based on the regression model, the average interest rate can be expected to grow, with the average mortgage amount predicting a declining trend. The regression coefficient indicates how many variables it will change when the time unit is incremented by one unit. A positive sign means that the value will increase with the increase in the number of time units, the negative sign means that the value of the variable will decrease with the increase in the time unit.

#### 3.1 Correlation analysis

Spearman's correlation coefficient was used for the correlation analysis. There was a negative correlation of -0.6617647059 between the variables - the average interest rate and the average amount of the mortgage. There-fore, the variables are linearly dependent on each other and it has been shown that the average interest rate significantly affects the amount of the mortgage loan.

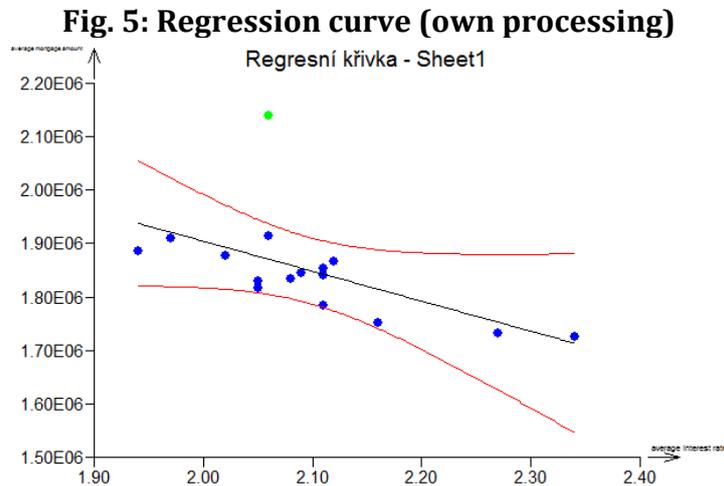
**Fig. 4: Correlation between average interest rate and average mortgage amount**



Source: own processing

### 3.2 Regression model

The average amount of the mortgage loan was selected as an independent variable and the average amount of the interest rate as a dependent variable. For the following analysis, the linear model  $Y = A + Bx$ , where  $A = \text{Abs} = -15643207.62$ , is used and  $B$  is the average interest rate, i.e. the dependent variable, see Figure 5.



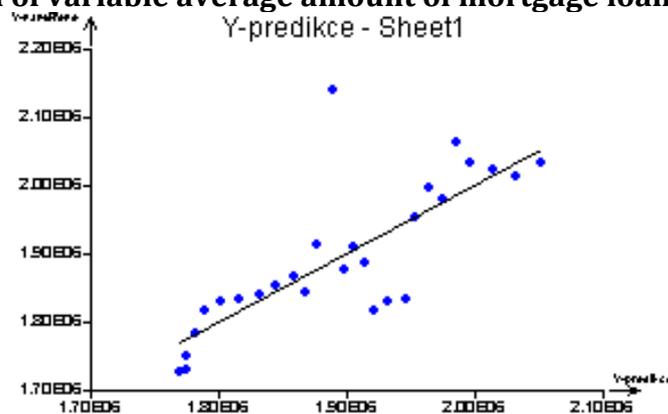
Source: own processing

Determination index = 0.3358014479, due to a small range of input data. The model demonstrated the statistical significance of parameter  $B$ . Wald autocorrelation test also demonstrated the correctness of the model used, autocorrelation of the data used proved to be below the level of statistical significance. Using the sign test, it was shown that the data did not show a trend.

### 3.3 Prediction for the next period using regression models

Following figures show predictions for the next period using regression model.

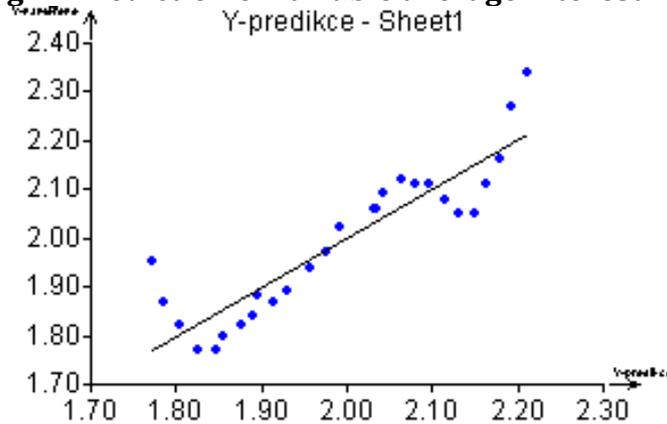
**Fig. 6: Prediction of variable average amount of mortgage loan (own processing)**



Source: own processing

In the first model is independent variable average amount of mortgage loan and in the second model is independent variable average interest rate. From the regression model can be seen, that the average interest rate can be expected to grow, with the average mortgage amount predicting a declining trend.

**Fig. 7: Prediction of variable average interest rate**



*Source: own processing*

## Conclusions

In June 2016, the Chamber of Deputies approved the Consumer Credit Act Act No. 190/2004 Coll., (Including Act No. 137/1414 Coll.). The law will strengthen the position of consumers in the financial market and clarify the credit market. The law sets maximum penalties for late repayments. Additionally, before the sale of the property the lender has in custody, the consumer has to provide 6 months to repay the debt. People will be able to repay the mortgage prematurely without penalty, while banks will only charge for expense. "The Ministry of Finance has long been of the opinion that repayment of the loan should not be penalized," says Czech Finance Minister Andrej Babiš. The question in the discussion is the impact this new law will have on the level of interest rates. (MFCR, 2016)

As of 31 March 2017 mortgage loans are also terminated up to 95% of the value of the property collateral. From April 1, at the recommendation of the Czech National Bank, it will be possible to borrow only up to 90 percent of the value of the property collateral. In addition, banks will need to ensure that the proportion of newly negotiated mortgages in the LTV range from 80 to 90 percent does not exceed 15 percent. (MFCR, 2017)

From April 1, 2017, the maximum mortgage rate on mortgage (LTV) will fall from the current 95 percent to 90 percent on the basis of the CNB's recommendations. At the same time, banks will have to ensure that the proportion of newly negotiated mortgages in the LTV range from 80 to 90 percent does not exceed 15 percent. (Hypoindex, 2017)

Although interest rates are the lowest since the Czech Republic's emergence, real estate prices are rising in recent years. Clients get into a paradox where they can borrow at very

low interest rates, but apartment prices are on the contrary at the highest price per square meter. According to the regression model, average mortgage amount is expected to grow; conversely, the average interest rate is expected to decrease.

## Acknowledgment

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## Selected Aspects of Road Cargo Transport in Poland

### Abstract

The paper is an attempt to look into currently actual structure and level of development of the sector of road cargo transport for hire or reward in Poland in its selected areas. The research measurements were based on the questionnaire utilized in the survey, directed at the representatives of the investigated business entities. The applied cognitive method was the survey in the framework of which there was categorized the technique to obtain primary information – the questionnaire. A sample of 147 filled questionnaire forms of 147 commercial cargo motor transport enterprises located in the Silesian Voivodeship (Southern Poland) created the sufficient representation of the population tested. There have been presented selected results of the conducted research with reference to the number of employees in the surveyed companies, the volume of their annual net turnover from sales and also motor vehicle fleet meeting the requirements of environmental protection, i.e. the number of motor vehicles having EURO environment class, the number of the possessed trailers, semitrailers and types of unpowered fleet. The obtained research results have been related to the nationwide results of selected aspects of the operation of the companies of the road cargo transport sector throughout Poland.

### Key Words

*road cargo transport, management, questionnaire*

**JEL Classification: L91, Q56, R41**

## Introduction

Since the beginning of the nineties of the twentieth century in Poland there has been the evolution of the conditions concerning different aspects of the performance of road transport, including road cargo transport for hire or reward, both with reference to the adjustment to the requirements of market economy and the solutions applied in this field in the European Union (European Commission 2011). The current period of development of the concept of transport system significantly accelerated and deepened in recent years, has been favorable for service activities of road cargo transport also in the region of the Silesian Voivodeship (Southern Poland).

Road cargo transport, particularly for hire or reward, is one of the least recognized segments of transport market which mostly results from the lack of statistical data, referring to both enterprises and vehicles, but also the lack of provisions regulating the principles of the operation of this segment in Poland to 2001 inclusive (Materials by the Ministry of Infrastructure 2016). In the paper, there has been made an attempt to look

into currently actual structure and level of development of the sector of road cargo transport for hire or reward in Poland in its selected areas. The aim of the paper is to present conditions of the operation of enterprises of the road cargo transport sector in the Silesian Voivodeship in Poland.

## **1. Methods of Research**

In order to identify the subjected area of chosen conditions of functioning within the investigated companies, the measurements were based on the questionnaire utilized in the survey, directed at the representatives of the investigated business entities (Nogalski 2011). The applied cognitive method was the survey in the framework of which there was categorized the technique to obtain primary information – the questionnaire. A sample of 147 appropriately filled questionnaire forms of 147 commercial cargo motor transport enterprises located in the Silesian Voivodeship (Southern Poland) created the sufficient representation of the population tested.

Within the greater part of instances, survey forms were distributed to the respondents by traditional mail, which was 650 forms, 19 forms were provided to the respondents in person, whereas 330 forms were delivered by electronic mail. As about the results of return rate, very little number of filled questionnaire forms was achieved for the final stand for of delivery. The group of 34 representatives of the enterprises sent away filled forms by electronic mail, of which, winning preface viewing, 7 forms were abandoned appropriate to the rawness or unpredictability of given data - the level of return rate of the questionnaire form return rate was of 8.18%. Through traditional mail, 136 forms were given back, and of which, winning preface selection for the rawness or untrustworthiness of indicated data, 31 forms were redundant - here the level of return rate of the questionnaire forms was of 16.15 %. The maximum return rate of filled questionnaire forms was achieved for their delivery attained for personal service: 17 representatives of enterprises properly filled their forms and the level of return rate was of 89.47 %. In total, of the entire 999 delivered questionnaire forms, 147 full forms appropriate for following assessment were accepted, which built a whole questionnaire form return rate of 14.91% (Kadłubek and Grabara 2015).

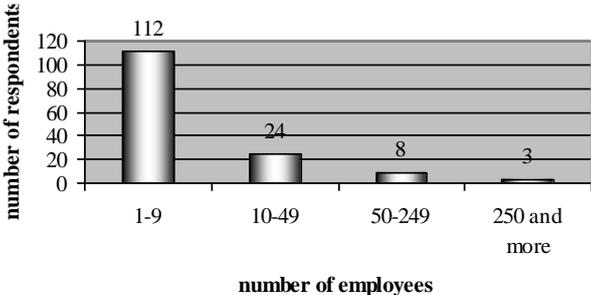
Below there are presented the selected results of the conducted research with reference to the number of employees in the surveyed companies, the volume of their annual net turnover from sales, and also motor vehicle fleet meeting the requirements of environmental protection, i.e. the number of vehicles with EURO environment class, the number of the possessed trailers, semitrailers and types of unpowered fleet.

## **2. Results of the Research**

As the analysis of the responses to the first two questions included in the questionnaire indicates, among 147 surveyed companies, the distribution of employment was the

following: 112 enterprises (76% of all the surveyed ones) employed up to 9 people, and 24 respondents (16.5%) – from 10 to 49 people. Few entities of the research sample employed from 50 to 249 people, while constituting 5.5% of the research population (8 enterprises), whereas the smallest share fell on the companies employing 250 and more – only 3 entities (2%). The structure of the surveyed companies by the number of employees is presented in Figure 1.

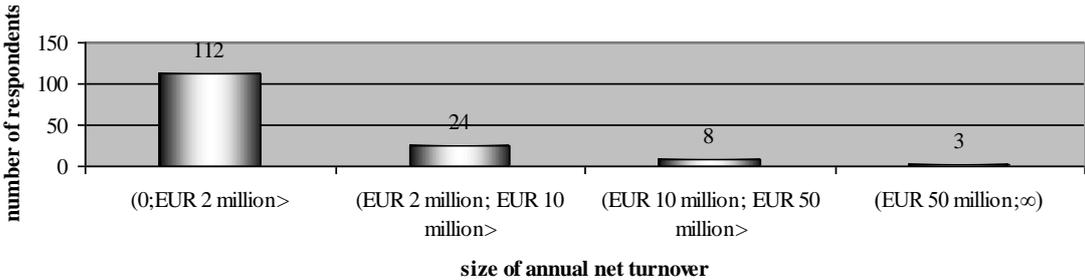
**Fig. 1: The structure of the surveyed companies by the number of employees**



Source: authors' own elaboration

Annual net turnover from sales amounting to up to EUR 2 million in its last financial year was declared by 112 surveyed companies (76%), and 24 ones (16.5%) recorded their annual net turnover higher than EUR 2 million but not more than EUR 10 million. Only 5.5% of the research sample (8 companies), in the last financial year, reached more than EUR 10 million (up to EUR 50 million) of annual net turnover from sales and even smaller percentage of the entities reached more than EUR 50 million – 2% of all the respondents (3 enterprises). The structure of the surveyed companies by the size of annual net turnover from sales is presented in Figure 2.

**Fig. 2: The structure of the surveyed companies by the size of annual net turnover from sales**

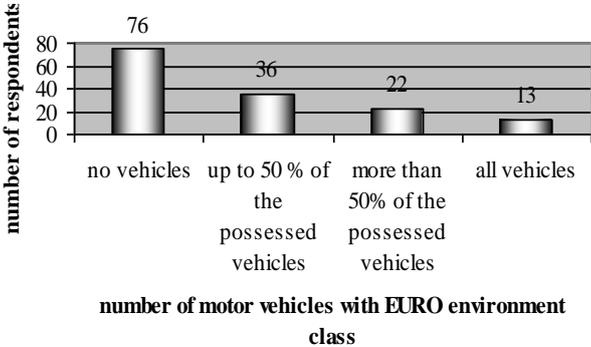


Source: authors' own elaboration

Motor vehicle fleet of 147 surveyed companies was analyzed, among others, in relation to meeting the requirements of environmental protection. In the questionnaire, there was formulated the question concerning the number of moto vehicles having EURO environment class (I, II, III, IV, V or VI). Nearly half of the surveyed enterprises, since 71 (48.3%), informed on having EURO certificates for their vehicles, whereas the number of green vehicles amounted to 100% of the possessed fleet in the case of 13 enterprises (8.8 %), less than 50% in the case of 36 enterprises (24.5%) and more than 50% in the case of 22 companies (15%).

The other respondents, i.e. 76 enterprises (51.7%), admitted having no vehicle of environment class. The structure of the surveyed companies by the number of motor vehicles having EURO environment class (I, II, III, IV, V or VI) is illustrated in Figure 3.

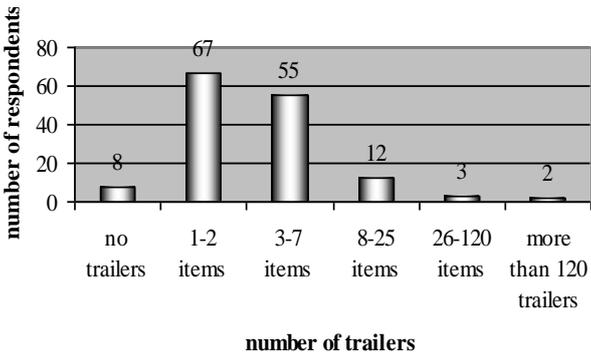
**Fig. 3: The number of motor vehicles with EURO environment class (I, II, III, IV, V or VI)**



*Source: authors' own elaboration*

Apart from motor vehicles representing the means of road transport powered by engine, the surveyed representatives of the companies also revealed the use of unpowered fleet in the conducted activity, i.e. trailers and semi-trailers. In the subsequent point of the questionnaire, the respondents were requested to indicate the numerical interval including the number of trailers owned by the company. Among 147 surveyed companies only 8 (5.4%) did not possess a single trailer. The largest number of companies, since as much as 67 (45.6%), had one or two trailers. The number of this unpowered fleet, in the range of three to seven vehicles, was selected as the real one for 55 enterprises (37.4%). The belonging to the range of 8 to 25 items of the possessed trailers was declared by 12 entities (8.2%) whereas the range of 26 to 120 trailers was declared by only 3 enterprises (2%) from among all the respondents, and more than 120 trailers – 2 companies (1.4%). The structure of the surveyed companies by the number of the possessed trailers is presented in Figure 4.

**Fig. 4: The number of the possessed trailers**

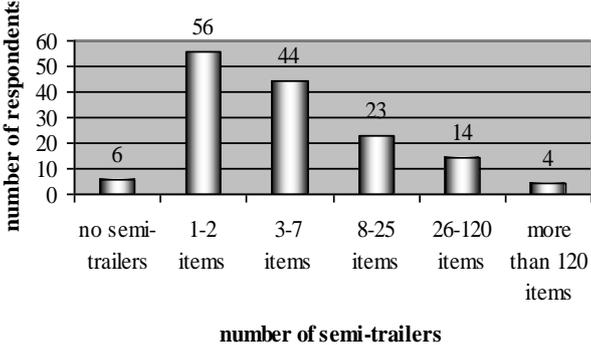


*Source: authors' own elaboration*

Another issue referred to in the questionnaire was the number of semi-trailers owned by the surveyed companies. From among the adopted research sample of 147 enterprises,

barely 6 (4%) did not have a single semi-trailer. The largest number of the surveyed companies, since as many as 56 (38.1%), had one or two semi-trailers. The number of this unpowered fleet, in the range of three to seven vehicles, was selected as the real one for 44 enterprises (30%). The belonging to the range of 8 to 25 items of the possessed semi-trailers was declared by 23 entities (15.6%), whereas 26 to 120 was owned by only 14 enterprises (9.58%) from among all the respondents and more than 120 trailers – 4 companies (2.72%). The structure of the surveyed enterprises by the number of the possessed semi-trailers is shown in Figure 5.

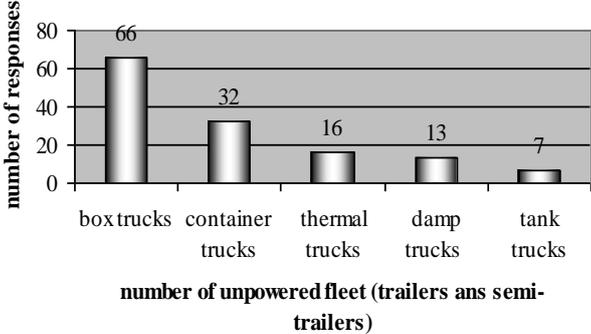
**Fig. 5: The number of the possessed semi-trailers**



*Source: authors' own elaboration*

In the responses to the subsequent issue referred to in the questionnaire, the respondents indicated more than one of the listed options. Therefore, the size of individual shares was indicated with reference to all the given responses and not to the number of the respondents taking part in the research.

**Fig. 6: Types of the possessed unpowered fleet (trailers and semi-trailers)**



*Source: authors' own elaboration*

On account of a different type of transported cargo, its intended use and type of packaging of goods, the unpowered fleet (trailers and semi-trailers) is subjected to classification into different types. The subsequent issue of the research tool was related to the classification of these means of road cargo transport into five main types used in the surveyed enterprises. The obtained responses clearly indicate the popularity of the unpowered box fleet – this type of the possessed trailers and semi-trailers was indicated by as many as 66 enterprises (49.2%). Common trailers and semi-trailers of the container type were also possessed by a

significant part of the research sample, i.e. 32 companies (23.9%). In the case of the unpowered thermal fleet (e.g. isotherms or refrigerator trucks for transport of food products), there were recorded 16 entities (11.95%) declaring their possession. The smallest share in the total of the research sample was recorded for damp trucks (for transport of bulk cargo) – they were possessed by 13 companies (9.7%), and tank trucks (for transport of liquid cargo) – they were owned by 7 enterprises (5.25%). The distribution of the shares of the listed types of the unpowered fleet (trailers and semi-trailers) owned by the surveyed companies, in all the obtained responses, is presented in Figure 6.

### **3. Discussion**

As already mentioned, the survey was conducted among 147 companies of road cargo transport for hire or reward operating in the area of the Silesian Voivodeship. As a result of the processing and analysis of empirical material there has been obtained the above information, presented in accordance with the division by subject applied in the questionnaire characterizing selected aspects of the profile and economic potential of selected transport companies of the indicated region, referring mostly to the motor vehicle fleet meeting the requirements of environmental protection. The obtained research results must be referred to the nationwide results of the selected aspects of the operation of the companies of the sector of road cargo transport for hire or reward throughout Poland. Indication of this reference point aims to broaden the framework of presentation of the conditions of operation of enterprises of the road cargo transport sector in the Silesian Voivodeship in Poland.

According to the data by Central Statistical Office (2015), in 2015 road transport was used to carry 1505.7 million tons of freight. The share of transport for hire or reward in general transport amounted to 59.2% whereas in transport work the share of transport for hire or reward reached the level of 85.1%. Transport for hire or reward was used to carry 892.0 million tons (by 2.0% more than a year before), and transport work was higher by 5.4%.

The achieved amount of cargo transport by road expressed in ton-kilometers amounted to 14.5% in general transport of the European Union, which puts Poland in the second position among 28 countries of the European Union, behind Germany and ahead of Spain and France. In international transport Poland had even a larger share since more than 25%, and held the first position ahead of Spain and Germany.

In 2015, in road transport for hire or reward, a dominant share (79.0% in tons and 86.6% in ton-kilometers) belonged to the companies included by Polish Classification of Activity in section H „Transportation and storage”. These companies carried 705.0 million tons and performed transport work at the level of 201.3 billion ton-kilometers (i.e. by 6.8% more than in 2014). In these companies, there dominated small companies (up to 9 employees), whose share amounted to 61.9% in cargo transport and 31.6% in transport work expressed in ton-kilometers. The fleet of transport companies of up to 9 employees was used to carry 268.3 million tons.

Average employment based on employment contract throughout the whole transport sector amounted to 521.0 thousand people in 2015 and it was by 3.0% higher compared to 2014 (in the public sector it fell by 13.9%, and in the private sector it increased by 10.6%). Gross profit achieved by the units with the number of employees of more than 49 people amounted to PLN 4303.2 million in 2015, and net result increased from PLN 2027.1 million in 2014 to PLN 3382.9 million in 2015. Gross profitability ratio amounted to 4.4% and net profitability ratio rose from 2.2% in 2014 to 3.5%.

The total number of trailers in road transport for hire or reward in truck fleet amounted to 7046 items with loading capacity of 77928 tons, including trailers of up to 10 tons amounting to 34%, whereas of over 10 tons amounting to 66% of the total number of trailers. On the other hand, the total number of semi-trailers in road transport for hire or reward in truck fleet amounted to 59 676 items with loading capacity of 1501710 tons, including semi-trailers of up to 20 tons amounting to 2.3% of the total number of semi-trailers, whereas of more than 20 tons – as much as 97.7%.

According to General Inspectorate of Road Transport (2017), in 2015 there was a decrease in the number of issued certificates confirming the compliance with relevant vehicle safety requirements or conditions for entry into service (there were issued a total of 7847). The largest number of certificates is issued for semi-trailers, vehicles with Euro 5 standard, and also the ones with Euro 6 standard. As for truck vehicles with Euro 6 standard, there are 26691 whereas a year before there were registered 8270 vehicles of this type. Also there is an increasing number of vehicles with Euro 5 standard on the market (in 2015 there were registered 85834 items and 79515 in 2014).

## **Conclusion**

The situation of the sector of road cargo transport for hire or reward in Poland, subjected to the analysis based on the study of primary and secondary sources of information, both external and internal, allows for some conclusions. The conclusions coming from the analysis allow to formulate the statement that the operation of the companies of road cargo transport for hire or reward in a situation of permanent changes in the conditions of management, taking place on the Polish market of transport services, as a result of different factors, amounts to the ability to maintain the existing or to create new competitive advantage, also when facing the need to meet the requirements of environmental protection.

As a EU member, Poland must introduce regulations and directives that apply directly to the issues related to the environmental performance of transport and sustainable development. An example is the so-called EURO standards defined by European Commission Directives: 91/441/EC, 94/12/EC, 98/69/EC and 2007/715/EC, applicable to engines in commercial road transport. The new standards provide for increasingly stringent exhaust gas emission standards.

The predictions of the majority of researchers (Burnewicz 2015, Nowicka-Skowron 2009, Wojewodzka-Krol and Rolbiecki 2013), referring to the directions of development of road cargo transport in Poland, are diversified depending on the time horizon. In the coming year, the significance of road cargo transport will be maintained at the current level, with the occurring downward trend as a result of the State intervention such as the implementation of charges related to environmental protection or administrative regulations in the form of traffic restrictions. Nowadays, road transport is an expensive link in the integrated supply chains but the relation of prices to other branches is not significant enough to compel customers to use eco-efficient (Mesjasz-Lech 2012) and infrastructurally effective branches, even for long-distance transport routes. In the subsequent period, the role of road transport will be significantly reduced. The main reasons for this trend will be stabilized, implemented charges of users of road infrastructure and environmental charges as well as the development of intermodal transport. The assumption that during this period there will be an effective link of the transport network with the location of points of production and points of its reception seems to be real. There is predicted the development of the operation of fully integrated eco-friendly transport chains, both nationally and internationally.

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## Impact Assessment of the CETA for the Czech Economy through CGE Modelling

### Abstract

The goal of this article is to quantify the impacts of the Comprehensive Economic and Trade Agreement concluded between Canada on one side and the European Union and its member countries on the other side (hereinafter the CETA only) on the Czech national economy. The CETA, as a modern agreement on international trade, modifies not only the international trade tariff barriers, but primarily the non-tariff barriers (NTBs), whose quantification is relatively complicated. With the exception of some agricultural products, CETA eliminates customs tariffs on all goods and also diminishes technical barriers to trade, especially double testing in selected groups of industrial goods.

The Computable general equilibrium (CGE) model was selected as an impact estimation tool. The Global Trade Analysis (GTAP) database was used for the impact quantification purposes. The applied model's discussion and its calibration for the purposes of quantification of the CETA's impacts are included in this article. The results represent the quantified changes in the area of both the tariff and non-tariff trade barriers between the EU, or Czech Republic, and Canada. In the conclusion, the CGE model results applicable to the Czech Republic are commented upon, and recommendations on the CETA implementation are made for the Czech Republic.

### Key Words

*CGE model, CETA, tariff and non-tariff trade barriers, GTAP*

**JEL Classification: F11, F17**

## Introduction

The official discussions on the Comprehensive Economic and Trade Agreement between Canada on one side and the European Union and its member states on the other side (hereinafter the CETA only) began on 6 May 2009, during the joint summit of Canada and the EU in Prague, and ended on 1 August 2014. The European Union published the CETA consolidated text on 26 September 2014. (EC, 2014) Upon its successful ratification at the European Parliament on 15 February, 2017, the ratification process is to be successfully completed through the approvals of all the EU member countries' national parliaments. The CETA will be submitted for ratification to both Chambers of the Parliament of the Czech Republic during the first half of 2017. The submitted documentation also includes a national study of the CETA's impacts on the economy of the Czech Republic. The goal of this article is to quantify the CETA's impacts on the Czech national economy, specifically

in the area of elimination of the tariff and non-tariff trade barriers concerning the goods and services exchanged between the Czech Republic and Canada.

With the exception of some agricultural products, CETA **eliminates customs tariffs** on all goods (EC, 2016). The majority of customs tariffs will be eliminated once the agreement becomes effective, and a small part of them will be eliminated three, five, or seven years later. This primarily applies to agricultural production since the EU pledged to eliminate 92.2 % of the customs tariffs once CETA becomes effective, and 93.8 % of them seven years later. Once CETA becomes effective, Canada will eliminate 90.9 % of its agricultural tariffs and 91.7 % of them after seven years. Almost all the customs tariffs on industrial products will be eliminated when CETA becomes effective, only the customs tariffs on transportation means like automobiles, buses, caravans, etc. will be eliminated no later than within 7 years after CETA becomes effective (EC, 2016).

Duties on the other types of goods are already quite low. The EU's customs tariffs imposed Canadian imports represent approximately 1.94 % of the imported Canadian goods value, while the Canadian customs tariffs applied to goods imported from the EU represent on average 2.42 % of the imported European products value. Somehow different circumstances are faced by the Czech exporters who are exposed to the Canadian average import tariff of 3.23 %, while Canadian goods exported to the Czech Republic is subject to the average customs tariff of 2.32 % *ad valorem*.

The volume of goods exchanged between the Czech Republic and Canada is basically **marginal** for both parties. The Czech products exported to Canada only represent 0.2 % (2010 – 2015 average) of the total Czech exports. The Canadian products imported from Canada represent 0.13 % of the total Czech imports. Canada is only the 46<sup>th</sup> most critical business partner of the Czech Republic. In 2010 – 2015, the average annual export of Czech goods from the Czech Republic to Canada reached about 4.9 billion CZK, while the Canadian imports were about 3.5 billion CZK on average. In the recent years, the Czech exports demonstrated a growing tendency. In 2015, they reached 6.4 billion CZK. Contrary to that, the Canadian exports' value reached during the past six or seven years has been stagnating at about 4 billion CZK. Resultantly, the foreign trade balance shows a surplus on a long-term basis in favour of the Czech Republic.

The Czech producers who export their goods to Canada currently only deal with greater **customs (tariff) burdens** in connection with their exports of clothing and leather products (almost 17 % on average), textile (7.8 % on average), and specific food products not specified elsewhere (7.5 %). Their wood products are subject to the average customs tariff of 6.3 %, and in the case of the automotive production, it is 6 %. Canada imposes its five-percent customs tariff on petroleum and coal products and other specific products of the processing industry.

The Czech exporters face the greatest **non-tariff** barriers on the Canadian market during their iron exports (4.8 % of their exported goods), metallic products (3.2 %), and some agricultural products. The other sectors of the Czech national economy suffer from non-tariff barriers, which do not exceed 3 % of the exported goods value *ad valorem*.

The estimation of the CETA's impacts on the Czech economy was achieved through the Computable General Equilibrium (CGE), which is based on the GTAP world trade database operated by the Purdue University in West Lafayette, Indiana, USA. The CGE method and GTAP database represent one of the most advanced analytical instruments applied to macroeconomic impacts of economic shocks. They include, for example, the quantification of the impacts of changed economic and trade strategies used by numerous international organizations (OECD, WTO, WB, etc.). It is used both by the team of Colin Kirkpatrick (Kirkpatrick et al., 2011) for its estimates of CETA's impacts on the EU's economy and Joseph Francois and Olga Pindyuk for their assessments of CETA's impacts on the Austrian economy (Francois and Pindyuk, 2013). The GTAP database underpins thousands of economic model applications worldwide and to date, the GTAP website contains more than a thousand International Trade studies (Aguiar et al., 2016).

## 1. Methodology and Assumptions

The CGE models were created in order to find a way of predicting economic strategy's impacts on complex and interconnected systems: e.g. a single customs tariff change's impact on multiple markets of a given economy or even more markets of more economies (regions). One of the lines of the CGE models development may be seen as a direct extension of the input-output analysis application, in which the original input-output analysis weaknesses like the absence of induced effects or substitutions among products, semi-finished products, or production factors are compensated for through the inclusion of economic behavioural models of firms, consumers, and selected limitations (budgets, maximum debt, trade balance setting, etc.).

There are two basic limitations that must be followed during the model design: availability of data necessary for the model's basic calibration and mathematical solubility, i.e. the correct number of exogenous variables and parameters, since the number of variables used in CGE models exceeds the number of their equations. It means that reaching usable results requires adding the correct number of "variables" to the model from outside. Despite the fact that even the CGE basic model in the GTAP database may only be described as extremely comprehensive and complex, there are still numerous factors that are not included in the model and its results (Burfisher, 2012):

1. Neither the model, nor the database works with any product quality differences. For example, they do not consider any potential changed quality impacts on value provided to the consumers. In these days, there is probably no sufficiently empirical model (and database), which would be completely able to process this requirement.
2. The results do not significantly reflect on any potential impacts in the form of expanded consumer choices that are often associated with the trade liberalization.
3. Neither the basic GTAP model structure, nor GTAP database directly includes any data on non-tariff barriers. This data must be either added to the model from outside, or these barriers' impacts must be approximated through other parameters.
4. The model does not analyse impacts on foreign investment flows or changes in the public contracts area.

5. The model does not include any effects of changed consumer behaviour and its impacts on the long-term accumulation of savings and subsequent capital generation in the individual sectors.
6. The model does not reflect the multiplication effects of additional household expenses.
7. The model does not include any import quota regimes.

## **2. Mathematical Structure of the Model**

The design of the model consists from several steps in which the concrete, most suitable structure of the model is defined:

1. For simpler interpretation purposes, all the 140 regions available in the GTAP database were merged into nine areas, which seemed to be key for the CETA's impacts analysis. They were: Austria, Czech Republic, Germany, Poland, Slovakia, rest of the EU countries, Canada, United States, and rest of the world. The goal was to analyse effects associated with exports through the German market and impacts on imports from semi-finished products source countries. For this reason, the most important markets were the ones with spread production chains, in which the Czech economy is involved as well (Germany, Slovakia, Poland, Hungary, and Austria). They are defined as independent regions.
2. The sectors were left in their completely disaggregated into 57 branches. Despite the fact that the majority of the specified branches will not be critical for the Czech economy, this depth of detail seems to be justified due to the more detailed mapping of the partial impacts of the liberalization of trade between Canada and the European Union. The goal is to cover sectors key for the Czech Republic without any unnecessary complications.
3. Regarding the production factors, the standard GTAP model classification was preserved. It includes capital, land, natural resources, and educated and uneducated labour. To model short-term impacts, we kept both the uneducated labour and capital mobile. The long-term impacts were then estimated on the basis of inter-sector mobile labour and capital inputs.
4. The model's comparative-static variant was kept, i.e. its results indicate what the current Czech economy would have looked like (or the 2011 reference year economy), if it had faced significantly eliminated barriers of international trade barriers suggested by CETA, while its available capital, labour, firms behaviour, and consumer behaviour remained unchanged.
5. Cobb-Douglas production function is used, with constant returns to scale and decreasing returns to labour and capital.
6. Constant unemployment rate with flexible wages, in the short run mobile skilled labour force, but immobile capital and unskilled labour force, in the long run all types of factors are mobile.

If the mathematical model structure is applied together with the data from the GTAP database, it is possible to calibrate all the missing model parameters. During calibration, the unknown parameters are calculated, providing the analysed economies behaved

during the selected referential period as they should have optimally behaved. In the next phase, the mathematical model (now featuring information generated during the calibration) was used to simulate the CETA’s impacts.

### 3. Calibration of the CETA’s Economic Impacts Evaluation Model

To model the CETA’s economic impacts on the Czech economy, it was necessary to record the custom tariff changes completed both in Europe and in Canada. We utilized the data from the World Trade Organization in our classification per the Harmonized system and applied a four-position code (WTO, 2016). The custom tariff savings were identified right after the CETA became effective and upon expiration of all the transitional periods (i.e. after seven years after the CETA became effective).

**Tab. 1: Annual Savings through the CETA Tariffs and NTBs Reduction**

|   | Right after CETA became effective | Seven years after CETA became effective |
|---|-----------------------------------|---|
| Import custom tariff savings during exports from the Czech Republic to Canada | CZK 103,060,443                   | CZK 103,146,576                         |
| Import custom tariff savings during imports from Canada to the Czech Republic | CZK 85,203,868                    | CZK 85,925,602                          |
| NTB savings during exports from the Czech Republic to Canada                  | CZK 77,275,598                    | CZK 109,242,700                         |
| NTB savings during imports from Canada to the Czech Republic                  | CZK 33,831,526                    | CZK 47,683,504                          |

*Source: own calculations based on (Eurostat, 2016), (WTO, 2016), and (Kee, Nicita, and Olarreaga, 2004)*

These import custom tariff savings (the *tms* variable in the GTAP database) converted to percentages represent an economic shock whose impacts on the macroeconomic equilibrium of the Czech economy will be modelled. However, besides the custom tariff savings, the CETA will also contribute to the elimination of international trade non-tariff barriers. The scopes of non-tariff barriers faced by the Czech or European exporters in Canada and, on the other hand, the barriers affecting the Canadian goods exporters on the European markets, may be roughly estimated on the basis of the non-tariff barriers (NTBs) database produced by the World Bank (Kee, Nicita, and Olarreaga, 2004) in classification per the Harmonized system and with its four-position code division. The scope of savings resulting from NTBs elimination per the CETA is estimated by the joint study of the European Commission and Canadian government as 2 % of the exporting companies’ total costs (Hejazi and Francois, 2008). However, we may assume that the gradual implementation of coordination mechanisms in the TBT and SPS areas will eventually contribute to even greater savings in the area of non-tariff trade barriers between the EU countries and Canada. Therefore, to estimate the impacts of trade liberalization in the area of non-tariff trade barriers (the *ams* variable in the GTAP database), we model the reduced NTB’s impacts as impacts of a 2% company costs reduction right after the CETA becomes effective and after seven years – a rather modest 3% (Rezková et al., 2016). In connection with this, one may assume that the CETA will

generate much greater savings in the NTBs area on a long-term basis. It is also important to remember that the NTB estimates completed by the World Bank are converted *ad valorem*; however, one may expect their relative importance will decrease with a greater foreign trade volume (Egger, et al. 2015).

## 4. Results and Discussion

The model outputs are extremely comprehensive; therefore, due to the focus of this article, the following tables only feature data concerning the Czech Republic. Since the customs tariffs will not be eliminated per the CETA in a single step, and a smaller amount of customs tariffs will be eliminated only after transitional period expirations (3, 5 or 7 year periods), the modelling results were focused both on the CETA's immediate impacts (short run) and the scenario upon the expiration of all the transitional periods (long run). However, it is always very important to remember that the results derive from the situation of the Czech, Canadian, European, and world economy in 2011.

Table 2 only indicates a very small change of the Czech economy's aggregate output initiated by the CETA impacts. The Czech national product will probably only increase by a few thousandths of percent, which is definitely caused by the very small trade exchange both between the Czech Republic and Canada and between the neighbouring EU member countries and Canada. The point is that it is impossible to assume that even indirect trade relationships of the Czech neighbours with Canada would somehow intensify the impacts of eliminated customs tariffs in the European-Canadian trade.

**Tab. 2: The CETA's Macroeconomic Impacts**

| [In mil. USD]                         | Before CETA | Right after CETA<br>(customs tariffs only) | Right after CETA<br>(customs tariffs + NTB) | 7 years after CETA<br>(customs tariffs only) | 7 years after CETA<br>(customs tariffs + NTB) |
|---------------------------------------|-------------|--|---|--|---|
| Consumption                           | 109,450.36  | 109,449.85                                 | 109,453.44                                  | 109,451.57                                   | 109,456.95                                    |
| Investments                           | 52,182.07   | 52,186.84                                  | 52,188.55                                   | 52,185.70                                    | 52,188.27                                     |
| Government Expenditures               | 44,824.76   | 44,826.69                                  | 44,828.16                                   | 44,826.77                                    | 44,828.98                                     |
| Exports                               | 162,683.63  | 162,696.38                                 | 162,701.72                                  | 162,687.01                                   | 162,695.00                                    |
| Imports                               | -153,080.47 | -153,095.17                                | -153,100.20                                 | -153,085.71                                  | -153,093.22                                   |
| Gross Domestic Product                | 216,060.34  | 216,064.58                                 | 216,071.67                                  | 216,065.36                                   | 216,075.97                                    |
| Comparison with the initial situation |             | +0.0020 %                                  | +0.0052 %                                   | +0.0023 %                                    | +0.0072 %                                     |

*Source: own calculations based on (Aguilar, Narayanan, and McDougall, 2016)*

Therefore, it is possible to confirm that the Czech economy's benefit from the customs tariff and non-tariff barriers eliminated through the CETA will only be marginal. Greater benefits may only be expected from a more intense elimination of the international trade non-tariff barriers and from improved conditions for foreign investors. However, these

will probably be realized in a longer period of time. The Czech Republic’s foreign trade and terms of trade will tend to rather reduce the Czech Republic’s surplus trade balance.

To calculate the total **impacts on the Czech population, we selected an indicator identified as so-called “equivalent variation”**. This identification represents an estimate of how much higher the population average income would have had to be before the interference into the analysed policy (CETA) in order to achieve the same consumption utility available to this population identical to the one achieved after the change. Therefore, these numbers (see Table 3) comprehensively describe CETA’s impacts on the average Czech population. The agreement’s importance may be roughly described as follows: Thanks to the tariffs and NTBs elimination, the Czech citizens would be richer by max. 7.7 million USD every year. This estimate confirms the previous conclusions that CETA’s impact on the Czech economy is probably positive; however, relatively small.

**Tab. 3: The CETA’s Impacts on the Czech Population’s Prosperity**

|                             | Right after CETA<br>(Customs tariffs only) | Right after CETA<br>(Customs tariffs + NTB) | 7 years after CETA<br>(Customs tariffs only) | 7 years after CETA<br>(Customs tariffs + NTB) |
|-----------------------------|--|---|--|---|
| Population Welfare          | -0.253 mil. USD                            | +6.313 mil. USD                             | +1.567 mil. USD                              | + 7.707 mil. USD                              |
| Wages<br>(unskilled labour) | -0.0141 %                                  | -0.0151 %                                   | +0.0007 %                                    | +0.0007 %                                     |
| Wages<br>(skilled labour)   | -0.0046 %                                  | +0.0042 %                                   | +0.0014 %                                    | +0.0041 %                                     |

*Source: own calculations based on (Aguilar, Narayanan, and McDougall, 2016)*

Table3 also indicates the expected impacts on the wages of qualified and unqualified labour. It becomes clear again that the Czech economy mostly receives its benefits in connection with the elimination of non-tariff barriers on a long-term basis when the liberalization of the Euro-Canadian trade relationships further develops, compared to the situation right after the CETA becomes effective.

In terms of the Czech gross national product’s generation sectoral structure, the changes are obviously insignificant. Only the textile industry (textile, clothing, leather products), some sectors of agriculture, several light industry subsectors, and automobile industry are going to benefit from the CETA on a long-term basis. The similar sectors (together with the chemical industry) seem to be export-potent in the Czech Republic – Canada relationship. However, it is necessary to emphasize again that even after the large-scope elimination of customs tariffs and NTBs through the CETA, Canada will not play any more significant role in the Czech foreign trade. Therefore, the elimination of the Canadian customs tariff barriers will only impact the Czech Republic’s overall exports structure through truly insignificant changes.

## Conclusion

The elimination of the customs tariff barriers through the CETA will impact the Czech economy rather **insignificantly**. The quantification of this impact through the GTAP econometric model proved slightly prevailing weak economic benefits.

The analysis and CGE modelling results foresee a moderate gross national product increase, increased prosperity of the Czech households, development of the Czech economy's key branches, further growth of exports, and improving Czech competitiveness on the international markets. Although the quantifiable impacts are marginal, some sectors will be, based on the modelling results, impacted more strongly, and some less strongly. We may expect a growing foreign demand for Czech production in the engineering, automobile, chemical, and textile industries. On the contrary, especially the agricultural and food industries will get slightly weaker due to the Canadian competition (however, by max. 0.05 %) even if the impacts on the individual sectors of agricultural and food production are very much different.

Per the CGE modelling and sector analyses results, the CETA implementation should not negatively impact the Czech economy from any perspective. The foreign trade liberalization – trading with either a remote or marginal partner – should contribute to the more effective allocation of resources and their more efficient utilization in the Czech economy.

Multiple effects associated with the non-tariff barriers elimination, including the measures in the area of investments, public procurement, and services, depend on their implementation after the CETA becomes effective. That is why it is important for the **Czech Republic** to be involved either through its professional and special-interest associations and chambers, national certification bodies, and, of course, at the national administration level and diplomacy, in the implementation of the agreement measures and to actively strive to be represented in the CETA commissions. In connection with this, it is important to monitor the current issues and challenges of the international trade with Canada and to purposefully promote our interests on the international field. It is very important to:

1. Deepen cooperation with professional chambers, entrepreneurial special-interest (export) associations, etc. – for example through round table events such as the one organized by the Honorary Consulate General of the Czech Republic in Calgary, by the Regional Chamber of Commerce of Liberec and by the Liberec Region on June 21<sup>st</sup>, 2017 under the title “Possibilities of Cooperation between the Czech Republic and Canada”;
2. Stimulate contacts among trade and professional chambers in the Czech Republic and Canada – for example through trade (entrepreneurial) missions or at convenient occasions such as the “Conference EU-Canada Comprehensive Economic and Trade Agreement (CETA): Opportunities for Czech Companies” held on March 13<sup>th</sup>, 2017 at the Ministry of Industry and Trade of the Czech Republic, in the presence of the

- Ambassador of Canada in the Czech Republic, Barbara C. Richardson and of the deputy of Directorate General for Trade of the European Commission, Mauro Petriccione;
3. Increase the effectiveness of distribution of information on the current status of CETA implementation – just like the Ministry of Industry and Trade of the Czech Republic has been doing with their website BusinessInfo.cz (<http://www.businessinfo.cz/cs/clanky/obchodni-dohoda-mezi-eu-a-kanadou-ceta-61835.html>);
  4. Monitor the impacts on the trade balance and Czech economy and continuously evaluate potential opportunities and threats.

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## **Improvement Conceptual Principles of the Construction Sector Business Associations Management System with the Application of Information-Communication Technologies in Conditions of Hypercompetition**

### **Abstract**

In this article, the “hypercompetition matrix” analysis results to form a new management system for modern business associations of the construction sphere in the material-virtual business environment with the application of information-communication technologies are presented. Using the method of the pairwise consideration of hypercompetition driving forces impact on the success factors principles for the proper functioning of the construction sphere business associations new management system in terms of the hypercompetitive material-virtual business environment is formulated. An achieved by the authors during the study conceptual system of principles based on the use of appropriate criteria is classified and can be represented in the form of two classes and three subclasses of principles of the construction sector business associations management system improving in terms of hypercompetitive material-virtual business environment. In the result of the developed by the author’s concept, comprising the basic theoretical regulations system, it is possible to develop methods of principles application to the construction sphere business associations management systems.

### **Key Words**

*hypercompetition matrix, material-virtual business environment, business associations of the construction sector, the information-communication environment, management system improving principles, concept*

**JEL Classification: D01, D81, P13, Y2**

## **Introduction**

Today development of society is reflected by the change in almost all branches and fields of our country’s activity including spheres of construction. Construction occupies one of the leading places in national economy practically of any state. The construction sector is a part of the country social-economic system by means of which it is developing, being engaged in the construction of roads, bridges, tunnels, buildings. It actualizes questions of management systems improvement within the construction sector (Buzyrev et al., 2017).

Therefore, in the article two questions, which are connected with administrative innovations in terms of the modern Material-Virtual Business Environment (MVBE), are considered:

1. Tendencies and administrative innovations in construction;
2. The scientific basis of management improvement regarding the construction organizations in terms of MVBE.

## **1. Tendencies and administrative innovations in construction.**

Now dynamics of the scientific-technical progress processes is a prerequisite for the organizational structures formation "traditional" paradigm and its management systems change. Besides, market economies of many countries undergo cardinal changes and are transformed to the knowledge economy. All this induces managers of the modern organizations, such as the Business Association of the Construction Sector (BACS), and their Managing Enterprise Structures (MES) to solve a set of new problems by means of post-industrial society artifacts. For example, such artifacts as latest Information-Communication (Infocom) Technologies (ICT), which, in particular, are a technical-technological and infrastructure basis of Infocom-management in terms of the virtual business environment (Martynov, 2007).

Earlier in the works (Kunyaev et al., 2016), (Kunyaev and Martynov, 2016a), (Kunyaev and Martynov, 2016b) devoted to the review of scientific publications on the considered subject (e.g., in such as (Anne et al., 1998), (Buzyrev et al., 2017), (Martynov, 2007), (KOH and MAGUIRE, 2009) and othes), we have already studied and specified the corresponding conditions and requirements which are urgent for effective economic activity of the BACS and its MES today. Its activity is carried out in turbulent MVBE for the purpose of construction projects implementation. For the proper interaction of MES in MVBE, the latest ICT in the BACS management systems are used. For this reason, first, it is especially important to create proper unitary Infocom network of interrelations and the corresponding Infocom Environment (ICE) of the considered BACS management system, and secondly, such environment requires to apply Infocom-management to this system (Martynov, 2007).

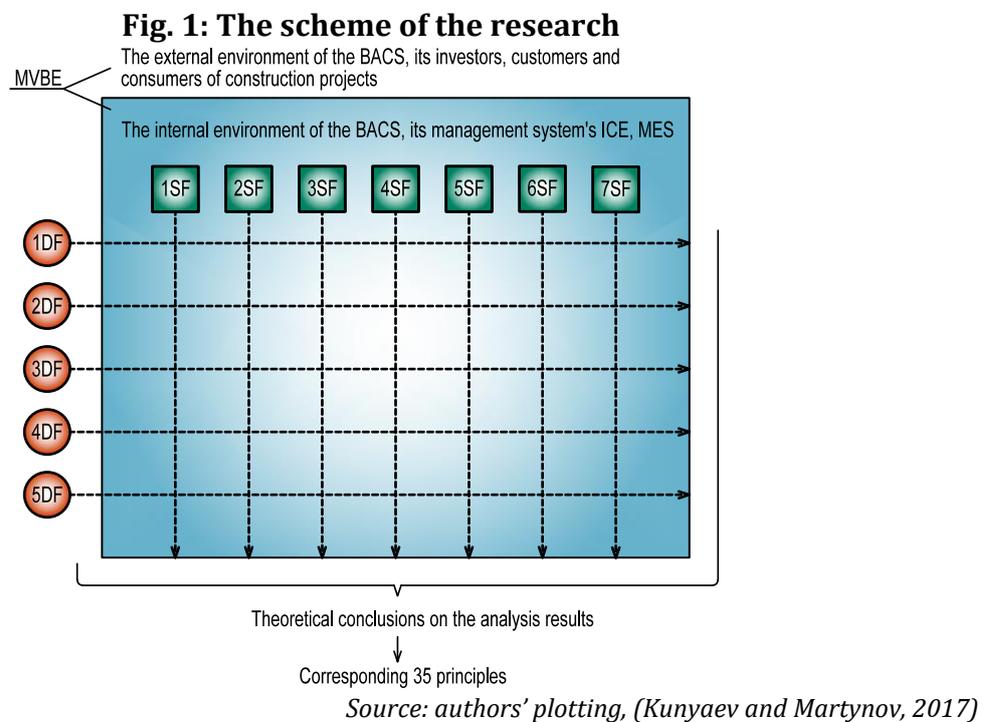
It should be noted that the BACS economic activity is carried out in a new and rigid competitive situation, which is possible to be called hyper-competitive. In work (Martynov, 2016) relevant aspects of hypercompetition and its driving forces are considered. These aspects require their influence on many organizations economic activity to be calculated. Therefore, it is especially important for the BACS management system to timely consider this influence and to adapt quickly, using in its practice success factors within hyper-competitive MVBE (Martynov, 2016).

Hence, the main question of the research is following: "How hypercompetition influences the economic activity of the BACS in terms of MVBE?". Our research will give the answer to this question.

To answer this question, in work (Kunyaev and Martynov, 2017) the following problems of our research have been defined:

1. The influence analysis of the connected with the development of ICT hypercompetition driving forces and their exclusive properties on success factors in management practice within ICE taking into account features of the BACS activity in MVBE;
2. Definition and formulation of management system functioning and development principles in the modern BACS, managing in the conditions of hypercompetition in MVBE.

For the solution of these tasks, a step-by-step procedure has been offered in work (Kunyaev and Martynov, 2017). It allows to methodologically structured and ordered realize the influence analysis of five driving forces on seven success factors in terms of the BACS management system – see fig. 1 (Kunyaev and Martynov, 2017).



In figure 1 the analysis scheme of the influence of such five hypercompetition driving forces (1DF-5DF), specified in work (Martynov, 2016), is submitted:

- 1DF – Process of globalization in the conditions of world information-communication environment formation;
- 2DF – Polarization of markets;
- 3DF – Process of branch borders washing out;
- 4DF – Deregulation of markets;
- 5DF – Rapid distribution and improvement of information-communication technologies.

These five driving forces directly affect the BACS management system in ICE, which uses in its economic activity seven success factors (1SF-7SF) (Martynov, 2016):

- 1SF – Constant updating of market assessment;
- 2SF – Frame conditions for joining in a general network of business partners;
- 3SF – Correct assessment of the competition temporary parameter;
- 4SF – Creation of the strategic unions (alliances, associations);
- 5SF – Ability of flexible adaptation to quickly changing market environment;
- 6SF – Organizational culture, professional culture of the business processes and administrative processes participants;
- 7SF – Development of organizational management.

These success factors should be considered, improving the BACS management system under the driving forces of hypercompetition influence. Accordingly, the formulation of the corresponding concepts is especially important for the formation of the scientific basis which is one of the main goals of our research. All this is necessary for the improvement of the management systems of BACS, managing in hyper-competitive conditions of MVBE. Therefore, it is required to consider each driving force of hypercompetition with each success factor. It is exactly what we have done to form a conceptual basis, systematize its aspects and receive not only theoretic-methodological yet methodical and important for administrative practice results.

The formalized procedure of the research mentioned earlier assumes implementation of its each step with the corresponding synthesis in the form of theoretical generalizations by results of the conducted analysis. After such a set of analyses and syntheses, it is possible to define the corresponding 35 principles. These principles are necessary for the proper functioning and development of management systems of the BACS, managing in the conditions of hyper-competitive MVBE. All this is required for the development of BACS management system concept in ICE, which is based on these 35 principles. BACS managers should consider them as rules, which need to be carried out in the conditions of hyper-competitive MVBE. Regarding methodology let's note that the system approach in together with the complex method is used in an investigation and on its basis we will continue our research.

## **1. The Scientific basis of the construction organizations' management improvement in terms of the material-virtual business environment**

In work [2] we have used a paired influence consideration method, in particular, of globalization process in conditions of world information-communication (Infocom) environment formation on constant market assessment updating (Martynov, 2016). As a result of such influence analysis on the example of the first "hypercompetition matrix" (Martynov, 2016) couple the first principle is defined and formulated, as well as other 6 principles have been defined:

1. The principle of constant internal and global market assessment updating with use of ICT;
2. The principle of frame conditions up to global association in the business partners general network on the basis of ICT and the global Internet;
3. The principle of a hypercompetition constant temporary parameter assessment with the use of ICT;
4. Principle of creation of the global strategic unions on the basis of ICT;
5. The principle of flexible adaptation to rapidly changing global market environment with the use of ICT;
6. The principle of professional culture of the mediated interactions of administrative and business processes participants with use of ICT and the global Internet;
7. The principle of organizational management development with the use of ICT in the conditions of the economy globalization.

Proceeding with the numeration, we will specify the received carried-out influence research results of the corresponding hypercompetition remained couples of driving forces and success factors of the considered "hypercompetition matrix". The principles defined as influence analysis results of the markets polarization on seven success factors (Martynov, 2016):

8. The principle of constant updating of construction production consumer preferences assessment with use of ICT;
9. The principle of frame conditions for association in the general network with clients and consumers of construction production with the use of ICT;
10. The principle of a constant assessment of temporary parameter concerning construction production consumer preferences with the use of ICT;
11. The principle of the strategic unions creation with construction production clients and consumers with the use of ICT;
12. The principle of flexible adaptation ability to quickly changing preferences of construction production clients and consumers with the use of ICT;
13. The principle of organizational culture, professional culture of business processes participants and administrative processes taking into account preferences of construction production clients and consumers with the use of ICT;
14. The principle of organizational management development taking into account preferences of construction production clients and consumers with the use of ICT.

The principles defined as influence analysis results of the branch borders washing out process on seven success factors (Martynov, 2016):

15. The principle of constant updating of external and internal branch borders assessment with use of ICT;
16. The principle of frame conditions for association in the external and internal branch borders business partners general network with the use of ICT;
17. The principle of a constant assessment of temporary parameter of the competition on external and internal branch borders with the use of ICT;

18. The principle of the strategic unions creation in external and internal branch borders with the use of ICT;
19. The principle of ability of flexible adaptation to quickly changing internal and external branch borders with the use of ICT;
20. The principle of organizational culture, professional culture of business processes participants and administrative processes in internal and external branch borders with the use of ICT;
21. The principle of the organizational management development taking into account internal and external branch borders with the use of ICT.

The principles defined as influence analysis results of the markets deregulation on seven success factors (Martynov, 2016):

22. The principle of constant updating of the internal and external markets quality standards assessment with the use of ICT;
23. The principle of frame conditions for joining in a business partners general network for the consumer's inquiries and demands satisfaction with the use of ICT;
24. The principle of a constant assessment of temporary parameter of the deregulated markets competition with the use of ICT;
25. The principle of the strategic unions creation for differentiation of production with the use of ICT;
26. The principle of flexible adaptation ability to quickly changing deregulated market environment with the use of ICT;
27. The principle of organizational culture, professional culture of business processes participants and administrative processes taking into account the internal and external markets new quality standards with the use of ICT;
28. The principle of organizational management development taking into account the internal and external markets new quality standards with the use of ICT.

The principles defined as influence analysis results of the Infocom-technologies rapid distribution and improvement on seven success factors (Martynov, 2016):

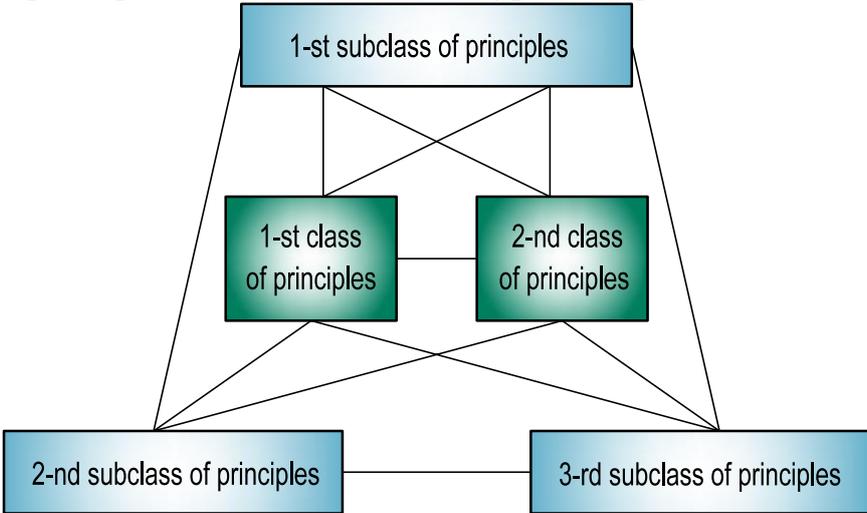
29. The principle of constant markets assessment updating in ICE with the use of ICT;
30. The principle of frame conditions for joining in a business partners general network in ICE with the use of ICT;
31. The principle of a constant assessment of temporary parameter of the competition in ICE with the use of ICT;
32. The principle of the strategic unions creation in ICE with the use of ICT;
33. The principle of flexible adaptation ability to quickly changing market environment in ICE with the use of ICT;
34. The principle of organizational culture, professional culture of business processes participants and administrative processes in ICE with the use of ICT;
35. The principle of organizational management development in ICE with the use of ICT.

Thus, this conceptual system of principles on the basis of the corresponding criteria is classified by the authors. It can be presented in the form of two classes and three

subclasses of the BACS management system improvement principles in the conditions of hyper-competitive MVBE. At the same time, keeping the statement generality of the considered procedure, concerning the hypercompetition driving forces on success factors influence analysis, we don't provide specific names of these classes and subclasses here. The scheme of such classification is submitted in figure 2.

The scheme submitted in figure 2 reflects not only interrelations of the considered principles classes and subclasses but also serves as certain tools for the definition of their application priorities in managers' administrative practice within the specific BACS in the conditions of hyper-competitive MVBE.

**Fig. 2: The classification scheme of the BACS management system improvement principles in the conditions of hyper-competitive MVBE**



*Source: authors' plotting*

**Conclusion**

In conclusion, we want to underline that in MVBE hyper-competitive conditions the relevance of theoretic-methodical improvement, practical provisions improvement and also recommendations on the BACS proper management system formation on the basis of the latest ICT is obviously increasing. On the basis of the use of the system approach together with the complex approach the investigation allows us to develop the corresponding methodical provision for the improvement of the management system of the BACS, operating in the conditions of hyper-competitive MVBE and will be a subject of our further research.

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## Resilience of Regional Labour Markets: Case of the Plzen and Karlovy Vary Regions

### Abstract

Resilience is a concept that has drawn much attention lately due to consequences of the global financial and economic crisis of 2008-09. It concerns with a capacity of the system to respond to, adapt to and cope with a shock of various types. The concept highlights several categories such as challenge (type of the shock), responses to challenges (sensitivity, adjustment) and outcome (restoring the pre-shock state, worse or better). The article primarily focuses on the second component in terms of sensitivity of regional labour markets to the global economic crisis of 2008 - 2009. Sensitivity reflects depth of reaction, which can be measured using various indicators. In the article, data on total employment and general unemployment rate are used. Consequently, comparative analysis of labour market response using employment data in two selected regions is carried out aiming to account for their diversified capacity to resist the shock.

### Key Words

*resilience, employment, sensitivity, labour market, regions, shift share analysis*

**JEL Classification: R1, R5, E3**

## Introduction

Resilience is a concept that has drawn much attention lately due consequences of the global financial and economic crisis of 2008 - 2009. Rather extensive literature exists on the topic that treats the problem theoretically and/or brings empirical evidences on the resilience of various systems. The notion of resilience is interpreted differently in different fields, psychology, ecology and/or regional studies. Generally speaking, it concerns with a capacity of the system (region, community, individual) to respond to, adapt to and cope with a shock of various types. These may be economic recessions, technological shocks (i.e. digitalization), institutional shocks (the liberalization process), environmental shock (natural disaster) and/or organizational shocks (closure of key companies in a region).

The most significant contributions to this research area are presented by Martin et al. (2012, 2015, 2016), Foster (2007), Hill et al. (2012), Briguglio et al. (2008), and Boschma (2015). In Czech academic literature, the concept of regional economic resilience has been expounded for instance by Lungová (2013, 2016), Koutský et al. (2012), Sucháček (2012), and Svoboda (2013). Besides, territorial impact of the latest crisis and estimating

resilience of regions was the subject of applied research known as ECR2 (Economic Crisis: Regional Resilience) that was carried out across the European Spatial Planning Observation Network territory (Bristow et al., 2014).

Relatively less attention is paid specifically to resilience of labour markets despite the fact that workforce carries major weight of the burden of disturbances. Data on employment is often used in operationalizing resilience, mainly to quantify the extent of a shock or recovery. The phenomenon of labour market resilience is more complex, though. A close link between resilience and the concept described by economists as hysteresis can be identified (Martin, 2012, p. 10). Hysteresis is usually associated with the impact of recessionary shocks on labour markets in terms of a permanent rise in the natural rate of unemployment, thus, a permanent slowdown in the employment growth rate. Major conceptualization of the labour market resilience is provided by Bigos et al. (2013), Sainsbury, (2001), Ortiz (2002), Taylor-Gooby (2002) and/or Drew et al. (2004). Resilience is not perceived only as an economic, but also a social and institutional phenomenon. At the national level, labour market resilience has been explored in OECD Outlook (2012) that brought the notion of adaptive resilience to the labour markets. This approach was also used in Diodato and Weterings (2015). Seminal works in the field of labour market resilience present Chapple and Lester (2010), van Dijk and Edzes (2016). The concept of labour market resilience can be viewed from the perspective of the firm or the worker with entirely different results. By adopting the workers perspective, primary concerns are changes in social costs and workers' welfare, which can be operationalized by unemployment rate, changes in total earnings, the way the earnings' impact is distributed over the labour force and the long term unemployment (Bigos et al., 2013, p. 20). Using the firms' perspective, a deeper insight into structural changes in employment is required as it is a region's structure, its prior economic growth performance, competitiveness, innovative propensity of its firms, the skills of its workforce that shapes mainly the resistance to a shock (Martin, 2012). All possible factors can be categorised into three groups: institutional (such as active labour market policies, employment protection legislation, wages setting institutions, labour taxation), socio-economic (such as industrial structure, firm size and regional disparities) and structural-demographic factors (such as age structure, education attainment, migration). In the follow-up analysis, an attention is paid only to socio-economic category due to limited extent of the paper.

## **1. Methods of Research**

The article aims to explain differences in the sensitivity of regions to the global economic crisis of 2008 - 2009. Sensitivity is a component of the resilience concept that reflects a depth of reaction, which can be measured using various indicators. As the paper focuses on the labour market resilience, degree of sensitivity to a recessionary shock is measured by both a contraction in employment (in total number of employed people) and a rise in the general rate of unemployment (based on labour force survey) in fourteen Czech higher territorial self-governing units (NUT 3 level according to NUTS classification). Each indicator is compared in its trough against its peak. At the national level, a peak in employment and unemployment rate was achieved in 2008 and a trough in 2011 and

2010 respectively. As the shock spread across the country with different speed, each region has been assigned its specific time frame regarding its peak and trough. All statistical data are taken from the Czech statistical office, especially its database of regional accounts and public database.

Secondly, a comparative study is provided, focused on two regions out of the total number of NUTS3 regions, due to limited extent of the paper. To gain a detail understanding of the structural features of selected regions, data on their employment structure against the national average is provided first. The fundamental part of the paper consists in decomposition of the labour market development in the period of economic downturn using a method of shift share analysis. This analysis was firstly applied by Dunn (1960) for analysis of employment dynamics, however, it can be used to decompose other variables, such as value added, labour productivity etc. It helps explain dynamics and structural changes in given variable in terms of individual sectors and/or static assessment of structural changes from the point of view of individual regions and sectors. In this article, the method enables to determine how much of the employment development in the aftermath of the shock can be attributed to national or industrial trends and how much is due to unique regional factors. Therefore, the regional employment change ( $\Delta e$ ) is decomposed into three effects as the following formula illustrates:

$$\Delta e_i = e_i^{t+n} - e_i^t = Ni + IMi + RSi = e_i^t \left( \frac{E^{t+n}}{E^t} - 1 \right) + e_i^t \left( \frac{E_i^{t+1}}{E_i^t} - \frac{E^{t+1}}{E^t} \right) + e_i^t \left( \frac{e_i^{t+n}}{e_i^t} - \frac{E_i^{t+n}}{E_i^t} \right), \quad (1)$$

where  $t$  – basic period,  $t+n$  compared period,  $i$  – industry,  $E$  – employment at the national level,  $e$  – employment at the regional level.

The national growth effect ( $Ni$ ) explains how much of the regional industry's development happens due to the overall growth of the national economy. The industrial mix effect ( $IMi$ ) shows the share of regional industry growth explained by the development of the specific industry at the national level. The regional competitive effect ( $RSi$ ) shows how much of the industry change can be attributed to some unique competitive advantage of the region.

## 2. Sensitivity to the global economic crisis of 2008-2009

To illustrate the sensitivity of Czech regional labour markets (NUT3 level) to the global economic crisis of 2008-2009, data on employment and general unemployment rates are analysed. Majority of regions reached peak in employment in absolute figures in 2008 (JHC, PLK, KVK, ULK, JHM, ZLK, MSK). All regions but Prague and the Central Bohemia region experienced contraction in employment in 2009 (in absolute figures); some of them even hit a low then (PLK, ULK, LBK, PAK, JHM). By contrast, several regions reached peak in total employment already in 2007. The Karlovy Vary region stands out among all

regions completely owing to its continuously declining employment until a low was finally hit in 2013. The extent of the contraction illustrate table 1.

**Tab. 1: Relative contraction in total employment and unemployment rate between peak and trough**

|            | CZ    | PHA   | STC   | JHC   | PLK  | KVK    | ULK  | LBK   | HKK   | PAK   | VYS   | JHM   | OLK   | ZLK  | MSK   |
|------------|-------|-------|-------|-------|------|--------|------|-------|-------|-------|-------|-------|-------|------|-------|
| $\Delta E$ | -3,09 | -2,87 | -1,28 | -4,64 | -1,9 | -11,37 | -4,1 | -4,22 | -4,49 | -3,95 | -6,84 | -2,35 | -7,36 | -6,8 | -4,48 |
| $\Delta u$ | 2,9   | 1,9   | 2,6   | 3,1   | 2,7  | 3,3    | 3,2  | 3,2   | 3,8   | 3,6   | 3,7   | 3,3   | 3,2   | 4,7  | 2,8   |

Source: authors' own calculations, data from (CZSO, 2017a,b)

Notes:  $\Delta E$ : contraction peak to trough in employment (in %),  $\Delta u$ : contraction peak to trough in general rate of unemployment (in p.p.)

Table 1 points at four less sensitive regions against the national average in terms of employment development, namely Central Bohemia, the Plzen, South Moravian and Prague regions. Remaining ten regions showed higher drop in employment than the national average. Worth noting is the Karlovy Vary region that experienced the highest decline in employment whatsoever. Regional disparities in terms of unemployment response to the crisis seem to be less extreme using the change in percentage points. Yet, the very same pattern is apparent with Prague, Central Bohemia and the Plzen region having lower sensitivity against the national average. Considerable differences in initial values of unemployment rate are of great interest, though. There are regions having the unemployment rate persistently above the national standard, such as the Moravian-Silesian (7.4 % in 2008, 9.7 % in 2009 and 10.2 % in 2010), Usti (7.9 %, 10.1 % and 11.2 % in the same years respectively) and Karlovy Vary region (7.6 %, 10.9 % and 10.8 %). Moreover, when it comes to relative contractions, these regions registered more severe drop in the unemployment rate against the national average.

Provided data raise number of questions concerning considerably diverse sensitivity of regions to the shock. A case-study approach is adapted to allow a deeper insight into regionally-specific responses. Two regions were selected for the comparative analysis, such that draw much attention owing to their notably dissimilar sensitivity results. These are the Plzen and Karlovy Vary regions.

### 3. Case study: the Plzen and Karlovy Vary regions

The Plzen and Karlovy Vary regions are remarkable for several reasons. Firstly, it is their geographical proximity. In the past, they formed the West Bohemia region. Both of them are peripheral regions situated on the national border with Germany. The Plzen region is adjacent to the southwest border with Germany (Bavaria) and the Karlovy Vary region to the northwest. Besides their geographical location, the Karlovy Vary region does not seem to bear much resemblance to the Plzen region, though. The Plzen region is the third biggest region in terms of its geographical area, and regarding population poses the sixth position among the Czech regions. By contrast, the Karlovy Vary region is one of the smallest regions in the Czech Republic. The Plzen region belongs to areas with the highest economic performance using GDP per capita over the long run. On the other hand, the

Karlovy Vary region witnessed deterioration of its position since 1995 when the region occupied the fifth place (while the Plzen the second). In 2007, the Karlovy Vary reached the last position and has kept it ever since.

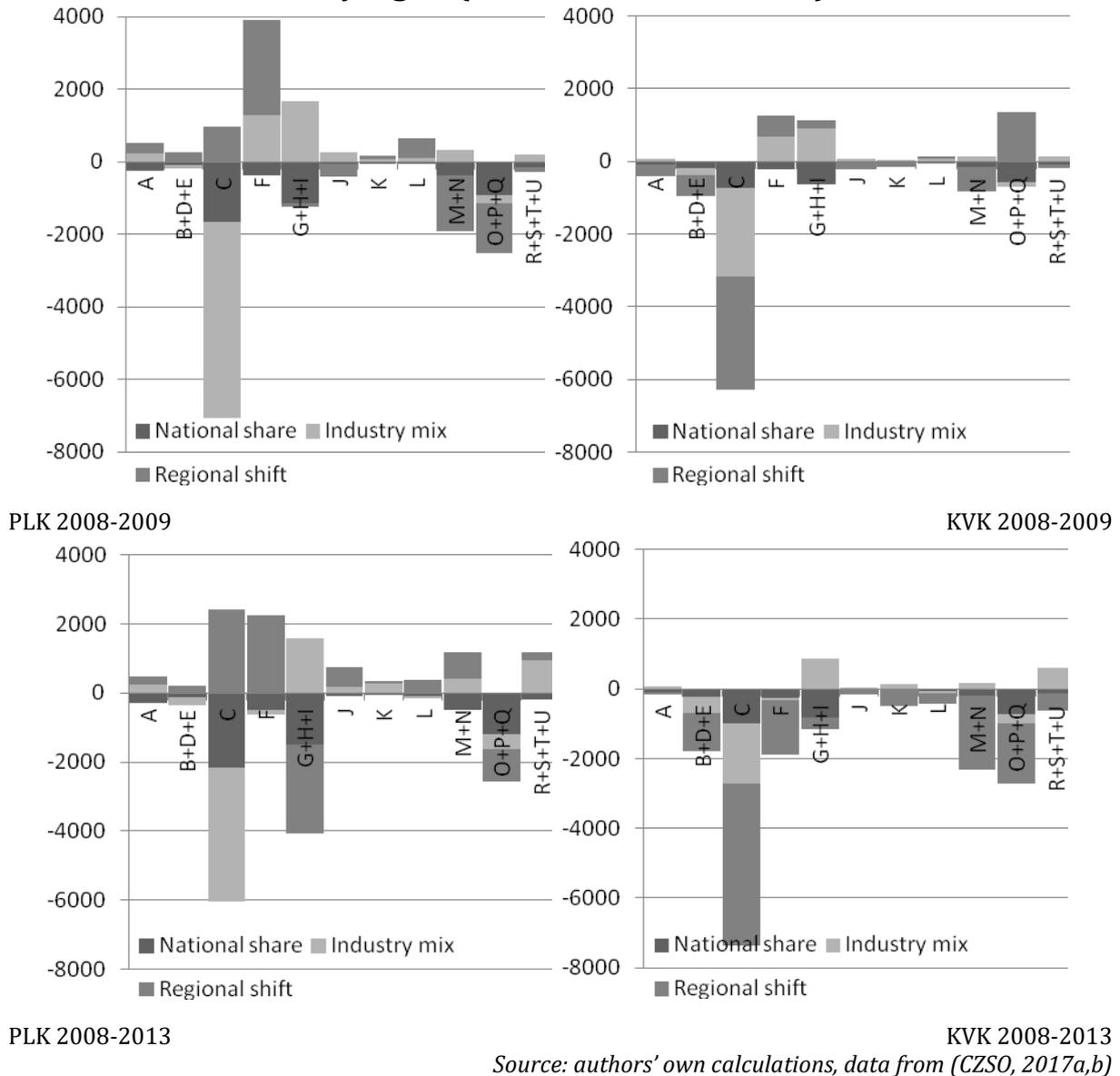
Much of the current literature on economic resilience conventionally agrees on the crucial significance of industrial structure to both the economic performance and sensitivity of regional economies. Also it is deemed to affect labour market resilience. On the other hand, rising number of empirical studies point out that industry mix no longer fully accounts for the regionally differentiated responses to the cyclical developments (such as Martin et al., 2016). To explain a role of industrial structure in sensitivity to the economic shock of 2008-09, information about regional industrial structure is needed. The Karlovy Vary region is known particularly for its spa industry and its sources of natural mineral water. Tourism and health care is the most important sector in the region followed by production of glass and ceramics. In comparison, the Plzen region is traditionally very industrial region, famous for machine-building industry associated with the company Skoda, automotive, electronic producing industry and/or glass and ceramic industry.

With regard to labour market resilience, the long term trend in the structure of total employment is worth describing. Thus, the sectoral structure in both regions against the national average has been explored in 1995 and 2015 using data from regional accounts database of the Czech statistical office. The most important industry in terms of jobs creation is manufacturing industry with about 26% share on total employment at national level. Its share has not undergone a notable change over twenty years. In the Plzen region, this figure is even higher and steadily rising (28,5 % in 1995; 32,87 % in 2015), while it is slightly below the national level in the Karlovy Vary region (24,08 % in 1995, 25,68 % in 2015). Still it represents the highest share on total employment there. Other sectors with the highest share on total employment pertain to tertiary sector. Namely, these are trade, transportation, accommodation and food service with about 23 – 24 % at the national level (about 22 % in the Plzen region and 25 % in the Karlovy Vary region) and public administration, education, health and social work, with approximately 18% share (PLK 17,5 %, KVK registered increase from 18,37 to almost 22 %). Construction reached almost 10% share on total employment in 1995. Since 2015, its significance appears to have diminished both, regionally and nationally, though. In contrast, sector of professional, scientific and technical activities indicates an upward trend. Nationally, its share has risen from 6,81 to 8,55 % over twenty years. The Plzen region recorded a rise from 5,71 to 7,97 % while the Karlovy Vary noticed somewhat declining importance over given period (from 6,31 % to 4,54 %).

To illustrate a role of regionally specific factors in sensitivity of employment development to the latest crisis of 2008-09, shift share analysis is carried out in two regions in question. As each of them experienced trough at different points in time, comparison of two relevant situations is provided. The Plzen region hit a low in 2009 and registered a short increase in employment again in 2010. The Karlovy Vary region experienced continuous decline in employment until a trough was hit in 2013. As the Plzen region did not manage to restore its pre-crisis employment level till 2013, situation in both regions is compared in 2009 and 2013 against the peak in 2008. Rather protracted period of employment

stagnation may indicate several mutually intertwined processes happening at labour markets, such as consequences of various economic policy measures and/or a gradual onset of the fourth technological revolution.

**Fig. 1: Shift share analysis of employment development in the Plzen and Karlovy Vary region (2008 - 2009, 2008 - 2013)**



Notes: A: agriculture, forestry and fishing, B+D+E: mining and quarrying and other industry, C: manufacturing, F: construction, G+H+I: Trade, transportation, accommodation and food service, J: Information and communication, K: Financial and insurance activities, L: Real estate activities, M+N: Professional, scientific, technical and administrative activities, O+P+Q: Public administration, education, health and social work, R+S+T+U: Other service activities

National component implies the increase in employment in a sector and a region if the national employment dynamics were maintained. Total employment dropped by 1,8 % in

2009 and by almost 2.4 % in 2013 against 2008 at national level. Industrial component reflects a difference in the employment dynamics in individual sectors against the total national employment dynamics. The most important part is the regional component illustrating the extent to which the employment development in a region and a sector differs from the benchmark given by employment in individual sectors of the national economy. If the industry in a region follows the national development, the regional component is zero. In case the employment dynamics in a sector in a region is greater than at the national level, regional share component is positive. This suggests a positive development of the sector at the regional level.

Fig. 1 reveals important aspects behind relatively smaller sensitivity of the Plzen region to the latest crisis. Generally, primary and secondary sector appeared to outperform the national trends in the Plzen region immediately after the onset of the crisis. Worth mentioning are construction and manufacturing industries, followed by the real estate activities. Construction seems to have defied conventional belief about cyclically sensitive sector by outperforming the negative national trend. On the other hand, the regional competitive factors were not enough to reverse a decline in employment in manufacturing industry. This results contrast with the situation in the Karlovy Vary region. Apparently, the regional competitive strength mainly consisted in the sector of public administration, education, health and social work. Positive regional development is also visible in the sector of construction and trade transportation, accommodation and real estate activities even though less significant than the national trend suggests. All other sectors registered drop in total employment. Especially worth mentioning is a rather deep decline in the manufacturing industry and the sectors of professional and scientific activities.

The difference between given regions stands out even more, when comparing their employment dynamics in 2013 against 2008 (see fig. 1). Despite the negative national and industrial component, the Plzen region demonstrated its regional advantage in the manufacturing industry. Besides, several other industries proved positive dynamics contrary to its national and industrial trend in the Plzen region. This applies namely to the sector of construction, information and communication services, real estate activities and professional and scientific activities. By contrast, all industries were clearly underperforming compared to the national and industrial trends in employment in the Karlovy Vary region. Worth noting are the industries that went against the negative national employment trend. Despite the employment in the IT sector has risen by around 2.7 % and in financial and insurance activities by 6.7 % nationally between 2008 and 2013, employment in these sectors dropped by 17.2 % and 22.7 respectively in the Karlovy Vary. In this respect, the Karlovy Vary appears to be facing serious disadvantages comparing to the Plzen region.

## **Conclusion**

The paper aimed to explore regional labour market resilience in the context of the global economic crisis of 2008-2009. Firstly, the sensitivity analysis of employment and unemployment development was provided to select regions with significantly different

results in terms of their resistance to the crisis. Subsequently, a case-study approach was adopted to allow a deeper insight into factors determining regionally-specific responses to the shock. Shift share analysis was used to identify regional advantages that might account for their high or low sensitivity. In the Plzen region, the primary sector and major part of secondary (manufacturing industry) outperformed both the negative national and industrial development while in the Karlovy Vary region all of these industries proved negative regional competitive effect in 2013 against the peak in 2008. Especially the manufacturing industry development is worth mentioning as it has represented the largest share on total employment virtually in both regions. In the Karlovy Vary, the manufacturing industry and trade, transportation, accommodation and food service have created almost quarter of total employment each. In both regions, construction appears to have been a positive development factor in 2009. This could be attributed to certain inertia of the construction projects. A main regional competitive advantage seems to consist in the sector of public administration, education, health and social work in the Karlovy Vary region. It is obvious that provided data cannot explain fully differences in resilience of regional labour market. A follow-up research is needed to explore other aspects of labour market resilience, such as additional socio-economic data, structural-demographic and/or institutional factors.

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## Managerial Utility in DSGE Model

### Abstract

In the paper the new DSGE model is developed. All contemporary used models are built on households' utility maximization and firms' profit maximization. There is assumed that the households are owners of the firms and instruct managers to fulfil the maximum of profit. In our model there are two utility maximization problems, the first one is standard households' dynamic problem and the second one is static managers' utility maximization under constraint of exhausting the whole production by the owners of labour and capital, i.e. households. The arguments of managerial utility function are the amount of labour and capital hired. A new factor of production has to be included in the production function. It is the managers' effort as a specific factor of production but this effort is not awarded at all as in presented basic model or the award for managers could be negligible to their marginal product. The first order condition of this problem compares the marginal utility from hired factor with the cost for factor payment. The key feature of the model is then overpayment of factors of production above their marginal productivity. Model completely separates the decision making of households and firms while the profit maximization approach assumes the collaboration between them.

### Key Words

*DSGE, firms' behaviour, impulse responses, managerial utility*

**JEL Classification: C61, E21, E32**

## Introduction

The aim of paper is to develop non-traditional way of firms' behaviour which can be included into the dynamic stochastic general equilibrium (DSGE) framework. In present the DSGE modelling is prevailing tool for macroeconomic forecasting and simulating. The origin of dynamics approach to utility maximization could be found in Ramsey (1928). This pioneering article was rediscovered by Koopmans (1963) and Cass (1965). The popularity of dynamic optimization under rational expectations assumption rise rapidly up during seventies and eighties, from the set milestones let us quote only a few: first prototype of these models (Lucas, 1972), very famous Lucas Critique (Lucas, 1976), real business cycle models - RBC (Kydland and Prescott, 1982) and (Long and Plosser, 1983). The next development of these models was focused on introduction of nominal and real price rigidities (Calvo, 1983), (Ball and Romer, 1990) or information rigidities (Mankiw and Reis, 2001). The incorporation of rigidities into previous real business cycle models is known as New Keynesian Macroeconomics. Further augmentations of the dynamic

stochastic general equilibrium framework were done by factor cost adjustment, for review of this topic see e.g. (Hamermesh and Pfann, 1996) or specific firms' capital (Woodford, 2005). All above mentioned modification of real business cycle model results in better data fitting and therefore are used in most of macroeconomic models from the provenience of central banks. These models are useful for modelling of the effects of monetary policy because they conquer the neutrality of money and are able to fit and predict the development of not only real variables but also of nominal variables, which are in interest of monetary policy makers.

The present DSGE models including all modifications use the standard concept developed already in the end of 19<sup>th</sup> century by Leon Marie-Esprit-Léon Walras (1874) and Alfred Marshall (1890). Although the first one constructed the general equilibrium approach and the second one the partial equilibrium approach, both are very similar and became the basis of the mainstream economics of 20<sup>th</sup> century. The cornerstones of present mainstream economics including DSGE are:

1. Given households' preferences expressed by suitable utility function
2. Given firms' production capabilities expressed by suitable production function
3. Given institutional framework – the constraints governing the interaction among agents and also market structures described by two types of competition: prefect and imperfect; nowadays mostly used is the concept of Dixit and Stiglitz (1977)

Basic scheme always consists of households' lifetime discounted utility maximization and firms' profit maximization. The models do not use different goals of firms' behaviour but in this paper we show that also another goal is compatible with this framework.

## 1. Model set-up

We will use simple RBC model with competitive markets so all agents are price takers. The well-known standard decision problem of representative household can be described as maximization of the sum of discounted utility (1) subject to budget constraint (2):

$$\max_{C_t, N_t} \sum_{t=0}^{\infty} \beta^t \left( \frac{C_t^{(1-\sigma)}}{1-\sigma} - \theta \frac{N_t^{(1+\varphi)}}{1+\varphi} \right) \quad (1)$$

$$w_t N_t + r_t K_t = C_t + K_{t+1} - (1-\delta)K_t \quad (2)$$

where  $C_t$  is consumption in time  $t$ ,  $N_t$  is labour,  $K_t$  is capital owned by household,  $w_t$  is real ware rate,  $r_t$  is real interest rate (rate of capital return),  $\beta$  is subjective discount factor,  $\sigma$ ,  $\varphi$  and  $\theta$  are parameters of utility function and  $\delta$  is rate of capital depreciation.

The solution of first order conditions leads to labour demand (3) and Euler intertemporal choice equation (4):

$$w_t C_t^{-\sigma} = \theta N_t^\varphi \quad (3)$$

$$C_t^{-\sigma} = \beta(r_t + 1 - \delta) C_{t+1}^{-\sigma} \quad (4)$$

Similar models including solution methods can be found in basic RBC or DSGE literature, e.g. (McCandless, 2008). Now we will modify simple RBC model only in the part of firms' behaviour. Assume that the representative firm is governed by manager pursuing her utility function. The arguments of this function are the quantity of labour  $N_t$  and capital  $K_t$  hired. Our approach is inspired by microeconomic managerial theory of the firm developed by Oliver Williamson (1964), where the satisfaction of manager increases with the size of firm measured by the quantity of factors employed. The new factor of production has to be introduced - the manager also works in the firm, so  $M_t$  denotes her specific factor. For simplicity we will assume that in the economy the number of managers is negligible in comparison with number of workers so the payment for managerial specific factor is not considered. Then the firm's behaviour is described by the following static optimization problem (we drop the time subscript  $t$  out):

$$\max_{N,K} (1 - \theta_m) \frac{K^{(1-\sigma_m)}}{1 - \sigma_m} + \theta_m \frac{N^{(1-\varphi_m)}}{1 - \varphi_m} \quad (5)$$

$$wN + rK = AK^{\alpha_K} N^{(1-\alpha_K-\alpha_M)} M^{\alpha_M} \quad (6)$$

where  $\sigma_m$ ,  $\varphi_m$  and  $\theta_m$  are parameters of utility function,  $M$  is manager's effort (constant in the model);  $A$  is technology level and  $\alpha_K$ ,  $\alpha_M$  are parameters of production function (elasticities of production with respect to factors). The equation (6) expresses that all product is distributed to households in form of wage and interest, and therefore there must be the constant returns to scale. Using common solution method (Lagrange multipliers) we obtain:

$$\frac{(1 - \theta_m) K^{-\sigma_m}}{r - A \alpha_K K^{(\alpha_K-1)} N^{(1-\alpha_K-\alpha_M)} M^{\alpha_M}} = \frac{\theta_m N^{-\varphi_m}}{w - A K^{\alpha_K} (1 - \alpha_K - \alpha_M) N^{(-\alpha_K-\alpha_M)} M^{\alpha_M}} \quad (7)$$

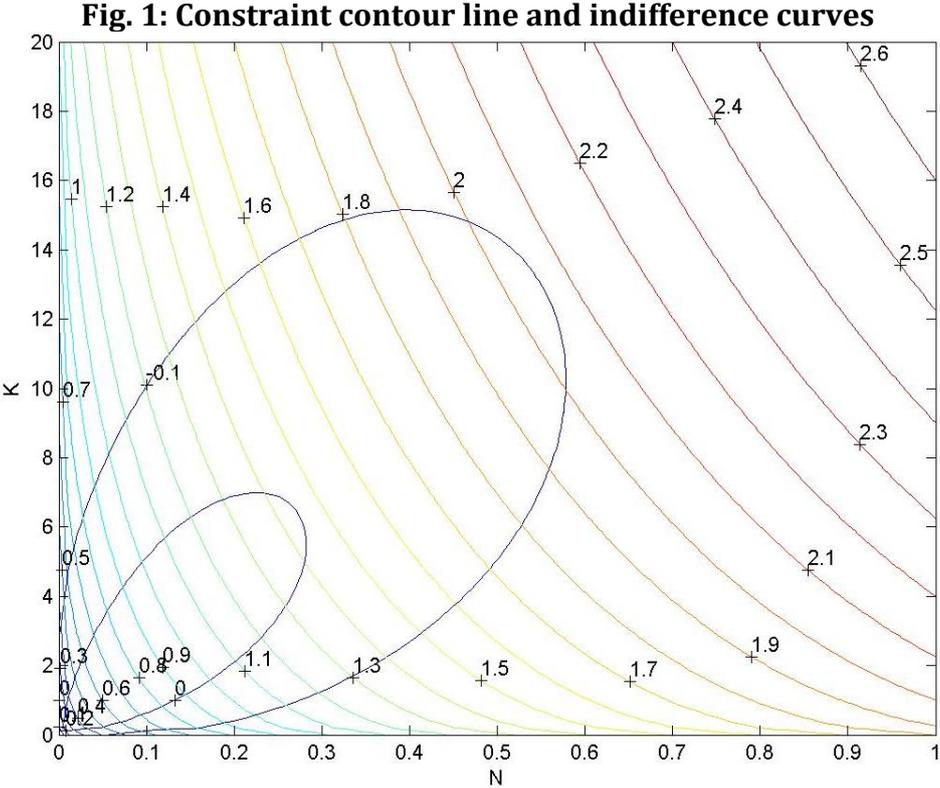
This is the managerial utility maximization condition under the all product distribution to households, i.e. product is exhausted by owns of factors. In the optimum the slope of constraint must equal the slope of indifference curve. In the case of constant returns to scale production function the constraint is closed curve, chosen form of utility function (constant relative risk aversion function) results in "normal" i.e. downward sloping and convex indifference curves. So the unique solution exists. The set of indifference curves and two constraints are shown on the Fig. 1. The used parameters are described in next chapter. The fact that the contribution of labour and capital is less than one ( $1 - \alpha_M < 1$ ) allows the manager to hire more labour and capital than in profit maximization model.

The final model consists of household's constraint (2) - often called as low of motion of capital, labour demand (3), Euler equation (4), firm's constraint (6) and optimality

condition (7). These five equations content five endogenous variables: consumption  $C_t$ , labour  $N_t$ , capital  $K_t$ , real wage rate  $w_t$  and real interest rate  $r_t$ . The technology level  $A_t$  follows the exogenous AR(1) process:

$$A_{t+1} = A_t^\rho e^\varepsilon \tag{8}$$

where  $\rho$  is persistence of shock and  $\varepsilon \sim N(0, \text{var})$  is i.i.d. process.



Source: author's own computation in Matlab

## 2. Model features

The model was solved in Matlab Dynare toolbox, which can produce the impulse response functions (IRFs) to analyse the model behaviour under exogenous shock. In our model we have only one variable (technology level  $A_t$ ) exposed to stochastic shock. The parameters used in simulation are:  $\beta=1/1.01$ ;  $\sigma=1/2$ ;  $\varphi=1/3$ ;  $\theta=4$ ;  $\delta=0.025$ ;  $\rho=0.9$ ;  $\text{var}=0.01^2$ ; these values correspond with the ones often used in RBC or DSGE models. The parameters resulting from our model modification were set:  $M=1$ ;  $\alpha_K=0.27$ ;  $\alpha_M=0.1$ ;  $\theta_m=0.9$ ;  $\sigma_m$ , and  $\varphi_m$  were changed the same way from 0.1 to 0.9. The responses on negative technology shock are shown in Fig. 2 where the full IRFs are drawn and when it is necessary the zooms of beginnings of the trajectories also. The added two variables  $I$  and  $Y$  are gross investment and production ( $Y=C+I$ ).

We can see that higher values of parameters  $\sigma_m$ , and  $\varphi_m$  (i.e. more curved the manager's utility function is) lead to smaller economy fluctuations. The marginal utility falls faster to zero and manager is then less motivated to change the amount of hired factors as a response to technology shock. In the model the manager has the influence on the business cycle and the power of this influence depends on the utility function used to describe her behaviour. There is also the influence on the steady state values. Higher parameters (lower incentive to hire more factors) result in lower production. This is shown in Tab. 1, where *MPN* and *MPK* means marginal product of labour respectively capital.

**Tab. 1: Steady state values**

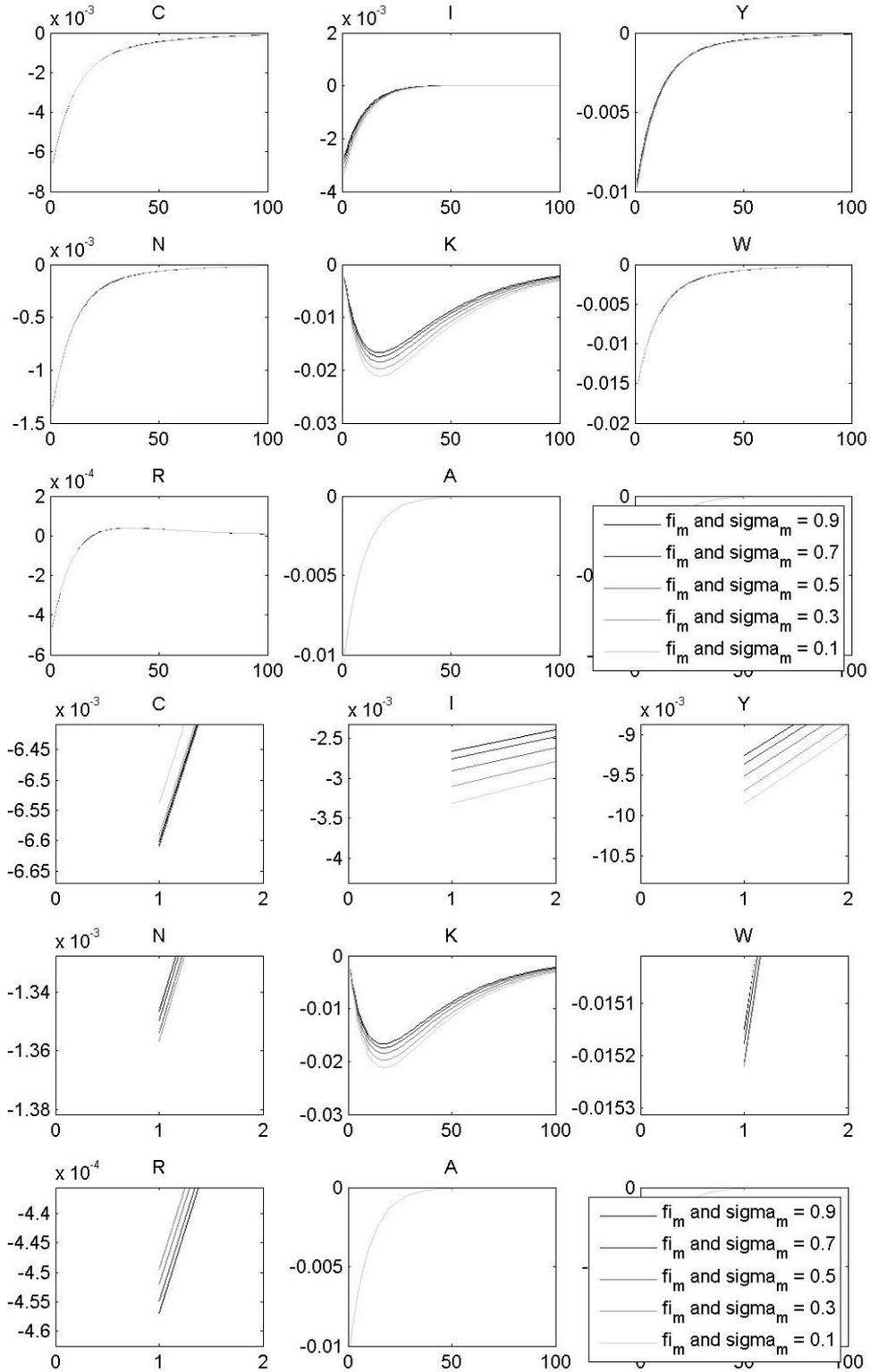
| $\sigma_m$ | $\varphi_m$ | $C$   | $I$   | $Y$   | $N$   | $K$   | $w$   | $r$   | <i>MPN</i> | <i>MPK</i> | $N*W/Y$ | $K*R/Y$ |
|------------|-------------|-------|-------|-------|-------|-------|-------|-------|------------|------------|---------|---------|
| <b>0.1</b> | 0.1         | 0.571 | 0.182 | 0.753 | 0.272 | 7.274 | 1.830 | 0.035 | 1.742      | 0.028      | 0.662   | 0.338   |
| <b>0.3</b> | 0.3         | 0.571 | 0.170 | 0.741 | 0.273 | 6.803 | 1.841 | 0.035 | 1.709      | 0.029      | 0.679   | 0.321   |
| <b>0.5</b> | 0.5         | 0.570 | 0.159 | 0.728 | 0.274 | 6.344 | 1.848 | 0.035 | 1.675      | 0.031      | 0.695   | 0.305   |
| <b>0.7</b> | 0.7         | 0.568 | 0.150 | 0.718 | 0.274 | 5.984 | 1.853 | 0.035 | 1.648      | 0.032      | 0.708   | 0.292   |
| <b>0.9</b> | 0.9         | 0.566 | 0.144 | 0.710 | 0.274 | 5.741 | 1.854 | 0.035 | 1.629      | 0.033      | 0.717   | 0.283   |

*Source: author's computation in Matlab*

The (7) is the key equation of our model, which differs from standard approach profit maximization. The manager compares the marginal utility from hired factor with the cost of paying more than the factor marginal productivity is. It means that the manager "overpays" the factors. This is the basic difference against the profit maximization model. The space for this overpaying is given by the manager's contribution to production which is not compensated. The same result is obtained if the manager's compensation is smaller than her marginal productivity i.e. contribution to production. The overpaying is easy to see in the Tab. 1:  $w > MPN$  and  $r > MPK$ . The sum of last two columns is always one, it is just the proof if the model is consistent and the whole product is divided between labour and capital, eq. (6).

The simulation was shown only for the identical change of parameters. But the similar (even the same) results will be obtained in case of one parameter change, because the chosen managerial utility function has the same properties in both arguments  $K$  and  $N$ . Of course, the results could be different for different utility functions, but the mainstream economy always uses arbitrarily functions specified by the constructor of the model.

**Fig. 2: IRFs for negative technology shock**



Source: author's own computation in Matlab

## Conclusion

In this paper we developed the DSGE model with managerial utility function. Contemporary models use only profit maximizing firm and it does not matter how complicated the models are. The different goals of firms are known in partial equilibrium microeconomics but to put these goals inside the general equilibrium framework is not simple task. We introduced the simple model which indicates that it is possible. The model consists of two utility maximization problems. The first one is standard dynamic maximization of household's discounted utility in infinite time horizon. The second one is static maximization of manager's utility. This utility depends on the quantity of labour and capital used in production. The special production functions have to be used in the model. There is the manager's effort as an extra factor of production, but this factor is not rewarded. This omission of manager's reward can be explained by the smaller amount of managers in comparison with labourers. Our model really separates the households and firms behaviour (two different utility functions) while the rest of DSGE models and literature assumes, that households are owners of firms and instruct the management to maximize profit.

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## Measuring Performance of Small Retail and Wholesale Companies in the Czech Republic

### Abstract

The aim of this article is to analyze the performance of retail and wholesale companies operating in the Czech Republic. The development of company performance remains a crucial topic for company's management. Because of the specific nature of trading companies as the measure of performance the trade margin is used. This specific measure is suitable for evaluating the performance of the main activity of those companies. To reflect different size of companies the trade margin per one employee is calculated in individual regions of the Czech Republic excluding the capital city of Prague. The research sample is focused on small companies because they represent the most important part of business entities in the Czech Republic regarding the number of employees. To analyse the performance of the analysed companies a comparative analysis of secondary data is used. Firstly, the situation of retail companies is analysed and then the same analysis is done by the wholesale ones. Then the difference between the two type of companies is analysed. The research has shown that the trade margin per employee is on average about three times higher in case of wholesale companies than by the retail ones. Some differences can be seen comparing the results in individual regions.

### Key Words

*small company, retail, trade margin, wholesale, performance*

**JEL Classification: L81,M10**

## Introduction

The concepts of retail and wholesale do not currently have a legal definition in the Czech legal system. As amended by the Trade Act, it defines wholesale as the activities related to the purchase and sale of goods for the purpose of resale for other business activities and retail trade is defined as activities related to the purchase and sale of goods for the purpose of sale to the direct consumer and sale of such goods.

In general, the difference between retail and wholesale is that retail supply chain consists of manufacturers, wholesalers, retailers and the consumer (end user). The wholesaler is directly connected to the manufacturer, while the retailer is connected to the wholesaler, and not to the manufacturer. A retailer, or merchant, is an entity that sells goods or commodities directly to consumers, through various distribution channels with the goal of earning a profit.

There is no doubt about the important role of small and medium-sized businesses in the economy. Their ability to react quickly to changes in market conditions, government regulations, or to absorb free labor is irreplaceable. (Belás, 2015).

Small and medium-sized enterprises represent more than 1 million businesses in the Czech Republic, i.e. 99.84 % of all entrepreneurs. At the same time it employs over 1.8 million employees, exports account for about 51 % and about 56 % for imports. Small and medium-sized enterprises play an important role in the development of the endogenous potential of individual regions in the Czech Republic because they are significantly entrepreneurial and socially connected with the region and constitute a regional business backbone. (Czech Trade, 2017).

Segment costs are generally similar for most operators, but can vary between firms of different operating sizes and specialties. Larger operators benefit from cost savings achieved through bulk purchasing, allowing them to generate higher returns. (Mattilla, 2002) These firms also benefit from lower operating expenses, as they can use their vast distribution and supply networks to ship products and manage inventories. (Panigyrakis, 2007) In contrast, smaller operators have lower profit margins and higher operating costs, as they are unable to take advantage of economies of scale. (Mazzone & Associates, 2015).

## **1. Methods of Research**

As the research sample the retail and wholesale companies excluding the motor vehicles in individual regions in the Czech Republic were selected. Because of the specific nature of companies operating in the capital city of Prague this region was excluded from the analysis. The reason for this exclusion was that companies from other regions have their headquarters right in this region. The research period covered the years from 2010 to 2014. Newer periods were not taken into account because of the unavailability of financial statements in sufficient number. The selection of small companies was done by using the Bisnode database. As the measure the classification of the Czech statistical office was used. Small companies are those employing between 10 and 49 employees. For the own analysis only such companies whose financial statements for the whole analysed period were available were analysed. The number of companies analysed is shown in Tab. 1.

According to the data in Tab. 1 the higher availability of data was obtained by wholesale companies than from the retail ones. This could be caused by higher turnover and revenues disclosed by the wholesale ones that leads to the necessity to publish the data according to the Accounting act. But as there is no fine that the companies would face if they do not publish their financial statements in the public register some companies do not respect this obligation. This situation could lead to a slight influence of the results of the following analysis.

According to Bushman (2001) the information embodied in financial statements affects economic performance through at least three channels that should enhance financial

performance of a company. Because of the specific nature of trading companies as the measure of performance the trade margin is used. This specific measure is suitable for evaluating the performance of the main activity of those companies. In general, trade margin generally means the difference between the sales and the purchase price of the goods sold. This information could be easily found out from accounting, as a difference between the final balance of the account - Sales for goods and the final balance of the account - Goods sold. It should be remembered that the trade margin is not a profit. A trade margin is the difference between the actual or imputed price realised on a good purchased for resale (either wholesale or retail) and the price that would have to be paid by the distributor to replace the good at the time it is sold or otherwise disposed of. To reflect different size of companies the trade margin per one employee is calculated in individual regions.

**Tab. 1: Trade margin per employee in retail companies in the Czech Republic**

| Region                   | Wholesale |        |         | Retail |        |         |
|--------------------------|-----------|--------|---------|--------|--------|---------|
|                          | Total     | Sample | Percent | Total  | Sample | Percent |
| South-Bohemian Region    | 156       | 92     | 58.97%  | 120    | 49     | 40.83%  |
| South-Moravian Region    | 551       | 374    | 67.88%  | 293    | 122    | 41.64%  |
| Karlovy Vary Region      | 42        | 30     | 71.43%  | 49     | 26     | 53.06%  |
| Hradec Kralove Region    | 156       | 127    | 81.41%  | 92     | 56     | 60.87%  |
| Liberec Region           | 98        | 64     | 65.31%  | 68     | 38     | 55.88%  |
| Moravian-Silesian Region | 354       | 228    | 64.41%  | 218    | 83     | 38.07%  |
| Olomouc Region           | 166       | 106    | 63.86%  | 100    | 36     | 36.00%  |
| Pardubice Region         | 147       | 87     | 59.18%  | 76     | 33     | 43.42%  |
| Pilsen Region            | 123       | 79     | 64.23%  | 97     | 35     | 36.08%  |
| Central-Bohemian Region  | 463       | 274    | 59.18%  | 206    | 63     | 30.58%  |
| Usti Region              | 141       | 92     | 65.25%  | 102    | 37     | 36.27%  |
| Vysocina Region          | 114       | 75     | 65.79%  | 77     | 36     | 46.75%  |
| Zlin Region              | 183       | 120    | 65.57%  | 88     | 38     | 43.18%  |

*Source: authors' calculations*

The aim of this research lies in analysing the performance of retail and wholesale companies having headquarters in individual regions of the Czech Republic. The secondary aim of the research is to analyse whether there is a difference in performance between retail and wholesale companies.

## 2. Results of the Research

Firstly the performance of retail companies in individual regions in the Czech Republic in years 2010 and 2014 was analysed (see Tab. 2). Based on the data in the table it was found out that on average the trade margin per employee in the examined period fluctuates from 474,315 CZK to 855,742 CZK. From this point of view the most successful retail companies had headquarter in the Central-Bohemian Region, followed by the South-Bohemian and

Karlovy Vary Region. On the other hand, the least performing companies were to be found in the Liberec Region, followed by the Hradec Kralove and Zlin Region. Considering the change of the performance of retail companies in time in most regions the it is quite constant. Only in case of Karlovy Vary and South-Bohemian Region there is an ascending tendency and, on the other hand, in Central-Bohemian Region the performance is falling.

**Tab. 2: Trade margin per employee in retail companies in the Czech Republic**

| Region                   | Year    |         |         |         |         | Average margin | Average position |
|--------------------------|---------|---------|---------|---------|---------|----------------|------------------|
|                          | 2010    | 2011    | 2012    | 2013    | 2014    |                |                  |
| South-Bohemian Region    | 773,414 | 814,314 | 797,735 | 892,552 | 896,063 | 834,816        | 2                |
| South-Moravian Region    | 578,225 | 582,292 | 540,194 | 543,806 | 561,115 | 561,127        | 5                |
| Karlovy Vary Region      | 700,429 | 789,813 | 891,768 | 847,604 | 933,436 | 832,610        | 3                |
| Hradec Kralove Region    | 437,908 | 477,150 | 484,486 | 490,677 | 513,335 | 480,711        | 12               |
| Liberec Region           | 440,067 | 491,804 | 484,420 | 475,343 | 479,944 | 474,315        | 13               |
| Moravian-Silesian Region | 548,554 | 554,749 | 561,116 | 545,220 | 565,734 | 555,075        | 6                |
| Olomouc Region           | 474,042 | 555,271 | 568,350 | 564,385 | 527,891 | 537,988        | 8                |
| Pardubice Region         | 568,431 | 633,578 | 648,423 | 636,561 | 630,603 | 623,519        | 4                |
| Pilsen Region            | 505,564 | 585,274 | 521,046 | 536,706 | 567,595 | 543,237        | 7                |
| Central-Bohemian Region  | 943,134 | 873,343 | 810,416 | 811,025 | 840,789 | 855,742        | 1                |
| Usti Region              | 564,568 | 528,529 | 482,423 | 455,815 | 518,435 | 509,954        | 10               |
| Vysocina Region          | 475,261 | 504,119 | 522,598 | 511,003 | 537,696 | 510,135        | 9                |
| Zlin Region              | 459,137 | 498,287 | 485,884 | 515,935 | 574,657 | 506,780        | 11               |

*Source: authors' calculations*

In the next step, the similar analysis was performed on the sample of wholesale companies in the same regions. The results of this analysis are shown in Tab. 3. The table 3 shows that on average the trade margin per employee in the examined period fluctuates from 914,078 CZK to 1,729,609 CZK. From this point of view the most successful wholesale companies had headquarter in the Hradec Kralove Region, followed by the Central-Bohemian and Pilsen Region. On the other hand, the least performing companies were to be found in the Karlovy Vary Region, followed by the Zlin and Olomouc Region. Considering the change of the performance of wholesale companies in time in most regions the it is quite constant. Only in case of Hradec Kralove Region there is an ascending tendency.

As the last step, the comparion of wholesale and retail companies was made. Tab. 4 shows the difference between the trade margin per employee of wholesale and retail companies in the examined regions.

The difference between the trade margin per employee of the wholesale and retail companies fluctuates on average from 81,468 CZK to 1,248,898 CZK. The biggest difference was found out by the companies that have headquarters in the Hradec Kralove Region, followed by the Liberec and Pilsen Region. On the other hand, the least difference was found out by the companies that can be found in the Karlovy Vary Region, followed by the South-Bohemian and Pardubice Region.

**Tab.3: Trade margin per employee in wholesale companies in the Czech Republic**

| Region                   | Year      |           |           |           |           | Average margin | Average position |
|--------------------------|-----------|-----------|-----------|-----------|-----------|----------------|------------------|
|                          | 2010      | 2011      | 2012      | 2013      | 2014      |                |                  |
| South-Bohemian Region    | 1,095,271 | 1,170,725 | 1,127,873 | 1,117,108 | 1,035,425 | 1,109,281      | 8                |
| South-Moravian Region    | 1,369,742 | 1,366,637 | 1,276,835 | 1,260,127 | 1,343,437 | 1,323,356      | 5                |
| Karlovy Vary Region      | 907,515   | 949,433   | 951,973   | 908,458   | 853,012   | 914,078        | 13               |
| Hradec Kralove Region    | 1,651,870 | 1,792,603 | 1,648,523 | 1,622,767 | 1,932,283 | 1,729,609      | 1                |
| Liberec Region           | 1,264,683 | 1,348,233 | 1,272,245 | 1,378,079 | 1,426,850 | 1,338,018      | 4                |
| Moravian-Silesian Region | 1,069,061 | 1,151,504 | 1,034,307 | 1,026,376 | 1,038,602 | 1,063,970      | 9                |
| Olomouc Region           | 963,625   | 1,067,587 | 1,045,410 | 1,024,297 | 1,149,817 | 1,050,147      | 11               |
| Pardubice Region         | 1,073,717 | 1,067,221 | 1,060,890 | 995,984   | 1,098,948 | 1,059,352      | 10               |
| Pilsen Region            | 1,255,101 | 1,381,890 | 1,376,283 | 1,355,696 | 1,361,785 | 1,346,151      | 3                |
| Central-Bohemian Region  | 1,447,328 | 1,516,748 | 1,481,600 | 1,556,768 | 1,600,463 | 1,520,581      | 2                |
| Usti Region              | 1,046,890 | 1,156,870 | 1,181,353 | 1,173,145 | 1,312,929 | 1,174,237      | 7                |
| Vysocina Region          | 1,231,154 | 1,253,138 | 1,245,866 | 1,261,416 | 1,373,163 | 1,272,947      | 6                |
| Zlin Region              | 945,742   | 1,040,426 | 976,923   | 945,033   | 1,025,352 | 986,695        | 12               |

*Source: authors' calculations*

**Tab.4: Differences between the trade margins of wholesale and retail companies**

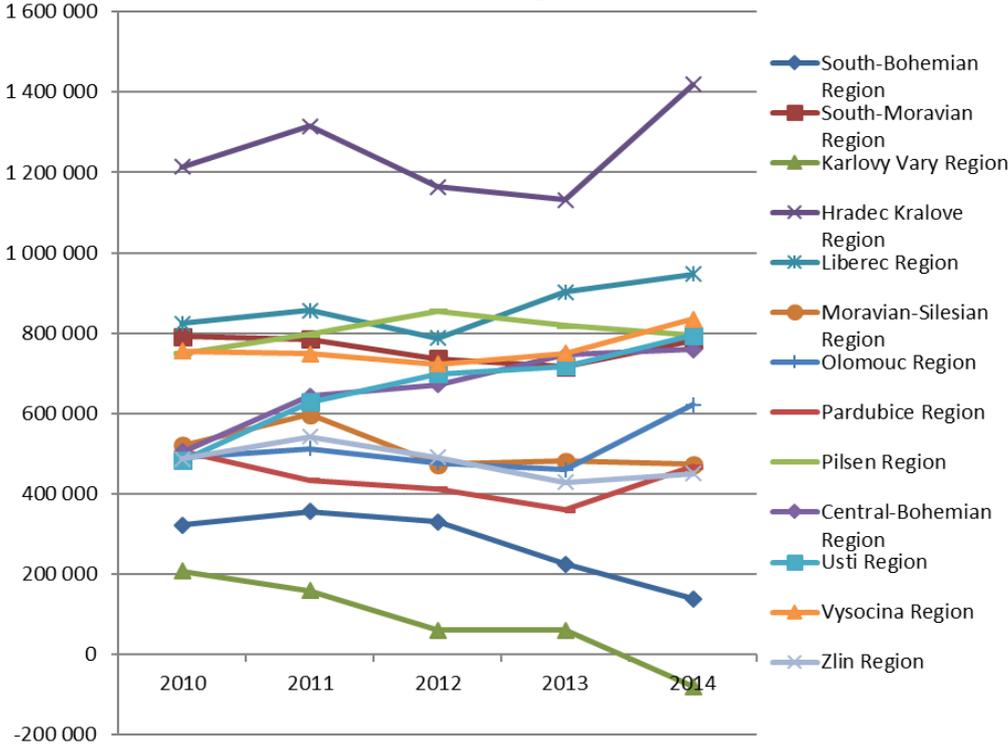
| Kraj                     | Year      |           |           |           |           | Average margin | Average position |
|--------------------------|-----------|-----------|-----------|-----------|-----------|----------------|------------------|
|                          | 2010      | 2011      | 2012      | 2013      | 2014      |                |                  |
| South-Bohemian Region    | 321,857   | 356,411   | 330,139   | 224,557   | 139,361   | 274,465        | 12               |
| South-Moravian Region    | 791,517   | 784,344   | 736,642   | 716,321   | 782,322   | 762,229        | 5                |
| Karlovy Vary Region      | 207,086   | 159,621   | 60,205    | 60,854    | -80,424   | 81,468         | 13               |
| Hradec Kralove Region    | 1,213,962 | 1,315,453 | 1,164,037 | 1,132,090 | 1,418,948 | 1,248,898      | 1                |
| Liberec Region           | 824,617   | 856,429   | 787,825   | 902,737   | 946,906   | 863,703        | 2                |
| Moravian-Silesian Region | 520,507   | 596,755   | 473,191   | 481,157   | 472,869   | 508,896        | 9                |
| Olomouc Region           | 489,583   | 512,316   | 477,060   | 459,912   | 621,926   | 512,160        | 8                |
| Pardubice Region         | 505,287   | 433,643   | 412,467   | 359,422   | 468,345   | 435,833        | 11               |
| Pilsen Region            | 749,536   | 796,616   | 855,236   | 818,990   | 794,190   | 802,914        | 3                |
| Central-Bohemian Region  | 504,194   | 643,405   | 671,184   | 745,743   | 759,673   | 664,840        | 6                |
| Usti Region              | 482,322   | 628,341   | 698,930   | 717,330   | 794,494   | 664,284        | 7                |
| Vysocina Region          | 755,893   | 749,019   | 723,268   | 750,413   | 835,468   | 762,812        | 4                |
| Zlin Region              | 486,606   | 542,139   | 491,039   | 429,098   | 450,695   | 479,915        | 10               |

*Source: authors' calculations*

To put the results in a graphical perspective Fig. 1 shows the relations between the difference between the trade margin per employee of wholesale and retail companies in individual regions. As the figure clearly presents the biggest difference was found out by the Hradec Kralove Region. It is about 400,000 CZK than the second Liberec Region which is closely follow by the Pilsen, Vysocina, South-Moravian, Central-Bohemian and Usti Region. The third group consists of the Olomouc, Moravian-Silesian, Zlin and Pardubice Region where the difference is about 600,000 CZK in favour of the wholesale companies.

The smallest difference is by the companies having headquarters in the South-Bohemian and Karlovy Vary Region where in the year 2014 the trade margin per employee was higher in case of retail companies than the wholesale ones. Considering the change of the performance in time in most regions the difference between the retail and wholesale companies is quite constant. Only in case of Hradec Kralove and Liberec Region there is an ascending tendency and, on the other hand, in Karlovy Vary and South-Bohemian Region the difference between the performance of the wholesald and retail companies is falling.

**Fig. 1: Differences between the trade margins of wholesale and retail companies**



Source: authors' own calculations, data from (CZSO, 2014)

### 3. Discussion and Conclusion

This paper summarizes the basic characteristics of retail and wholesale performances by small companies and it focuses on retail and wholesale entities operating in the Czech Republic regions excluding Prague. The aim of this paper was to compare the retail and wholesale sector in several aspects due to their trade margin per employee. From the results of the research it can be concluded that on average the trade margin per employee of retail companies was from 474,315 CZK up to double in the examined period 2010-2014 and the most successful retail companies had headquarter in the Central-Bohemian Region. For wholesale companies on average the trade margin per employee was twofold the amount of retail value and also moved up to double the value in the examined period. The most successful of wholesale ones had headquarter in the Hradec Kralove Region. Subsequently the difference between the trade margin per employee of the wholesale and

retail companies was examined. The biggest difference was found out by the companies that have headquarter in the Hradec Kralove Region and the least difference was found out by the companies in the Karlovy Vary Region. Therefore, it can be concluded that the performance or both retail and wholesale companies measured by the trade margin per employee is influenced by the region in which the company is located. I can also be concluded that there is a difference in performance between the retail and wholesale companies. Considering the development of performance of both retail and wholesale companies the difference is expected to fall in some regions and, on the other hand, in some regions the difference will probably be rising.

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## **Review of Relevant Approaches for Evaluation of Development Potential: Use for the EU Regions**

### **Abstract**

Regional development policies based on local potential triggers a shift in the economic structure of territories (country, regions, provinces, counties, cities). The shift in the structure of the economy is a rapid change in the economic structure as a policy strategy synergizing system of the various sectors in the regions that have an impact on economic performance, employment, public services, public participation, and other aspects. Developments are conducted in the form of planned changes in various aspects of social life by exploiting all the potential of human resources, natural resources, and institutions available in the region. The territorial to improve economic growth coupled with efforts to change the economic structure of the dominance of the primary sector towards improving secondary and tertiary sectors becomes very important. The question is what strategy is used to increase the effectiveness of regional development policies impact the shift in the economic structure of territory? Regional development strategies should be based on the sound assessment of regional resources, capabilities, competencies and core competencies, as well as on dynamic capabilities aiming to develop the resource configurations in order to form regional competitive advantage. Competitive advantage is based on its resource configurations, but these resource configurations have to territorial over time in order to keep them competitive. The main aim of the paper is to analyse the existing approaches to development potential, specialisation and performance of the European territory and to identify the key factors as background for a construction of the own composite index to an evaluation of development potential. Potential of regional development is determined by exogenous and endogenous factors and it is necessary to use different indicators and methods to its evaluation.

### **Key Words**

*database, potential of regional development, European Union, factor/indicator, region*

**JEL Classification: B41, C82, O18, R11, R12**

## **Introduction**

One of the many paradoxes of the processes of globalisation is the continued significance of regions, in the sense of sub-national spaces as foci of economic activity. Regional development is inseparable from the development of national development. Development activities of the government in these areas are intended in improving national development and vice versa. Increasing national development will bring a positive impact on regional development, which can boost revenue. Developments are conducted in the form of planned changes in various aspects of social life by exploiting all the potential of

human resources, natural resources, and institutions available in the region. Actually, efforts to improve economic growth coupled with efforts to change the economic structure of the dominance of the primary sector towards improving secondary and tertiary sectors becomes very important. Systemic processes of rapid technological change, enhanced capital mobility and neoliberally inspired inter-regional competition for investment have focused attention on the need for regional-level interventions among a broad community of academics and policymakers. Two recent strands of work attempt to tackle the links between globalisation dynamics and notions of regional development. In their early formulations, both of these literature could be criticised for their failure to effectively conceptualise regional economic development in an era of globalisation. The new regionalism literature seemed overly pre-occupied with local transactions and institutional forms at the expense of the many extra-local connections within which regions are embedded, while the functional connections between seemingly desirable regional institutional configurations and actual levels of economic development were open to question (Coe et al., 2004; Amin and Thrift, 1994). Recent developments in these two fields, however, have begun to address these shortcomings and to move somewhat closer together. The new regionalism literature, for example, places increased weight on the extra-local dynamics shaping economic growth within regions (both knowledge, capital and labour flows and also the wider institutional structures within which regions are embedded), see e.g. Amin, 2002; MacKinnon et al., 2002; Bunnell and Coe, 2001. The main aim of the paper is to analyse the existing approaches to development potential, specialisation and performance of the European territory and to identify the key factors as background for the construction of the own composite index to the evaluation of development potential. This paper is based on literature review approach investigating research works on the issues of regional development and components of potential concept to obtain general overview for own constructing the EU regional index of potential development.

## **1. Literature Review in Potential of Regional Development**

Inequalities, development potential and performance of the European territory in the context of cohesion and competitiveness has become an important issue that is frequently discussed in the European Union (EU). The problem of insufficient economic growth, social welfare and competitiveness of the EU as a whole has been intensified since 2004 (later on 2007 and 2013) when central and eastern European and Balkan countries join the EU. The elimination of socioeconomic differences at the all territorial units became a primary interest of the EU Member States as a major obstacle to the balanced and harmonious development of the EU territory, see e.g. Minarčíková (2015), Staníčková (2014), Skoan and Staníčková (2011), and Molle (2007). Generally, the term development can be defined as the process of positive quantitative or qualitative changes. Development also has a number of dimensions from multinational, through regional to a local level (Ďurková, Čábyov and Vicenová, 2012). Regional development is a complex of processes taking place within the regions that affect economic, social, environmental and other changes of a region. Regional economic and social development may be described from various perspectives using different criteria, often oriented in different directions.

Regional development involves economic as well as social and ecological development providing good conditions for increasing regional cohesion and competitiveness. This shows that the evaluation of regional development is a complicated problem to be addressed by complex approaches (Poledníková, 2014; Ginevičius, Podvezko and Mikelis, 2004).

**Tab. 1: Theories of regional development and economic growth**

| General theory   | Specific theoretical approach           | Leading factors  |
|--|---|--|
| <i>Traditional neoclassical economic growth theory</i> | Neoclassical growth theory              | the increase of productivity, individual welfare, incomes  |
|  | Factor endowment theories               | the increase of productivity   |
|  | Export-base theory                      | the increase of export   |
|  | Growth-pole theory                      | large-sized firms, growth centres, foreign direct investment   |
|  | Centrality/peripherality theory         | accessibility, distance from the centre  |
| <i>Regional innovation theory</i>                      | Epidemic models of innovation diffusion | percipience for innovations, dissemination of technologies, networking, cooperation                    |
|  | Innovative effectiveness                | innovations, knowledge, human capital  |
| <i>New growth theory</i>                               | Industrial districts                    | agglomeration, functional economic theories, industrial districts, economic, social links              |
|  | Infrastructure endowment theory         | development of infrastructure  |
|  | New economic geography                  | choice of location of enterprise, transport costs, lower costs, migration flow                         |
| <i>Endogenous growth theory</i>                        | Endogenous growth theory                | territorial competitiveness, innovations, economy of scale, administration, cooperation, human capital |

*Source: overview elaborated by Kalnina-Lukasevica (2013)*

‘Development of the area is based on an effective regional policy, which requires a different kind of resources composed in total the potential of the region’ (Cheymetova and Nazmutdinova, 2015, p. 74). In broad interpretation, the term potential can be considered as a source of opportunities, resources, stock, which can be activated, used to solve a problem or achieve a certain goal; capabilities of the individual, society and state in a particular field (Cheymetova and Nazmutdinova, 2015). ‘Combined expression of the material base of the region should be considered economic potential, take into account not only the volume located within a given territorial unit property, expressed in various quantitative indicators but also the qualitative characteristics that determine the potential of the region. The aggregate potential of the territory must be considered, first of all, the socio-economic, as the research of any kind components of only the economic potential of the region will inevitably lead to the inclusion of the social dimension, which characterizes the relationship between the people on the creation, development and effective use of resources in the region’ (Cheymetova and Nazmutdinova, 2015, p. 75). Baksha, Gamukin and Svintsova (2001) understand the concept of potential as a system of material and labour factors (conditions), ensuring the achievement of the purposes of production, and an opportunity through the use of resources to solve complex tasks entrusted to it. Moreover, Svobodin (1991) considers potential as a set of co-operating resources with the ability to produce a certain amount of production (Cheymetova and

Nazmutdinova, 2015). Then, economic potential can be seen as ‘the capacity for growth and development that has a geographic space as a result of a combination of factors, geographical, historical, economic, institutional and social’ (Rivera, 2012, p. 466).

The overview of the theories of the economic development of regions demonstrates that each of the theories aims to put forward one specific condition that ensures the regional development, however, none of these theories provides a complete response on how to ensure growth and development of a region, see Tab. 1 on the previous page.

## **2. Factors Influencing the Economic Level of Regions**

For the growth and development of a region depends on the dynamics of interaction among the activities in the surrounding areas, because the region has different development issues across the region with other regions. Differences of the intended development problems are caused by differences in economic potential, sociocultural, demographic, and political backgrounds. Related to differences in the characteristics of each region, the differences invite regional development policies based on local potential. Policies based on intent, every region or area should have its own policy in the planning and implement development activities in promoting regional development which impacted on the shift of economic structure and the subsequent impact on other development sectors in the region. The economic performance of a region is influenced by a range of factors. Key determinants of long-term regional economic growth set the foundation for the regional development framework, and provide a common lens through which to analyse a region and identify regional economic development priorities. There are various factors influencing the level of development and number of indicators that can be used for the assessing of development potential, growth and performance of given territory. Regions differ mainly in the economic level, based on Ďurková, Čábyová and Vicenová (2012), this level is affected by the following factors: localization of enterprises in the region, their frequency, branch structure, economic stability, the intensity of intra-regional economic relations, types of organizational forms; quantitative and qualitative characteristics of the population and its movement; technical and social infrastructure in terms of complexity, quality and quantity; the available natural resources and their utilization rate; and direct and indirect impacts of the state economic policy.

Based on stage of economic level of territory, it is possible to identify the driven forces of regional development. Keune (2001) discussed four major areas, found to be of major importance in promoting regional development, i.e. technology transfer, innovation and information; training, retraining and employment creation; support to particular groups of enterprises, promoting inter-firm cooperation in horizontal networks, vertical networks and/or sectoral clusters; promotion of inward investment. Viturka (2014) evaluates development potential of regions in an integrative way, from factual (integration of economic, social and environmental factors) as well as spatial (integration of territorial structures) perspectives. According to Boryczko (2007) to achieve successful regional development three components are necessary, i.e. genius loci or spirit of the place (economic and academic traditions, natural conditions, business climate, liability,

physical attractiveness, human capital, competition with other regions); tangible assets established by people in terms of technical, educational, social infrastructure and economic base (educational institutions, transportation, telecommunication, R&D framework, technical infrastructure, economic structure); regional strategy and all efforts enhance the development (relationships between academic and business circles, cohesive strategy of regional development, grassroots initiatives, partnerships among public, private and non-profit players). Capron (2002) deals with the importance of capital for regional development and differs natural, productive, creative, human and social capital.

Regional resource potential can be divided into three related blocks, based on Safiullin, Sarach and Prygunova (2016), i.e. environmental, social and economic potentials. Environmental potential includes natural resources, which can be theoretically available for use. Social potential represents a set of capabilities (social infrastructure as housing, education, health care, culture, etc.) available to the territorial unit to ensure the most favourable conditions of life of the population. Economic potential is largely determined by its social and environmental components and reflects the level of the region's productive forces development, its ability to produce goods, perform work and provide services. Crescenzi and Rodríguez-Pose (2012) or Čingule (2009) highlight technical infrastructure, especially transport infrastructure as the main alternative to raising the economic potential and promoting territorial cohesion, as well as social structure and development of entrepreneurship. The importance of business confirms also e.g. Gods, Gode and Serjogina (2007), or Harmaakorpi and Pekkarinen (2003) whereas the assessment of business potentials should include an audit of the regional industrial and institutional structure building the basis for the regional innovation system. Cheymetova and Nazmutdinova (2015) describe the structure of the socio-economic potential by four basic approaches, while three approaches have common elements as labour and natural resources, population, production or infrastructure; and the fourth approach reflects the best the possibility for a comprehensive assessment of the socio-economic potential of the area and highlights the availability of resources, their use and also reflected the willingness of the region to economic reform and development. The fourth approach is based upon its division in three blocks that characterize the resource potential for economic development, as well as the willingness of the process (Baksha et al., 2001), i.e. basic unit of resource potentials; potentials, ensuring economic development of the region; and block of potential readiness of the region to economic reform.

### **3. How to evaluate the Potential of Regional Development?**

An approach based on Baksha et al. (2001) reflects the best the possibility for a comprehensive assessment of potential of regional development. This approach highlights all the necessary conditions: the availability of resources, their use and also reflected the willingness of the region to economic reform and development. Therefore, this approach is taken as the basis for determining the structure of the regional potential and could serve as background for selection of appropriate indicators for constructing the EU regional index of potential development, but with some adjustments. The first part continues natural resources, economic and geographic and demographic, as they fully

reflect the resource base of the region – the availability of natural resources, their reserves, the climatic zone of the territory; reproduction and population of the region; the existence of transport infrastructure and the density of economic activity. The second part consists of the labor potential, which reflects the region's enterprises providing human resources and their effective use; production potential – the existence and development of the power industry, production of their products; social and infrastructural potential determines the conditions and quality of life of the population, i.e. the development of vital infrastructure. Budgetary potential, showing the change only the revenue and expenditure of the regional budget, is supplemented by financial content. The third part carrying out the processes for development of territory is not possible without the willingness of the population of this region, so this unit is turned on intellectual and volitional capacity, reflecting the level of professional development of the population, its ability for sustainable choice of objectives and activities to implement them. Proposed structuring of the potential of regional development is based on a comprehensive evaluation of the effectiveness of its use and development, which is essential in the generation options and the rationale of strategic choice of territorial development, the formation of economically justified both state and regional policy.

**Tab. 2: Selected approach for evaluating the potential of regional development**

| Potential of regional development  |  |  |
|--|--|--|
| <i>Part of resource potentials, opportunities for economic development of the region</i> | <i>Part of potentials, ensuring economic development of the region</i> | <i>Part of potentials of the readiness to the economic development of the region</i> |
| Natural resources  | Labor aspects  | Socio-economic readiness aspects   |
| Economic and geographical aspects  | Industrial aspects   | Regulatory readiness aspects   |
| Demographic aspects  | Social and infrastructural aspects                                     | Scientific and methodical readiness aspects  |
|  | Market infrastructure aspects  | Intellectual and volitional aspects  |
|  | Investment aspects   |  |
|  | Budget and Finance aspects   |  |

*Source: own elaboration based on Baksha et al. (2001)*

Suitable databases for selection the relevant indicators, with respect to specified dimensions and territorial interest of analysis (i.e. the EU NUTS 2 regions), are the EU statistics – Cohesion Policy reports and ESPON applied research projects in categories Attractiveness (ATTREG), Economic crisis (ECR2), EU Directives (ARTS), EU 2020 Strategy (SIESTA), Globalisation (TIGER), Governance (TANGO), Growth Poles (SGPTD), Specific types of territories (GEOSPECS), Territorial Cooperation (TERCO), Territorial impact assessment (TIPTAP), Neighbour Regions (ITAN), Scenarios (ET2050); and these will be subjected to further analysis.

## Conclusion

To detect the potential and challenges of a region, it is important to analyse its global and future challenges and potential. A territorial focus on the external trends and processes of globalisation and regionalization entails detecting current and future trends affecting the region, such as environmental changes, shifting demographic structures and

technological developments. It also requires a focus on the potential and challenges of cultural and economic globalisation processes and the ways in which politics and policies on a variety of scales are imposed on a region. To detect the territorial potential and challenges of a region, it is also important to analyse and compare its territorial performance and its European regional competitiveness. This territorial approach emphasises that every region in the EU has different regional assets and advantages that can be identified by comparing territorial performance. The territorial attractiveness and performance of a region are to a large degree dependent on its comparative advantage, potential for endogenous growth and agglomeration of economies, and its endowment (ESPON, 2014). Traditionally, the potential of regional development is understood as the ability of the socio-economic system to the production and reproduction of its structural elements. This approach is the result of a well-established paradigm of a limited and well-defined set of objectives of economic activity, which functioned on the basis of a planned economy. In the paper, approach to consider the potential of regional development is based on set of resources of area and properties that define how sustainable and effective functioning of the socio-economic system under varying environmental conditions. The paper confirms the urgency of identifying and assessing the potential of regional development. Review of approaches to structuring the potential of regional development is made, on the basis of which the methodological tools is selected that allow in further studies to make a comprehensive assessment of the EU individual regions at NUTS 2 territorial level. In the selected approach, the key conditions are highlighted and these determine the readiness of region to development, which is essential in the generation options and the rationale of strategic choice of territorial development, as well as in the formation of an economically viable state and regional policy. The paper offers suitable starting point for further analyses of specialisation, diversity and determinants of territorial dynamics, i.e. following steps will be selecting the databases and finding the relevant indicators within specified dimensions for potential of regional development, and choice of quantitative methods for construction of the EU regional index of potential development.

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## **Readiness of the Ústí nad Labem Region for the Implementation of the Industry 4.0 Concept**

### **Abstract**

The aim of the paper is to analyse and discuss the foundational ideas of the current Industry 4.0 concept in the context of the realities of the Ústí nad Labem region. Currently, the Ústí nad Labem region is generally perceived as an area with a number of major socio-economic problems. As compared to other regions of the Czech Republic, the region's economic performance is below average. Industry 4.0 represents a great opportunity for the future development and increase in the competitiveness of this industrially-oriented region. The question is to what extent the region is ready for the changes connected with automation, digitalisation, or robotisation, and what changes it should go through in the future in order for the possible ideas and some of the Industry 4.0 processes already under way to be successfully implemented. Due to the fact that Industry 4.0 is a very complex and comprehensive concept, this paper focuses on four key selected factors on which Industry 4.0 puts the most emphasis. These comprise research, development and innovation, human resources, education, and infrastructure. Therefore, the specific aim is to analyse these four factors in the territory of the Ústí nad Labem region, and point out the necessary changes related to the commencement of Industry 4.0. It is apparent from the performed analysis that the Ústí nad Labem region suffers from a lack of capacity (in the field of science and research, human resources, or in the qualification structure and communication infrastructure) and an insufficient involvement of the stakeholders themselves (company owners and management, workers, but also the young generation).

### **Key Words**

*Industry 4.0, Ústí nad Labem region, education, IT/ICT, research and development*

**JEL Classification: O14, O15, J24**

## **Introduction**

The Ústí nad Labem region is currently generally perceived as an area with a number of major socio-economic problems. As compared to other regions of the Czech Republic, the region's economic performance is below average. The structure of the economy exhibits the persistent industrial character of the region with a high representation of traditional industries. The region has above-average employment in the manufacturing industry, primarily due to the arrival of foreign investors. The Ústí nad Labem region is also specific with respect to the size composition of its companies. Compared to the rest of the Czech Republic, the region hosts a relatively small number of small and medium-sized

companies, whereas there are an above-average number of companies with 100 or more employees (ICUK, 2014).

**The aim is to analyse and discuss the foundational ideas of the current Industry 4.0 concept in the context of the realities of the Ústí nad Labem region.** Industry 4.0 represents a great opportunity for the development and increase in the competitiveness of this industrially-oriented region. However, the question is to what extent is the region ready for the changes connected with automation, digitalisation, or robotisation, and what changes it should go through in the future in order for the possible ideas and some of the already ongoing Industry 4.0 processes to be successfully implemented. Due to the fact that Industry 4.0 forms a very complex and comprehensive concept, the attention of this contribution is dedicated to four key selected factors on which Industry 4.0 puts the most emphasis. These comprise **innovation, human resources, education, and infrastructure. Therefore, the specific aim is to analyse these four factors in the territory of the Ústí nad Labem region, and point out the necessary changes related to the commencement of Industry 4.0.**

To analyse the above-mentioned factors, statistical data provided by the Czech Statistical Office, in particular, was utilised. Information on Industry 4.0 has been sourced from the Ministry of Industry and Trade documents, and also from annual reports of the World Economic Forum. Another source used is a study of the National Training Fund “Industry 4.0 in Relation to Qualified Workforce in the Field of IT/ICT in the Czech Republic”, which includes an evaluation of interviews conducted with experts in the field of ICT on the one hand, and the results of surveys among representatives of companies from the Ústí nad Labem region on the other.

## 1. Industry 4.0

The term "Industry 4.0" was revived in 2011 at the Hannover Fair. In October 2012, the Working Group on Industry 4.0 presented a set of Industry 4.0 implementation recommendations to the German federal government (KAGERMANN, 2013). The main idea behind this strategic concept is to push the current industrial production towards the so-called “production of tomorrow” based on intelligent factories that take advantage of the latest information and communication technologies to digitalise production processes. The Industry 4.0 initiative was introduced in the Czech Republic in 2015 by the former Minister of Industry Jan Mládek (MPO ČR, 2016). It was only in the beginning of the current decade that the fourth industrial revolution started to be discussed. It is thought that its result will be an almost total automation and robotisation of production, including the control and management processes which are currently still handled by people.

The World Economic Forum 2016, which examined the issue of Industry 4.0 in detail, included the term into its annual report on country competitiveness. Table 1 provides a preview of the key factors of Industry 4.0 and their development for the Czech Republic in 2014-2016 (for the option of a longer-term comparison, the table also includes the year

2017). While the Czech Republic has been improving its rank in the area of Technological readiness, in the area of Innovation (and particularly with respect to the Availability of scientists and engineers) it has been gradually losing competitiveness. In 2016, the Czech Republic finished in a comparatively unflattering 56<sup>th</sup> and 59<sup>th</sup> places in terms of the Quality of math and science education and the Quality of the education system, respectively. The following chapters will focus on the analysis of these key factors at the level of the Ústí nad Labem region, specifically in relation to innovation, human resources, education, and infrastructure.

**Tab. 1: Key Factors of Industry 4.0 and Their Development in 2014-2016 (Czech Republic)**

| Parameter                                   | 2010 | 2014 | 2015 | 2016 |
|---|------|------|------|------|
| Innovation                                  | 27   | 39   | 35   | 37   |
| Quality of scientific research institutions | 21   | 36   | 34   | 30   |
| Capacity for innovation                     | 24   | 28   | 26   | 29   |
| Company spending on R&D                     | 25   | 31   | 30   | 32   |
| University-industry collaboration in R&D    | 29   | 42   | 42   | 47   |
| Availability of scientists and engineers    | 50   | 55   | 66   | 89   |
| Higher education and training               | 24   | 35   | 29   | 27   |
| Quality of math and science education       | 25   | 35   | 29   | 56   |
| Quality of the education system             | 34   | 77   | 60   | 59   |
| Availability of highly qualified experts    | 50   | 55   | 26   | 24   |
| Extent of staff training                    | 40   | 55   | 39   | 35   |
| Technological readiness                     | 32   | 36   | 29   | 29   |
| Availability of latest technologies         | 46   | 51   | 32   | 27   |
| Firm-level technology absorption            | 36   | 50   | 48   | 37   |

*Source: (WEF, 2016), adapted by author*

## 2. Analysis of Selected Factors of the Industry 4.0 Concept in the Ústí nad Labem Region

### 2.1 Research, Development, Innovation

According to data from the Czech Statistical Office (CZSO, 2016b), 110 workplaces conducting research and development (hereinafter R&D) are currently located in the Ústí nad Labem region, and their number has been steadily increasing in the long-term. In spite of this, the region places as one of the last in a nationwide comparison, both with respect to the number of R&D workplaces and in respect to their focus – only 2 workplaces state that R&D is their main economic activity. The region also lags behind in terms of spending on R&D. While, on average, nearly 10% of R&D workplaces spend more than CZK 50 million on science and research, only 4% of workplaces in the Ústí nad Labem region spend a corresponding amount. In recent years, the number of R&D workplaces grew the most in the field of technical sciences, which now make up more than half of all workplaces. However, this still does not match the significantly industrial character of the Ústí nad Labem region. The number of workers in research and development can also be considered unsatisfactory. In 2015, this sector employed 1069 employees (recalculated

to a full annual workload fully devoted to R&D). Fewer R&D workers are recorded only in the Karlovy Vary and the Vysočina regions, where, incidentally, no university or other public research organisations are located (CZSO, 2016a).

The primary participants in the region's R&D are the Jan Evangelista Purkyně University (hereinafter UJEP) and research institutes (e.g. the Inorganic Chemistry Research Institute, Lignite Research Institute and Hop Research Institute). The scientific orientation of these research institutes is historically focused on the local economy sectors. However, this does not apply to the case of UJEP. Indeed, the university has evolved from a former pedagogical university, and its research primarily focuses on the humanities. In recent years, however, it is apparent that the university has been taking pains to align its research activities with the regional economy, e.g., material research of aluminium, ferrous and non-ferrous metals, or research of nanomaterials. Generally, however, it can be argued that UJEP's R&D results have no significant economic applicability. On the opposite side of the spectrum are, for example, the Inorganic Chemistry Research Institute and the Crop Research Institute in Chomutov, whose results reach the economic applicability of approximately 40% (CZSO, 2015).

Companies operating within regionally significant industries also make vital contributions to R&D. A typical example is that of the mining industry, which, in addition to innovations of mechanical technologies for mining, also focuses its research activities on new methods of reclaiming damaged landscape. The glass industry can also be described as significantly innovative, particularly due to the economically strong regional company AGC Flat Glass Czech. The glass industry spends relatively large sums on R&D, and, furthermore, it collaborates with extra-regional research institutions (ICUK, 2014). Several supporting research institutions and facilities are also located within the territory of the region (e.g. Business Centre Rumburk, Technology Park Chomutov, or Business Incubator and Technology Park NUPHARO PARK). However, their activity has more or less been limited to providing office space. There were high hopes that the above-mentioned NUPHARO PARK incubator would break through these limitations. Within the incubator, patents and prototypes were supposed to be put into practice, and new production options were to be explored. However, less than a year after its completion, the park became insolvent due to lack of interest (only 40% of the capacity of the technology park was occupied, and there was no interest in the scientific incubator) (ČERNÝ, 2016).

## **2.2 Human Resources and the Labour Market**

Since the 1990s, the Ústí nad Labem region has been struggling with a high unemployment rate as compared to other regions of the Czech Republic, which has been above the national average due to structural changes in the economy and historical developments. With respect to this indicator, the Ústí nad Labem region commonly places last among the regions of the Czech Republic. For example, in January 2017 the general unemployment rate in the region reached 7.79%, while the national average was 3.5%. In territorial terms, however, unemployment is significantly differentiated; while the

districts near the Central Bohemia Region and Prague fare noticeably better, the situation in the border areas is significantly worse. An important negative is long-term unemployment, which has a higher than 40% share in the total unemployment figure.

Based on the average wage level, the Ústí nad Labem region is among the average regions of the Czech Republic (not including the City of Prague) (ICUK, 2014). In 2016, the average gross monthly nominal wage per number of employees was by CZK 2,441 lower than the national average. However, it grew at a faster pace (by 4.8% as compared to 4.2% nationwide). Due to the increase in consumer prices in that year (by 0.7%), the real purchasing power of the population in the region increased by 4.1%. In the Czech Republic, there was a real increase in wages of 3.5% (CZSO, 2017) (to compare the real income levels regionally, the regional price-level index can also be used, see (ŽIŽKA, et. al., 2017) following the methods developed by (KOCOUREK, et. al., 2016)).

The fourth industrial revolution brings along the demand for skilled workers in the field of IT, and at the same time threatens jobs, particularly those of workers with lower qualifications, whose work is routine in nature. A survey conducted by the National Training Fund among companies in the Ústí nad Labem region found that companies currently undergoing digitalisation or planning it for the near future expect a decrease in the number of workers (particularly in simpler, manual professions, administration, or among operators). Some of them have declared a possible dismissal of employees in logistics and warehousing. Conversely, increased demand for IT workers can be expected. This need has been expressed by IT companies and small businesses in particular. Today, large companies already employ large teams of IT specialists (often located abroad), nonetheless, they have not rejected the possibility of recruiting new workers. The respondents unequivocally agreed that Industry 4.0 has an impact on the skills of IT specialist employees, but also on the skills of other professions. Due to gradual automation and robotisation, multidisciplinary skills will become essential for IT specialists, that is, there will be an overlap of ICT skills into other, particularly technical, disciplines. These ICT specialists will become “drivers” of a kind for the whole production process, while ICT issues at the lower level should be possible to resolve by the general company staff – that is, basic ICT skills should become essential for most professions (NVF, 2016).

The Ústí nad Labem region has at its disposal one of the lowest concentrations of IT experts in the Czech Republic (7,500 – almost 2% share of the total workforce). Should the proportion of IT experts in the total workforce reach the national average (i.e. 3%), the number of specialists would have to increase to approximately 11,800. The problem is that many university-educated people leave the Ústí nad Labem region and move, in search for higher wages, to Prague or the Central Bohemia Region. While the average wage of an IT specialist in the Ústí nad Labem region is approx. CZK 34,000, in the Central Bohemia region this amount is higher by CZK 4,000, and in Prague it reaches approximately CZK 43,000 (CZSO, 2016b).

In connection with the rejuvenation of economic growth, new jobs have been created in the territory of the Ústí nad Labem region; however, this has been happening with much

less dynamism in comparison to other regions of the Czech Republic. At the beginning of this economic growth, professions with more demanding qualification were in demand, however, over time demand has shifted towards labour and craft professions, which predominantly require apprenticeships or merely primary education. In general, it can be concluded that the demand for IT specialists and experts is lower as compared to other regions, while it is progressive professions in particular that are in demand. However, according to a study of vacancies conducted by the National Training Fund, almost one third of jobs demanded in the Ústí nad Labem region are formed by professions with a high potential for the use of ICT skills (NVF, 2016).

## 2.3 Education

In the words of Roman Dvořák (Editor-in-Chief of MM Industrial Spectrum magazine) at a conference entitled “Industry 4.0 – No Time For Delay!”, changes in current education are crucial for the implementation of the Industry 4.0 initiative: “If there is to be a revolution in relation to industry, then it needs to take place in academia. Schools must transform into new conditions, they must offer professionally-focused disciplines” (DVOŘÁK, 2016). This corresponds to the Global Competitiveness Report published by the World Economic Forum, which ranked the Czech Republic among the worst in the EU in terms of the quality of the educational system. According to World Economic Forum analysts, the power of the Czech Republic to attract and retain talent is limited, and development of the educational system would greatly strengthen the competitiveness of the country (WEF, 2016). Experts and representatives of companies from the Ústí nad Labem region also expressed their opinions on the role of schools in the education for the needs of Industry 4.0. They criticised the rigidity of universities, which, in their view, do not respect the individual needs of students (limited options to customise the composition of subjects to suit individual needs) or companies (teaching detached from practice). The offer of subjects which would combine technical and social science or humanities knowledge, meaning to teach multidisciplinary skills, is also considered insufficient. The Managerial Informatics specialisation at the Economic Faculty of the Technical University in Liberec, for example, was cited as exemplary in this context. Experts have also made several recommendations for universities in the Ústí nad Labem region, e.g., to create disciplines focused on mobile hardware programming, to deal with the Industry 4.0 concept within the scope of theses, or to organise workshops or conferences showcasing examples of a successful implementation of Industry 4.0. Schools should play the role of promoters in this area. However, according to experts, students should be motivated to study disciplines focused on IT technologies in the first instance, as, in this respect, the situation in the Ústí nad Labem region is unsatisfactory (NVF, 2016).

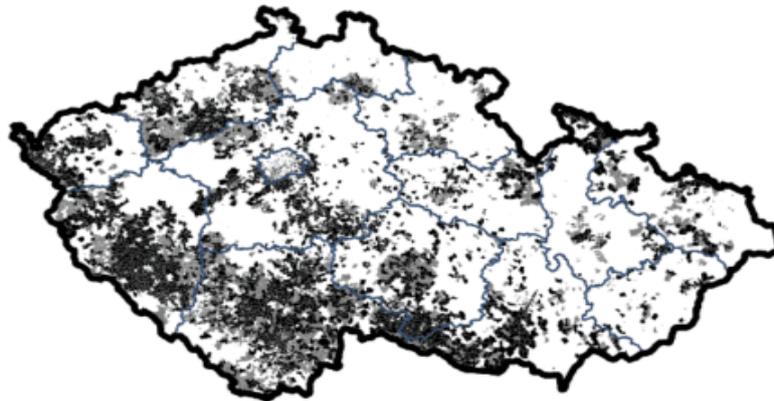
Data in the Statistical Yearbook of the Ústí nad Labem region suggest that the interest of young people from this region in IT disciplines is very low. In 2015, the share of students of IT disciplines in the total population of people aged 20-24 was only 1.6%, while the national average reaches that of 3.4% (e.g. in the Hradec Králové region even 4.5%). In general, more IT students are located in those regions which offer study programmes focused in this direction, most often in regional cities (e.g. Hradec Králové, Liberec, or

Prague). The Ústí nad Labem region, however, does not have an available range of IT disciplines, and students are thus forced to study at universities outside of the region. In 2015, students of computer science had a 2.6% share in the total number of students in the region (e.g. in the Hradec Králové region this share was 10%, and in the Pardubice Region 8%), whereas the nationwide average is 5.3% (CZSO, 2016a).

## 2.4 Infrastructure

With the introduction of robotisation and digitalisation into Czech industry, the demands on the communication infrastructure in the Czech Republic will also increase significantly. According to the Industry 4.0 Initiative published by the Ministry of Industry and Trade (hereinafter the MPO), the current high-speed Internet coverage in the Czech Republic represents a weakness in the country's readiness for Industry 4.0. The document primarily addresses the lack of strategic and legislative support for fast Internet coverage in the Czech Republic (MPO, 2016). Figure 1 shows a map of high-speed Internet coverage in the Czech Republic at the end of 2015. Black spots indicate that at least 2 providers of fast networks operate in this area, serving more than 50% of address locations. Grey spots contain one provider, and white spots have none. According to the Czech Telecommunications Office, coverage amounted to 51% at the time of publication, where this value should increase to 79% by 2018. The map clearly indicates that coverage in the Ústí nad Labem region is relatively good as compared to other regions. The availability of fast Internet is higher in the southern part of the region (districts of Litoměřice, Louny), as well as in the Chomutov and Most areas. Nevertheless, in the areas of the largest cities (Teplice, Ústí, and Děčín), coverage is at present lacking (SLÍŽEK, 2016).

**Fig. 1: Map of high-speed internet coverage in the Czech Republic in 2015**



*Source: SLÍŽEK, 2016*

The Ústí nad Labem region lags behind other regions of the Czech Republic in relation to the availability of communication infrastructure within households. However, to fulfil the Industry 4.0 vision, it is essential that as many people as possible become accustomed to new technologies, the knowledge of which will become crucial in the future, and accept them as an integral part of life. According to data from the Czech Statistical Office, the Ústí nad Labem region ranks last in terms of the number of households equipped with a

computer (62.4% households have a PC, national average is 71.2%), and second last in the case of households equipped with the Internet (63% – this figure is 70.7% for the Czech Republic). This deficit, caused to some extent by high levels of long-term unemployment and lower average income, could be offset by a supply of publicly-available locations providing IT infrastructure. However, even in this case the Ústí nad Labem region ranks among the last places (CZSO, 2016b).

In the field of transport infrastructure, the Ústí nad Labem region has a relatively good-quality network of roads with connections to the German Federal State of Saxony. The business attractiveness of the region is likely to increase with the completion of the D8 highway from Prague to the Saxon capital of Dresden. River transport on the Elbe River, which is navigable up to the port of Hamburg and further to the North Sea, is typical and traditional for the Ústí nad Labem region. The largest river port in the territory of the Czech Republic is also located on the Elbe River, namely in the city of Děčín near the German border. Děčín is also an important railway junction.

### **3. Digitalisation in Companies – Communication with the Business Sphere**

Experience and opinions of companies from the Ústí nad Labem region on the issue of digitalisation and robotisation are very valuable for the implementation of the ideas contained in the Industry 4.0 concept. The companies provided a plethora of information in the context of their participation in the National Training Fund study. That a number of the surveyed companies identified the term “Industry 4.0” as vague and poorly definable is a finding of interest. In their view, the term is often used at the theoretical level; however, it does not sufficiently draw on real events. The processes of automation and digitalisation are already addressed in some way in all of the surveyed companies. Some of the companies replace repetitive manual activities with machines, or automates production with the help of robots. Among the respondents, there were also companies which do not plan a significant change in their production processes in the short term. This is because, for example, they have not found suitable technology. Other advantages of robotisation, as nominated in the survey, included payroll savings, quality improvement, or the transfer of work with a harmful effect on health from people to robots. In general, companies do not expect any revolutionary changes to take place in the near future. They plan to continue in the existing trends and introduce new technologies that are familiar from their competitors – that is, they plan to approach production changes gradually, not in the form of a complete overhaul.

According to the surveyed companies, high investment into new technologies, which have a low short-term returnability and expected yield, is a significant obstacle to the automation of production. This is a problem in the case of corporations that expect a fast effect and make predominantly short-term investments. In connection with the above, representatives of IT companies expressed the view that foreign owners of industrial companies, who often only provide their Czech branches little room for autonomous

decision-making in matters of fundamental processes, are an obstacle to technological changes in production. As has already been mentioned, another significant obstacle is also the lack of qualified professionals (NVF, 2016).

## **Conclusion**

The economic structure of the Ústí nad Labem region is dominated by industry. The analysis carried out leads to the conclusion that a number of problems exist in the region, which complicate the transition of industrial production towards digitalisation and automation. To a large extent, innovations focus on improving existing products or production processes. In the case of companies with a foreign owner, Czech branches are prevented from implementing any major innovations by insufficient decision-making powers and the preference of owners for short-term investments and immediate results. The question, then, is whether company leadership truly has a stake in the application of the Industry 4.0 concept – if so, their business mindset must change. Organisation of conferences, workshops, or lectures on the topic of Industry 4.0, with specific examples of successful business practice, appears to be beneficial. As the only university in the region, UJEP should be the promoter of these events. Its existing innovation contributions and cooperation with regional companies are insufficient. In general, the university should align with the regional economy and, for example, collaborate with companies or other universities in providing options for practice in the required study disciplines. Although several technological supporting facilities operate in the region, there is little interest in their services. The leadership of the region should intensify its endeavours to attract new entrepreneurs (particularly in sectors with a high added value) by creating a favourable business environment. The advantage of the region is a relatively high-quality infrastructure, which includes river transport, railway, as well as a newly completed motorway. All of these routes link the region with the city of Prague and Germany.

The arrival of new, progressive disciplines producing a higher added value would stimulate demand for the work of skilled workers (e.g. in the IT industry), which is currently low in the region. This is also due to the fact that it is not possible to study IT disciplines in the region, which results in students choosing other disciplines, or commuting outside of the region. In view of the fact that an increased interest in IT/ICT specialists can be expected in the future, this offers an opportunity for UJEP to create such a discipline.

In general, it can be argued that the processes of automation and digitalisation are already under way in some companies of the Ústí nad Labem region – of course, with differing degrees of intensity. Although Industry 4.0 is frequently mentioned today, companies do not always apply the term to the transformation of their production process. They consider it more a part of a natural technological evolution, and they do not expect the fourth industrial revolution to occur in the strict sense – that is, as a “revolutionary”, comprehensive, or step-change transformation of production.

## Acknowledgment

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## **The Issue of the Adequacy of Educational Subsidies for the Educational Expenses in City Counties**

### **Abstract**

The problem of financing education by local governments and in particular the adequacy of the received funds for the expenditures is not a new issue. Since the beginning of the educational system of subsidies, the scale and the method used in the calculation of the subsidy were open to doubt. With relatively low level of own revenues country, providing further tasks in the process of decentralization to local governments, uses fiscal transfers such as subsidies and grants (mainly related to the performance of tasks assigned and transferred – adequate for the estimated costs). This means that the educational element of general subsidy does not have to be directly correlated with the costs incurred by local governments for the fulfillment of educational tasks. The study juxtaposed the amount of part of the educational subsidies obtained from the state budget in all city counties in Poland in 2007-2015 with selected categories of educational expenses effected in them in the analyzed period. The study used, among others, measures of central tendencies (median, mode, arithmetic mean, quartiles) and measures of dispersion (range). The research has shown that the educational subsidy not only does not guarantee financing of the implementation of educational tasks assigned to the surveyed cities, but even, in most of the units, it does not provide coverage of the cost of employment of teachers. Thus, a question arises whether it is right to apply the existing algorithm as a basis for the allocation of funds for educational activities.

### **Key Words**

*decentralisation, financing education, intergovernmental grants*

**JEL Classification: H40, H75, H77**

## **Introduction**

School education in Poland, till September 2017, covers education in three successive types of schools: primary school (6 years), middle school (3 years) and secondary school (3 years). The competences for implementing public education were entrusted in 1996 to the local governments by law. At the same time, as a rule, education in the first two types of schools has been entrusted to the municipalities, while education in the secondary schools to the districts. The tasks of each of the local government units in setting up and running the school and public institutions are specified in the Act on the Education System (2004). However, the towns that apart from performing the functions of municipalities also perform the function of districts (city counties) are in the process of educating

students in all three types of institutions. As the process of education and core curriculum, by assumption, are homogeneous throughout the country and supervised by the Ministry of National Education, and local governments were entrusted with freedom in the fulfillment of administrative tasks, Poland has a mixed system of financing education based on educational subsidies having the character of non-conditional grant. This is due to the fact that the system of financing local governments in Poland does not provide, as part of their own income, income level adequate for the tasks. With relatively low level of own revenues country, providing further tasks in the process of decentralization to local governments, uses fiscal transfers such as subsidies and grants (mainly related to the performance of tasks assigned and transferred – adequate for the estimated costs). This means that the educational element of general subsidy does not have to be directly correlated with the costs incurred by local governments for the fulfillment of educational tasks. The main objective of this paper is to analyse how surveyed cities were supported by educational subsidy in performing educational task in 2007-2015 period. The main research area are: to what level this subsidies covered expenses on education, is participation of state government in financing education rising or dropping down, are main costs (and independent from municipalities – rigid expenditures) of educational services covered by central government fully. Answering this questions should allow us to point out most important areas of future changes and research and to compare witch findings of previous research.

## **1. Methods of Research**

The study juxtaposed the amount of part of the educational subsidies obtained from the state budget in all 66 city counties in Poland in 2007-2015 with selected categories of educational expenses effected in them in the analyzed period. The study assumed that the total expenditure on education were the expenses effected and included in the reports of the units of the selected sections devoted to upbringing and education obtained from the databases of the Ministry of Finance (Ministerstwo Finansów, 2016). In subsequent analyses asset-related expenditure and current expenditure on salaries and its derivatives (including contributions to ZUS – Polish Social Insurance Institution) were highlighted. Due to the limited access to the source data, a small portion of the expenses of the nursery not funded by the subsidy, was not highlighted. The proportion of educational subsidies for the audited entities, the number of students and the number of urban residences were determined on the basis of databases of Central Statistical Office (Główny Urząd Statystyczny, 2016). The study included determining characteristic indicators for particular groups, covering part of the educational subsidy of the aforementioned groups expenditures on education in different types of city counties highlighted due to the number of population and also the number of students. Likewise, the dynamics of changes in the level of expenses subsidy was analyzed. The study used, among others, measures of central tendencies (median, mode, arithmetic mean, quartiles) and measures of dispersion (range). Unfortunately, information on the structure of employment of teachers in various institutions and values of the point indicators of the subsidies for amount of subsidies were not available for the audited local government entities in databases (for more details see section 4). The study did not measure the

correlation of the amount of educational expenses, subsidies and expenditures on salaries in relation to the number of students due to the lack of data on individual amounts of revenue and expenditure by type of school, that as follows from the observations, in practice are characterized by various financial needs arising from the growing specialization of branches together with the students' age.

## 2. The design of educational subsidies

First solutions for subsidizing municipalities concerning education were created in 1993 in connection with the planned for subsequent years taking over the running of schools from the state by the municipalities in the form of their own tasks. It was connected with the necessity to equip the municipalities with the adequate financial resources. The basis for determining the amount of the educational subsidy was the calculated number of students, number of posts of teachers and their qualifications. In subsequent years, the algorithm for determining the educational subsidy or educational part of the general subsidy for municipalities underwent multiple modifications, the most important of which took place in 1999-2003 (see more (Olejniczak, 2016)). They mainly involved adjusting components for the calculation of changes in the education system (e.g. a new system of remuneration of teachers, changes in the scope of supporting non-public schools) and changes in the structure of the tasks performed by the school. Currently, the division of the total amount of the educational part is made after deducting the reserve components taking into account the extent implemented by these units' educational tasks, excluding the specific tasks (e.g. commutation of students, running public kindergartens, etc.). This means that the corrected amount of the educational part of the subsidy is divided by the total number of calculated students in Poland and the amount obtained is the so called Financial standard A. While the amount of the educational part of the general subsidy for local government is the sum of three values: the base amount (SOA), the supplementary amount (SOB) and the amount for extracurricular tasks (SOC) according to the formula:

$$SO = SOA + SOB + SOC \quad (1)$$

Where: SO – educational part, after deduction of reserves; SOA – basic amount of the educational part according to the financial standard A of division of the educational part of the implementation of school tasks; SOB – a supplementary amount of the educational part in accordance to the P weight increasing the financial standard A for school tasks; SOC – amount of the educational part for the implementation of extracurricular tasks. The calculation of SOA, SOB, SOC occurs separately by multiplying each of them: financial standard A, correcting indicator  $D_i$  individualized for the local government units (based on the national average rate of real investment and salary expenses for administration and service employees and salary index of the structure of the teachers' employment in schools and educational facilities in the municipality, and additional indicators) as well as the so-called calculated number of students (resulting from the statistical number of students in the municipality– weighted for different groups of students to supplement the number of students – weighted for each of the school tasks and students benefiting from

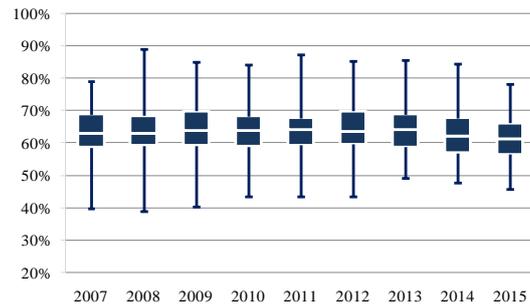
them, and the calculated number of children – weighted for the respective extracurricular tasks). As can be seen the main differentiator of the municipality is the scale of educational tasks and structure of employment and not the actual number of students. It should be emphasized that the subsidy does not depend on the number of the employed teachers but it depends on the percentage of teachers of each grade of professional advancement in the overall number of teachers from schools run by a unit - the higher the level of the professional advancement, the higher the amount of the subsidy.

### 3. Results

As it was mentioned before, the system of supplementing incomes of local government units in terms of investments in education evolved from the mechanism of refinancing in 1993-1996 municipalities' costs of running schools as tasks taken over by them on the basis of an agreement with government administration. The first issue that needs consideration is the degree of covering of educational expenses ( $W_o$ ) of individual local government units ( $S_o / W_o$ ) with educational subsidy ( $S_o$ ). It should be noted that the subsidy does not cover property expenditures with its algorithm, so this stage of the analysis is purely cognitive. The analysis shows that in the examined period in all the analysed local government units, educational subsidy covered from 40% to 87% of the total educational expenditures (Figure 1), which means that the total costs incurred for expenses related to the implementation of educational tasks in individual cities were extremely different. At the same time, for half of the analysed units concentrating this relation throughout the period between 60% and 70% is noticeable. A question arises whether current expenditure (excluding expenditure on the construction and modernization) of school facilities will still be so differentiated or the gap between them much smaller.

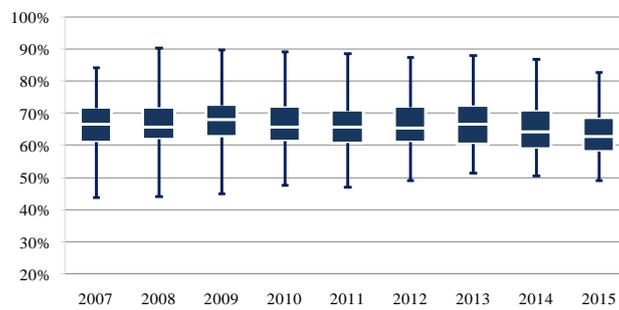
The result of the omission of educational property expenditures is obtaining information on the actual level of financing from the state budget (subsidy) of current expenditure of cities on education ( $W_{bo}$ ) (relation  $S_o/W_{bo}$ , Figure 2). As it can be seen in the examined period, the analysed relation was higher by about 3-5 percentage points and 1-2 percentage points in quartiles 1,2,3 from relation of education subsidy to the total expenditure on education ( $S_o/W_o$ ). Such similar changes in an analysed relation between the first and third quartile are mainly due to the relatively low property expenditure of analysed cities (apart from expenditure financed by the EU). As presented, the median of an examined relation ( $S_o/W_{bo}$ ) was from 67% to 64%, and the range between 1 and 3 quartiles was approximately 11 percentage points. This indicates a similar scale of "shortage" of funds from the state budget for the financing of education in the analysed cities. However, as it was mentioned before, the extent of subsidy is partially related to the level of wages paid to teachers employed in the schools of individual local governments. Due to the fact that the data on the qualification structure of teachers in individual units are not available to the author, only the analysis of the total expenditure on salaries (including expenses for administrative staff salaries) incurred by cities in relation to the amount of the obtained educational subsidies ( $S_o/W_{bo}$ ) is possible.

**Fig. 1: The education subsidy in relation to the total expenditure on education in the analysed cities (So / Wo)**



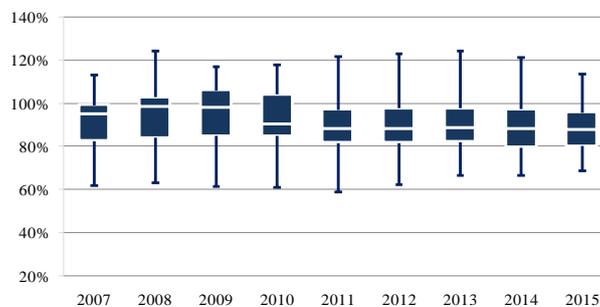
Source: Own calculations based on (Ministerstwo Finansów, 2016) and (GUS, 2016)

**Fig. 2: The education subsidy in relation to current expenditure on education in the analysed cities (So/Wbo)**



Source: Own calculations based on (Ministerstwo Finansów, 2016) and (GUS, 2016)

**Fig. 3: The education subsidy in relation to current expenditure on salaries in education in the analysed cities (So/Wbo)**

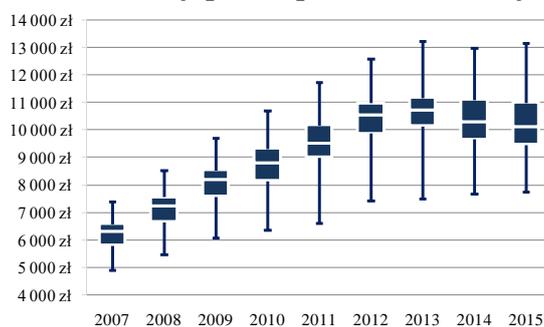


Source: Own calculations based on (Ministerstwo Finansów, 2016) and (GUS, 2016)

The basic question that arises after a calculation of subsidy/salaries rate is the problem of the adequacy of subsidies towards the amount of wages of teachers largely conditioned by regulations of "Teacher's Card", which are independent of local governments (Figure 3), Essentially it could be said that the obtained results of the research indicate that nearly 75% of the surveyed cities should fund not only the ongoing costs of activities of schools, but also wages of teachers employed in these schools, who are paid on the basis of minimum wages imposed on local governments by the statutory regulations. It must be

kept in mind that cities have the possibility of setting the salary rate higher than the minimum, but usually this is due to the need to adjust salaries to the cost of living in a city.

**Fig. 4: The education subsidy per capita in the analysed cities (So / U)**



Source: Own calculations based on (*Ministerstwo Finansów, 2016*) and (*GUS, 2016*)

Another issue worth analysing is the amount of funds obtained by individual cities per pupil (U) (relation So/U). This is, of course, from the viewpoint of algorithm construction, a measure inadequate to the estimated number of students; however, it very clearly shows the effects of the application of the algorithm (Fig. 4). Analysis of changes in values of the individual quartiles and the span between them indicates an advancing process of diversifying the extent of received subsidy as a consequence of use and modification of individual values in its structure. Observable steady increase in the extent of subsidies per capita (So / U) in 2007-2012 was the result of a gradual increase of statutory minimum wages thresholds of teachers in this period, and thus partial compensation of this increase by the automatic indexation of the extent of the subsidy. After 2012, minimum wages thresholds were frozen in the state budget, which resulted in stopping the growth of subsidies per capita in analysed municipalities. At the same time, it can be presumed that the changes in the professional promotion levels of teachers in individual cities and reversing a downtrend in the number of students caused the reduction of the relation span up to a minimum in 2014-2015 from 177% to 170% in relation to 2010-2013. It should also be pointed out that the additional analysis of correlation between the number of students in individual units and the amount of educational expenses per capita did not indicate the existence of such a relation.

## 4. Discussion

The problem of financing education by local governments and in particular the adequacy of the received funds for the expenditures is not a new issue. Since the beginning of the educational system of subsidies, the scale and the method used in the calculation of the subsidy were open to doubt (Olejniczak, 2016). Research conducted by M. Herbst (2000) in the first years of the new system of financing education, indicated the fact that the coverage of educational expenses by the subsidy reached only about 92% (1998) of current expenditures. In the year 2000 the formula of calculating subsidies was modified - an emphasis was put on increasing the element of per-capita (Levacic, 2011). Another study (Maj-Waśniowska and Góral, 2010) indicates the deterioration of the situation,

despite the correction of the educational algorithm (decrease in the running costs of the municipalities on education to about 82% in 2006). Also, other authors (Gońda, 2008; Olejniczak, 2006; Wesołowski and Kobiąka, 2014) indicated the decrease in importance of the educational part in financing municipalities. The problem of defective construction of the whole mechanism of the subsidy was also indicated by M. Poniatowicz and D. Wyszowska (2015) or A. Sekuła (2015). The design of the educational algorithm was also analyzed by many authors because of its variability (see. e.g. Stępień B., (2009)). Similar solutions in the field of financing education are also present in other post-socialist countries (Alonso and Sánchez, 2011) and are subjected to similar criticism. The research has shown that in the examined period in all the analysed local government units, educational subsidy covered from 40% to 87% of the total educational expenditures and was slightly rising up in first period then dropping down. The level of financing from the state budget of current expenditure (ommiting property ones) of cities on education was also dropping down in almost all cities (some of them simply reduced spendings) and was covering current expenditures from 67% in 2007 and only 64% in 2015 (looking at median). The decrease in importance of the educational part in financing municipalities underlined by mentioned authors is rising. As it was shown earlier a big part of current expenditures is caused by amount of wages of teachers. The obtained results of the research indicate that problem inadequacy of wages of teachers employed in schools to amount of subsidy is rising. This also shows that the problem of defective construction of the educational part of the subsidy should be considered as an important area of research. Conducted research confirm earlier hypotheses about the need to change the system of subsidizing municipal education and link it with the actual costs incurred by local governments. There should be also assumed a certain standardization of educational costs (Olejniczak, 2010).

## **Conclusion**

The problem of inadequacy of the amount of funds transferred from the state budget to local government units for the implementation of educational tasks in the form of educational subsidies in proportion to the scale of expenses to perform their duties in this regard has been growing for many years. The research has shown that the educational subsidy not only does not guarantee financing of the implementation of educational tasks assigned to the surveyed cities, but even, in most of the units, it does not provide coverage of the cost of employment of teachers. Thus, a question arises whether it is right to apply the existing algorithm as a basis for the allocation of funds for educational activities, for despite taking over these tasks by local governments, a large part of the costs of this activity is still conditioned externally and remains outside the impact of cities. What should be, therefore, considered is the possibility of introducing a different, adequate to the real costs of the implementation of the tasks, system of financing educational tasks delegated to local governments. One of these solutions is a system of refinancing costs based on subsidies. It should be borne in mind that this would mean a departure from setting a calculative number of posts as the basis for a disbursement. A current change in the educational system from three-step to two-step system creates new opportunities to redefine and improve a system of its financing.

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## Evaluation of Quality of Life in MEP Liberec Using CCR-O Model of Data Envelopment Analysis

### Abstract

The article deals with the quality of life in the administrative district of municipalities with extended powers (MEP) Liberec using the Data Envelopment Analysis. The aim of the article is to evaluate the quality of life in these municipalities in terms of economic and social efficiency. The article is divided into three main parts. The first part focuses on the literary research of the quality of life concept and the use of DEA for the evaluation of quality of life. Another part describes the research methodology. DEA is based on a set of selected inputs and outputs of socio-economic characteristics. The socio-economic characteristics of the input and output variables are key elements of the entire evaluation system. In the article, only measurable and comparable indicators that are detectable in each municipality and they are objective indicators for evaluating their efficiency are used. The evaluation of municipal efficiency itself is made using the appropriate DEA model. Regarding the characteristics of the inputs and outputs used, an output-oriented CCR-O model is used. Using this model, the efficiency and super-efficiency of municipalities is defined that subsequently presents the level of quality of life in the given municipality. The last part of the article discusses the results of the evaluation.

### Key Words

*quality of life, data envelopment analysis, CCR-O, municipality*

**JEL Classification: C21, R13**

## Introduction

Quality of life in municipalities is a broad concept and is influenced by many factors. Despite the existence of many ways of calculations, there has not been found an approach yet that would be widely used. The aim of the article is to evaluate the quality of life of the administrative district of municipalities with extended powers Liberec (further MEP Liberec) in terms of economic and social efficiency of the municipality according to selected socio-economic characteristics. The administrative district of MEP Liberec comprises a total of 28 municipalities. The aim of the article is to find out which municipalities are achieving better efficiency and therefore a better quality of life. When applying Data Envelopment Analysis (further DEA), we assume that the higher the quality of life in a municipality, the higher the efficiency level. Evaluating the quality of life at the level of smaller territorial units is important for determining the disparities among the

evaluated territorial units. The importance of monitoring inequalities lies in the discovery of negative effects. They can be subsequently targeted at by regional and local authorities.

## **1. Literature Review**

At present, the term of "quality of life" is a highly discussed topic in a number of scientific disciplines. Experts have not yet agreed on a clear definition of the concept of quality of life, nor is there any confirmation of the existence of a clear concept of this notion. Frequently used synonyms of quality of life are the terms "social welfare" and "standard of living" (Heřmanová, 2012). In the most general sense of the word, quality of life can be understood as the result of social, health, economic and environmental factors. It is clear that the quality of life can be evaluated both from the subjectively psychological point of view (from the point of view of an individual) and within an objectively spatial dimension, focusing on the conditions in which people live. The latter aspect can be considered as a prerequisite for a person's quality of life (Veenhoven, 2000). Their individual level cannot be influenced; their "life chance" is determined by the characteristics of the environment, i.e. the municipality, the region, and so on. Everyone would like to live in a place that provides the best living conditions. The quality of life in municipalities, cities or regions can be seen from many points of view, from the existence of natural resources in the given area through social resources to cultural resources. Some basic factors influencing the life in the municipality include, for example: sufficient job opportunities, services, cultural activities, transport accessibility (Lagas, Dongen, Rijn and Visser, 2015).

DEA is a non-parametric method that is based on linear programming and used to evaluate the relative technical efficiency of a set of homogeneous units. DEA provides a relative measure of efficiency for the mutual evaluation of Decision Making Units with multiple inputs and outputs (Zhu, 2015). In 1978, Charnes, Cooper and Rhodes designed the first DEA model called CCR model (Kao, 2017). This model is based on the assumption of constant returns to scale and exists in two forms - input and output oriented. The input-oriented technical efficiency measures address the question of how much the input can be reduced while maintaining the current level of output. The output-oriented technical efficiency measures address the question of the extent to which output can be increased while maintaining the current level of inputs (Charles and Kumar, 2012).

## **2. Methods of Research**

DEA was applied to 28 municipalities with extended powers MEP Liberec. Due to a larger number of DMUs, a model with two or three inputs and outputs can be used. The data from the Regional Statistics Database of the Czech Republic were used to analyze the efficiency of the MEP Liberec. The database consists of five indicators - two represent inputs and three outputs. The reference period was given by the availability of the indicators used (2006, 2009, 2011 and 2014). The source of data was the CZSO database (CZSO, 2016). The research process can be divided into the following steps.

In the first step, the input criteria were selected. For the evaluation of quality of life in the MEP Liberec were selected inputs and outputs that are detectable in each municipality, they are an objective indicator for the evaluation of efficiency, they are crucial for the performance of the unit and they do not correlate too much together. Selected indicators which influence the economic level of the municipality according to the methodology developed at the Faculty of Economics, Technical University of Liberec were examined (Rydvalová, Žižka, 2008).

Prior to the calculation of efficiency, a correlation analysis was performed at selected inputs and outputs. Testing was carried out in STATGRAPHICS Centurion XVII software, all tests were performed at a significance level of  $\alpha = 5\%$ . Given the calculated values of the correlation coefficient  $r$ , two inputs and three outputs could be included in the model (the correlation coefficients are in absolute values less than 0.8).

The following inputs were considered for applying DEA. The first selected input is the registered employment rate which is one of the employment factors and is expressed as the share of registered job seekers to the total number of the population in an economically active age deducted from 100 %. The increase in employment could be one of the major development needs of the municipality and has a key impact on local quality of life. The second input is the reciprocal value of the index of the economic burden of the population which is one of the factors of an age population structure. This index reflects the ratio of the number of seniors and children to the population in an economically active age. The smaller the resulting value of this index, the more favorable the ratio is between the economically inactive and the active population in terms of the age structure of the population.

The following three outputs were considered for DEA application. The first output was the number of completed dwellings in 5 years per 1,000 inhabitants. This indicator can be included in a group of attractiveness factors of the place of housing and is one of the most important indicators in the evaluation of the quality of life in the municipality. Housing construction very closely depends on the level of services provided in the given municipality. Thus, it can be said that the quality of life in a particular municipality can also be inferred from the intensity and type of housing construction. The second output was the average living area of completed dwellings in  $m^2$ , which also belongs to the group of factors of attractiveness of the place of housing. This variable also significantly influences the subjectively perceived quality of life in the municipality. The third output was the number of pharmacies per 1,000 inhabitants. Available health care belongs to the category of civic amenities and is also a key factor in the quality of life in the municipality.

On the input side, there is very weak and direct relationship between registered employment and reciprocal value of the index of the economic burden of the population ( $r = 0.0740$ ). On the output side, very weak and direct correlation between average living area of completed dwellings in  $m^2$  and number of completed dwellings in 5 years per 1,000 inhabitants ( $r = 0.0984$ ) and number of pharmacies per 1,000 inhabitants ( $r = 0.0033$ ). Further, very weak and undirect correlation between number of pharmacies

per 1,000 inhabitants and number of completed dwellings in 5 years per 1,000 inhabitants ( $r = -0.1959$ ).

The choice of a particular DEA model depends on the fact which of the above characteristics can be influenced and which, on the contrary, cannot be controlled. To calculate the efficiency of MEP Liberec was used CCR-O model. This model is output-oriented, uses multiple inputs and outputs, and works with constant returns to scale. The constant returns to scale model was chosen because of its more rigid evaluation. Using the CCR-O model, first, the efficiency and consequently the super-efficiency of individual municipalities was evaluated. In the CCR-O model, a municipality with an efficiency ratio equal to 1 is considered efficient, a coefficient greater than 1 determined inefficient municipalities. The higher the value of the efficiency coefficient, the worse the municipality evaluation. It is also possible to infer from this model how the output of a given municipality would have to change while maintaining the input level to bring it closer to the efficiency limit. The equations below (1) characterize the mathematical formula of the CCR-O model.

$$\begin{aligned} \frac{1}{E_0} &= \max .\varphi + \varepsilon \left( \sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right) \\ \text{s.t.} \sum_{j=1}^n \lambda_j X_{ij} + s_i^- &= \theta X_{i0}, i = 1, \dots, m, \\ \sum_{j=1}^n \lambda_j Y_{rj} - s_r^+ &= Y_{r0}, r = 1, \dots, s, \\ \lambda_j, s_i^-, s_i^+ &\geq 0, j = 1, \dots, n, i = 1, \dots, m, r = 1, \dots, s. \quad \varphi \text{ unrestricted in sign} \end{aligned} \tag{1}$$

where  $\lambda_j, j = 1, 2, \dots, n$  are weights of all DMUs,  $s_i^-, i = 1, 2, \dots, m$  and  $s_r^+, r = 1, 2, \dots, s$  are slack/surplus variables,  $\varphi$  is the efficiency score that expresses the improvement rate of outputs in order this unit reaches the efficient frontier.

Subsequently, the super-efficiency model was applied to the data as well. In this model, the municipalities that were identified as efficient acquired a super-efficiency rate of less than one. The lower the value of the super-efficiency coefficient, the better the municipality evaluation. This allows a further classification of all efficient municipalities. The CCR-O model was solved in MS Excel (DEA-solver application).

### 3. Results of the Research

Table 1 shows the relative efficiency scores (hereinafter the Efficiency Score) for each of the 28 municipalities, as well as the average score calculated as the arithmetic average of the scores for all periods. Efficient municipalities are highlighted in grey. It can be learned from Table 1 that three municipalities (Cetenov, Osečná and Šimonovice) were marked as efficient in 2006. In 2009, four municipalities (Cetenov, Český Dub, Liberec and

Šimonovice) were marked as efficient. In 2011, four municipalities (Hrádek nad Nisou, Jablonné v Podještědí, Osečná and Šimonovice) were marked as efficient. In 2014, four municipalities (Hodkovice nad Mohelkou, Liberec, Rynoltice and Šimonovice) were marked as efficient. The overall evaluation of municipal efficiency then shows that Šimonovice, which was identified as efficient in each year of the monitored period, achieved the best result.

Subsequently, the order of municipalities was created based on the calculated average efficiency score. On the first place there was Šimonovice, on the second Cetenov and the third place was taken by Liberec. The worst evaluated municipality was Hlavice, which finished on 28<sup>th</sup> place. Janovice v Podještědí took the 27<sup>th</sup> place.

**Tab. 1: Efficiency model results for MEP Liberec**

| Municipality           | Eff. Score |         |         |         | Average | Ranking |
|------------------------|------------|---------|---------|---------|---------|---------|
|                        | 2006       | 2009    | 2011    | 2014    |         |         |
| Bílá                   | 1.61365    | 1.45177 | 1.86016 | 1.59611 | 1.63042 | 17.     |
| Bílý Kostel nad Nisou  | 1.96158    | 1.21507 | 1.85754 | 1.53584 | 1.64251 | 19.     |
| Cetenov                | 1.00000    | 1.00000 | 1.24986 | 1.06376 | 1.07841 | 2.      |
| Český Dub              | 1.33685    | 1.00000 | 1.67363 | 1.36323 | 1.34343 | 7.      |
| Dlouhý Most            | 1.72549    | 1.52816 | 1.52148 | 1.37260 | 1.53693 | 13.     |
| Hlavice                | 8.27910    | 3.42785 | 1.18353 | 1.22104 | 3.52788 | 28.     |
| Hodkovice nad Mohelkou | 1.35826    | 1.94084 | 1.77256 | 1.00000 | 1.51792 | 12.     |
| Hrádek nad Nisou       | 1.50901    | 1.19638 | 1.00000 | 1.32150 | 1.25672 | 5.      |
| Chotyně                | 1.90129    | 1.70378 | 1.92288 | 1.74806 | 1.81900 | 23.     |
| Chrastava              | 1.67827    | 1.26388 | 1.79952 | 1.63898 | 1.59516 | 15.     |
| Jablonné v Podještědí  | 1.37795    | 1.25234 | 1.00000 | 1.03681 | 1.16678 | 4.      |
| Janovice v Podještědí  | 7.24983    | 3.35433 | 1.55711 | 1.40224 | 3.39087 | 27.     |
| Janův Důl              | 1.91488    | 2.07355 | 2.15019 | 1.55428 | 1.92323 | 24.     |
| Jeřmanice              | 1.43932    | 1.34663 | 1.49784 | 1.43999 | 1.43095 | 8.      |
| Kryštofovo Údolí       | 1.63273    | 1.50241 | 2.72080 | 2.33639 | 2.04808 | 26.     |
| Křížany                | 1.88521    | 1.45898 | 1.76110 | 1.62031 | 1.68140 | 20.     |
| Liberec                | 1.54046    | 1.00000 | 1.09688 | 1.00000 | 1.15933 | 3.      |
| Mníšek                 | 1.51595    | 1.31921 | 1.92104 | 1.73323 | 1.62236 | 16.     |
| Nová Ves               | 2.04893    | 1.47729 | 1.92461 | 1.64638 | 1.77430 | 22.     |
| Oldřichov v Hájích     | 1.68981    | 1.21944 | 1.75343 | 1.64140 | 1.57602 | 14.     |
| Osečná                 | 1.00000    | 1.63084 | 1.00000 | 1.59467 | 1.30638 | 6.      |
| Proseč pod Ještědem    | 2.16348    | 1.38579 | 1.50484 | 1.48304 | 1.63429 | 18.     |
| Rynoltice              | 1.81296    | 1.79112 | 1.12227 | 1.00000 | 1.43159 | 9.      |
| Stráž nad Nisou        | 1.53658    | 1.32259 | 1.58882 | 1.39133 | 1.45983 | 11.     |
| Světlá pod Ještědem    | 1.62689    | 1.58373 | 1.38411 | 1.14806 | 1.43569 | 10.     |
| Šimonovice             | 1.00000    | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.      |
| Všelibice              | 2.30910    | 2.04576 | 1.72332 | 1.75987 | 1.95951 | 25.     |
| Zdislava               | 2.12558    | 2.03134 | 1.17219 | 1.46248 | 1.69790 | 21.     |

*Source: authors' calculations in MS Excel*

For further classification of all efficient municipalities in each period and for the possibility of determining the trend in the development of municipal efficiency scores over time, a super-efficiency model was applied to the data. Efficient municipalities gained a super-efficient rating of less than one. Subsequently, the average efficiency

scores (or super-efficiency) were calculated from the new values, on the basis of which a more precise order of municipalities was created (see Table 2).

**Tab. 2: The results of the super-efficiency model for MEP Liberec**

| Municipality           | Supeff. Score |         |         |         |         | Ranking |
|------------------------|---------------|---------|---------|---------|---------|---------|
|                        | 2006          | 2009    | 2011    | 2014    | Average |         |
| Bílá                   | 1.61365       | 1.45177 | 1.86016 | 1.59611 | 1.63042 | 17.     |
| Bílý Kostel nad Nisou  | 1.96158       | 1.21507 | 1.85754 | 1.53584 | 1.64251 | 19.     |
| Cetenov                | 0.54841       | 0.62827 | 1.24986 | 1.06376 | 0.87257 | 2.      |
| Český Dub              | 1.33685       | 0.69743 | 1.67363 | 1.36323 | 1.26778 | 7.      |
| Dlouhý Most            | 1.72549       | 1.52816 | 1.52148 | 1.37260 | 1.53693 | 13.     |
| Hlavičice              | 8.27910       | 3.42785 | 1.18353 | 1.22104 | 3.52788 | 28.     |
| Hodkovice nad Mohelkou | 1.35826       | 1.94084 | 1.77256 | 0.54301 | 1.40367 | 9.      |
| Hrádek nad Nisou       | 1.50901       | 1.19638 | 0.99312 | 1.32150 | 1.25500 | 6.      |
| Chotyně                | 1.90129       | 1.70378 | 1.92288 | 1.74806 | 1.81900 | 23.     |
| Chrastava              | 1.67827       | 1.26388 | 1.79952 | 1.63898 | 1.59516 | 15.     |
| Jablonné v Podještědí  | 1.37795       | 1.25234 | 0.89557 | 1.03681 | 1.14067 | 5.      |
| Janovice v Podještědí  | 7.24983       | 3.35433 | 1.55711 | 1.40224 | 3.39088 | 27.     |
| Janův Důl              | 1.91488       | 2.07355 | 2.15019 | 1.55428 | 1.92323 | 24.     |
| Jeřmanice              | 1.43932       | 1.34663 | 1.49784 | 1.43999 | 1.43095 | 10.     |
| Kryštofovo Údolí       | 1.63273       | 1.50241 | 2.72080 | 2.33639 | 2.04808 | 26.     |
| Křížany                | 1.88521       | 1.45898 | 1.76110 | 1.62031 | 1.68140 | 20.     |
| Liberec                | 1.54046       | 0.96522 | 1.09688 | 0.86720 | 1.11744 | 4.      |
| Mníšek                 | 1.51595       | 1.31921 | 1.92104 | 1.73323 | 1.62236 | 16.     |
| Nová Ves               | 2.04893       | 1.47729 | 1.92461 | 1.64638 | 1.77430 | 22.     |
| Oldřichov v Hájích     | 1.68981       | 1.21944 | 1.75343 | 1.64140 | 1.57602 | 14.     |
| Osečná                 | 0.36431       | 1.63084 | 0.36722 | 1.59467 | 0.98926 | 3.      |
| Proseč pod Ještědem    | 2.16348       | 1.38579 | 1.50484 | 1.48304 | 1.63429 | 18.     |
| Rynoltice              | 1.81296       | 1.79112 | 1.12227 | 0.82485 | 1.38780 | 8.      |
| Stráž nad Nisou        | 1.53658       | 1.32259 | 1.58882 | 1.39133 | 1.45983 | 12.     |
| Světlá pod Ještědem    | 1.62689       | 1.58373 | 1.38411 | 1.14806 | 1.43569 | 11.     |
| Šimonovice             | 0.36354       | 0.36508 | 0.37377 | 0.40373 | 0.37653 | 1.      |
| Všelibice              | 2.30910       | 2.04576 | 1.72332 | 1.75987 | 1.95951 | 25.     |
| Zdislava               | 2.12558       | 2.03134 | 1.17219 | 1.46248 | 1.69790 | 21.     |

*Source: authors' calculations in MS Excel*

We learn from Table 2 that in 2006 among three municipalities marked as efficient, Šimonovice was on the first place followed by Osečná on the second and Cetenov on the third place. In 2009, Šimonovice was again evaluated the top efficient out of the four most efficient municipalities. Cetenov was on the second place and Český Dub on the third. In 2011, four municipalities were marked as efficient, of which Osečná finished first as super-efficient, the second Šimonovice and the third Jablonné v Podještědí. A total of four municipalities were marked as efficient in 2014. According to the super-efficiency evaluation, Šimonovice were the first followed by Hodkovice nad Mohelkou and Rynoltice.

Based on the average value of the super-efficiency coefficient for the whole monitored period, the ranking of municipalities was then made. Šimonovice was on the first place, Cetenov was the second and Osečná took the third place.

From Table 1 and Table 2 we can infer that Hlavice and Janovice v Podještědí were marked as the least efficient municipalities. The DEA-solver application provides detailed information about each municipality and also evaluates how municipalities should increase their outputs while maintaining their inputs in order to become efficient. Table 3 shows how the three least efficient municipalities would have to adjust their outputs while maintaining their inputs to become efficient (for the year 2014).

**Tab. 3: Potential improvement of inefficient municipalities**

| Municipality          | 2014   |  |  | Sample values  |  |  |
|-----------------------|--|--|--|--|--|--|
|                       | Number of completed dwellings in 5 years per 1,000 inhabitants | Average living area of completed dwellings in m <sup>2</sup> | Number of pharmacies per 1,000 inhabitants | Number of completed dwellings in 5 years per 1,000 inhabitants | Average living area of completed dwellings in m <sup>2</sup> | Number of pharmacies per 1,000 inhabitants |
| Hlavice               | 12.77  | 8.65   | 0.00                                       | 17.56  | 10.56  | 0.00                                       |
| Janovice v Podještědí | 21.51  | 11.56  | 0.00                                       | 30.16  | 16.21  | 0.00                                       |

*Source: authors' calculations in MS Excel*

In Hlavice the number of completed dwellings in 5 years per 1,000 inhabitants would have to be greater by approx. 37 %, and in Janovice v Podještědí by approx. 40 %. In view of the construction of the indicator, this could be done through the intensive construction of new flats in the next years. It is important to take into account additional facts that the number of inhabitants of Hlavice was 235 at the end of year 2014 and 232 at the beginning of year 2017. The population of Janovice v Podještědí was even only 93 inhabitants at the end of year 2014 and 97 at the beginning of year 2017.

Average living area of completed dwellings in m<sup>2</sup> of these municipalities would also have to rise. In Hlavice it would have to increase by about 22 % of its original value, the municipality of Janovice v Podještědí would have to increase this indicator by about 40 % of its original value. With a view to the construction of the indicator, construction of new dwellings should be focused on flats with a higher living area. The initial value of the indicators for both municipalities indicates rather on the construction of flats with a smaller living area, such as studios or flats of category 1 + kk or 1 + 1, where the kitchen area did not exceed 8 m<sup>2</sup> and therefore was not included in the living area of the flat.

## 4. Discussion

It can be stated that within the evaluation of the efficiency and super-efficiency models, Šimonovice reached the best overall ranking for the whole monitored period (i.e. years 2006, 2009, 2011 and 2014) according to the coefficients of efficiency and super-efficiency. In Šimonovice, the registered unemployment rate, which has long been below the Liberec region's average, can be positively evaluated. The attractiveness of the place of residence is also influenced by the favorable high housing construction intensity. According to the values of super-efficiency coefficients, there is a degressive trend in this municipality, though. This trend is reflected in a slowdown in housing construction.

However, this is a natural development that cannot be evaluated negatively. The municipality is situated on the northern slope of Rašovský ridge, in a preserved environment, and it is very close to Liberec.

Within the framework of the carried out analysis, Hlavice was evaluated as the least efficient municipality according to the values of coefficients of efficiency and super-efficiency. The main cause of its inefficiency can be seen in the high values of the registered unemployment rate and the economic burden index of the population which reflects the unfavorable age structure of the population. A long-term zero housing construction also negatively affected the unfavourable evaluation of the municipality. The lack of infrastructure (sewerage system) and the absence of a territorial plan obstruct the development of housing construction.

## **Conclusion**

The article dealt with the evaluation of the quality of life of the administrative district of MEP Liberec using the CCR-O model of the Data Envelopment Analysis. The administrative district of MEP Liberec is defined by the territory of 28 municipalities. Their quality of life was examined in this article. The research was carried out using the data from the years 2006, 2009, 2011 and 2014. The DEA method evaluated municipalities on the basis of selected input and output socio-economic characteristics. With a view to the nature of the inputs and outputs, the CCR-O model working with constant returns to scale was used for the evaluation. The efficiency and then the super-efficiency of municipalities was first evaluated using this model. The defined efficiency and super-efficiency of the municipalities showed the level of quality of life in the given municipality. At the same time, it helped to identify changes that would have to take place to make the inefficient municipalities efficient. It can also be inferred from the results that some facts are difficult to tackle on the basis of an analysis of official statistical data, a local investigation needs to be carried out to determine the actual situation in the municipality.

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## Methods of Regional Development Evaluation: Case of Spatial Autocorrelation

### Abstract

In the European Union (EU), the level of regional development differs across the countries. Besides the analysis of mechanisms and factors that contribute to regional differentiation, the fundamental research question is how to evaluate the level of regional disparities and their trends (increase or decrease). The main aim of the paper is to analyse the existing quantitative approaches to regional development and development potential evaluation in European territory with a focus on usability of a method of spatial autocorrelation. The method of spatial autocorrelation is mostly used at the lower territorial level of NUTS 3 regions or municipalities. The method is employed to analyse the spatial differentiation not only economic but also a social phenomenon. Results of presented studies show the positive or negative spatial autocorrelation of selected economic or social variables based on the most commonly used of global spatial autocorrelation statistics – Moran's I coefficient. Currently, a majority of researchers improve the spatial autocorrelation knowledge by using of modified geographic weights matrix or by computation of the local spatial autocorrelation using the Local indicator of spatial association (LISA). Based on the conducted literature review, spatial autocorrelation can be considered as the suitable tool in regional development evaluation which helps to understand the spatial processes in the EU area.

### Key Words

*European Union, methods, regional development, spatial autocorrelation, territory*

**JEL Classification: C31, R11, R12**

## Introduction

Regional development is a complex of processes taking place within the regions that affect economic, social, environmental and other changes of a region. Regional development involves economic as well as social and ecological development providing good conditions for increasing regional cohesion and competitiveness (Poledníková, 2014). With the regional development is related the term *potential* that can be considered in general as a source of opportunities, resources, stock, which can be activated. The aggregate potential of the territory must be considered, first of all, the socio-economic, including not only the economic potential of the region but also the social dimension, which characterises the relationship between the people on the creation, development and effective use of resources in the region (Cheymetova, Nazmutdinova, 2015). Therefore, nowadays the problem of determining the internal reserves of regional development becomes more

important, the solution of which requires the development of new approaches to the definition of essence, structure, methods for assessing the potential of regional development.

Regarding the issues of regional development, attention is paid to socio-economic inequalities. An important position among the approaches explaining the regional differences has the group of theories working with the concept of the core and the periphery, for which the idea of polarised development is of key importance. Polarisation and differentiation of the society are the result of close links between social and economic dimension, which is reflected not only in economic but also in social differences among regions, along with a wide range of other different factors. Spatial differentiation of regional differences often results from different localisation effects, see e.g. Bednářová (2015), Sucháček (2015), Slavík, Grác, Klobučník (2011). In addition to the analysis of mechanisms and factors of regional differentiation, one of the fundamental research questions is the evaluation of increase/decrease in interregional disparities (divergence/convergence) (Novák, Netrdová, 2011). Modern socio-economic situation and the need for constant adjustment of processes occurring in the region thus require the development and formation of conceptual and methodological tools of complex analysis of the level of the development potential of the area. Cross-section analysis of regional development is important also due to the fact, that one of the policy objectives of socio-economic development is the establishment of long-term regional development priorities, what requires knowledge on how to influence the development. Socio-economic development of the area is based on an effective regional policy, which requires a different kind of resources composed in the total potential of the region. In this case, the most important task of regional policy is to create a system for monitoring the socio-economic development of the area, which will provide the regional management bodies with complete, timely and reliable information on the processes occurring in the economic entity. As Cheymetova, Nazmutdinova (2015) emphasised, the problem solution involves the appropriate theoretical framework, the methodology for assessing the socio-economic potential of the region based on its structuring.

In recent years, the issue of territorial imbalances in the European Union (EU) has been examined in numerous studies using a variety of different approaches. There are various reasons for the amount of interest surrounding this issue. Among them is the fact that economic growth theory has advanced greatly over the last decades, another is the need to reduce the existing differences in terms of development across the various European regions, an issue closely linked to some of the basic principles that have inspired the construction of the EU, especially with the Single Act and the Maastricht agreements (Ezcurra, Gil, Pascual, 2005). Indeed, one of the specific assumptions of the European integration programme is that it will drive the growth of all Member States, and thereby lead to economic, social and territorial cohesion. In the EU, the level of regional development differs across countries. Assessment of regional (spatial) disparities (mainly at the level of NUTS 2 regions) and identification of key development factors, that may contribute to increasing the dynamics and development potential, is crucial to adopt the measures supporting the long-term growth of regional economies. The EU's internal diversity and inequalities are reflected in the quality of living standards, different pace of

development of the European territory (e.g. based on GDP per inhabitant, the most developed regions are eleven times richer than the poorest regions, see e.g. Eurostat, 2017) and also spatial organization of economic and social activities. The main purpose of the paper is to identify the specific aspects of spatial analysis used in the regional development context. The main aim of the paper is to analyse the existing quantitative approaches to regional development and development potential evaluation in the EU territory with the focus on usability of the method of spatial autocorrelation.

## **1. Approaches to Regional Development Evaluation**

There are no uniform quantitative methods for evaluation of regional disparities and development potential of the regions in the EU. Several regional indicators are processed by different mathematical, statistical or econometric methods (Poledníková, 2014). Based on the literature review, several groups of methods can be identified: univariate statistical methods (e.g. mean, standard deviation, coefficient of variation, correlation, traffic light method); multivariate statistical methods (e.g. cluster analysis, factor analysis); multicriteria decision-making methods; composites indices, see e.g. Klímová, Žítek (2015), Melecký (2015), Staníčková (2014), Poledníková (2014), Michálek (2012), Campo, Monteiro, Soares (2008), Ginevičius, Podvezko, Mikelis (2004). Despite the indisputable advantages of these methods, their application to spatial data is problematic. Spatial data includes, in addition to attribute information indicating the characteristics of the observed event, spatial information indicating the location of the given event (Spurná, 2008). Although we can find studies including the importance of the spatial aspect of data in measuring socio-economic differentiation, in the vast majority of existing research the non-spatial statistics and indicators still prevail. This is in contradiction with the current regional economy that introduces space into economic theories and to practical procedures and trends in quantitative geography emphasising the application of spatial analysis (local and exploratory spatial analysis), see e.g. Bednářová (2015), Novák, Netrdová (2011).

## **2. Theoretical Case of Spatial Autocorrelation**

The theory of spatial autocorrelation has been a key element of geographical analysis for more than twenty years. A number of measurements of spatial autocorrelation were proposed so that we can investigate the spatial process of geographical evolution from differing points of view. Spatial autocorrelation is a property of spatial data that exists whenever there is a systematic pattern in the values recorded at locations in a map. The term of spatial autocorrelation elaborated authors Cliff and Ord in 1973 and is a method of Exploratory Spatial Data Analysis. According to Griffith (2003), spatial autocorrelation is the correlation among values of a single variable strictly attributable to the proximity of those values in geographic space, introducing a deviation from the independent observation assumption of classical statistics. Generally, the principle of spatial autocorrelation can be understood as the existence of a certain functional relationship

between the probability of a certain even occurring in the location  $i$  and the probability of occurrence of this event in units  $j$  which are spatially close to it. Formally it can be expressed as (Spurná, 2008):

$$p_i = f\left(\sum_i w_{ij} p_{ij}(y)\right), \quad (1)$$

where  $p_{ij}(y)$  is the probability of occurrence of the event  $y$  in unit  $i$ ,  $w_{ij}$  for  $i \neq j$  is the chosen weighing scheme.

The geographic version of spatial autocorrelation (automeaning self) is the relationship between a value of some variable at one location in space and nearby values of the same variable. These neighbouring values can be identified by an  $n$ -by- $n$  binary geographic connectivity/weights matrix  $W$ . If two locations are neighbours, then  $w_{ij} = 1$ , if not, then  $w_{ij} = 0$ . Global autocorrelation analysis involves the study of the entire map pattern and generally asks the question as to whether the pattern displays clustering or not. Local autocorrelation, on the other hand, shifts the focus to explore within the global pattern to identify clusters or so-called hot spots that may be either driving the overall clustering pattern, or that reflect heterogeneities that depart from the global pattern, for more detail, see e.g. Slavík, Grác, Klobučník (2011). The most common, and the oldest indicator of global spatial autocorrelation is currently *Moran's I coefficient* (2) proposed by Patrick Alfred Pierce Moran (see e.g. Spurná, 2008; Griffith, 2003):

$$I = \frac{\sum_i \sum_j w_{ij} c_{ij}}{s^2 \sum_i \sum_j w_{ij}}, \quad (2)$$

$$c_{ij} = (x_i - \bar{x})(x_j - \bar{x}) \text{ and } s^2 = \frac{\sum_i (x_i - \bar{x})^2}{n}, \quad (3)$$

where  $n$  is number of cases (e.g. number of regions),  $x_i$  is the value of variable  $X$  at location  $i$  (e.g. value of variable/indicator in regions  $i$ ),  $w_{ij}$  is the cell  $(i, j)$  of the geographic weights matrix  $W$ .

Positive autocorrelation ( $I > 0$ ) implies that geographical proximity tends to produce similar values of the variable examined. With negative autocorrelation geographically nearby values of a variable tend to be dissimilar on a map (high values tend to be located near low values). Spatial autocorrelation can be visualised by the scatterplots or two-dimensional maps. Local autocorrelation is calculated by the *Local indicator of spatial association* (LISA). Spatial autocorrelation plays an important role in the geographical analysis; however, there is still room for improvement of this method. The advantage of spatial autocorrelation is that it takes into account the relative position of the areas, i.e., these indices are no longer invariant to permutations of locations. However, indices are more akin to an agglomeration index, as they evaluate the correlation between the value of an economic variable for a given area and the distance-decay sum of the values of this variable for all the other areas.

### **3. Key Issues for Using of Spatial Autocorrelation**

Following part describes the main findings of analysed literature regarding the usability of spatial autocorrelation in terms of the territorial unit; used indicators; and also basic results and findings of studies. The paper is based on the method of literature review objectively describing and discussing the state of the science of a specific topic from the theoretical and contextual point of view. The literature review provides current thinking and research on a selected area of study and may justify future research into a previously overlooked or understudied area (Rother, 2007).

#### **3.1 Territorial Level of Analysis**

The method of spatial autocorrelation is mostly applied at the lower territorial level in the European states. Spatial autocorrelation is used in case of municipalities in Slovak Republic, Czech Republic by Novák, Netrdová (2011), Slavík, Grác, Klobučník (2011), at the level of NUTS 3 regions in Germany and Central and Eastern Europe by Dańska-Borsiak, Laskowska (2014), Zierahn (2012), Smętkowski, Wójcik (2010), Pautelli, Griffith, Tiefelsdorf, Nijkamp (2006). The sample of the higher territorial level of NUTS 2 and NUTS 3 regions, as well as functional regions, used Niebuhr (2003), moreover Verspagen (2010) analysed the NUTS 1, NUTS 2 and also mix these regions.

#### **3.2 Type of Indicators for Empirical Analysis**

The method of spatial autocorrelation can be employed for the wide range of variables. Dańska-Borsiak, Laskowska (2014) examine the spatial diversification of the GDP per capita, human capital and social capital. Novák, Netrdová (2011) focused on spatial differentiation of social, demographic and economic variables. Slavík, Grác, Klobučník (2011) showed the spatial differentiation of economically active population and unemployment rates. Smętkowski, Wójcik (2010) focused on convergence process in terms of GDP. Zierahn (2012) analyses the role played by spatial interdependencies between regions in explaining their employment growth. Spurná (2008) presents the LISA on age index, the share of university educated people, unemployment rate and altitude. Verspagen (2010) discusses the possibility of a spatial hierarchy of innovation and growth dynamics in Europe where 30 variables of general state of economic development, education and patenting were used. Pautelli, Griffith, Tiefelsdorf, Nijkamp (2006) assessed how important spatial effects are in explaining unemployment levels in Germany (unemployment rates, commuting flows). Niebuhr (2003) analysed the regional data on unemployment, working population, employment, population and area.

#### **3.3 Main Findings of Empirical Analysis**

Dańska-Borsiak, Laskowska (2014) showed that the spatial clustering of high values (and/or low values) of human and social capital is significant (clustering is stronger for

social capital, as the Moran's I-values are higher than for human capital). They used also local measures of spatial autocorrelations which consist of studying the correlations of the variable value in the chosen location with its neighbours, and the results provide the answer to the question in which part of the studied area, the autocorrelation occurs. Social capital showed the tendency for the clustering of positive values. The correlation was positive and is of high – high or low – low type. This meant that no significant changes in the spatial patterns occurred in relation to human and social capital. The next analysis confirmed the positive correlation between the GNP level per capita and the human capital measure. However, the results of the spatial analysis show that some subregions with the high level of development are surrounded by regions with low human capital and social capital. Niebuhr (2003) points out the role of spatial distance costs as a reason for insufficient equilibrating forces and persistent disparities between regional labour markets in Europe. The correlation analysis indicated a strong positive autocorrelation of both regional unemployment and the change in regional unemployment. Adjacent regions that form clusters of high and low unemployment seem to be a central feature of disparities in Europe. Furthermore, spatial dependence is not solely the consequence of national differences since a significant auto-correlation also characterises relative unemployment rates. Unemployment clusters are not exclusively national clusters, covering all regions that belong to the same EU member state. Niebuhr (2003) used the correlation analysis based on Moran coefficient using distance decay function, as well as Pautelli, Griffith, Tiefelsdorf, Nijkamp (2006) used modified geographic weights matrix. Smętkowski, Wójcik (2010) point out to a decreasing spatial correlation relating to the development level of regions expressed in GDP per capita for the Central European macroregion. The data prove a considerable polycentric of the macroregion since the growth centres in individual countries were separated from one another by less-developed areas, which resulted in the lack of statistical significance of Moran's I, suggesting a random distribution of the growth poles. Polarisation processes were visible in the macroregion, manifested by a spatial concentration of the development dynamic, which meant that regions which were surrounded by faster-developing areas would grow faster themselves and, conversely, slow development rate of neighbouring regions, led to the emergence of macroregions with a low dynamic of growth. This could prove that the regional hinterland does have some, rather weak, influence on development processes.

In parallel, however, examples clearly contradicting this hypothesis could be found. Zierahn (2012) emphasises that regional employment growth is characterised by spatial autocorrelation, the development of employment in a region is interrelated with the employment development of nearby regions. This also holds true for major factors of regional employment, such as wages and qualification. Verspagen (2010) calculated the positive correlations (58% of the cases), where positive spatial correlation is particularly frequent along the row and column of the GDP per capita, and within the patenting per head block. The patenting sectors that have high spatial correlation along the diagonal of the matrix are also the ones that are spatially correlated with each other (off the diagonal) and the economic variables. GDP per capita correlates strongly with services and in particular business services, employment, and the same patenting sectors as mentioned before. The other strong correlations that are found off-diagonal are mostly negative. This is especially frequent for the sectoral employment shares variables, the general economic

variables, and the education variables. The results point to a hierarchy consisting of four groups: South Europe, East Europe, and two groups in West and North Europe. The analysis suggests that in the South and East, such interactions have not yet emerged very frequently. Both in the South and East, major urban centres exist in which economic growth and innovation flourishes. But these cities do not seem to support a surrounding area with which knowledge interactions are taking place. At this stage, the metropolis of the South and East remain isolated centres, not yet capable of generating enough spillovers. Slavík, Grác, Klobučník (2011) showed the spatial autocorrelation of economically active population (macroparticular attractiveness is identified mainly in the region of western Slovakia) as well as the unemployment rate. Based on the results, four types of regions were defined: areas with a high proportion of the economically active population and low unemployment rate; regions with low economically active population and low unemployment rate; regions with economically active population, but also with high unemployment rate; municipalities with low economically active population and high unemployment rate. Novák, Netrdová (2011) identifies the most extensive areas of similar values among municipalities in the unemployment rate and commuting over 45 minutes. Also, six types of spatial clusters were found: core regions, Ostrava, Northern Bohemia, Bohemian-Moravian Highlands, non-development areas, other territories.

## **Conclusion**

Geographer Waldo R. Tobler's stated in the first law of geography: "Everything is related to everything else, but near things are more related than distant things." (GISGeography, 2017). Spatial autocorrelation measures the degree to which one object is similar to other nearby objects (degree of clustering of units with similar values). Spatial autocorrelation can be measured by global statistics Moran's I or by LISA statistics. Today, the concepts and methods of spatial autocorrelation have been applied to many fields, which have resulted in a number of interesting findings. Results of presented research studies highlighted the relevance and usefulness of spatial autocorrelation in the analysis of regional economic and social differentiation and variability, which complements the spatial dimension. Spatial autocorrelation can be used as a tool for evaluation of the state, changes and development of the spatial structure. Currently, spatial autocorrelation is accentuated mainly in the context of the development of geographic information systems (GIS) (Spurná, 2008). GIS enables to collect and maintain spatial data provides tools for their analysis and for graphical presentation of resulting spatial models of the area of interest. The paper showed how the spatial autocorrelation can be used in regional economic and social research and can improve the understanding of spatial processes. It offers suitable starting point for further research in which the method of spatial autocorrelation will be used to find out the certain relations among regions that would create particular clusters; to find out the spatial distribution of the selected indicators of regional development; to identify the types of regions based on the level of development; or to analyse the determinants of territorial dynamics, e.g. by comparing spatial localization of regional resilience and regional development potential through constructing the own indices. The more-themed classification of regions has significant

application potential in the field of regional policy with regard to targets and specification of support instruments.

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## Is the Czech Republic Preparing for Society 4.0?

### Abstract

Activities collectively called Society 4.0 are a new present-day worldwide phenomenon. In spite of the fact that these activities are just beginning, they hide enormous potential, for both individuals and entire economies and their competitiveness. These changes are already beginning to manifest in some segments of industrial production, but in the future they will affect all areas of our lives – the labour market, the educational system, finance, banking, logistics, transport, agriculture and environmental protection.

In this text the author sets herself two goals. First of all she wishes to map how and whether the Czech Republic is prepared for the oncoming period of digitalisation, whether specialised analyses and surveys are performed in regard to these issues, whether the necessary documents are being accepted, whether specialised discussions are being realised with subjects that the specific changes should affect, and how these subjects perceive the need for these changes and prepare for them. The second goal was to find out whether the necessary changes are also being prepared within the terms of the educational system, which should be capable of preparing workers for new challenges arising for the labour market from the concept of the 4<sup>th</sup> industrial revolution.

### Key Words

*Society 4.0, Industry 4.0, digitalisation, cybernetic-physical systems, labour market, education*

**JEL Classification: R23, I25, O3**

## Introduction

In the middle of February the Czech government approved important Society 4.0 Alliance concept material, which is intended to link the activities of individual departments in the field of the future of employment, technological innovations, digitalisation and education. The goal is active preparation of the Czech Republic for technological revolution and innovation in the field of industry. The Society 4.0 Alliance should submit an Action Plan for Society 4.0 to the government by the end of June.

Four fundamental milestones of technological progress can be defined in history to date (tab.1). *The first industrial revolution* began at the end of the 18<sup>th</sup> century and took place in the spirit of manufactories utilising hydro and steam energy. The transition from hand manufacture to large-scale machine production continued during the 19<sup>th</sup> century. These changes had a colossal impact on society and all sectors of the economy underwent a fundamental transformation. *The second industrial revolution* took place from the last

quarter of the 19<sup>th</sup> century and was distinguished by assembly line production, utilisation of electricity and combustion engines. *The third industrial revolution* started in the nineteen seventies with the arrival of microprocessors, utilisation of computers and automation of individual manufacturing processes. The beginning of the *fourth industrial revolution* in the technical field is represented by cybernetic-physical systems, thanks to which “clever factories” will be created. Intelligent solutions offer enormous opportunities in fields such as mechanical engineering or the automotive industry. Digitalisation of industry means software interconnection of all manufacturing processes, from orders, through proposals of solutions, manufacture, to dispatch of the finished goods. It results in greater efficiency, work productivity and lower manufacturing costs. This is a qualitatively new situation, which is not just automation of mass production, but of the entire process, from the enquiry, to delivery of the goods to the customer. Unified mass production provides opportunity for automated production of products adapted to the individual wishes and requirements of customers, whether these are consumers or enterprises. The entire process is distinguished by automatic communication between manufacturing factors, controlled by artificial intelligence elements.

**Tab. 1: Four industrial revolutions and their characteristics**

|    |      |  |
|----|------|--|
| 1. | 1784 | Mechanical looms, steam engines, hydropower, mechanisation. The key term of this period is industrialisation.  |
| 2. | 1870 | Creation of assembly lines, division of work, mass production, invention of the light bulb, electrification, combustion engines, utilisation of new materials.             |
| 3. | 1969 | Automation, electrification, boom of informatics and other technologies.   |
| 4. | 2011 | Mass spread of the internet, digitalisation, cybernetic-physical systems, automation of flexible production according to individual requirements, artificial intelligence. |

*Source: by the author*

It is assumed that the consequences of the 4<sup>th</sup> industrial revolution will be truly far-reaching and fundamental for the whole of society. The question is: how is the Czech Republic preparing for this new period? Does our government have specific economic goals and is it accepting the necessary measures in response to the changes taking place? In the new situation it will only be possible to compete by adopting a highly complex approach, for which cooperation between key departments and their institutions is essential. These topics must be discussed on a society-wide level with all social players – with the public administration, representatives of employers, with the academic sphere. And discussion is not enough. Changes must rapidly be planned and trends and foreign experience studied. But is this happening?

According to a number of prognoses many professions will become redundant. Others will face a shortage of qualified people. Completely new occupations will also be created. New principles for organising work will be promoted, completely new skills will be required and changes will be made to the work tasks of most professions. How will these changes influence the job market, how will they influence employment and unemployment rates? Are the educational system, government apparatus and legislation prepared for these requirements?

# 1. Starting Points and Methods of Research

Economists in advanced countries, especially Germany, USA, Japan, China or in France, have been discussing the potential impact of a digital economy for several years now. Digitalisation is a concept describing accelerated automation and substitution of work by capital, all based on application of advanced information and communication technologies. This process will result in transformation of all sectors of economics and the whole of society (Wolter et al., 2015). The basic vision of the so-called fourth industrial revolution was first outlined by the German government in 2011, the national “Industrie 4.0” was officially presented and launched at the trade fair in Hannover in 2013. Leading German engineering and electrical engineering companies, such as Siemens, Bosch or Volkswagen were also involved in its preparation. The German Federal Government has earmarked 400 million EUR for this initiative to date. Digitalisation, the related automation of robotic production and the connected changes to the German job market have been discussed for example by Bauer et al. (2015), Weber (2016), Vogler-Ludwig et al. (2016). It is expected that structural shifts caused by digitalisation will fundamentally change utilisation of human work and will lead to higher fluctuation in employment. However, experts differ in their opinion whether the overall impact on the level of employment will be positive or negative (Brynjolfsson, McAfee, 2014; Author, 2015). Frey and Osborne (2013) created a completely new model based on expert opinions of the possibility of computerising professions. Levy and Murnane (2013) point out the difficulty of replacing non-routine manual tasks.

In the Czech environment, manifestation of the 4<sup>th</sup> industrial revolution is registered more or less marginally for the time being, which is clear from the so-called Digital economics and society index, which is measured within the terms of EU countries (EC, 2016). However, understanding of the threats and opportunities arising from new conditions is essential for those involved in the Czech economic policy. As the country with the highest percentage of industry in the European Union, employing over two fifths of its economically active individuals in the secondary sector, the Czech Republic must approach digitalisation actively. We may assume that major foreign investors will automatically welcome innovations, even in their Czech manufacturing capacities, but will this truly be so? Many of them chiefly remain here due to the lower price of the labour force and Industry 4.0 is distinguished by the extraordinary scope of substitution of human work throughout the entire manufacturing process.

Logical methods in particular, including analysis, synthesis, deduction, specification and historic approach by graphic analysis will be used to answer the set questions.

## 2. Digitalisation of the Economy and the Labour Market

Experts usually consider the chief advantage of the fourth industrial revolution to be savings in time and money. The fact that it will be possible to carry out a number of activities using machines, means that companies will be more flexible. They will not need

to seek out short-term employees during an unexpected rise in demand, and they will avoid complicated dismissal when consumption falls. “In some sectors savings in operating and overhead costs will rise by up to 30 per cent, costs for processing products will fall by 25 per cent and work productivity will rise by 30 per cent. The problem of the shortage of employees in a number of technical professions will be resolved. “The flexibility and quality of production processes will increase, energy and raw material demands will fall, and new production and trading processes will be created”, the Confederation of Employment and Business Associations (KZPS, 2016) lists the benefits and advantages for the Czech corporate sphere.

The need for a shift in the Czech Republic’s economy based on data is also emphasised by the government in its **Action plan for development of the digital market** (August 2015). This is its response to the Strategy for a unified digital market published by the European Commission (May 2015), with the goal of increasing the competitiveness of the European Union on a global scale in oncoming years. The Czech Republic elaborated the action plan further into an **Action plan for development of the digital market** (October 2016).

This is very important, because some of the systemic limits of existing economic policy tools have begun to be revealed in full from 2016 in relation to economic growth. An unnecessarily cheap economy and cheap work pose a risk for the Czech Republic in the future, which may result in technological lagging, limited attractiveness for investors, loss of jobs and reduction of their quality. In August 2016 the **Industry 4.0 Initiative** was executed under the administration of the Ministry of Industry and Trade, with the goal of maintaining and increasing the competitiveness of the Czech Republic at the time the fourth industrial revolution commences. The document provides the most important information related to this topic, outlines possible directions of development and proposes measures that will support not only the traditional industrial foundation, but may also help prepare all of society for this enormous technological change. Additional initiatives were executed in relation to this initiative, for example Agriculture 4.0, Construction 4.0, Education 4.0, Employment 4.0.

All these initiatives basically respond to changes to jobs and the related requirements for skills, for which it will be necessary to adequately prepare workers. For examples, in the field of **Education 4.0** measures will focus on reinforcing key competences, digital skills and the field of lifelong education. **Employment 4.0** is specifically concerned with the expected impact of informatisation and cybernetization on employment and the labour market.

As mentioned above, the process of digitalisation will lead to some professions ceasing to exist, and also to creation of completely new professions and also jobs. Estimates of the extent of these changes differ significantly in specialised literature, depending on the methodologies used for calculation. Calculations are either occupation-based or task-based. The difference in conclusions arising from various studies is shown in table No. 2.

**Tab. 2: Summary of estimates of creation and extinction of jobs**

| Author   | Estimate  |
|--|---|
| Frey, Osborne (2013)   | 47 % jobs for the USA at risk depending on profession                 |
| Office of the Government of the Czech Republic (Chmelař and coll., 2015) | ratio of at risk and newly created jobs is 5:2 for the Czech Republic |
| Davos Forum (2016)   | ratio of at risk and newly created jobs is 7:2 for advanced countries |
| Arntz, Gregory, Zierahn (2016)   | ratio of at risk and newly created jobs is 7:6 for Germany            |

*Source: by the author*

In their article Frey and Osborne (2013) offered a new methodology for estimating the probability of computerisation of a profession within the meaning of automation of a profession using computers. The disadvantage of this and other similar studies based on professions is that they assume that a specific profession will cease to exist or will not cease to exist as a whole. They do not examine the possibility of automation of individual work tasks. This approach may therefore lead to overestimation of automation of professions, because even a profession identified as high-risk, frequently still contains a significant percentage of tasks that are very difficult to automate and the need for human work remains.

The study by German economists Melanie Arntz, Terry Gregor and Ulrich Zierahn (2016) on the consequences of automation and robotics on the labour market, is a specific reaction to this study. The authors do not work with professions in this study, but with individual work tasks and come to the conclusion that work tasks are more at risk of automation than jobs. Each profession has tasks connected to literacy, writing and ICT knowledge. The frequency of these tasks significantly reduces the probability of automation. According to the authors, it is necessary to differentiate between the potential for automation and the actual risk of a fall in employment rates.

The quite significantly different conclusions of both studies, concerning the risk to the number of jobs on the labour market, results in the fact that:

1. the consequences of digitalisation are different for jobs and for work tasks – the study by Frey and Osborne de facto identified with this;
2. the study by Frey and Osborne was based on a questionnaire sent to managing employees, the study by Arntz, Gregor and Zierahn was based on the extensive OECD empiric database arising from a survey of adult skills (PIAAC);
3. estimates of the consequences of digitalisation on the labour market reflect technological possibilities based more on expert estimates rather than on actual use of these technologies in practice, which may lead to some overestimation (study by Frey and Osborne). On the contrary, the study by Arntz, Gregor and Zierahn was based on the assumption that a number of obstacles preventing the spread and application of technologies, for example the shortage of investments, the lack of capital, investment trends in the field of research and development, government regulations,

the lack of skills or social aversion, cannot be ignored, therefore the consequences on the labour market will be less in actual fact;

4. the authors of the first study only take existing professions into consideration. Use of new technologies will probably create new professions, a fact the authors of the second study take into consideration in their conclusion.

The study executed by the Office of the Government of the Czech Republic (OSTEU, 2015) seems fairly unfavourable because it is based on a methodology examining impact on jobs. On the contrary, the OECD (Employment Outlook 2016) study, which estimates that automation places 10% of jobs strongly at risk and significant changes will be made to 35% of jobs in relation to the executed activities, seems more favourable for the Czech economy. If this estimate is applied to the number of employed people, approx. 408 thousand jobs will be strongly at risk and significant changes will be made to 1.4 million jobs.

Individual population groups will cope differently with the changing situation on the labour market due to the effects of digitalisation and robotisation. It can be assumed that, similarly to now, the older population in particular will have the most difficulty coping with changing requirements, particularly due to its low digital literacy, whereas the gap between the older generation (over 55 years) and the younger generation (25-34 years) continues to widen.

Another group finding it difficult to adapt is the population group with a low level of education and with the highest unemployment rate. This population is distinguished by its fairly low willingness to improve its position on the labour market, which is also demonstrated by its low participation in further education, which fluctuates around 2%, while this willingness of the population group with a tertiary level of education is 8-10 x higher (Employment Initiative 4.0, page 7).

Women are more at risk on the job market than men. Under-employment and a lower level of IT literacy is more frequent in women, because they choose technical fields less frequently in their education and graduates of these fields are in high demand on the job market.

Polarisation of employment must be expected in the future. This will lead to the population group with medium income reduced to jobs with lower incomes, whether this is due to the fact that these people occupy less demanding positions from the aspect of qualifications or occupy positions in services, in which income is lower in comparison to income in industry. The average income of the middle class is falling worldwide today.

Surveys focusing on consequences of Industry 4.0 in the Czech Republic (e.g. ČNOPK, 2015; ManpowerGroup, 2016) indicate that 85% of society considers Industry 4.0 to be an opportunity for expansion of their business activities. But only 34% of the questioned companies have experience with implementing the specific technologies and tools of Industry 4.0. According to 50% of respondents, one of the biggest obstacles during this process is the shortage of qualified personnel.

The results of the “Industry 4.0 in the Czech Republic – current situation, opportunities and challenges” (ČNOPK, 2015) survey, which took place in spring 2015, are very interesting and a little surprising. 274 companies took part in this survey. From the aspect of company size, 30% of these were micro-enterprises, 27% were small enterprises, 24% were medium enterprises and 19% were large enterprises. Digital interconnection in processed for creating added value play a decisive or very important role for over 50% of companies. Only 20% of companies consider it to play a small or no role. With regard to the current situation, three quarters of respondents identified digitalisation in their companies as fully (10%), well (39%) or sufficiently (28%) developed. This are naturally purely subjective responses, their interpretative value cannot be objectively verified. Another fairly unexpected fact for the author was that the survey did not confirm the frequent concerns related to extinction of jobs in relation to growing digitalisation of industry. Nearly two thirds of the companies stated that they do not expect any significant changes to the number of their employees. 26% of large companies count on a reduction in the number of employees in relation to digitalisation and only 8% of small and medium companies count on this reduction. This indicates that Czech companies evidently believe that digitalisation and automation chiefly affects positions in large manufacturing sheds. The future qualifications of employees are also decisive for companies and many companies expect problems here. 17% of companies in total consider employee qualifications a risk or obstacle to digitalisation. Nearly 70% of small and medium companies currently do not have an employee who is specifically responsible for digitalisation, compared to 60% of large companies, which do have such an employee. This great difference may be partially related to costs, but also probably to the fact that there is generally more pressure on innovations in larger companies.

### **3. The Consequences of Digitalisation on Changes to the Educational System**

Due to the rapid development of technologies most employees will need to innovate their qualifications throughout their lives. The OECD (2016, page 26) study examining the issue of development of employee competences, indicates that: “Growing globalisation, the increasing influence of technologies, and also demographic changes, migration and development of the labour market, have drastically changed the employment structure and requirements for the abilities of job applicants in many countries in the world during the last decades – and these trends will continue. Current development opens questions concerning the extent this concerns insufficient qualifications of job applicants, or inappropriate qualifications, in individual countries....In the EU 40% of employees currently feel that their qualifications do not meet the requirements they need to carry out their occupation.”

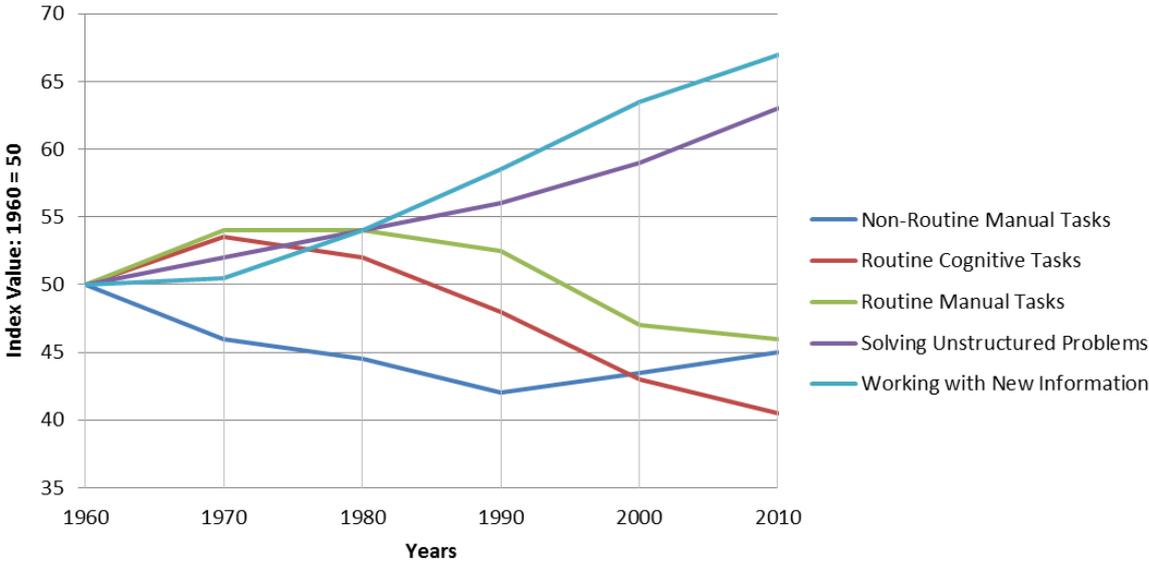
The Czech Ministry of Education, Youth and Sports is also intensively aware of the importance of digital competence, which is why two important documents have been accepted. The Strategy of Digital Education Until 2020, which was approved by the Czech government on 12 November 2014, discusses the field of initial education. The Strategy

of Digital Literacy in the Czech Republic for the period from 2015 to 2020, discusses the field of further education.

**The Strategy for Digital Education Until 2020** focuses on deficiencies in the Czech educational system in the field of the digital literacy of pupils and students. It discusses methods how to make IT fields more attractive for pupils and students, it emphasises the need to implement development of computational thinking into school curricula, the ability to understand the main principles of technologies, which will also enable pupils and students to think logically and critically in their everyday lives. It is also necessary to improve the skills of pupils in the field of work with digital technologies, so that they are capable of using mobile technologies or the internet. It is also important to open education to the new methods and forms of learning allowed by digital technologies. The EU calls this “opening up of education”. A specific example is the massive increase in on-line courses, which are available on the internet free of charge, or so-called webinars, or on-line video conferences, which anyone can watch.

**The Strategy for Digital Literacy in the Czech Republic for the period from 2015 to 2020** endeavours to resolve the situation of the shortage of IT specialists on the job market. Technical fields have a high-quality level of education in the Czech Republic, in spite of long-term low interest of studying in university technical courses. Unfortunately, this is not just a problem of the Czech Economy, there is a shortage of IT specialists worldwide today. A paradoxical situation results, when people are unable to find work, while companies are unable to find candidates for jobs requiring capable experts in the field of digital technologies. According to data from the European Commission (EC, 2017), over 800 thousand such jobs may remain vacant by 2020.

**Fig.1: Changes to the character of work activities on the labour market in the USA 1960–2009**



Source: LEVY, F. and R. MURNANE. *Dancing with robots: Human skills for computerized work*. 2013, executed by the author

However, branches with low technological demands currently predominate within the terms of the employment structure in industry in the Czech Republic. I.e. those jobs with low demands for the quality of the labour force. Entrepreneurs in industry consequently frequently criticize the educational system because it does not prepare graduates so that there are enough job candidates on the labour market interested in working in factories with the necessary qualifications, and lobbies for an increase in the number of pupils at vocational schools and secondary vocational schools. However, this course of action is questionable for the near future. Some fields may continue to need skilled craftsmen, but in general the number of employees in labourer professions will fall and their qualifications will change, as stated above. Fig. 1 accurately demonstrates the changes to requirements for the character of work activities.

The future will need people with information literacy, who have the ability to resolve unexpected problems. Job candidates, who only perform routine activities based on remembering factual knowledge, will have the least chance of success. The main skills for the 21<sup>st</sup> century according to economists will include the ability to learn new things, analyse information, creativity, critical thinking, independence of work, communication skills, management of people, use of technologies (cognitive skills). Social and emotional intelligence, empathy, active behaviour and inner discipline (non-cognitive skills) will also be desirable.

As well as education, Society 4.0 should also discuss configuration of legislation in other areas. The greater extent of automation of production will require fundamental changes example in the field of occupational safety for, where a new series of standards will have to be set. Practice here will overtake legislation significantly and investors will be subject to legal uncertainty. Other areas, which deserve complex analysis and evidently also a range of modifications are financing of public budgets in the event that negative scenarios in development of employment are confirmed. Public budgets are exceptionally dependent on income from taxation of human work, particularly employees, in the Czech Republic. Changes, which will shift financing of public budgets in the direction of increased taxation of consumption, or to such tools that have not been utilised extensively to date, for example taxation of property, must be prepared.

## **Conclusion**

The commencement of the digital era affects all areas of society, including the labour market. Only a small number of professions do not require any digital knowledge at present and this need will continue to grow in the oncoming years. According to the EC (2017), up to 90% of professions require at least basic digital skills today.

The author has used this very limited space to try to map how the Czech economy is preparing for these truly fundamental and far-reaching changes, which the new technological revolution will bring. On one hand we can state that some changes are being made, particularly on the level of the government and its institutions, particularly in the crucial field of education. Many problems are already being discussed at “round tables”,

with the participation of public administrations, representatives of employers and the academic sphere, unfortunately this only occurs on a very general level. Attention is frequently focused only on the technocratic foundation of the issue, the consequences that these changes will have on various spheres of the economy and also on the lives of people are discussed only rarely. There is no concept of dealing with the broader context, such as legislation regulating various aspects of production, logistics, safety and liability. No analytical foundation for objective discussion of changes to tax policy in the event that there is an extensive reduction in the need for human work, has been laid either.

The author also found the fact that, according to surveys executed in companies, their managements are not afraid of the risks arising from the fourth industrial revolution and do not assume negative impact on jobs in their companies, surprising. The question is whether the companies actually believe this, or whether smaller and medium companies in particular have a sufficiently clear idea of these processes and whether they fully understand their impact on their business activities.

Great deficiencies are also evident in the field of education, where it is necessary to significantly reinforce digital skills in children from pre-school age, at primary and secondary schools, at universities and in the field of life-long education.

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## **Creation of Composite Index of the EU Regional Resilience: Analysis and Selection of Indicators**

### **Abstract**

Territorial economies have always been prone to different kinds of shocks such as economic downturns, industry shocks, financial and monetary crises, which can destabilize the path and pattern of regional economic growth. Regional economy perturbed by a shock may move onto a new growth path by re-establishing economic linkages both internally and with other regions. The question why one region is more vulnerable to economic shock than other, impelled to analyse resilience and identify their strengths and weaknesses in terms of resilience and flexibility. Several methods of evaluating territorial economies exist, most of methods have their own limitations, especially in selection of relevant indicators and weighting scheme. Despite the limitations, several approaches in the form of composite indices has been proposed by the European Union (EU) and the other institutions, in the field of cohesion, competitiveness, regional development and potential, resilience, social progress, etc. The aim of the paper is to review the relevant approaches to evaluation of all resilience aspects (especially the EU case) based on composite indices and obtain overview of the appropriate indicators for constructing the EU regional resilience index. Literature review is based on comprehensive analysis of research studies on constructing the territorial composite indices. Results of the paper in the form of appropriate indicators will be utilised as a tool for future analysis in measuring regional resilience of the EU NUTS 2 regions based on constructing the own index.

### **Key Words**

*Composite index, European Union, indicators, regional economy, resilience*

**JEL Classification: B41, C82, O18, R11**

## **Introduction**

Over the past few years, a new buzzword has entered academic, political and public discourse: the notion of resilience – a term invoked to describe how an entity or system responds to shocks and disturbances. The concept of resilience is routinely used in research in disciplines ranging from environmental research to materials science and engineering, ecology, psychology, sociology, and economics, it is thus now invoked in diverse contexts, both as a perceived (and typically positive) attribute of an object, entity or system and, more normatively, as a desired feature that should somehow be promoted or fostered (Martin and Sunley, 2015). Given this rise and spread of resilience talk, it is not surprising that the notion should have found its way into economic geography and regional studies. Regional resilience research area broadly investigated in foreign scientists' research studies (Martin, 2012; Rose, 2009; Hill et al., 2008;

Norris et al., 2008; Foster, 2006). In these studies, regional resilience is generally determined how the region or system responds to shock or disturbance and under these circumstances able to ensure its continuous development. However, this rush to use the idea of regional and local economic resilience in policy circles has arguably run somewhat ahead of the concept understanding. The concept of resilience is rather complicated and deep in content as well as quite complex for an assessment and measurement. Nowadays, there is no universally agreed notion of resilience in the context of regional development as well as considerable ambiguity about what, precisely, is meant by the notion of regional economic resilience, about how it should be conceptualized. There is still no one generally accepted methodology for how regional resilience should be measured, what its determinants are, and how it links to patterns of long-run regional growth. Consequently it leads to a certain misunderstanding and different variations in using of resilience concept – therefore the main purpose of the paper is to identify the specific aspects of resilience notion used in the regional development context. The aim of the paper is to review the relevant approaches to evaluation of all resilience aspects (especially the EU case) based on composite indices and obtain overview of the appropriate indicators for constructing the EU regional resilience index. This paper is based on literature review investigating research works on the issues of resilience measurement and components of resilience concept.

## **1. Review of Existing Composite Indices**

Measurement the progress that societies have made in their developmental efforts, has proven to be difficult but also very popular, see e.g. Minarčíková (2016). Composite indicators or indices (CIs) which compare territorial (e.g. country, region, city or local municipality) performance are increasingly recognised as a useful tool in policy analysis and public communication and very common for benchmarking the mutual and relative progress of territories in a variety of policy domains. CIs as a tool for a ranking become more and more popular, because they illustrate a comprehensive view on a phenomenon that cannot be captured by only one single indicator. CIs provide simple comparisons of territories that can be used to illustrate complex and elusive issues in wide-ranging fields. It often seems easier for the general public to interpret CIs than to identify common trends across many separate indicators and CIs have also proven useful in benchmarking territorial performance. This reflects growing recognition of the important role that CIs can play as a tool for evaluating trends in level of territorial development and for assessing the impact of policy on well-being. However, CIs can send misleading policy messages if they are poorly constructed or misinterpreted. In fact, CIs must be seen as a means of initiating discussion and stimulating public interest. Literally hundreds of sets of CIs on economic and social well-being have been developed throughout the world. CIs are very common in field of economics and are used in a variety of policy domains such as national or regional competitiveness, sustainable development, quality of life assessment, globalisation and innovation (Huggins, 2003; Saisana and Tarantola, 2002). The proliferation of these indicators is a clear symptom of their political importance and operational relevance in decision-making processes. CIs are valued for their ability to integrate large amounts of information into easily understood formats for a general audience.

**Tab. 1: Overview of the EU main composite indices**

| Authors   | Year   | Publication                                       | Territory   | Indicators   |
|---|--------|---|---|--|
| Annoni, P., Kozovska, K. (EC - DG JRC)  | 2010   | EU Regional Competitiveness Index 2010            | 268 EU27 NUTS 2 regions   | RCI 2010 is composed of 69 indicators in 11 pillars: inputs (institutions, macroeconomic stability, infrastructure, health, quality of primary and secondary education, higher education/training and lifelong learning, technological readiness); outputs (labour market efficiency, market size, business sophistication, and innovation).   |
| Annoni P., Dijkstra L. (EC - DG JRC)  | 2013   | EU Regional Competitiveness Index 2013            | 262 EU28 NUTS 2 regions   | RCI 2013 has basically the same framework and structure of the 2010 edition. RCI 2013 is based on a set of 80 candidate indicators of which 73 have been eventually included in the index within the pillars.  |
| Annoni, P., Dijkstra, L., Gargano, N. (EC - DG RUP)                             | 2017   | EU Regional Competitiveness Index 2016            | 263 EU28 NUTS 2 regions   | RCI 2016 has basically the same framework and structure of the 2010 and 2013 edition. RCI 2016 index is based on 74 mostly regional indicators in the same pillars.  |
| Annoni, P., Dijkstra, L., Hellman, T. (EC - DG RUP, Social Progress Imperative) | 2016   | EU Regional Social Progress Index                 | EU28 Member States (272 NUTS 2 regions)                                   | Index is an aggregate index of 50 social and environmental indicators that capture 3 dimensions of social progress (Basic Human Needs, Foundations of Wellbeing, and Opportunity) and their underlying 12 components (nutrition and basic medical care, water and sanitation, shelter, personal safety, access to basic knowledge, access to information and communications, health and wellness, environmental quality, personal rights, personal freedom and choice, tolerance and inclusion, access to advanced education). |
| ESPON (European Spatial Planning Observatory Network)                           | 2014   | Economic Crisis: Resilience of Regions            | EU27 Member States, Iceland, Liechtenstein, Norway, Switzerland.          | Evaluation of regional resilience is based on 2 principal indicators: the number of persons employed and levels of economic output (GDP).  |
| Grunfelder, J., Rispling, L., Norlen, G., (Nordregio)                           | 2016   | Nordregio's New Regional Potential Index          | Denmark, Finland, Iceland, Norway, Sweden, Faroe Islands, Greenland, Ålan | Criteria: Regional potential, Demographic potential, Labour market potential, Economic potential. Indicators: Population density, Net migration rate, Demographic dependency rate, Female ratio, Employment rate, Share of the age group 25-64 with high education degree, Youth employment rate, GRP/capita, Total R&D investments.   |
| Domínguez-Torreiro, M. (EC - DG JRC)  | 2016   | Developing Regional Inclusive Society Index in EU | EU regional level   | Dimensions for proposed indicators: Income distribution and well-being, Access to employment and good quality jobs, Access to knowledge, Access to health, Social protection performance, Social capital and governance, Vertical social mobility, Gender equality, Non-discrimination and tolerance, Personal security.   |
| European Commission - DG RUP  | 2014 b | Regional Entrepreneurship Development Index       | 125 regions of 24 EU Member States  | Index consists of 3 sub-indices (Entrepreneurial Attitudes, Entrepreneurial Abilities, Entrepreneurial Aspirations), 14 pillars, and 28 variables.   |

Source: own elaboration based on reviewed references, 2017

The paper examines number of published studies on this topic corresponds to well-being concept. In the paper, for each type of CI, reviewed general information on the number and type of indicators are offered (see Tab. 1), and these will be utilised in measuring regional resilience based on construction of the own author's index.

Importance of CIs approach for the EU research is confirmed by the number of studies evaluated the level of development in specific thematic topic across the EU territory. Many more approaches evaluating the EU in terms of CIs exist, but they are not included in evaluated sample (Tab. 1) with regard to their progress in terms of theory and empiricism, timeliness and validity, e.g. An Indicator for Measuring Regional Progress towards the Europe 2020 Targets (European Commission, 2014a), The Regional Lisbon Index (European Commission, 2010), Synthetic index: Regional perspective on the Lisbon Agenda (European Commission, 2007). Staníčková, Melecký and Poledníková (2011) made review of data base analysis for exploration of EU cohesion and competitiveness, i.e. ones of the most common areas that are the subject of the EU evaluation and also the topics of CIs creation. There are also CIs which do not represent an official EU approach (approach of an international institution or country), however these CIs evaluate the territories in relevant topic, e.g. Social Progress Index (Porter, Stern and Green, 2016), Resilience Index Measurement and Analysis model (United Nations, 2016) or OECD approach to quality of life and well-being evaluation (OECD, 2016), and others.

## **2. Analysis of Approaches to Resilience Measurement**

Generally, resilience can be defined as a status of system in which its characterizing parameters tend to make system economically resilient and at the same time capable of harmonic development and improvement, at any changes of the external environment (Melecký, 2015). In social science literature reviews on resilience, perhaps the most traditional meaning of resilience is the ability of a regional economy to maintain a pre-existing state (typically assumed to be an equilibrium state) in the presence of some kinds of exogenous shocks. Today, regions all over the world are facing pressures that are forcing them to rethink the impacts of policies aimed at competitiveness and integration into global economy on their socio-spatial structures, following a period of entrepreneurial policies shaped by the notions of globalization and competition (Eraydin and Tasan-Kok, 2013). However, the existing assets of competitiveness can quickly be eroded, since their effects may differ from place to place. More importantly, the reliance on global conditions and the dominance of deregulatory measures make regions vulnerable in economic terms. In these cases, a system can fail, leading to a major reduction or complete loss in performance with respect to some or all measures. Resources are then needed to restore a system's performance to its normal levels. Similarly, the performance of a system over time can be characterized as a path through the multidimensional space of performance measures. Opinions vary to the definition of resilience, and there is no mainstream approach for measurement and expression of resilience and thus no uniform strategies for strengthening resilience of economies. Quantifying systems and regional resilience is a complex process, and scales for measuring resilience, at any level, do not currently exist.

Following the below research studies, indicators and subsequently factors of regional resilience factors are designed which are considered as crucial for purposes of the paper leading to find out relevant indicators which could be background for constructing the EU regional resilience index, i.e. the main aim of the paper. This leads to a broader conceptualization of resilience and to the question: what are the main characteristics for regional resilience? The first group of factors suggests Martin (2012) and among the key factors of regional resilience ranks: dynamic growth of region, structure of the economy, export orientation and specialization of region, human capital, innovation rate, business and corporate culture, localization of region, and institutional arrangement in region. The second group of factors defines Foster (2006) and among the key factors of regional resilience suggests: regional economic capacity, socio-demographic capacity of region and regional community capacity. To capture the effects of shock absorption or shock counteraction policies across countries, Briguglio et al. (2009) proposed four components (and their related indicators) of a resilience index, i.e. macroeconomic stability, microeconomic market efficiency, good governance and social development. Koutský et al. (2012) engage issues of regional resilience determinants and define following factors: the main macroeconomic indicators, labour market indicators and additional ones. Based on these three sets of factors of regional resilience above, Melecký and Staníčková (2015) have defined a set of indicators of regional resilience and this approach was used for purposes of construction of composite weighted index of regional resilience as a primary approach to assessing regional resilience requiring improvement in terms of theoretical concept, databases and also in methodical part of index construction. In their study, five dominating factors (including indicators) of regional resilience has been extracted: community links, human capital and socio-demographic structure, labour market, economic performance, innovation, science and research. It is very important to understand the extent to which areas (territories/localities or regions) compete with each other, where this competition comes from, and what factors determine a territorial economic attractiveness. Taking the competitiveness concept a step further, understanding territorial resilience challenges allows us to not only think about wealth generation of our territories, but also ensure the wellbeing of all citizens, enable sustainable economic development, and how to manage economic shocks and decline into our territorial strategies (Tamásy and Diez, 2013). The authors point out that regional resilience is has certainly influenced by the nature state economic policy, export-orientation of regions, business and corporate culture, institutional arrangement of regions and other factors. In the future steps and especially for construction of the EU regional resilience index, it is necessary to linked the concept of resilience with competitiveness, what influnced the choice of indicators.

### **3. Selection of Relevant and Eligible Indicators for Resilience**

One way to assess regional resilience is by its qualities to cope with future challenges. Resilience index is intended to measure the effect of shock absorption or shock counteraction policies across evaluated territories. Resilience index can be effectively used to communicate to relevant stakeholders the importance of resilience building and

thereby act as an effective focal point in policymaking (in all areas of political activities) by using an integrated approach to improve the components featured in Tab. 2.

**Tab. 2: Proposal of dimensions and indicators for construction of resilience index**

| Resilience index  |  |
|---|--|
| Candidate dimensions and indicators   | Selected dimensions and indicators   |
| <i>macroeconomic stability</i><br>(the fiscal deficit to GDP ratio, the sum of the unemployment and inflation rates, the external debt to GDP ratio)  | <i>macroeconomic capacity</i><br>(GDP per capita, disposable income per capita, harmonised index of consumer prices, government surplus/deficit, gross national savings, government bond yields, government debt, corruption in government services, quality and accountability of government services, impartiality of government services, voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, transparency of government policymaking)  |
| <i>microeconomic market efficiency</i><br>(the size of government, legal structure and security of the ownership right, access to healthy money, freedom of international trade, regulations in the field of labour, business and credit)     | <i>microeconomic capacity</i><br>(employment in financial, real estate, professional, scientific and support activities, GVA in financial, real estate, professional, scientific and support activities, innovative SMEs collaborating with others, ease of doing business index, property rights, intellectual property protection, availability of latest technologies, firm-level technology absorption, technological adoption, FDI and technology transfer, eEnterprises having purchased online, enterprises having received orders online, enterprises with fixed broadband access) |
| <i>good governance</i><br>(economic freedom of the world index: judicial independence, impartiality of courts, protection of intellectual property rights, military interference in rule of law, political system, integrity of legal system) | <i>labour market capacity</i><br>(income inequality, employment rate, long-term unemployment, unemployment, labor productivity, labour costs, gender balance unemployment, gender balance employment, female unemployment, share of population aged 15-24 not in education, employment or training, public expenditure in labour market policy, net earning, tax rate)   |
| <i>social development</i><br>(income dispersion, proportion of population living in poverty, long term unemployment rate, proportion of population with type level of education)  | <i>sociodemographic and health capacity</i><br>(level of population, people at risk of poverty or social exclusion, people living in households with very low work intensity, people at risk of poverty after social transfers, severely materially deprived people, healthy care expenditure, health care staff, health care facilities, road fatalities, healthy life expectancy, infant mortality, cancer disease death rate, heart disease death rate, suicide)  |
| <i>economic performance</i><br>(GDP per capita, labour productivity, gross fixed capital formation)   | <i>education capacity</i><br>(participation rate in education and training, expenditure on education, graduates, education attainment level, population 25-64 with higher education, lifelong learning, early school leavers, early leavers from education and training)   |
| <i>innovation and research and development</i><br>(percentage of innovating enterprises, total R&D expenditures, number of employees working in R&D)  | <i>infrastructure and connectivity capacity</i><br>(accessibility of motorways, accessibility of railways, accessibility to passenger flights, intensity high-speed railways, volume of freight transport relative to GDP, households access to broadband, individuals buying over internet, households access to internet)  |
| <i>human capital and labour market</i><br>(economic activity level, unemployment rate, educational attainment - primary, secondary, tertiary level)   | <i>innovation and research capacity</i><br>(total patent applications, core creative class employment, knowledge workers, scientific publications, total intramural R&D expenditure, human resources in science and technology, employment in technology and knowledge-intensive sectors, high-tech-inventors, ICT inventors, exports in medium-high/high tech manufacturing)  |

Source: own elaboration based on reviewed references, 2017

It is however important to note that the effectiveness of the index is dependent on the 'appropriate coverage, simplicity, ease of comprehension affordability, suitability for

international comparisons and transparency' of its components, as mentioned Briguglio et al. (2009). The question of considering for evaluation of regional resilience is the inclusion of environmental pillar relating the issue of competitiveness. Next step will be thus selection of appropriate quantitative methods for construction of the EU28 resilience index at NUTS 2 regional level.

## **Conclusion**

Despite the growing importance of resilience during the current period of global crisis, there is no generally accepted methodology for how the concept should be operationalized and measured empirically. Similarly, there is as yet no theory of regional economic resilience as such. Quantifying systems and regional resilience is a complex process, and scales for measuring resilience, at any level, do not currently exist. Regional economies are no less susceptible to unexpected and unforeseen shocks and disruptions than other types of system. Resilience of regional economies is thus a valid topic for academic enquiry, not only in its own right, but also because of its potential importance for informing policy-making. Only a thorough analysis involving multiple research dimensions from economic, environmental, institutional, social, and political studies may assure a conceptual definition and a reliable and relevant comprehensive analysis of the regional resilience. This paper showed that CIs approach could be perspective method for evaluation of resilience, because there is no only one correct method how to create CI and thus CIs can be employed, what is also the EU case. Own approach in the form of the EU28 resilience index at NUTS 2 regional level should serve to compare resilience of regions and measure change in resilience over time; to clearly highlight the strengths and weaknesses of regional economies to inform and address actions. The contribution of the own concept to regional resilience measurement will be especially in the territorial extent of analysis (i.e. the EU28 NUTS 2 regions), and then the thematic extent (i.e. not only socio-economic aspects of resilience, but also institutional, aspects of knowledge-based economy, and also environmental factors). The own concept will vary greatly by approach to index construction, i.e. in using of quantitative methods such as Factos Analysis, or more advanced like Data Envelopment Analysis and Entropy Method.

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## Do Gender and Personality Traits (BFI-10) Influence Achievement of Success?

### Abstract

There exists a body of literature on impact of personality traits on academic performance. But there appears to be a gap in literature when it comes to impact of personality traits on extracurricular activities. In order to fill the gap, the paper focuses on impact of personality traits: extraversion, openness to experience, conscientiousness, agreeableness, and neuroticism, as well as gender on success in extracurricular activities. Extracurricular activities were such as participation of students in the faculty competitions, Slovak competitions for students, international competitions for students and taking some of the first three or five places, Student personality of the year and participation in a special programme aimed at talented students. The research was conducted in Slovakia on a sample of university students. Personality traits were measured using Big Five Inventory-10 (BFI-10). While previous studies, which were focused predominantly on grades, found a positive link to conscientiousness, the findings of this research are that success in extracurricular activities is positively linked to openness to experience. Students with a high degree of openness to experience are curious, broad in interests and more open to experience extraordinary activities. This fact seems to be more important to success in various competitions than conscientiousness that influences the grades.

### Key Words

*personality traits, Big Five Inventory, success, university students, extracurricular activities*

**JEL Classification: M53**

## Introduction

Success is considered to be a general value for most people, including university students. The achievement of success and the prerequisites of its achievement are the subjects of an interest for many researchers. Personality traits are supposed to influence the success of students during their study and furthermore in performing other activities connected with study. The success during study helps students also in future carrier by gaining experience, building professional relationships and maintaining self-esteem. According to Debicki et al. (2016), "Identification of personal and situational factors that affect

students' academic performance is of considerable interest and importance to management educators."

The Big Five Inventory examines personality traits as follows (Zhao and Seibert, 2006):

1. Extraversion describes the extent to which person is assertive, dominant, energetic, active, talkative, and enthusiastic;
2. Openness to experience characterizes someone who is intellectually curious and tends to seek new experience and explore novel ideas;
3. Conscientiousness indicates degree of organisation, persistence, hard work, motivation in the pursuit of goal accomplishment;
4. Agreeableness describes interpersonal orientation, involving the tendency to prefer positive interpersonal relationships and cooperation;
5. Neuroticism means the tendency to exhibit poor emotional adjustment and experience negative affects, e. g. anxiety, insecurity, and hostility.

Nguyen, Allen and Fraccastoro (2005) measuring Big Five Inventory with Goldberg's (1999) 50-item instrument, and Higgins *et al.* (2007) measuring personality traits using Costa and McCrae's (1992) 240-item Revised NEO Personality Inventory (NEO-PI-R): Form S identified conscientiousness as the only Big Five Inventory personality trait significantly correlated with grades. The correlation was positive, i.e. high conscientiousness was linked to good grades.

But there exists a notion that grades in our education system could be biased by a student's obedience (Feřtek, 2015). The aim of the paper is to examine the influence of personality traits and gender on achievement of success in extracurricular activities. Considered are namely activities such as:

1. Participation in the faculty competitions for students and taking some of the first three places (e. g. Student scientific and professional activity "ŠVOČ").
2. Participation in a programme HONORIS aimed at talented students. The programme is focused on project management. The students after passing a selection interview attend the training in last 2 years of their study. After the study they can achieve international certificates in project management and the use of PMI methodology.
3. Participation in Slovak competitions for students and taking some of the first three positions (e. g. best diploma thesis in the field of economics and management, international scientific conference, regional competitions organized by different organizations).
4. Participation in competition Student personality of the year. The project is conducted under the auspices of the President of the Slovak republic with the support of the Slovak Rectors' Conference and the professional auspices of the Slovak Academy of Sciences.
5. Participation in international competitions for students and taking some of first five places (Global Management Challenge, 7<sup>th</sup> International Student Seminar, X – Culture Competition).

Success in performing tasks is related to self-competence. The realization of one's goals will give a global experience of efficacy and power, thus maintaining high self-competence (Tafarodi and Swann, 1995). Self-competence significantly correlates to extraversion and openness to experience (Ramsdal, 2008), so the correlation between these personality traits and success can be expected.

The paper is organised in the following way: In the next section, there is a description what data were collected and how, and how they were analysed. In the following section, results of the analysis are presented. The last section offers conclusions.

## 1. Methods of Research

Data were collected in late 2016-early 2017 using a paper-based questionnaire. Respondents were students of the Faculty of Business Economics, the University of Economics Bratislava. The questionnaire contained the instrument to measure Big Five Inventory (John and Srivastava, 1999) personality traits, namely the validated translation (Hřebíčková et al., 2016). For the analysis in this paper, Rammstedt and John's (2007) 10-item Big Five Inventory-10 (BFI-10) was used. The instrument uses a 5-point Likert scale for each item. Authors are aware of the new version of Big Five Inventory - Big Five Inventory-2 (Soto and John, in press) but there is no validated translation available yet.

The questionnaire included also questions on gender and on where the respondent lives - with parents, with parents and in the dormitory, or in their own household. Big Five Inventory personality traits, gender, and where a respondent lives are going to be used as independent variables. The dependent variable is success. The research focuses rather on extraordinary performance, success in extracurricular activities, not on grades. Success of students was determined by achieving at least one of successes during their university study, as follows:

1. participation in the faculty competitions for students and winning the first to third place,
2. participation in a programme HONORIS focused on project management,
3. participation in Slovak competitions for students and winning the first to third place,
4. participation in competition Student personality of the year,
5. participation in international competitions for students and winning the first to fifth place.

Overall, there were 87 respondents of whom one did not provide information on success, and another on gender, accommodation, and success. So, the effective sample size was 85 respondents, of whom 23 were male, and 62 female.

Since the dependent variable - achievement of success - is binary, binary logistic regression was used to estimate the model. A multivariate approach was used, i.e. impact of all hypothesised relationships was tested in one step. In the past, also discriminant analysis (based on normal distribution, i.e. a parametric approach) was widely used for models with binary dependent variables but it was abandoned in favour of logistic

regression (a non-parametric approach). SPSS software was used for the analysis. The predicted value was achievement of success, i.e. a positive regression coefficient means a higher probability of achieving success and vice versa. As achievement of success is less prevalent than lack of success, there are unbalanced classes. If classes were balanced, i.e. half of the respondents would report achievement of success, the binary logistic regression model with .5 threshold would correctly predict approximately the same percentage of positive and negative cases. But since classes are unbalanced, it could be expected that with .5 threshold the smaller class would be predicted less correctly than the larger class. The way to increase correctness of prediction of the smaller class which is of interest (i.e. to increase *recall*) is to change the threshold. Changing the threshold from default .5 to any different value decreases correctness of prediction of both classes together (*precision*). In order to suggest a reasonable threshold for practical use, several threshold values were used, and related classification tables will be provided at the of the next section.

## 2. Results of the Research

The research question is if gender, extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience influence achievement of extracurricular success. (Is it (only) conscientiousness as in case of achievement of good grades or (also) something else?) Binary logistic regression results for the full model are provided in Tab. 1 (S.E. stands for standard error, df for degrees of freedom, and Sig. for p-value). Cox&Snell pseudo  $R^2$  is 0.184, Nagelkerke pseudo  $R^2$  is 0.286 and *p-value* is 0.027.

**Tab. 1: Binary logistic regression for the full model**

|                           | <b>B</b> | <b>S.E.</b> | <b>Wald</b> | <b>df</b> | <b>Sig.</b> | <b>Exp(B)</b> |
|---------------------------|----------|-------------|-------------|-----------|-------------|---------------|
| Intercept                 | -5.846   | 2.943       | 3.946       | 1         | .047        |               |
| Extraversion              | .416     | .408        | 1.038       | 1         | .308        | 1.515         |
| Agreeableness             | .381     | .394        | .934        | 1         | .334        | 1.463         |
| Conscientiousness         | -.363    | .444        | .669        | 1         | .413        | .695          |
| Neuroticism               | -.072    | .287        | .063        | 1         | .802        | .930          |
| Openness to experience    | 1.067    | .432        | 6.106       | 1         | .013        | 2.906         |
| Gender = male             | 1.052    | .683        | 2.371       | 1         | .124        | 2.864         |
| Lives = with parents      | -1.166   | .884        | 1.741       | 1         | .187        | .311          |
| Lives = with parents&dorm | -1.153   | .859        | 1.803       | 1         | .179        | .316          |

*Source: authors' calculations*

Openness to experience significantly influences achievement of extracurricular success, and its influence is positive. Classification table with .5 threshold is provided in Tab. 2. With regards to precision, the model is able to correctly predict 82.4 % of cases. With regards to recall, the model is less correct in predicting success rather than no success.

**Tab. 2: Classification table for the full model with .5 threshold**

| Observed\Predicted | Yes | No | Total |
|--------------------|-----|----|-------|
| Yes                | 6   | 12 | 33.3  |
| No                 | 3   | 64 | 95.5  |
| Total              |     |    | 82.4  |

*Source: authors' calculations*

Carlson and Wu (2012) suggest to exclude independent variables that are not significant. Binary logistic regression results for the streamlined model are provided in Tab. 3. Cox&Snell pseudo  $R^2$  is 0.135, Nagelkerke pseudo  $R^2$  is 0.209 and  $p$ -value is 0.002.

**Tab. 3: Binary logistic regression for the streamlined model**

|                        | B      | S.E.  | Wald   | df | Sig. | Exp(B) |
|------------------------|--------|-------|--------|----|------|--------|
| Intercept              | -5.603 | 1.580 | 12.574 | 1  | .000 |        |
| Openness to experience | 1.070  | .394  | 7.354  | 1  | .007 | 2.914  |
| Gender = male          | 1.140  | .606  | 3.544  | 1  | .060 | 3.127  |

*Source: authors' calculations*

After least significant variables were removed, it seems that achievement of extracurricular success may be influenced also by gender. In the whole population, the effect of gender may be more significant; maybe the significance of gender in this model was affected by the sample structure - only about a quarter of males, not one half. Classification table for the streamlined model with .5 threshold is provided in Tab. 4. With regards to precision, the model is able to correctly predict 83.5 % of cases, marginally more than the full model. The recall marginally decreased compared to the full model.

**Tab. 4: Classification table for the streamlined model with .5 threshold**

| Observed\Predicted | Yes | No | Total |
|--------------------|-----|----|-------|
| Yes                | 5   | 13 | 27.8  |
| No                 | 1   | 66 | 98.5  |
| Total              |     |    | 83.5  |

*Source: authors' calculations*

In this case (given the coding of variables), recall can be increased by increasing the threshold. If the threshold increased to 1.0, all instances of achievement of success would be correctly predicted by, i.e. recall would be 100% but the second class would be completely incorrectly predicted (SPSS does not allow to set threshold 1.0). In order to find a suitable threshold, classification tables with threshold from .6 to .9 will be provided. Classification table for the streamlined model with .6 threshold is provided in Tab. 5.

**Tab. 5: Classification table for the streamlined model with .6 threshold**

| Observed\Predicted | Yes | No | Total |
|--------------------|-----|----|-------|
| Yes                | 7   | 11 | 38.9  |
| No                 | 3   | 64 | 95.5  |
| Total              |     |    | 83.5  |

*Source: authors' calculations*

Increasing the threshold from .5 to .6 increased recall while precision stayed the same. Classification table for the streamlined model with .7 threshold is provided in Tab. 6.

**Tab. 6: Classification table for the streamlined model with .7 threshold**

| Observed\Predicted | Yes | No | Total |
|--------------------|-----|----|-------|
| Yes                | 10  | 8  | 55.6  |
| No                 | 15  | 52 | 77.6  |
| Total              |     |    | 72.9  |

*Source: authors' calculations*

Increasing the threshold to .7 increased recall above one half, while more than three quarters of the second class are correctly classified. Classification table for the streamlined model with .8 threshold is provided in Tab. 7.

**Tab. 7: Classification table for the streamlined model with .8 threshold**

| Observed\Predicted | Yes | No | Total |
|--------------------|-----|----|-------|
| Yes                | 14  | 4  | 77.8  |
| No                 | 29  | 38 | 56.7  |
| Total              |     |    | 61.2  |

*Source: authors' calculations*

Increasing the threshold from .7 to .8 inverted the situation, recall is above three quarters, while more than one half of the second class is correctly classified. Classification table for the streamlined model with .9 threshold is provided in Tab. 8.

**Tab. 8: Classification table for the streamlined model with .9 threshold**

| Observed\Predicted | Yes | No | Total |
|--------------------|-----|----|-------|
| Yes                | 15  | 3  | 83.3  |
| No                 | 45  | 22 | 32.8  |
| Total              |     |    | 43.5  |

*Source: authors' calculations*

Increasing the threshold from .8 to .9 increased recall above four fifths but it less than one third of the second class is correctly classified.

Tables 4-8 provided classification tables for the streamlined model with threshold from .5 to .9. The threshold of .6 clearly dominates the threshold of .5 as it has a higher recall with the same precision. The threshold of .8 leads to a higher recall, while correctly classifying more than one half of the second class. Higher thresholds are suitable only for instances when it does not matter how incorrect is classification of the second class.

To sum up, unlike grades which are positively linked to consciousness, success in extracurricular activities is positively linked to openness to experience. E.g. Higgins *et al.* (2007) found openness to experience linked to IQ.

### 3. Discussion and Conclusion

It is already established what personality trait influences academic performance (mostly measured as grades). The aim of the presented research was to investigate whether conscientiousness influences also success in extracurricular activities and/or what other personality traits do so.

It was discovered that not conscientiousness but openness to experience influences success in extracurricular activities. Students with a high degree of openness to experience are curious, broad in interests and more open to experience extraordinary activities. This fact seems to be more important to success in various competitions than conscientiousness that influences the grades. Kauffmann *et al.* (2008) found in their study that locus of control along with the Big Five factors were significant prediction variables for grade average of students. Therefore, the locus of control should be examined in future research as it could also be significant prediction variable for success in extracurricular activity of students. Individuals who believe that they have control over the events in their lived have an internal locus of control (Rotter, 1966) and it can be expected that these individuals would be open to experience.

Gender was used as a control variable. When the remaining personality traits were removed from the model, significance of gender improved but it still stayed above the 0.05 threshold.

In practical university life, students with a high degree of openness to experience should be encouraged to participate in extracurricular activities. Also, in creating teams for competitions, a student open to experience should be a part of a team, ideally with someone with high degree of conscientiousness.

Future research should be aimed at the examination of detailed personality traits. Therefore, 60-item version of the questionnaire for the Big Five (Soto and John, 2016) should be used to reveal if there are some relations between facet scales and success of students.

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## Cluster Analysis in Context of ICT Sector in NUTS 3 Regions of the Czech Republic

### Abstract

Information and communication technology sector and Information and communication technology companies are considered in general level as a highly potential for contemporary and future development for each economy with significant positive impact on labour productivity, economic growth and standard of living. The present article is focused on analysis of 7 assessable indicators characterizing ICT sector on regional levels NUTS 3 in the Czech Republic between years 2008 and 2015. These selected sectoral indicators were then used in a hierarchy cluster analysis in the Ward method. Four clusters were created with different levels of development potential of ICT. Quest is to find regions in Czech Republic where information and communication technology is develops similarly or which are sectorally similar. Based on results from cluster analysis we can divide and name the formed groups of regions in context of their share on ICT activities. Analysis of information and communication sector which is defined by European classification of economic activities NACE Rev.2., in section J, information and communication, is based mostly on empirical data from Czech Statistical Office on regional level NUTS 3.

### Key Words

*Cluster analysis, Information and communication technology, NUTS 3 regions, Czech Republic.*

**JEL Classification: C38, L86, R12**

## Introduction

The information and communication technology (ICT) sector is characterized by multiplier economic effects when the activities and operations in this sector directly or indirectly affect the performance in other sectors, contribute to significant savings, productivity growth and increase of intellectual capital, especially human capital, growth. They also contribute to social value created by the synergy of knowledge, information and technology that is being created in this economic sector, developed and supported. All of these aforementioned positive effects associated with the activities of the companies in the ICT sector improve the competitiveness of the regions in which they operate and contribute to the improvement of the quality of life and growth in the standard of living (Turečková, 2014). The ICT sector has a big potential for the future development of the society and its economies due to its high added value that it generates, and it represents one of the most stable sources of the qualitative economic increase for the present as well

as for the future (Voříšek, Novotný et al., 2010, Dedrick, Gurbaxani & Kraemer, 2003, Kitson, Martin & Tyler, 2004). The influence of the ICT in the form of capital goods proved to be significantly important for its contribution to the economic growth (Schreyer, 2000). Atkinson and Castro (2008) believe that the economic activities related to the ICT sector are the principal innovative driving force of individual economies, and the investments put into the ICT sector are important for creating new job opportunities, particularly in the services sector. According to the European Commission (EC, 2010) the ICT sector significantly contributes to the gross national product (5 % in the USA, 4 % in Japan and approximately 3 % in the European Union countries), and at the same time it has been proved that during the last twenty years every increase in the ICT sector by 10 % was reflected in the increase in the workforce productivity by 0.5 % - 0.6 % (OECD, 2012). In this context Voříšek, Novotný et al., (2010) mention that the multiplication effects, which are characteristic of the information and communication technologies, contributed to the intensification of the performance and the quality of public administration, and also triggered an increase in the productivity in other sectors, e.g. in the EU countries the increase in the workforce productivity by 50 % was caused by applications created by the ICT sector. The Czech Republic is one of Europe's top locations for ICT investments because of its long industrial tradition and it is absolutely no surprise that new technologies naturally grow in the established environment of recognized universities, institutions and research centers. Czech Republic has very good education system which serves as a basis for future skills development and produces a very capable workforce. That is why we have creative, innovative, experienced and skilled professionals. (CzechInvest, 2014) That is why ICT sector in Czech Republic strengthens and gets the limelight interest.

This present study is enhancing author's previous partial analysis of information and communication technology sector by creating homogenous groups of regions ICT regional performance by point method. The aim of this paper is to define the groups of regions of Czech Republic which are sectoral similar in economic activities according to information and communication technology. ICT sector in particular region will be characterized through seven relevant characteristics and indicators. Definition of ICT sector is based on European classification NACE Rev. 2. and the regions for this analysis are defined by territorial level NUTS3. There are 14 regions in Czech Republic. The analyzed period covers the years 2008 – 2015.

The text of the paper below Introduction chapter will be organized as follow: Section 1, Methodology of Cluster Analysis and Data, describes theoretical approach to ICT sector and introduce the sources of data. The core of this part is to introduce and characterize the cluster analysis which is used for empirical calculation. In section 2, Application of Cluster Analysis in NUTS 3 Regions in context of ICT activities, is done division of regions of Czech Republic according to their similarity in ICT activities based on cluster analysis. Last section, Conclusions, highlights some major conclusions.

# 1. Methodology of Cluster Analysis and Data

Economic sector of ICT is defined by the NACE Rev. 2 (Nomenclature générale des Activités économiques dans les Communautés Européennes) where ICT sector is concretely defined in Section J - Information and communication activities (Information and Communication). It is including the activities of production of information ... data, information technology and its transmission and distribution and other related services (CSO, 2013). Based on this classification the Czech Statistical Office (and also Eurostat) divided ICT sector into four major categories: (I) production ICT (ICT manufacturing industry), (II) trade in ICT, (III) telecommunications services (telecommunications) and (IV) information technology (IT services). The territorial definition of the regions is analyzed based on territorial statistical units NUTS (Nomenclature of Territorial Units for Statistics - Nomenclature of Territorial Units for Statistics) which is used mainly for statistical purpose in EU. For a standard classification of territorial units in the Czech Republic is used CZ-NUTS and for purpose of this analysis is used regional level NUTS3. There are 14 regional units included in NUTS3 in the Czech Republic, namely Prague, Central Bohemia Region, South Bohemia Region, The Plzen Region, The Karlovy Vary Region, The Usti Region, The Liberec Region, The Pardubice Region, The Hradec Kralove Region, The Vysocina Region, The South Moravian Region, The Zlin Region, The Olomouc Region and The Moravian-Silesian Region (MMR, 2015).

From a methodological perspective the work is based on a cluster analysis and data analysis. The covered period includes the years 2008 - 2015. Data used here were collected from the Czech Statistical Office, from Selected Indicators by Industry stated in Database of Regional Accounts, from Statistical Yearbooks of particular region for each relevant year. A data about a number of firms based on take-over paid data from statistical database of Czech Statistical Office, concretely from the Registry of Economic Subjects. Analysis of 7 basic and available selected indicators characterizing ICT and determining its performance and success in ICT activities in regions are:

1. gross value added (GVA) produced by ICT sector in particular region,
2. sectoral employment in ICT sector in particular region,
3. ICT sector's gross fixed capital formation (GFCF) in particular region,
4. regional amount of ICT firms,
5. amount of IT specialists (IT professionals) in particular region,
6. share of GVA of ICT in particular region on total GVA of ICT,
7. share of sectoral employment in particular region on total sectoral employment.

It is important to note that the bigger number the indicator has the bigger is involvement of particular region in characterizing of ICT sector. The status of ICT sector is analyzed on background of cluster analysis. The principle of using this method is introduced in the text below (Majerová & Nevima, 2016). Cluster analysis is primarily focused on the search for similarities or differences between examined objects. „Cluster analysis provides one, empirically based, means for explicitly classifying objects” (Punj & Stewart, 1983, p. 134). If the research object is the region, as in our case, it is clear that only by applications of cluster analysis we can confirm our assumption about the most or the least developed

regions in the area of human development and its modifications. Blashfield & Aldenderfer (1988, p. 447) consider that „cluster analysis method has a long history – the earliest known procedures were suggested by anthropologists, later this ideas were picked up in psychology“. Clustering analysis became one of the qualifying methods in the 20<sup>th</sup> century, the usefulness of which immediately had an impact on practically all fields of science. The first comprehensive work dealing with cluster analysis was created in 1939 by Tryon (Tryon, 1939). The main motivation for the use of clustering is uncovering of hidden similarities or differences. For this reason, a cluster analysis is now widely used by all scientific disciplines (for us is most interesting use in the field of economy, see e.g. Halásková & Halásková, 2015).

If we want to formulate the principle of cluster analysis mathematically, it can be stated that it is the decomposition of set  $S(k)$  by the objects to  $k$  certain groups of clusters  $C$ , see Equation (1):

$$S^{(k)} = \{C_1, C_2, C_3, \dots, C_k\} \quad (1)$$

where  $C_1 \neq 0$ .

The basis of cluster analysis is sorting (for details see Meloun, 1994), of which we appoint two basic approaches. The first is called hierarchy cluster method and is most widely used by software. It is based on the use of once formed clusters. Thus formed clusters are then used to create other clusters from the rest of the data file. This manner is then preceded until all elements of the data file are a part of the cluster. This procedure has been chosen for our analysis of the regional level of human development in the V4+ countries. The second method is a non-hierarchy cluster approach, which is based on cluster search on the principle of the smallest difference from the average. The procedure, however, is advantageous only if the number of clusters we want to achieve, is determined beforehand. However, this may become a significant limitation in a further research, because only such a number of clusters are finally formed, which we determined beforehand and for example, some extreme values may merge with average ones (K-means).

The selection of cluster methods is necessary after determining the clustering process. There are seven methods (Caliński & Harabasz, 1974). The first two methods are based on the Between Groups Linkage or Within Groups Linkage. Their use depends on good knowledge of the data file and information about the number of clusters that we want to achieve. In the case of ignorance of the total number of clusters we want to achieve, both methods are limitations in further research. The third method, Nearest Neighbour is based on the shortest distance between clusters. The fourth method, Furthest Neighbour method, searches the values in the data file that are furthest apart. The fifth method, Centroid Clustering method, may look at first glance like the most ideal. It is based on the Euclidean distance between the centroids of clusters. The closest are those clusters which have the smallest distance between the centroids. But it does not solve the differences that may occur due to different weights for equally large clusters. The sixth method -

Median clustering - solves the problem of weights variance that the previous method gives to differently large clusters.

**Fig. 1: Ward Method in Cluster Analysis**



*Source: authors' own*

Since the values of each variable were in different units (years, population, monetary unit), it was necessary to standardize data. This standardization was carried out in two steps:

1. firstly the medium value  $\bar{z}_k$  and standard deviation  $s_k$  were calculated according to Equation (2) and (3)

$$\bar{z}_k = \frac{1}{n} \sum_{j=1}^n z_{jk} \quad (2)$$

$$s_k = \left[ \frac{1}{n} \sum_{j=1}^n (z_{jk} - \bar{z}_k)^2 \right]^{1/2} \quad (3)$$

2. afterwards the standardization through normalization of each object in the z-score was made (the standardization z-function) by the following Equation (4)

$$x_{ik} = \frac{z_{jk} - \bar{z}_k}{s_k} \quad (4)$$

One of the fundamental problems of clustering analysis is the concept of mutual similarity of objects and quantitative expression of this similarity. One of the most common ways of expressing relationships among objects is the metrics. The metric squared Euclidean distance (SED) was used for Ward's method (5):

$$d_e^2(x_i, x_j) = \sum_{k=1}^n (x_{ik} - x_{jk})^2 \quad (5)$$

where  $d^2$  is SED,  $x_{ik}$  is the value of  $k$ -symbol for the  $i$  observation of the variable and  $n$  is the total number of objects.

The software used was SPSS. Data matrix for the cluster analysis is shown in Appendix. All calculations and graphical analysis are author's own.

## 2. Application of Cluster Analysis in NUTS 3 Regions in context of ICT activities

Based on the methodology described in the previous section of this paper, cluster analysis will now be practically applied on the regions at NUTS 3 level of the Czech Republic. These 14 regions will be divided according to their sectoral characteristics in the context of information and communication technology. As already mentioned, the hierarchy cluster approach by means of Ward's method was used for the classification of regions, and all performed calculations were performed by using SPSS software. Ward's method not based on the optimization of distances between clusters, but on optimization of the clusters' homogeneity according to some criterion, which is the minimizing of increase in the error sums of squares of deviations from the points of the cluster centroid. The sum of squares is calculated for each possible pair of connection aggregates at each stage of this analysis. Then those clusters are combined where there is minimal increase in the error sum of squares. The advantage of using this method and also our motivation of its use, is the tendency to remove small clusters, thus forming clusters of about the same size, which is often welcome feature. This is because this method requires expression of objects' distance by the squared Euclidean distance. Since the Ward's method leads to minimization of intra-cluster dispersion, causing more accurate research examined objects, its choice was for our purposes the best option (Majerová & Nevima, 2016; Majerová, 2016).

**Tab. 1: Created clusters of NUTS 3 regions in Czech Republic taking into account the seven sectoral inputs between the years 2008-2015**

| NUTS 3                                  | Cluster |
|---|---------|
| 2008-2015: Prague                       | 1       |
| 2008-2015: Central Bohemia Region       | 2       |
| 2008-2015: South Bohemia Region         | 3       |
| 2008-2015: The Plzen Region             | 3       |
| 2008-2015: The Karlovy Vary Region      | 3       |
| 2008-2015: The Usti Region              | 3       |
| 2008-2015: The Liberec Region           | 3       |
| 2008-2015: The Pardubice Region         | 3       |
| 2008-2015: The Hradec Kralove Region    | 3       |
| 2008-2015: The Vysocina Region          | 3       |
| 2008-2015: The South Moravian Region    | 4       |
| 2008-2015: The Zlin Region              | 3       |
| 2008-2015: The Olomouc Region           | 3       |
| 2008-2015: The Moravian-Silesian Region | 3       |

*Source: authors' calculations in SPSS.*

Table 1 shows four created clusters of NUTS 3 regions in Czech Republic taking into account the seven ICT sectoral inputs between the years 2008-2015. The digits (1 - 4) for

the cluster in the Table 1 indicate which regions formed the group – cluster. None of the clusters remained unchanged throughout the monitored period so we can argue that the input indicators are constant in regions during analysed period of time. The subjects of cluster analysis are 14 NUTS 3 regions that have been evaluated by following metrics:

1. cluster 1, which consists of the Prague, we can mark with regard to the analysis result and the general knowledge of the situation and the size of the indicators as the **capital's extreme**,
2. the second cluster (cluster 4) was created by The South Moravian Region, which is a **region with significant concentration**,
3. cluster 2 is the group of two regions, Central Bohemia Region and The Moravian-Silesian Region, which can be marked as a cluster **of regions with a significant concentration potential** in the ICT sector,
4. and finally the last cluster (cluster 3) indicates the group of **regions with below-average concentration** of ICT activities. In this group of regions are the rest of 10 Czech NUTS 3 regions.

Definitely have emerged three specific clusters (1, 2 and number 4) which represent the regional "centers" in ICT. The cluster with number 3 then includes regions on the "periphery" of the ICT sector.

## Conclusion

The field of Information and Communication Technologies has over the past few years transformed from a field on the outskirts to one of the most important sectors of the Czech economy (CzechInvest, 2014). Seven relevant indicators which characterize ICT sector in Czech Republic were used in hierarchy cluster analysis in the Ward's method in the period from 2008 to 2015. The cluster analysis was divided into 4 groups of mutually similar regions, the largest group of which is the cluster marked 3, which consists of 10 regions of the Czech Republic, which participate at minimum in the activities related to information and communication technologies in the national comparison. The cluster analysis categorized regions in the Czech Republic as 4 mutually exclusive, relatively homogeneous groups, which, with their combination of sectoral characteristics, are similar to each other. Individual groups - the clusters were worded with terms (capital's extreme, significant concentration, significant concentration potential, below-average concentration) that comprehensively reflect the relationship of the region in the ICT sector. On the background of the cluster analysis, four groups of regions were formed which are similar in selected sectoral characteristics in the period 2008 - 2015. The first homogenous cluster (1) consists of the region Prague, the second cluster (4) is again formed by only one region and that region is The South Moravian Region, the third group (cluster 2) form sectoral similar regions: Central Bohemia Region and The Moravian-Silesian Region and last, the fourth cluster (cluster 3) is formed by the rest 10 regions (South Bohemia Region, The Plzen Region, The Karlovy Vary Region, The Usti Region, The Liberec Region, The Pardubice Region, The Hradec Kralove Region, The Vysocina Region, The Zlin Region, The Olomouc Region ) from the all 14 regions. Research carried out by

the cluster analysis above is part of a broader research into the status of ICT in regions of the Czech Republic made by authors of the paper. The conclusions on the distribution of regions in their similarity in the ICT sector and sectoral homogeneity are positively correlated with other research findings. ICT activities are concentrated in regions of the Czech Republic in clusters numbers 1, 2 and 4, while cluster with number 3 includes 10 Czech regions in which economic activities related with ICT sector are infinitesimally and insignificantly included.

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## Innovative Marketing in the Context of Industrie 4.0

### Abstract

Innovative marketing is a process that fosters the innovation of products and services based on the wishes of existing and potential customers. In the environment of Industrie 4.0, this mainly means marketing innovation based on a connection between the virtual cyber world and the world of physical reality. The article is based on research of marketing innovation and Industrie 4.0. The research was used to compile a scenario for a primary qualitative study. The focus group study was composed of representatives from 32 Czech companies chosen from the database of firms that publicly acknowledge the use of Industrie 4.0. The groups were divided based on the size of the companies. An evaluation using the method of content analysis produced a list of twelve main attributes that can be identified as essential marketing innovations connected with digitalisation. These determined attributes were briefly explained and electronically compared among the representatives of the participating companies, a necessary step given that the composed attributes uncovered latent information learned from the focus group. The responsible company representatives approved the resulting list and they also added a scale of importance. Following a statistical evaluation, a ranking of importance was compiled and subsequently statistically tested. The tests demonstrated that statistically significant differences exist among three attributes; the tests concerned the dependence of responses on the size of the companies. The results from the study showed that the representatives of companies with headquarters in the Czech Republic are aware of the content of Industrie 4.0. It also revealed that marketing innovation accompanies these great changes.

### Key Words

*innovative marketing, Industrie 4.0, focus group, augmented reality*

**JEL Classification: M31**

## Introduction

The implementation of industrial revolution 4.0 in the practice of Czech firms is at the beginning today, and marketers do not exactly know which tools will be used to create the marketing mix. The internet is the technology for the implementation of the “new marketing” and it should serve as a technological interface in the network connection of enterprise units with artificial or virtual intelligence. Corporate practice includes all communication technology capable of mutual communication based on the reception, processing and transmission of information. The application of marketing will be based on data and their advanced processing. Thanks to the perfect knowledge of the behaviour of individuals, the marketing mix will be optimised specifically for each customer. The massive growth of data will be accompanied by the problem of data storage; data lakes

and “In-memory” databases will be created and data will be singularised, i.e. massive parallelisation on a global scale. The price policy of companies, an integral part of the fourth industrial revolution, will include the use of cryptocurrency to increase internal efficiency and for external payments. The first example is the Bitcoins that are already widely used today. The essence of the project presented in the article is the identification of the current state of implementation of Industrie 4.0 in Czech companies from the perspective of marketing innovation.

- The main goal of the article is: A definition of marketing innovations connected with Industrie 4.0, which are a source of competitive advantages.
- Ancillary goal of the article: The identification of the importance of the determined attributes of innovative marketing.
- Hypothesis: The size of the company has no impact on the identified attributes of innovative marketing.

## **1. Overview of the literature**

The foundation of the article is research of domestic and foreign sources, especially from scientific databases. The research concerns two areas: marketing innovation and Industrie 4.0. Innovation can be characterised in general as the creation of something new that did not exist before and which has the potential capacity of attracting the attention of the customer. Tidd, Bessant and Pavitt (2007) argue that the basis for innovation is the ability to see connections, to perceive opportunities and exploit them. To define marketing innovation, Cummins (2000) states that "it is a shocking association of products, services or technologies". Such innovation is partly based on a continuous assessment of dynamic markets in the area of social responsibility, combating threats from substitutes and potential competitors (Simpson and Taylor, 2000, Blythe, 2001). In the Czech Republic, information on innovation is surveyed by the Czech Statistical Office. The content of the surveys is based on pan-European surveys on innovation. The methodology manual is the so-called Oslo manual of 2005. According to this material, innovation can be divided into two categories: a) technological innovation – product innovation, process innovation; b) non-technological innovation – organisational innovation and marketing innovation (OECD 2005). The linking of innovation and marketing leads to interaction of the innovation system and the economic area (Drucker, 2008). Indeed, marketing innovation or innovative marketing aims to meet the new needs of customers, seeking new opportunities for the use of products, the search for new market opportunities, new forms of distribution, communication (Kotler, 2005). The second part of the overview of the literature is the term Industrie 4.0. The impulse for discussions was the publication of a vision in Germany in 2011, where the term Industrie 4.0 emerged with a content explanation. Two years later, in 2013, a document with the concept of “Industrie 4.0” was presented at the Hanover Fair. The subject professionally includes the term "automation based on cyber-physical systems" and the goal is to use these systems to construct a so-called "smart factory" with minimal human impact and increased productivity by about 30% (BMW, 2017). The new approach is associated with the current level of technical civilization and is thus subject to scientific

developments in the field of IT, wireless communication with Wi-Fi cloud solutions, the biophysics for modern robotics and online monitoring. According to representatives of the Czech-German Chamber of Commerce (ČNOPK, 2015), over the next ten years the fourth industrial revolution will interconnect the entire production process, including development and follow-up service. Thanks to sensors, cameras, transmitters, code readers and cyber-physical systems, factories will to some extent run themselves. Automatic warehouses will ship orders on a timely basis. Parts and semi-finished products will be equipped with microchips and will themselves determine how they should be processed. The president of the Czech-German Chamber of Commerce, Rudolf Fischer (2015), emphasises that "it is not a futuristic vision, because the fourth revolution has already begun". For example, a "smart factory" operated by Siemens in Amberg manufactures Simatic programmable controllers. In implementing Industrie 4.0, the aim is to create an optimal overall package by leveraging existing technological and economic potential through a systematic innovation process drawing on the skills, performance and know-how of the workforce (Černá, 2016). Industrie 4.0 comes from Germany, where you can also find the most research. The major authors are Hermann, Pentek and Otto (2016) from the Technical University Dortmund, who determined the basic determinants of the industry as follows: Interconnection, collaboration, standards, security, data analytics, information, provision, decentralized, decisions, physical, assistance and virtual.

## 2. Methods of research

The research methodology is divided into five parts:

1. **The basic type of research** was a qualitative study. The logic of the qualitative study was inductive. This research served for an understanding of the subject of the study, i.e. innovative marketing.
2. **Purpose of the research:** With respect to the aim of the work, it is possible to identify an exploratory purpose in the study used in the case there is insufficient knowledge of the issue. A descriptive purpose was also partially used, since the determined attributes were subjected to an evaluation from the perspective of the level of importance.
3. **Method of selecting respondents:** "Purposive sampling" from the basic population was used to select respondents for the qualitative study. The basic population was composed of companies that report using Industrie 4.0.
4. **Method of data collection:** Data was collected using the "focus group" method. Company size was used as a classification factor for dividing them into groups. An electronic survey among the same respondents was used as a supplemental data collection method.
5. **Data evaluation methods:** Qualitative studies were evaluated from personal records and audio recordings, with marketing experts from the academic community and practice participating along with a psychologist. "Content analysis" was used as the method for evaluating the qualitative study. The definition of content analysis is connected with the terms: objective, systematic, manifest, reliable, valid and reductive analysis of information. Descriptive statistics were used to evaluate the supplemental

electronic survey: modus, median, mean and standard deviation. Pearson's chi square test method for testing statistical hypotheses was used to determine differences in the perception of innovative marketing in connection with the size of the company.

### 3. Results of the research

The research was conducted using the qualitative focus group method with three homogenous groups from the representatives of companies that present their attempts to utilise Industrie 4.0. Groups were divided by the size of the companies they represent. The first group was composed of managers from micro firms with up to 50 employees. The second group was made up of managers representing small and medium enterprises with 51-250 employees. The third group was composed of managers of large enterprises with 251 and more employees. The study was conducted in March 2017. A combination of written and audio records was used during the study. A smaller number of respondents is typically addressed for this type of study, with all three groups having 10-11 participants. The outputs of group interviews were subjected to a content analysis with marketing experts and an expert from the implementation of Industrie 4.0. A psychologist participated in the evaluation for the purpose of uncovering latent information. The overall analysis of the investigated issue was followed by a final synthesis, which resulted in the achievement of the goal. The content analysis procedure is captured in Table 1.

**Tab. 1: Content analysis procedure**

|  |
|--|
| 1. Slowed multiple playback. A comparison of written and video records acquired in tandem.                       |
| 2. A definition of variables derived from the research questions and hypotheses.                                 |
| 3. Uncovered latent content that appears repeatedly in the responses.  |
| 4. Compilation of independent groups of variables entered in the table.  |
| 5. A synthesis of variables into a final model of the most important factors falling under innovative marketing. |

*Source: author's own material*

#### 3.1 Identification of attributes of marketing innovation

The resulting list after the final synthesis of individual groups of respondents was composed of twelve attributes that can be designated as essential methods for the application of innovative marketing in the context of Industrie 4.0. The results were first evaluated separately by individual groups in the focus group. Since the aim of the project was to compile a comprehensive list of marketing innovations connected with Industrie 4.0, only the complete list of all attributes is presented, without their dependency on enterprise size. The resulting attributes are collected in Table 2.

**Tab. 2: Attributes presenting innovative marketing**

|                       |                                 |
|-----------------------|---------------------------------|
| Information terminals | Autonomous distribution         |
| Big data              | Additive production             |
| Augmented reality     | Machine-to-machine              |
| Virtual currency      | Marketing for individuals       |
| System integration    | Corporate Social Responsibility |
| Advergaming           | Cloud storage                   |

*Source: author's own material*

- **Information terminals** – terminals (kiosks) used in company spaces or in public spaces. Kiosks provide customers the required information in electronic form, which can be supplemented with augmented reality. Operation of the kiosks utilises touchscreens or in combination with a keyboard. Information kiosks can contain presentation, information and transaction applications making it possible to display or print out information 24/7 and to perform any other operation. The use is very broad, e.g. an advertising product presentation at exhibitions, in shopping centres, the collection of data from magnetic and chip cards, bar codes.
- **Big data** – big data is typically regarded as data in the scope of peta bytes ( $10^{15}$  bytes) and over, which exceeds the possibilities of contemporary database technology. Examples include image data, text data from the internet, business data, security data and combined multimodal data. The foundation is coding algorithms, e.g. for evaluating qualitative research. For marketing this means more precise, better utilisable information for campaigns, for the identification of target groups.
- **Augmented reality** – involves the depiction of a real environment and the subsequent addition of visual information using 3D graphic depiction. In the case of a camera connected to a computer, a so-called marker is most commonly used, i.e. a special image for which the application is “trained”; these markers can appear on product packaging, in printed catalogues, or they can be installed in stores. Thanks to 3D animation, it is possible to not only present the appearance of products in this manner, but also, for example, a cross-section of a product and its functionality. Today there are already digital showrooms where customers can watch a product on a PC monitor; a virtual instructor can demonstrate a product and the customer can even try the functions on their own.
- **Virtual currency** (cryptocurrency) – built on the principle of a peer-to-peer network (client-client). Hence, this currency system has no superior control regulating the currency. Thanks to complicated encryption, virtual currency cannot be counterfeited. All transaction and accounts are public, which serves as protection and the prevention of financial criminality. The best-known virtual currency today is the Bitcoin, the limited circulation of which prevents inflation. In the price policy of a company, this means a reduction in costs for payments, the elimination of inflation, possible optimisation of the tax burden and in addressing new segments.
- **System integration** – this involves horizontal and engineering integration which together form a connected ecosystem. The functioning of the vertical connection requires the processing of data in real time, the sharing of information and continual communication. (EDI - Electronic Data Interchange, ERP - Enterprise Resource Planning, CRM - Customer Relationship Management, RFID - Radio Frequency Identification, etc.).

- **Advergaming** – the connection of the gaming business and marketing; future customers play and want to play. The 3D game associates reality in which virtual and real shopping merge. This can be virtual worlds such as The Sims, or augmented games in which reality is combined with fiction, e.g. Pokémon (in which the real “sponsored” spaces serve as part of the game).
- **Autonomous distribution** – the delivery of products straight to the customer’s door. This involves the use of the autonomous robotisation now emerging in engineering, with the requirement of a platform that enables the connection of robots with the cloud. The autonomous robot delivers the product to the target location from production or another link in the distribution channel. This has mostly involved the testing and use of drones thus far.
- **Additive production** – is the process of joining materials according to 3D digital data, most often layer by layer. This involves the creation of products directly for end customers, i.e. the transition from the rapid prototyping of the 1990s to rapid tooling today toward rapid manufacturing. The product will be manufactured quickly and precisely, even for the most complicated forms, such as printing a house.
- **M2M (machine-to-machine communication)** – absolute change of product. Each product can have a built-in communication device allowing it to receive information from another product, to process the information and to pass it on to another device. In this way products are connected to a network that provides the customer the actual output. For example, products exchange information in the household on their own; they can attempt to resolve a certain situation or offer a person a proposed solution.
- **Marketing for individuals** – targeted marketing involves a focus on homogenous segments. No segment is entirely homogenous, as even customers have different wishes. An ideal solution is a focus exclusively and precisely on the individual. Social media, where individuals reveal almost everything about themselves, is a tool for absolute segmentation.
- **Corporate Social Responsibility** – the integration of social and ecological perspectives in daily company operations and interaction with company stakeholders. Emphasis is placed on environmental concerns in connection with ecological production fostering permanent sustainable development. Social responsibility is a competitive advantage in the advanced technological environment of Industrie 4.0. It is precisely technology that makes the implementation and promotion of social responsibility possible.
- **Cloud storage** – a cloud solution can be used for storing of “big data”, e.g. for unstructured data. Clouds also help with planning new production. For a company this means that they can use their historical production data to create several possible development scenarios that could occur after the production launch of a new product. Sharing information, e.g. on customers or the structure of sales, between hundreds of branches of a single company is a great advantage for marketing.

Although marketing information does not rank under technological innovations, technology cannot be separated entirely from marketing, which confirms the findings attributes. Marketing employs technology, but is not its primary source. For that reason, technology is also connected with marketing in the resulting attributes.

### 3.2 Evaluating the importance of identified attributes

The compiled list of attributes derived from the content analysis was then sent back electronically to the respondents in the focus group. The objective of this feedback was the comparison of the generated attributes with the opinions of the respondents. The content analysis also uncovered latent attributes that appeared under various names. To improve the evaluation of the determined attributes, the respondents were asked to rank the importance of individual attributes. The respondents were asked to rate the individual attributes of innovative marketing in the context of Industrie 4.0 on a scale of 1 to 7, with 1 being maximum importance and 7 being unimportant. The resulting values are presented in Table 3.

**Tab. 3: The importance of attributes**

| attributes of innovative marketing | modus | median | standard deviation | mean       | p-value      |
|------------------------------------|-------|--------|--------------------|------------|--------------|
| 1. Marketing for individuals       | 1     | 1      | 1.739              | <b>1.9</b> | 0.062876902  |
| 2. Corporate Social Responsibility | 1     | 2      | 1.671              | <b>1.9</b> | 0.08230727   |
| 3. Augmented reality               | 2     | 2      | 1.702              | <b>2</b>   | 0.537851596  |
| 4. Cloud storage                   | 1, 3  | 2      | 1.480              | <b>2.3</b> | 0.0258869691 |
| 5. Big data                        | 1     | 2      | 1.779              | <b>2.4</b> | 0.153166785  |
| 6. Additive production             | 2     | 2      | 1.537              | <b>2.4</b> | 0.14036495   |
| 7. System integration              | 2     | 3      | 1.825              | <b>2.4</b> | 0.200239612  |
| 8. Advergaming                     | 2     | 3      | 1.927              | <b>2.6</b> | 0.089591045  |
| 9. Machine-to-machine              | 2, 3  | 3      | 1.829              | <b>3.1</b> | 0.16862739   |
| 10. Autonomous distribution        | 1     | 3      | 1.606              | <b>3.1</b> | 0.045866064  |
| 11. Virtual currency               | 3     | 3      | 1.716              | <b>3.5</b> | 0.097100277  |
| 12. Information terminals          | 3     | 4      | 1.762              | <b>4.2</b> | 0.0056416616 |

*Source: author's own material*

If the results are viewed as ordinal variables, the important attributes are those whose mean falls in the interval <1;3>; neutral has a mean of 4 and unimportant has a mean in the interval of <5;7>. All of the attributes are evaluated as being important, with only "information terminals" having a mean evaluation as "neutral". If the results are evaluated as cardinal variables, the mean and standard deviation are calculated. Important attributes fall in the interval of <1;4), neutral attributes could have a value of 4 and unimportant attributes fall in the interval of (4;7>. According to this evaluation, eleven attributes are important and only one was ranked as unimportant. Although the "information terminals" attribute can be considered as borderline important, it is possible to say that the twelve listed attributes belong to innovative marketing connected with Industrie 4.0. And while the main objective was to identify attributes of innovative marketing, the calculation of statistically significant differences in the responses followed. Enterprise size was one of the classification parameters. The impact of enterprise size on the evaluation is determined by testing statistical hypotheses by means of Pearson's chi square test. Critical values are not presented in the article, only the p-value; the tests were conducted on a level of significance of  $\alpha=0.05$ . Tested hypothesis:

H0: The size of the company has no impact on the identified attributes of innovative marketing. H1: non H0

Statistically significant differences were identified for three attributes (4, 10 and 12), where hypothesis H0 can be rejected and hypothesis H1 can be accepted; there are statistically significant differences between the responses.

## **4. Discussion**

According to OECD reports, innovation is divided into technological and non-technological. In this classification, marketing innovation is ranked under non-technological innovation. However, the study unequivocally showed that technological and non-technological innovation cannot be divided. The foundation of Industrie 4.0 is the digital revolution, and innovative marketing is based on new technology. While the results deny the division into technological and non-technological innovation, it is possible to agree with the opinion that marketing innovation is not a source of technological expansion.

## **Conclusion**

The article presents research intended to map the gradual implementation of Industrie 4.0 from the perspective of marketing innovation in Czech enterprises. List of companies in the Czech Republic that present their application of Industrie 4.0. was the basic set for the selection of respondents. Of those that made the list, contact was established with 32 firms that joined the study. The companies were divided in three groups based on their size, and a focus group was put together for each of these separately with experts in marketing and innovation sent by each firm. The resulting records from the qualitative study and research served as the foundation for creating the list of attributes. The main goal was achieved thanks to the identification of twelve attributes under marketing innovation connected with Industrie 4.0. A separate goal of the article was the verification of the respondents' consent to the list of determined attributes and the ranking of the importance of the individual attributes. An electronic survey of the same respondents proved the accuracy of the list of attributes. The attributes were subjected to a point rating of their importance. The evaluation of the mean, modus and median in Table 3 showed that the representatives of the enterprises active in the Czech Republic agree with the results of the content analysis. Differences in opinion were established among only three attributes (cloud storage, autonomous distribution, information terminals), which, along with the results of the standard deviation, indicates the great consistency in the evaluation. The presented study is the first part of a long-term project uncovering marketing innovation at Czech firms. At the core of this industrial revolution is the connection of the virtual cybernetic world with the world of physical reality, which is a great opportunity for marketing. The prerequisite is a major change in the marketing strategy of tools in connection with the new environment. With the involvement of artificial intelligence, this change will have economic and social transformational impacts. The results of the presented study show that Czech firms that report their involvement in Industrie 4.0 already have an overview of the major new innovations in marketing. The

identification and definition of attributes of innovative marketing came only after the careful processing of the obtained information using a content analysis. It should also be noted that the identified attributes overlap and form a compact whole. This means that marketers will have to use multiple attributes to determine their strategy. Overall, it is possible to speak of new marketing emerging in conjunction with Industrie 4.0. The study successfully identified the main attributes that can be used both for further theoretical investigation and for use in practice for companies implementing Industrie 4.0.

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## The Impact of the Human Resources Deficit on the Development of a High-Technology Enterprise

### Abstract

The paper analyzes problems of surmounting the deficit of high-qualified specialists with higher education, specialists of medium and lower qualifications in the modern high-technology business. It is pointed out that the task of surmounting the personnel deficit on all levels of such business must be included in the enterprise development strategy.

The theoretical background of development of market structures within surmounting the deficit of qualified human resources is examined. It is demonstrated that in conditions of the monopsony and monopoly on the labor market the optimal quantity of employees and the optimal wage are different from the point of view of the employer and labor unions. At the same time, labor unions and employers create a bilateral monopoly on the labor market.

The results of analyzing the demand for human resources required for maintaining the high level of operating standards for enterprises in high-technology industries are presented. The structures of the deficit of human resources according to qualifications levels, as well as the types of the economic activities in the Russian Federation and Czech Republic (“Manufacturing”, “Research and Development”, “Education”) are demonstrated. On the basis of analyzing the structure of the deficit of human resources, recommendations for eliminating this negative factor, suppressing the high-technology business development, are provided.

The following methods have been used during the preparation of the paper: graphic-analytical apparatus, the deductive analysis method, and statistical methods.

### Key Words

*high-technology enterprise, human resources, labor market, monopoly, monopsony.*

**JEL Classification: D24, D42, I25, J23, J24, J42, O33**

## Introduction

As part of the world economic system, globalization processes bring forth significant changes in the development of market structures (Kraft et al., 2011). Within such structures the competitive environment is modified, and a significant number of small and medium enterprises emerges. Besides, the number of high-technology enterprises, characterized by high investments into R&D, creating products based on advanced and

unique innovative technologies, has been rapidly increasing since the end of the 20<sup>th</sup> century (Kucharčíková et al., 2011). At the same time, there is a significant growth of the demand for human resources that can ensure functioning of high-technology business in the field of mechanical engineering, electrical engineering, automation, electronics, etc. The demand is growing for both high-qualified specialists with higher education and specialists with medium and lower qualifications (Farek, Kraft, Zaytsev, 2013; Kraft, Bednářová, Kocourek, 2012; Nikolayev, Zaytsev, Baranov, Kraft, 2010; Zaytsev, Baranov, Kraft, 2009).

Consequently, requirements of the modern economy for the qualifications of university graduates and specialists of different qualifications levels that support enterprises from high-technology industries are changing. Therefore, it is necessary to shift from programs with highly specialized knowledge to expand the professional training by combining mastering natural, economic, and technical knowledge, abilities, and skills. Specialists of different qualifications levels who possess such training would be in demand by both small and large enterprises. This enables innovative enterprises to improve or maintain its position on the competitive market influenced by globalization processes. Hence, the globalization causes qualitative changes in the process of forming the human capital and intellectual-creative resources of the society by influencing market structures. However, to improve its positions on the competitive market high-technology business must surmount the labor deficit on all levels. This aim must be included in the competitive strategy of the enterprise development.

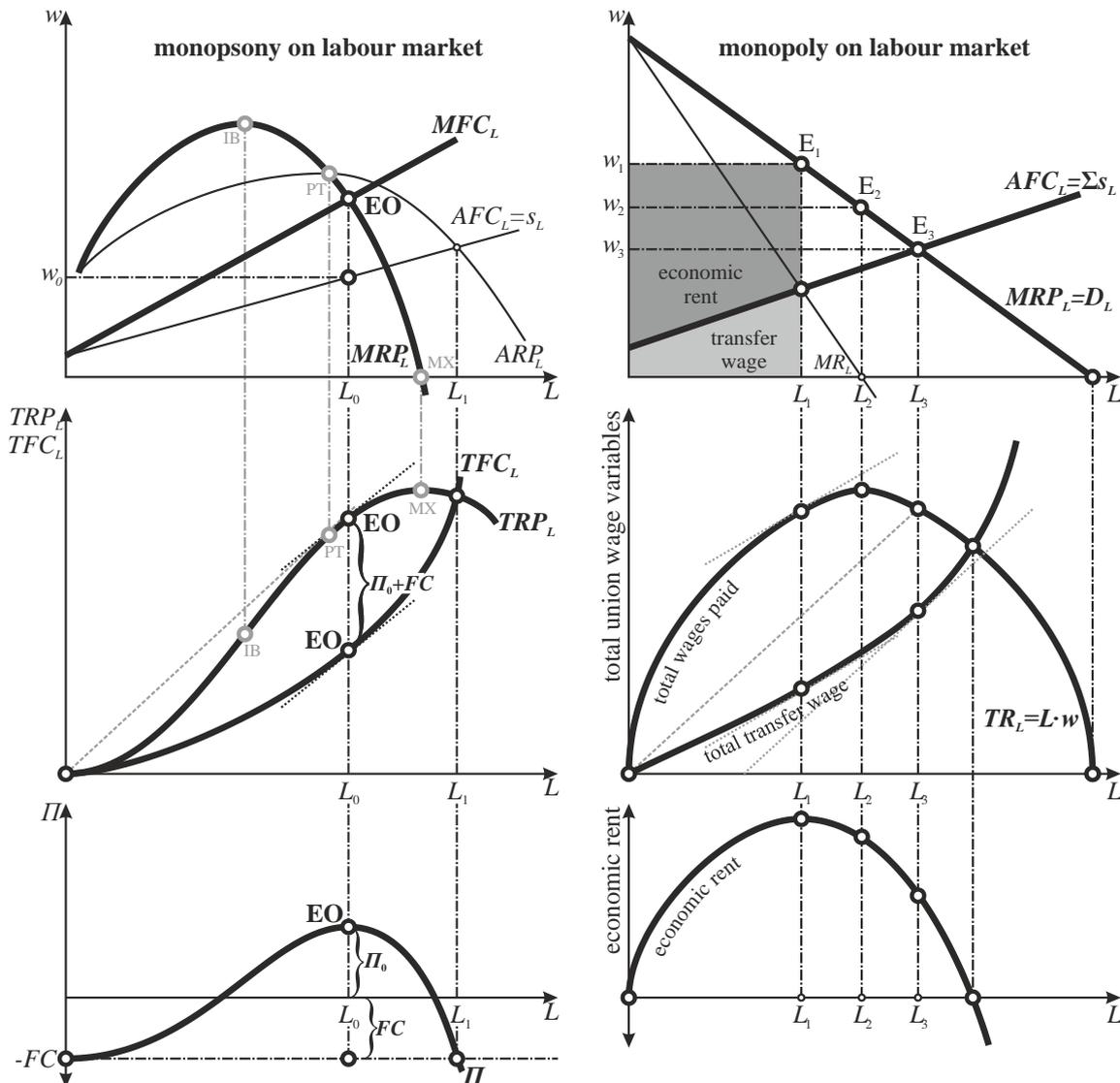
The aims of the paper are to provide the theoretical background, comparative analysis, recommendations for eliminating the existing deficit of qualified human resources in the Russian Federation and Czech Republic. The following methods have been used during the preparation of the paper: graphic-analytical apparatus, the deductive analysis method, and statistical methods.

## **1. Theoretical background of development of market structures in surmounting the deficit of qualified human resources.**

The world economic growth imbues economic activities with entrepreneurial meaning. At the same time it depends on the quality and quantity of available factors of production and on participation of science in creating the newest technology. The influence of those factors contributes to development of both the state and business innovative potential. The primary objective is to create promising, advanced technology that is currently or would be in the high market demand. While solving this task the society must actively participate in capitalizing one of the most significant parameters – the labor. The labor capitalization is a vital issue because the human capital and labor market represent the main development factor of innovative enterprises in conditions of the global economy (Fárek, Kraft, Zaytsev, 2013; Nikolayev, Kraft, Zaytsev, 2011).

High-technology enterprises are subjects of the so-called „Industry 4.0“, and their development depends on high-qualified specialists. In the current conditions of the labor deficit (especially – high-qualified) it is necessary to possess a clear understanding of the principles by which the market operates and to fully accept these principles. Failing to do so would curb the enterprises' development due to either the deficit of the required labor (too low wages) or its falling efficiency and competitiveness (too high wages). Therefore, it is necessary to keep in focus the labor market within Industry 4.0.

**Fig. 1: Comparison of monopsonies and monopolies on a labor market**



Source: Kraft, Bednářová, and Kocourek (2013).

where:

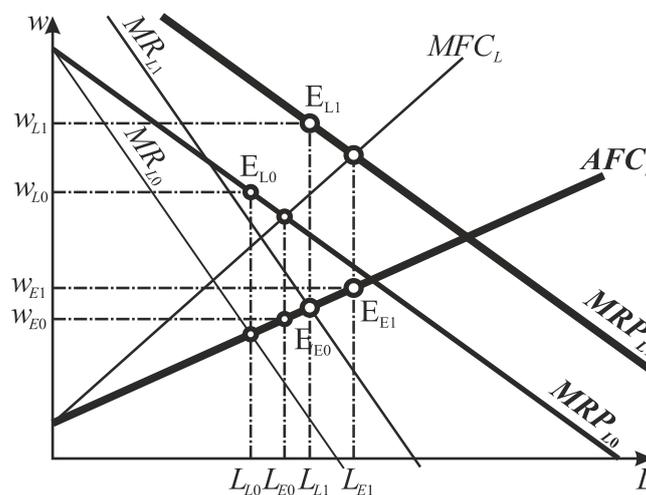
|                      |  |   |
|----------------------|--|---|
| $L$ = labor          | $TRP_L$ = total revenue product of labor | $MRP_L$ = marginal revenue product of labor |
| $w$ = wage           | $TFC_L$ = total factor cost of labor     | $MFC_L$ = marginal factor cost of labor     |
| $S_L$ = labor supply | $AFC_L$ = average factor cost of labor   | $ARP_L$ = average revenue product of labor  |
| $D_L$ = labor demand | $EO$ = economic optimum                  | $MR_L$ = marginal wage                      |
| $E$ = equilibrium    | $TR$ = total wage                        | $FC$ = fixed costs                          |

The labor market is a part of a specific market of factors of production, where households represent the supply, while enterprises represent the demand. The labor demand is a derivative of the demand for the end product that required factors of production to manufacture it.

The revenue an enterprise can generate using factors of production depends on the labor productivity and the value (price) of the manufactured product. The optimal number of people on the labor market for the employer to hire, i.e, the number of people the employer needs, depends exclusively on the marginal values of  $MRP_L$  and  $MFC_L$ , which must be equal. It is a mandatory condition for a real imperfect competitive labor market where a company holds the status of a monopsony. Fig. 1 demonstrates the optimal wage and the quantity of the employed labor for the employer (the buyer of the labor) in case of the monopsony. The labor supply depends on the aim of labor unions which hold the status of a monopoly on the imperfect competitive market. Fig. 1 demonstrates 3 possible aims of labor unions participating in labor disputes between employees and employers in case of the monopoly. E.g., such goals include maximization of wages, the amount of wages paid out, or total employment. Let us assume that as part of the existing practice labor unions select the first aim – the wage maximization. Point  $L_0$  defines the optimal quantity of labor for an employer, whereas point  $w_0$  defines the optimal wage. Labor unions would assess  $L_1$  as the optimal number of specialists employed by an enterprise and  $w_1$  as the optimal wage.

If we merge the labor monopsony and monopoly, then a bilateral monopoly emerges. It distinguishes different notions of employers and employees (labor union members) on the wage and the quantity of the labor employed (see Fig. 2).

**Fig. 2: Bilateral monopoly on a labor market**



Source: Kraft, Bednářová, and Kocourek (2013).

where:

Index L = values for labor unions  
Index E = values for employers

Index 0 = value before changes in  $MRP_L$   
Index 1 = value after changes in  $MRP_L$

In the economic reality the quantity of the labor employed should fluctuate prior to expected changes in  $MRP_{L0}$  between  $L_{L0}$  (labor unions) and  $L_{E0}$  (employers) depending on the wage fluctuations. In turn, the wages fluctuate between  $w_{L0}$  (labor unions) and  $w_{E0}$  (employers), depending on the power distribution between labor unions and employers. However, the existing deficit of the qualified labor on the market contradicts this theory, thus we do not analyze the parameters in the interval accepted by the market in the reviewed case.

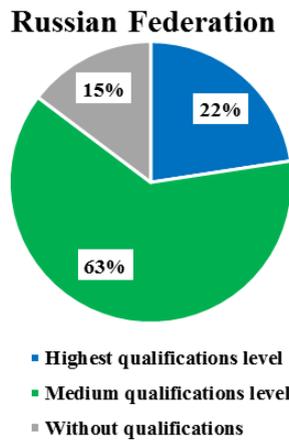
The reasoning for this situation is linked to the growth of proficiency of the specialists, and consequently – with the growth of the marginal revenue product of labor and the growth of the demand for the products, manufactured by employees. The value (price) of the product also increases, leading in turn to increase in marginal product revenue and then to increase in the marginal revenue product of labor which is the marginal revenue multiplied by the marginal product of labor.

Therefore, Fig. 2 demonstrates the marginal labor product shift from  $MRP_{L0}$  to  $MRP_{L1}$  and the marginal wage shift from  $MR_{L0}$  to  $MR_{L1}$ . The logical result are the expansion of the wage interval to  $w_{L1}$  and  $w_{E1}$  and at the same time – the increase in the labor employed within  $L_{L1} - L_{E1}$ . However, only those professions would experience the wage growth where the demand significantly exceeds the supply (Clark, 1965; Kraft, 2011). Therefore, it is safe to assume the labor mobility within one economy. It is also safe to assume that the labor with the required qualifications would transfer from those countries where the wages are lower (Hicks, 2011).

## **2. Analyzing the existing deficit of qualified human resources on the labor market for high-technology enterprises of the Russian Federation and the Czech Republic.**

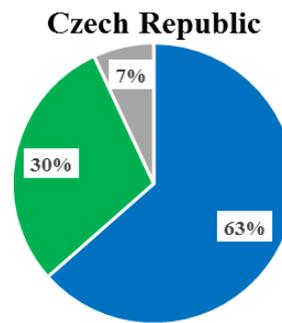
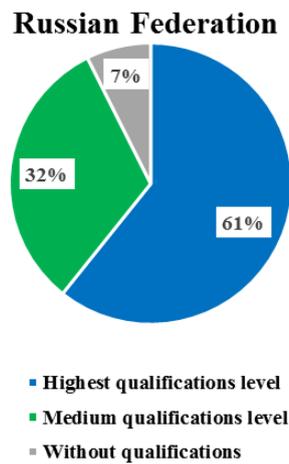
The problem of the suppressed development of innovative economies of Russia, Central Europe, and Eastern Europe lies within the growing deficit of employees of all qualifications (primarily in technical fields). Hence, we have analyzed the structure of the deficit of the human resources required for high-technology business. Vide infra the results of analyzing the demand for the human resources that are vital for maintaining high levels of operating standards for enterprises in high-technology industries. Figures 3 – 5 demonstrate the structure of the human resources deficit per qualification levels in the Russian Federation and the Czech Republic for Manufacturing, Research and Development (R&D), and for Education.

**Fig. 3: Structure of the human resources deficit according to the qualifications level for the economic activity “Manufacturing”**



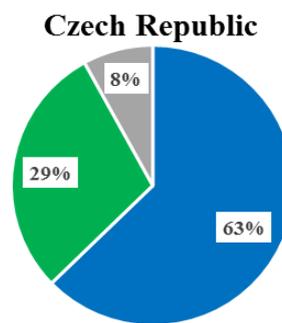
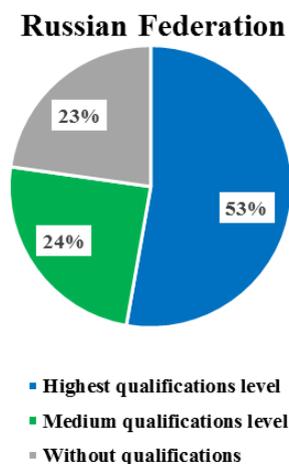
*Source: authors' own calculations, data from (FSSS, 2014; MLSA, 2017)*

**Fig. 4: Structure of the human resources deficit according to the qualifications level for the economic activity “Research and Development”**



*Source: authors' own calculations, data from (FSSS, 2014; MLSA, 2017)*

**Fig. 5: Structure of the human resources deficit according to the qualifications level for the economic activity “Education”**



*Source: authors' own calculations, data from (FSSS, 2014; MLSA, 2017)*

## Conclusion

The analysis of the structure of the human resources deficit of all qualifications sets a number of tasks for commercial and public subjects in order to eliminate this negative factor that suppresses the high-technology business development in the Russian Federation and the Czech Republic. One of the tasks is to develop such content for specific educational programs that meets the requirements of the modern economy (Keřkovský, 2009; Nikolayev, Zaytsev, Baranov, Kraft, 2010; Nikolayev, Kraft, Zaytsev, 2011). E.g., to develop such programs educational establishments and professional training centers must respond in a timely fashion to changing economic and social needs of the society and to maintain a close partnership with different market entities, including federal and regional state authorities, entrepreneurial structures, etc. The task of eliminating the deficit and improving human resources is inseparable from motivating and increasing the prestige of technical professions in the society. For that purpose, it is necessary to develop new approaches to financing both training of specialists and remuneration for labor in high-technology industries.

Bridging the gap between educational standards and needs of employers and the society, as well as improving the quality of education on all levels are the new challenges for the educational system and the professional workforce training system during realizing the strategy of increasing the efficiency of a high-technology enterprise (*Peculiarities*, 2011; Nohria, Joyce, Roberson, 2003; Zaytsev, 2012; Zaytsev, Baranov, Kraft, 2009; Zuzák, 2011). All categories of educational establishments are required to carry out the mission of creating innovative training programs, forming proposals on updating educational standards, implementing reforms in the field of managing the educational system in order to improve the quality of education and the level of knowledge of graduates. This means that future specialists must possess a certain set of competencies and be prepared to managing an enterprise in the new business environment.

## Acknowledgement

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## Section II

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# **Entrepreneurship (Start-up, Spin-off, Family Businesses)**





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## Knowledge-based System for Assessing Vitality of Family Businesses in the Czech Republic

### Abstract

The article presents the first results of the applied research project on the topic called "Family businesses as a source of community development in the Czech Republic". The authors explain the vitality assessment model of family business. Subsequently, the structure of the knowledge-based system that allows self-assessment of family business vitality is described. The research on family business should not only explain how families behave and then infer the consequences. It is important to explain natural characteristics of family business within a broader area of a municipality and a region. In this context, we talk about the interaction of family business and the region, the so-called regional familiarness. This approach was also used in the creation of the knowledge-based system that draws on the authors' own vitality assessment model of family business.

### Key Words

*Family business, Regional familiness, Sharing economy, Vitality, Knowledge-based system.*

**JEL Classification: D19, D830**

## Introduction

The topic of family business and its specifics is very current in the Czech Republic in the second decade of the 21<sup>st</sup> century. This is evident from the discussions in the media, as well as from proposals for legislative changes in civil law towards defining the terminology of the family business. (AMSP, 2016) About 25 years have passed since the change in the political and economic system in the Czech Republic. One of the reasons for discussing this topic is the issue of a generational handover of the businesses. Nowadays, a generation of children of founders of private businesses in our country has grown up. They often perceive running businesses as a demanding process limiting their privacy, especially in a period of great leisure opportunities and in conjunction with the resources offered by the so-called collaborative consumption and also sharing economy. This term means business built on lease, exchange or sharing of assets and the use of modern information and communication technology. (Antlová, Rydvalová, 2016) A collaborative consumption model goes somewhat against the philosophy of a family business that is based on ownership and responsibility for a family, property, and a place where the family

lives. These facts further complicate the processes of transferring business to future generations. At the same time, the family business is usually closely related to the location (municipality) of its existence and is, therefore, one of the important factors of regional development. We can say that family business and regional development are inter-linked systems. (Basco, 2015)

The aim of this paper is first to present a theoretical framework, the created model and subsequently introduce methodological procedure of the knowledge-based system for assessing the vitality of family business in the Czech Republic.

## 1. Literature review – a conceptual approximation

Family business takes place in the whole range of business sizes; however, it has its own specifics in the context of close links between business activities and a family harmony. Taguiri R. and J. A. Davis (1992) explain that family business is a system composed of three perspectives, namely a family, a management and an ownership. When creating the development strategy of the family business, it is, therefore, necessary to prepare its transfer in terms of a leadership succession, transfer of property values and control of the company and the family. On a principle of these three perspectives, the concept of a presented **model for the specification and the family business vitality assessment** is also built. Based on the specifications of family business in the Family Firm Institute documents (FFI, 2016), as well as the EU (Mandl, 2008), the findings from our own research (Rydvalová et al., 2015), the findings of Koráb et al. (2008), considering the legislative definition of the terminology in the Civil Code in the Czech Republic (MŠMT, 2012) and a press release from the Association of Small and Medium Enterprises (AMSP, 2016), the definition was provided for the purposes of a further research, study and education as follows. **The family business is seen as the employment of family members performed consistently, independently, on their own account, on their own responsibility, with a trade licence or in a similar way in order to generate profit/value for the family, with the assumption of a generational handover.** In the case of family businesses, family relationships are examined in relation to the founder or the owner of a given economic entity.

The important role of family businesses in the development of municipalities and regions is pointed out in the works of, for example, Koráb (2008), Koironen (2007) and others. Family businesses often have a close link to the community where they live and do business, and are inclined to influence social life. They tend to be key employers and service providers in small municipalities and rural areas where these services would otherwise be unavailable. Research in family business relations and regional development discusses in his work Basco (2015) who presents the "regional families" model. He explains this term as a set of unique factors (human, entrepreneurial and social). Relationships of a rather stewardship mode are one of the typical human regional factors supported by the existence of family business (see also Westhead and Howorth 2006). The family business is an institution through which the family influences the development of their surroundings. It is obvious that a situation may arise where the

family also can have a negative impact on their surroundings, for example, with the emergence of negative externalities such as, in relation to a possible lower profitability of companies, slower innovation and in relation to the investment caution. The regional familiarness model works with the hypothesis that the way to manage family businesses, decision making, aspects of regional proximity may intensify but also slow down the agglomeration effect. Therefore, it is necessary to take this situation into account in other research activities of the family business. (Basco, 2015)

In the model, vitality is understood by the theoretical concept of J. Plamínek. It is conditioned by mastering four key disciplines, which are usefulness, efficiency, stability and dynamics. At first, it is necessary to address the question of usefulness, and only in case of useful processes, deal with their efficiency. Consequently, only when the system is stable, it makes sense to address the issue of its development, dynamics. The theory of vitality is presented by J. Plamínek in his book 'Diagnosis and vitalization of companies and organizations' (Plamínek, 2014).

## 2. Methodological procedure

The methodological process of implementation of the specification model, defining the typology of the family business and assessing its vitality was as follows. In the first phase, the team focused on the issues of definition and typology of the family business in relation to the valid legislation of the Czech Republic, see Chapter 3.1. The basis is built on the F-PEC model where P factor (Power) provides regulatory instruments according to the legislation of the country. It is rated by the share of a family on the ownership of a company (ie. business share, the ability to manage and control). The other two factors - E (Experience) describes the transfer of experience between generations, C (Culture) values of culture and socially responsible business towards the municipality/office/ place of family business. (Koráb, 2008, also Astrachan, Smyrniotis, 2005)

In the second phase, the team focused on the specifics of the family business in three defined areas (modules), see Chapter 3.2. These were specified by literature analyses. The metrics evaluation of these areas was tested on a sample of 30 selected family businesses. As a follow-up, the structure of the knowledge-based system in a form of a flowchart was created. A substantial research question in creating the family business vitality model was whether all family businesses behave the same. Westhead P. and C. Howorth (2006) identified different types of private family businesses based on the theory of stewardship and the agency theory applied in family business. Based on their research, they stated that in the family business, behaviour under the stewardship theory prevails over the agency theory.

**An important result** of the above-mentioned study is that family businesses cannot be simply compared with one another. The notion of families does not have to carry typical general features. It is rather the behaviour and perceptions of family businesses in the society. Therefore, it is necessary to define the specifics of the family business which distinguishes it from other business entities and assess them qualitatively.

## **2.1 Structure of knowledge-based system**

For obtaining the required knowledge of typology definition and the assessment of family business vitality, structured data was prepared. Data elements and their properties, relationships and activities were defined as this knowledge. The architecture of the knowledge-based system was created using a flowchart. Users enter the system by signing under a password in relation to the identification number of their economic entity. First, they check and add publicly available data on the company obtained through machine learning from the public register. The description of the process of data analysis using machine learning for the project is given in the article by J. Michalik et al. (2016). This specifies the base of the facts about the given economic entity. Once the specific parameters are given, the derivation of statements through the mechanisms of the defined strategy takes place (the so-called inference mechanism) on three levels. First, in the area A) the typology of the family business; subsequently B) the potential of the village development, the location of the family business and finally C) the family business vitality. The vitality of the family business is assessed in terms of three modules, administrative-legal, managerial and financial. Their contents are intertwined in many issues.

In terms of informatics, there were implemented processes of knowledge acquisition, user interface design, hardware and software selection, implementation, validation and verification. The aim of the paper is not to explain the creation of the knowledge-based system in terms of the information and communication technology, but in terms of the content and in relation to the given topic of the family business vitality assessment. Therefore, we further focus only on the part of the content, which is creating a model for the knowledge-based system.

## **3. Model for creating knowledge-based system of family business vitality assessment**

This chapter focuses on one of the above areas that are the vitality of family business (ad C). The issue of the family business typology (ad A) is addressed in the article of Rydvalová et al.(2016) summarised in Chapter 3.1. The questions of the development potential of a municipality/region (ad B) were addressed and solved in projects TD010029 (years 2012-2013) and TD020047 (years 2014-2015). The outputs of both projects are available on the R & D web portal of the Faculty of Economics, Technical University of Liberec, and will be incorporated into the knowledge-based system.

### **3.1 Typology of family business**

The first reason for creating the family business typology was the need to define the family business for education. Furthermore, another motivation was to enhance future discussions on the topic of its support from the state, and creation of "representatives" categories for developing case studies. For the research team, it was crucial to defining

the typology in terms of creating the knowledge-based system. When categorising economic entity into the types of family business, the involvement of members of the family and the property into a business process is evaluated. At the same time, the focus of the given family business by CZ-NACE codes in relation to the subject of business is defined. On the basis of the above-mentioned facts, economic entities in the knowledge-based system are delineated as "family" from two perspectives. According to the legal form of business, it is a family enterprise, family groupings and a family business corporation. In terms of the business line, these are a family business, a family farm and an independent profession carried out within the family.

### **3.2 Family business vitality**

When selecting a self-assessment procedure of the family business vitality, three holistic approaches for evaluating the performance of enterprises were considered: Balanced Scorecard (BSC); European Foundation for Quality Management (EFQM); the assessment of enterprise vitality and viability within the framework of H. Pollak crisis management. In terms of a size, family businesses range from small to large. As regards the BSC method, its system introduction into the business is a demanding process and in the case of small businesses, it is unnecessarily complicated. As far as the EFQM method is concerned, the process of performance evaluation is complicated for small and medium-sized enterprises as well. Therefore, it was necessary to find a method that is simple and yet would allow focusing on a specific situation. It appears that the method of H. Pollak meets these determinations (2003). Although this method has its limitations, which is, for example, the subjectivity of an evaluator, it is simple and understandable.

Nevertheless, concerning the vitality assessment, a subjective view of the evaluator can be fruitful. Based on the above-given differences, there were defined three areas of the family business specifics. These are: administrative and legal, managerial and economic-financial. Subsequently, characteristics (10 each) which are specific to family business were included in the modules. The assessment of the internal environment of each family business is carried out on a six-level scale. Within each of the three modules, 0-2 level shows the weakness factor; 3-5 level the strength factor. The scales for their assessment are based on expert estimates in cooperation with 30 selected family business owners. The output of this assessment is the knowledge of the internal environment in their own family business. The levels for assessing vitality by individual modules and as a whole were also placed on the six-level scale, see Table 1.

**Table 1: Vitality assessment levels based on family business specifics**

| Family business vitality assessment   | Intervals (quantile distribution) % |
|---|-------------------------------------|
| A (excellent vitality)  | (83.33;100>                         |
| B (very good vitality)  | (66.67;83.33>                       |
| C (good vitality in a planning process)   | (50;66.67>                          |
| D (good vitality with a tendency to get worse in case it will not be solved systematically) | (33.33;50>                          |
| E (poor vitality)   | (16.67;33.33>                       |
| F (very poor vitality)  | <0;16.67>                           |

Source: own

## Conclusions

A family business can be one of the tools to maintain the quality of life in rural areas and help young people and their families to find a reason to live there. As Libor Musil from the LIKO-S company stated at the conference "Family businesses at a crossroads" on 12 December 2016, to continue the family business is not yet attractive in the Czech Republic. For young people, it is more interesting to work in managerial positions in multinational companies. It also reflects the education system at both secondary schools and universities. The education focuses more on systems of large business corporations with the addition of the problems of SMEs. The differences in family businesses are usually not taken into account. The team at the Faculty of Economics, the Technical University of Liberec, has been engaged in these issues for a long period as part of the research project co-financed from TA CR Omega (TD03000035). One of the outputs of the project is to create a knowledge-based system for education and training in the specifics of the family business. In the paper, the knowledge-based system which simulates decision-making activities of a consultant in family relations and business activities when running the family business is presented. These are tasks that require encoded knowledge prepared by experts with the aim to get closer to the decision-making process of the consultant/expert. First, it was necessary to define tasks and prepare input data from publicly available resources. Subsequently, there were defined questions that will allow supplementing the machine data on an economic entity to identify their families's and their relationship to the community where they operate. Finally, the questions on the vitality assessment for the development of family business were prepared. Based on the outcomes of the knowledge-based system which will be launched at the end of 2017, the research of a qualitative assessment of family business in the Czech Republic will be carried out.

## Acknowledgment

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## **Increasing Employee Engagement by Assessment of Their Satisfaction**

### **Abstract**

Assessment of satisfaction and finding incentives for greater engagement of employees should be a standard tool of human resources management. In healthcare organizations, satisfied and engaged employees are a guarantee of quality health care. The way leads through satisfied employees to satisfied patients, who are the main subject of interest of medical facilities. Organizational culture has a significant influence on the employee satisfaction and engagement. It is a task for the management to create a healthy organizational culture, conditions for effective communication, to increase employee loyalty and to motivate employees to achieve good results. This paper presents a part of the results of the satisfaction survey in a selected acute care hospital in the Czech Republic. The survey included 1 564 respondents. Data were obtained using anonymous questionnaires. These questionnaires contained six domains of stimulants involved in the creation of job satisfaction. The paper provides information on the average value of individual domain ratings and about relations between all domains expressed by Spearman's correlation coefficient. Respondents evaluated the best domain - the level of the formal setting of work (average rating 1.77), the worst domain - the level of belonging to the organization (average rating 2.62). This domain has a strong relation with the domain the level of self-realization, satisfaction with personal and professional development (correlation coefficient 0.70) and the domain - the level of engagement and conditions of potential for innovation and cooperation (correlation coefficient 0.61).

### **Key Words**

*engagement, health care, organization culture, satisfaction*

**JEL Classification: I11, M5**

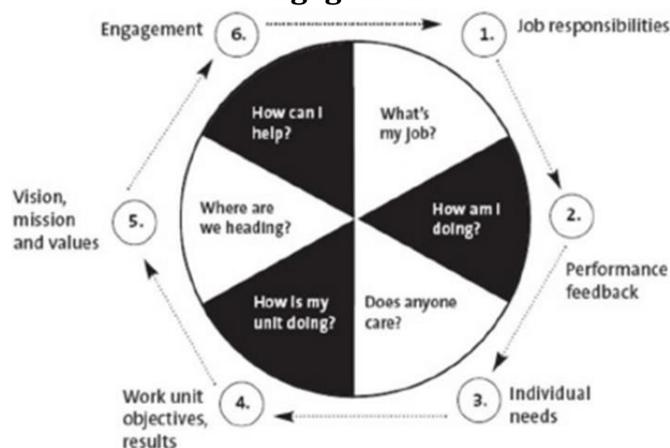
## **Introduction**

In connection with the current existing shortage of healthcare professionals, medical facilities have to face the problem of how to recruit and retain qualified and motivated staff (Bártlová, 2006). There is increasing interest in job satisfaction issues, especially of doctors and nurses, because their working satisfaction affects results of healthcare organizations and the quality of health care provided. Assessment of satisfaction and finding incentives for greater employee engagement should be the standard tool for the

successful human resources management. Human resources management is undergoing continuous development. Globalization and technological progress make employees much more informed, more demanding, and they expect more. The old ways of managing and the former approaches no longer work, managers have problems how to lead, and motivate staff, and how to increase employee engagement and satisfaction (Škrla & Škrlová, 2013). Management has to monitor employee satisfaction because it is a feedback and an important source of information for them. Especially in healthcare organizations, employee satisfaction must be monitored not only to ensure greater engagement but also to prevent a burnout syndrome, which also strongly affects the quality of healthcare provided.

Employee engagement is related to employee loyalty, to a situation where employees are to some extent identified with the employer and feel a certain degree of belonging to their own healthcare organization. Engagement occurs when people dedicate their work and are interested in what they do (Armstrong, 2007). According to the foreign research, employees who are fully engaged in their work and committed to their institution are more productive and usually work beyond their duties. They are satisfied with their job and with their superiors, they identify with the goals and strategies of the organization (Gallup, 2008). As stated by Truss et al. (2006), the opportunity to tell own opinions, the feeling to be well informed about what is going on in the organization and to know that your manager is committed to the organization, are very important factors for the engagement. According to Holá (2011), the quality of leadership and effective internal communication are very important for increasing employee engagement. The way to employee engagement through the quality of communication environment shows D'Aprix's model (D'Aprix, 2006), see the figure no. 1. According to D'Aprix, employees are disengaged if their job responsibilities, performance feedback, and individual needs are not satisfied. If these factors are satisfied, then social identification with the organization is what leads to higher levels of engagement. The graph shows a step-by-step path to increasing employee engagement.

**Fig. 1: The quality of the communication environment for increasing the employee engagement**



Source: D'Aprix, 2006

Communication is particularly significant in healthcare organizations. It follows from their specific nature - their human orientation. Communication is a principal component in the treatment of patients. It is also one of the basic conditions for ensuring effective and quality health care and for developing healthy professional relationships (Plevová, 2012, Šrkla & Škrlová, 2003).

Building good relationships between the institution and the employees is one of the main features of a successful organization (Plevová, 2012). It should be taken into account that employees are an important reference group that is also actively sought by the public. Engaged, satisfied and loyal employees speak well about their employer, spread the good name of the organization, both as a medical facility and a convenient employer (Holá, 2011). They tend to remain in the organization and show a lower rate of fluctuation. They also identify with the organization and its goals (Novotný & Pecáková, 2014). Just organizational identification is associated with job satisfaction, employee engagement and turnover intentions. A lack of organizational identification is, according to Knight and Haslam (2010), associated with increased stress and burnout syndrome. Identifying employees with the organization allows maintaining its internal integrity. Identifying employees with the organization also means accepting its organizational culture (Lukášová & Nový, 2004).

Organizational culture also has a significant influence on the job satisfaction and employee engagement. Organizational culture is presented with a set of ethical norms, values, beliefs, attitudes and behavioral patterns that form employee behavior. It expresses spirit of the organization, the informal rules of the game that affect the overall atmosphere in the institution (Bedrnová, Jarošová & Nový, 2012). Most healthcare organizations have the same basic values that emphasize the primacy of patients (Gladkij, 2003).

Management (and its communication) plays an important role in creating, managing and maintaining of a healthy organizational culture, especially its willingness to improve and respect employees as the most important asset of the company (Holá & Pikart, 2014). According to Gladkij (2003), the management must behave in accordance with the organization's goals. Through bad leadership, organizational culture can slow down the development or create a distrust. Knowledge of organizational culture should not be underestimated at all levels of management. It is a great task for the management to create a healthy organizational culture based on effective communication, that increases employee engagement and loyalty and motivates employees to achieve good results (Holá, Čapek, 2015).

## **1. Methods of Research**

Data were obtained within a satisfaction survey, conducted in December 2015 and January 2016, in a selected acute care hospital. Anonymous online questionnaires were used in the survey. Respondents filled out anonymous online questionnaires based on randomly generated unique password. The questionnaires were designed on the basis of

standardized questionnaires of Gallup agency (Gallup, 2008) and surveys conducted in the project Novotný and Pecáková (2014) Engagement of employees in the Czech Republic. The proposal of the questionnaire was discussed with the hospital top management.

The questionnaire contained seven selected domains of stimulants involved in the creation of job satisfaction: *1. the level of the formal setting of work, 2. education, professional and career development, 3. the quality of management, 4. the level of engagement and conditions of potential for innovation and cooperation, 5. the level of self-realization, satisfaction with personal and professional development, 6. the level of belonging to the organization.* The last part of the questionnaire contained the seventh part of the verification of importance of selected factors for satisfaction and improving organizational culture. There was an option to express comments or other suggestions at the end of the questionnaire. This paper presents the results of assessments and relations between domains D1 to D6.

The questionnaire was designed as a set of 47 statements (of which 35 were part of the domains D1 to D6). The respondents expressed the degree of consent to the statement on a scale from 1 (definitely agree) to 5 (definitely disagree), ratings 1 and 2 are considered the positive zone for the assessment. In addition, it was possible to state the answer "I cannot judge". All the statements were divided into the individual domains described above.

## 2. Some Results of the Research

The survey was addressed to all the population of the selected acute care hospital, i.e. to the total of 4 595 employees (doctors, non-medical healthcare personnel and other employees). The sample of respondents was created by those, who completed the entire questionnaire properly, i.e. 34% of all employees (1 564 employees). The proportion of respondents in the sample approximately corresponds to the distribution in the basic employee population.

**Tab. 1: Descriptive statistics of domain assessment**

| Domains | Average | Total variance | Share of evasive responses |
|---------|---------|----------------|----------------------------|
| D1      | 1.77    | 0.84           | 1%                         |
| D2      | 2.18    | 1.49           | 4%                         |
| D3      | 2.36    | 1.62           | 3%                         |
| D4      | 2.41    | 1.34           | 13%                        |
| D5      | 2.18    | 1.38           | 5%                         |
| D6      | 2.62    | 1.40           | 12%                        |

*Source: authors' calculations in STATISTICA*

Table no. 1 provides information on the average value and variance of individual domain ratings. The calculation is based on all responses where respondents chose the answer to the already mentioned scale. The answers "I cannot judge" have been discarded. As can

be seen in the table, positive assessment (i.e. rating 1 and 2) is presented only in the domain D1 – *the level of the formal setting of work* (average rating 1.77). All other domains are reaching the average values greater than 2. The weakest rating is in the domain D6 – *the level of belonging to the organization* (average rating 2.62).

The following table no. 2 contains correlations among all domains expressed by Spearman’s correlation coefficient. Only the questionnaires with all answers evaluated on the 1 to 5 scale were used to search for relationships between the domains. Such questionnaires were a total of 536. As the input for the analysis, the average values of each respondent's answers to the questions assigned to individual domains were used. Since the obtained values cannot be considered as normal probability distributions, Spearman's correlation coefficient was used. All results obtained are statistically significant at a level of 0.01, all of them have the character of positive correlation.

**Tab. 2: The relations between domains expressed by Spearman's correlation coefficient**

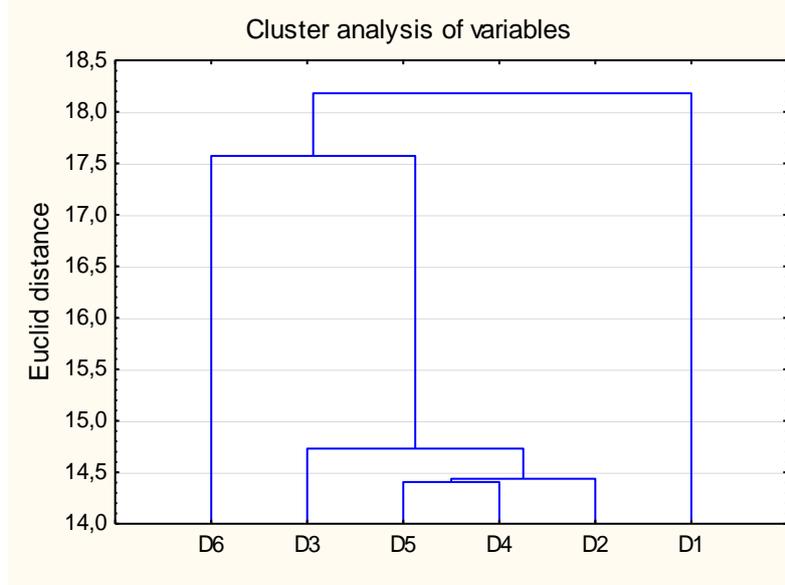
| Domains | D1   | D2   | D3   | D4   | D5   | D6   |
|---------|------|------|------|------|------|------|
| D1      | 1.00 | 0.44 | 0.46 | 0.42 | 0.53 | 0.51 |
| D2      | 0.44 | 1.00 | 0.68 | 0.55 | 0.72 | 0.57 |
| D3      | 0.46 | 0.68 | 1.00 | 0.61 | 0.79 | 0.57 |
| D4      | 0.42 | 0.55 | 0.61 | 1.00 | 0.66 | 0.61 |
| D5      | 0.53 | 0.72 | 0.79 | 0.66 | 1.00 | 0.70 |
| D6      | 0.51 | 0.57 | 0.57 | 0.61 | 0.70 | 1.00 |

Source: authors’ calculations in STATISTICA

Based on these results, it can be assumed that the domain D6 - *the level of belonging to the organization* has a strong link to all other domains. The domain D6 has the closest relation with the domain D5 - *the level of self-realization, satisfaction with personal and professional development* (correlation coefficient 0.70) and D4 - *the level of engagement and conditions of potential for innovation and cooperation* (correlation coefficient 0.61). The domain with the closest relation to all the other domains can be considered the domain D5. The domain with the weakest relation to the others is the domain D1 - *the level of the formal setting of work*.

Figure no. 2 shows the result of hierarchical clustering. As well as the correlation analysis, it is obtained on the basis of 536 questionnaires in which all responses were expressed by a value from the scale. Here, we have a similar result as in the previous analysis. Domains D2 - *education, professional and career development*, D4 - *the level of engagement and conditions of potential for innovation and cooperation*, D5 - *the level of self-realization, satisfaction with personal and professional development* and also the domain D3 - *the quality of management* form a relatively tight relation. In this case, the relation is expressed by the Euclidean distance of the data points representing the individual variables. The chart shows more clearly how the domains are close to each other. Thus, it is apparent that the domains D2, D3, D4 and D5 strongly correlate with one another and have a strong relationship to D6. D1 is more distant from all the other domains.

**Fig. 2: Result of cluster analysis of variables representing domains**



Source: authors' calculations in STATISTICA

### 3. Discussion

The domain D1 - *the level of formal setting of the work* has the weakest relation with the other domains. However, this domain is assessed best by the hospital staff. Employees are satisfied with the work performance setting and the organization's internal regulations are well understood. A very good assessment of this domain is based on the fact that all the hospitals are accredited and the setting of the basic processes and procedures is based on SAK standardization (SAK, 2013).

On the other hand, the domain D6 - *the level of belonging to the organization* has a strong relation to other domains. The D6 domain rating is intertwined in the rating of others domains. The result confirms that belonging to the organization comes along with opportunities for self-realization and leadership as Armstrong (2007) points out. Belonging to the organization is influenced by the assessment in the previous domains and consequently affects employee's own engagement. The weakest rating of the domain D6 could point to the employee distrust in the hospital top management and instability of the staff, which could disrupt the functioning of the whole organization in the future. Employees as the most important source of information in the organization spread its reputation towards patients and potential employees and significantly affect public relations to the organization and its image. As mentioned above, the strongest relations are between the domains D6 and D5 - *the level of self-realization, satisfaction with personal and professional development* and D6 and D4 - *the level of engagement and the conditions of potential for innovation and cooperation*. Employees who are constantly developing in their jobs and have a clear idea of their possible career advancement are more interested in their good work performance, they are more engaged and satisfied with their jobs. An inadequate internal communication plays an important role in the assessment of the

domain D4 (which was the second worst). This area also influences the overall climate of the organization. Based on these findings, there is an opportunity to improve the cooperation, feedback and support from the top management, to increase employee engagement and their belonging to the institution.

According to the Novotný and Pecáková (2013) research of employee engagement in the Czech Republic, which took place in December 2013 and included 2 323 respondents, only 7% of employees are highly engaged. Their research confirmed that engaged workers are satisfied with their job and their superior, they identify with the organization's goals and strategies, spread its good reputation and has a positive influence on the motivation of other workers. Key conditions for developing engagement include support of immediate superior and open communication. The authors also defined the most important factor influencing engagement - loyalty to the organization. Sense of work, efficiency of work, work team, immediate superior and improving work are the other important factors influencing engagement, according to their research (Novotný & Pecáková, 2013).

## **Conclusion**

Based on these survey results the hospital management could receive enough incentive for improvement in the area of human resources management. The results should be helpful to eliminate weak points and for further arrangement of human resources management. As can be seen from the survey results, respondents assessed the best *the level of the formal setting of work* and they assessed the worst *the level of belonging to the organization*. The strongest relations between *the level of belonging to the organization*, *the level of self-realization*, *satisfaction with personal and professional development* and *the level of engagement and conditions of potential for innovation and cooperation* were found out. In this context, it is a great task for the hospital management to create a healthy organizational culture. Good communication, employee loyalty, employee engagement, low fluctuation, etc. are the accompanying phenomenon of healthy organizational culture in healthcare organizations. Employee engagement and loyalty to the organization depend on how managers deal with the staff, whether they pay enough attention to them. The main recommendation based on the survey results is to improve management communication competences according to the D'Aprix (2006) chart, to improve human resources management (to create and maintain the organizational culture and background for professional and independent work, ensure compliance with the code of ethics, implement a system of regular reviews of employees and management, etc.) and to explain the organization's vision better and more often. Greater openness and willingness of the management to receive employee comments is also recommended. It is important to create an atmosphere of trust, to provide feedback to employees, to appreciate importance of employees' work to the organization, etc. All this is important for the future of health care organizations and has an impact on the quality of patient care.

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## Prototype-Funding as an Entrepreneurship Catalyst in Higher Education

### Abstract

Entrepreneurship and new business creation are one of the expected outcomes from public investments to higher education. In higher education, early-stage of new business creation is an uncertain business. Literature recognizes multiple kinds of uncertainties and many different strategies to clear them. Most funding at this stage is limited and mostly from publicly funded programs. The question asked in this paper is: To which commercialization activities should funding programs focus in order to maximize entrepreneurial outcomes? Based on sunk cost effect from psychology of human action we hypothesize that funding targeting demo and prototype-building activities are more effective than funding for outsourced initial business case analyses and novelty searches. We introduce data from a regional early-stage funding program Draft, which had a change of funding principles after a few years of operation. We show that teams with university-born business ideas who joined the program with emphasis in demo and prototype building were 5 times more likely to found a company than teams that took part in the earlier version of the program with emphasis on initial business case analysis and novelty searches.

### Key Words

*entrepreneurship, technology transfer, higher education, uncertainty, sunk cost*

**JEL Classification: I23, L26, O31**

## Introduction

Innovation, including the creation of new companies, accounts for half of the growth of economies (OECD, 2015). Also in higher education, entrepreneurship is seen as a possible outcome and a return of investment. Entrepreneurship education and other ways of supporting entrepreneurship has become a global phenomenon (Winkel, 2013). The economic impact of Massachusetts Institute of Technology is an extreme example. The companies founded by MIT alumni had an estimated combined annual revenue of 1.9 trillion dollars in 2014 (Roberts et al., 2015). However, the exact relationship between higher education and entrepreneurship, innovation and economic outcomes has remained somewhat unclear. OECD reported that clear relationship with the number of highly educated R&D jobs and national innovation outputs has not been established (OECD, 2011).

Companies can be categorized by their size: micro, small, medium and large enterprises . Blank (2012) has offered a different set of four: small business, scalable startup, large company and social entrepreneurship. Most companies are based on existing business models, such as chain cafes and fast food restaurants or lawyers' and doctors' services. Or they are only slight variations of the former ones. This type of entrepreneurship is about successfully repeating an already proven formula. The entrepreneurs choosing this path can skip the uncertain early stages involved in new business model development and focus in the execution of the formula (Dyer et al. 2009). However, the focus of this paper is the creation of new companies armed with new business models. In higher education, the startup companies founded by students or researchers are a good example of such a companies.

According to Christensen et al.(2016a) the evolution of a successful business model follows three different stages: 1.Creation, 2.Sustaining Innovation, and 3. Efficiency. A business clears the creation stage, which is the focus of this paper, when with the resources at its disposal it is able to offer a product or service to satisfy an unmet customer need. In other words, entrepreneur's task, is to search within these three main dimensions: properties of the product, the entrepreneur's resources at hand, and the customer need being targeted. Getting a first customer is a good milestone at this stage (Anthony, 2014).

Uncertainty is a central issue at the early-stage of entrepreneurship. About 50 % of new businesses fail in the first 4 years (US BLS, 2016). For example Gottschalk et al. (2014) studied the effect of past entrepreneurial experience on new venture survival. From the data of more than 8000 thousand German companies, they discovered that serial or portfolio entrepreneurs were no more likely to be successful in their new businesses than first time entrepreneurs. One interpretation of Gottschalk et al.'s study is that in order to be successful within a certain period of time, you should try as many times as possible. The success of an individual business venture is unpredictable, but long-term success comes from the ability to speed up the trial and error process.

Raffie et al.'s (2014) findings illustrate the benefits of the trial and error strategy. They found that people who didn't quit their paid jobs in the beginning of their transition to full-time entrepreneurship had better business outcomes compared to people who moved from employment to full-time entrepreneurship without any intermediary stages. The explanation Raffie et al. offer is that people keeping their paid jobs can better afford to kill mediocre ideas, only going full-time when the business is really good. In similar vein, Hmieleski & Baron (2009) found out that highly optimistic entrepreneurs especially on highly dynamic markets, i.e. markets with high uncertainty, are not going to be as successful as less optimistic entrepreneurs. Hmieleski & Baron explain: "Highly optimistic individuals often hold unrealistic expectations, suffer from overconfidence, and discount negative information". If you assume that things are not going to go as planned, you have better chances of success.

What is uncertainty exactly? Jalonen (2011) did a literature review on uncertainty and innovation. He grouped the inherent uncertainty of bringing new innovations to market

in to eight categories: technological uncertainty, market uncertainty, regulatory /institutional uncertainty, social/political uncertainty, acceptance/legitimacy uncertainty, managerial uncertainty, timing uncertainty, and consequence uncertainty. A new business venture must clear all these uncertainties in order to become successful.

Different innovation processes have emphasis on specific types of uncertainties. Technology Readiness Level (TRL) management tool focuses on technological uncertainties. As the tests of new technologies move from understanding of background knowledge to repeated use of the technology in real environments, TRL gives answers also to consequence, managerial and other uncertainties (EARTO, 2014). Design spiral, originally developed for naval ship design, is another method answering technological uncertainties (Singer, 2009). The First Mile methodology developed at InnoSight (Anthony, 2014) and Lean Startup, made famous by Eric Ries (2011) are business-oriented processes placing heavy emphasis on market and acceptance/legitimacy uncertainty. Koen et al. (2002) go through effective methods at the very early-stages. These include checking for novelty and existence of patents, i.e. regulatory/institutional uncertainty that might prevent the use of the technology.

Especially in higher education, the transfer of ideas into new business is a very uncertain activity. Thus, little private funding exists at these early-stages. Instead, nations, regions and universities have programs of their own. Recent analysis by Munari et al., (2015) discovered that all 21 studied European nations had implemented early-stage funding in some form. These so-called proof-of-concept (POC) programs aim to sponsor activities that clear or reduce some key uncertainties related to the idea or technology. This will in turn make them more attractive target for future private investments. Successful cases will head towards company formation and pre-seed and seed funding programs (Munari et al., 2014).

In the following sections of this paper we first isolate three separate early-stage activities: initial business case analysis, novelty search, and demo and prototype building. Then we ask the question of which of these activities should early-stage funding programs in higher education target? We introduce two versions of a regional university-centered early-stage funding program, which are used as representatives of funding programs focusing on either activities. We present our hypothesis and then compare the effectiveness of the two programs using purchase data. Finally, the limitations of results and possible future directions of the research are discussed.

## **1. Research Question and Methods**

Now we define three separate early-stage activities that we'll later use to characterize different funding programs. The activities are: initial business case analysis, novelty search, and demo and prototype building.

## **1.1 Activity: Initial business case analysis**

In formal processes such as the First Mile (Anthony, 2014) or the tools and methods listed by Koen et al. (2002) initial analysis of the business opportunity is done before anything is build or tested. Koen et al. lists activities such as evaluation of product's fit with company strategy, market segment and competitor analysis, and look in to the existence of an unmet customer need. Anthony divides initial analysis in to three tracks looking in to major questions of Is there a need? Can we deliver? and Is it worth it?. First track is about finding evidence for the proposed customer need, initially via online search and expert evaluations. Second track focuses on technological and manufacturing uncertainties; ant the third question includes estimates of market size, profitability and other financial aspects of the opportunity. When these initial analyses are done smartly and lightly enough, bad ideas can be killed quickly. Surviving ones move to testing and experimentation phase with simple demo products and services.

## **1.2 Activity: Novelty search**

Novelty search and freedom-to-operate (FTO) deal with regulatory/institutional uncertainty under Jalonen's (2011) classification of uncertainty types. Developer can get monopoly to their technology via Intellectual Property Rights (IPR). Novelty search is an early step, during which databases and websites are used to find similar technologies or solutions as the idea under study. If the idea is not new, useless patenting applications can be avoided (PRH, 2016a), (NIP, 2017). On the other hand, existing IPR can prevent entrepreneur from using certain technologies. Freedom-to-operate study assesses if businesses are free to use certain technologies in their target markets. Thus avoiding possible future legal problems (WIPO, 2005), (PRH, 2016b). Followers almost never beat incumbents by offering better and more expensive products (Christensen, 2013), making novelty search and more broader market analysis a smart thing to do.

## **1.3 Activity: Building a demo or prototype**

Building a demo or prototype is a way to assess the technological feasibility of the product or service idea. In systems like TRL (EARTO, 2014) and First Mile (Anthony, 2014) building and testing proceeds from simple to complicated prototypes and implementations. However, a demo or prototype can also be a way to clear possible uncertainties entrepreneur has about the customer need. The term Minimum Viable Product refers to such an experiment where a demo product is sold to a real customer. Customer's willingness to pay for the demo product and possible feedback from the actual usage are crucial signals for the entrepreneur (Ries, 2011), (Blank, 2012). Discovering early that the initial idea, technology or business model isn't working, is valuable as time and resources saved.

The question we want to answer in this paper, is whether early-stage funding programs in higher education should focus on initial business case analysis and novelty search

activities or sponsoring demo or prototype building. Given the limited nature of resources at this early-stage, this is not a meaningless question to ask. The general recommendation of dividing limited resources in high-uncertainty situations i.e. early-stage, to as many cases as possible (Taleb, 2011). This means that instead of trying to predict the winners and focus our budget on few cases, we should smartly select the most effective early-stage activities and then apply these activities to as many cases as possible.

To get an answer to this question we use data from an early-stage funding program i.e. Draft Program® that has been operational in Joensuu, Eastern Finland in higher education setting since 2008. The author of this paper has been coordinating the programs since 2008. What makes this data special is that the program had a complete shift in its funding principles after the first 2-3 years of operation. In the beginning, the emphasis was on novelty searches and initial business case analyses by third party business consultants. After a couple of years funding shifted to supporting demo and prototype-building and test-marketing of the demo products.

Draft Program® started in late-2008 as a university-level partially government-funded invention and innovation commercialization program TULI. As recommended by the nationally guided TULI program, the main focus was on novelty searches and initial business case analyses done by outside business consultants for ideas created by the students and faculty (Ketonen et al., 2013). Typical costs were couple of thousand euros per idea in the local program and almost 10000 € per idea in the national program. By the end of 2013, government funding came to an end and the Joensuu-area program, renamed Draft Program® in 2012, became completely self-funded by Karelia University of Applied Science and University of Eastern Finland. At the same time, the focus had shifted from initial business case analysis and of novelty searches to supporting demo and prototype-building and test-marketing of the demo products.

In its current form, since 2012, Draft Program® is a program that offers funding for teams with innovative business ideas (Draft Program). Teams that have at least one student or faculty member from Karelia University of Applied Sciences or University of Eastern Finland can apply for the funding. Selected teams receive 1000 € of support in the form of funding for different purchases. Most common forms of purchases are prototyping components, travelling expenses, test marketing costs and web domains. As mentioned in the program's website, the funding cannot be used as salary to the team members themselves or to hire the help of business consultants. The teams can freely adjust their plans, and even discard their original idea if it seems not to be working. Leftover funding can be used to the development of a new innovative idea that the team might have discovered. After their first 1000 €, teams can apply for more funding, up to 4000 € in total. The number of teams receiving additional funding is limited to no more than 50 % of the applicant teams.

Assumption behind formal innovation processes for large corporations is that people implementing those processes will act as expected in exchange of the salary they receive. In higher-education setting, we cannot assume such rational commitment, as the researchers or students are not paid directly. At least, this was the case for both local and

national TULI programs and the Draft Program. In this situation, a good cause for why an early-stage business idea didn't succeed, is that the team stopped working on it for whatever reason.

What factors affect probability of continued action? To answer this we need to look in to psychology of human action. According to Arkes & Blumer (1985): "*The sunk cost effect is manifested in a greater tendency to continue an endeavor once an investment in money, effort, or time has been made.*" This suggests that an early-stage program providing funding for demo or prototype building would decrease the likelihood of a team quitting the commercialization project compared to a situation where instead of demo building initial business case analysis or novelty search are ordered from outside experts and the team waits as a bystander. Research in to the foot-in-the-door technique also gives support to this line of thinking (Burger, 1999). If people are first asked to do a smaller initial action, they are more likely to continue and do a larger action later on.

Given the psychology of sunk cost and the foot-in-the-door effects and the differences in the nature of demo building activities compared to outsourced novelty search and initial business case analysis activities we form our hypothesis:

- **Hypothesis 1:** Teams that get non-salary-based funding from an early-stage program that emphasises demo and prototype building are more likely to form a company or receive private investments for their business than teams that take part in the program that focuses on novelty search and initial business case analysis.

## 2. Results

During the TULI program's era, which focused on novelty search and initial business case analysis, at Karelia University of Applied Sciences between October 2008 and April 2010, 30 ideas received funding. 54 % of the purchases were outsourced novelty searches, 41 % outsourced initial business case analyses and 5 % something else. At the start of the renamed Draft Program, University of Eastern Finland joined the program and with shifted funding principles between August 2012 and December 2013 31 one teams received funding. At the time of writing this article purchase data was available from a 4-month time-period between January 2013 and April 2013. Of these, 68 % were purchases of components or tools for demo or prototype building, 11 % hiring a technical consultant to help with demo or prototype building, 9 % test marketing e.g. business cards, web domain expenses, 6 % travel expenses, 4 % outsourced novelty searches and 2 % something else. From this data it is obvious that the TULI program, which became the Draft program had completely different purchase profiles. TULI's focus was on novelty search and initial business case analysis while Draft's purchases were related to demo and prototype building and to some extend to test marketing.

Out of all the 30 funded teams and their ideas during the TULI program period, only two one-person consultancy companies were founded as a result. However, the 31 teams from the Draft program resulted in the registration of 11 companies of which 4 received

funding in the form of private investments in their seed funding stage. Thus, a team joining the Draft program was 5.5 times more likely to register a company than a team joining the TULI program. Neither of the two TULI funded companies received private investments compared to 4 out of the 11 established from the Draft program.

When Draft program's results are compared to the TULI program's results (Ketonen et al., 2013) at the national level between 2008 – 2011 we also see some interesting differences. Between 2008-2011 all participating Finnish universities, research institutions and universities of applied sciences gave funding to over 2600 teams and their ideas total. Level of funding was from less than 5000 € to up to several tens of thousands of euros per idea. The average was about 9600 € per idea. During these years 164 companies were founded that were based on ideas that had received funding from the TULI program. If we compare that to the above mentioned 2012-2013 period in the Draft Program®, we can see that over 5 times more companies per funded idea were produced in the Draft program than in the TULI program at the national level.

Taken together, both the local and national differences in the programs' effectiveness strongly support our hypothesis. Here is a text of the third chapter.

### **3. Discussion and Conclusions**

The findings presented here have limitations. One specific way to improve these findings is to look in to individual spending data by different teams. This would allow us to compare different commercialization activities based on their likelihood of producing entrepreneurial outcomes at team level. Getting access to all purchase data since October 2008 would increase the explanatory strength of the analysis. One reasonable hypothesis is that it is not just the type of purchases, but the actual freedom for the team to choose the type of purchase. In other words, freedom to choose the type of action given the situation of the team.

Other features of the Draft funding program might also be reasons for better entrepreneurial outcomes. Did the selection process of the teams and ideas change from TULI to Draft program? Also, the possibility to spend the funding more freely might have attracted different teams, already more invested in their ideas. If yes, then the differing entrepreneurial outcomes might be explained at least partly by the fact that the ideas and/or teams who received the funding were of higher quality in the Draft program than in the TULI program. For example, using the Technology Transfer Readiness classification as analogy, if the teams who were selected to the Draft program were at higher levels of readiness i.e. less uncertain, then the differing entrepreneurial results are simply a logical outcome of these differing levels of uncertainty.

If we are able to assess how much the original ideas the teams had at the time they applied to the program changed by the time a company was registered or seed-funding received, we could possibly weed out at some explanations. If the ideas didn't change during the process, then a selection process that was able to pick the good ideas would have more

explanatory strength. If the ideas changed a lot, then the quality of team would be a more important aspect.

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## Evaluation of Students' Entrepreneurial Spirit Survey through a Structural Equation Model

### Abstract

This article contains the evaluation of the chosen part of GUESSS questionnaire which results from the structural equation modelling. The GUESSS survey was conducted at the universities around the world in the year 2016. It was the part of the same name research project with the purpose to grasp the entrepreneurial intent and activity of students using a geographical and temporal comparison. Structural equation modelling is a statistical technique developed to fit the model to the survey data and can help by exploring direct and indirect relationships among more latent variables. Structural model, which was used by authors for questionnaire evaluation, is focused on the influence of university entrepreneurial education and personal attitude on the wish to become an entrepreneur. The results are based on the relevant part of questionnaires which were answered by the respondents at University of West Bohemia. The results confirmed the most of outputs assumptions but one of them is different. The university environment, supporting the students' entrepreneurial activities, is not important for students' decision to become an entrepreneur. The strongest dependency for this decision results from latent variable – attractiveness of the future career as entrepreneur which is subjective.

### Key Words

*Entrepreneurship, survey, students entrepreneurial spirit, structural equation modelling*

**JEL Classification: L26, M20, C39**

## Introduction

This article is focused on the main results of students' entrepreneurial spirit at the University of West Bohemia which are based on the survey from the project GUESSS. GUESSS is a research project and this abbreviation means Global University Entrepreneurial Spirit Students' Survey (Sieger, Fueglistaller, Zellweger, 2016). This project is coordinated by University of St. Gallen in Switzerland. The first survey in the framework of GUESSS took place in the year 2003. The Czech Republic has been a partner of this project since 2015 and these results come from the first national survey.

Entrepreneurship is always the actual topic because entrepreneurs belong among basic pillars of national economy. That is why the entrepreneurial spirit and competencies should be developed in young people during their education process at schools and

universities. There is a large number of entrepreneurship definitions. Let us mention only the following ones:

- Entrepreneurship is an activity which is focused on starting, maintaining and developing profitable business. (Cole, 1968)
- Entrepreneurship is an innovative act that involves connecting existing resources with the ability to produce wealth. (Drucker, 1985)
- Entrepreneurship is a set of behaviours that initiates and manages the allocation of economic resources and whose purpose is to create value for them. (Herron and Robinson, 1993)

It is possible to say that the most of entrepreneurship definition share common features. Entrepreneurship is about the capacity and willingness to develop and manage own business in order to make a profit. Entrepreneurial spirit is characterized by innovation and risk taking. These activities should be supported in students through the entrepreneurial education.

According to the OECD (OECD, 2008), the entrepreneurship education should incorporate all activities which aim to foster entrepreneurial mindsets, attitudes and skills and cover a range of aspects (for example idea generation, start-up, growth and innovation). Entrepreneurship education includes also developing certain personal qualities, and is not necessarily directly focused on creation of new businesses. The objectives of teaching about entrepreneurship should therefore include:

- Promoting the development of personal qualities that are relevant to entrepreneurship – creativity, spirit of initiative, risk-taking and responsibility.
- In addition to this, entrepreneurship education should contribute to raising students' awareness of self-employment as a career option. (Egerová, 2016)

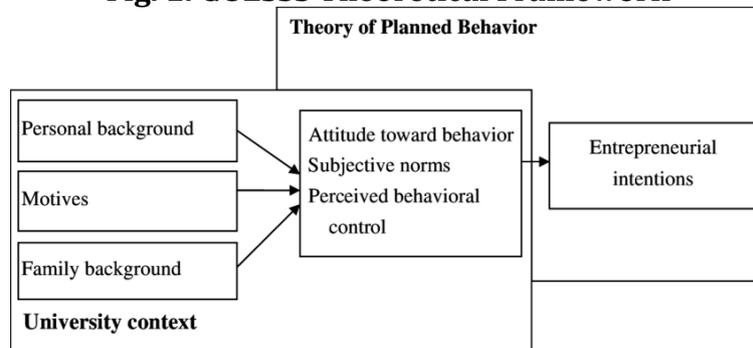
The main goal of GUESSS is to generate unique and novel insights into student entrepreneurship in the form of academic and practitioner-oriented output. This goal also corresponds with the objectives of entrepreneurship education and the results from the GUESSS survey could contribute to the development of entrepreneurship education at the universities.

## **1. Methods of Research**

The survey is based on the same international questionnaire which was created and updated in Switzerland and then translated into the national language. The questions ensue from the theoretical framework (see Fig. 1). In 2016 was realized the first survey in Czech Republic. The English version of the questionnaire was translated into Czech language and sent at the cooperating universities. Data are available from 9 universities. The questionnaire was answered by 3,040 respondents of which 1,135 sent relevant data. (Antlová, Rydvalová, 2016)

The first GUESSS survey in Czech Republic was conducted also at the University of West Bohemia (UWB). This university is the only public institution of higher education based in the Pilsen Region. Currently, the university has nine faculties consisting of more than sixty departments and three institutes of higher education. More than 12,000 students studying at the University can choose from a wide of range of undergraduate, postgraduate and doctoral study programs. (UWB, 2017)

**Fig. 1: GUESSS Theoretical Framework**



Source: <http://www.guesssurvey.org>

At the University of West Bohemia, the questionnaire was answered by 157 respondents but the results of the following analysis are based only on 127 questionnaires which contain the complete data of its selected part. In the research group, there were 88 women (69 %) and 39 men (31 %). Authors have used the structural equation modelling for analysing the part of the questionnaire with relevant data.

Structural equation modelling is a statistical technique developed to fit the model to the survey data and can help by exploring direct and indirect relationships among more latent variables. The main idea is to find the complex theoretical model based on the dataset. This method is very popular for reporting the social sciences questionnaires and is well described in literature, e.g. (Kaplan, 2009).

Our structural model is focused on the influence of university entrepreneurial education and personal attitude on the wish to become an entrepreneur. The analysis is based on the group of questions with the relevant data. These groups of questions were chosen according to respondents' answer frequency and the dependencies between these questions. The groups of questions should create following latent variables (in Fig. 2 marked by abbreviation in brackets):

- University environment supporting entrepreneurship spirit (Uni\_Support),
- Courses focused on entrepreneurship (Entre\_Courses),
- Entrepreneurial skills (Entre\_Skills),
- Ability to create and implement plans (Plans\_Creation),
- Attractiveness – to be an entrepreneur (Attractiveness),
- Decision – to become an entrepreneur (Decision\_BeEntre).

The research hypothesis is that all relationships used in the model will be positive and statistically significant. The construction of latent variables is connected with relevant questions from the questionnaire that are focused on the similar topic. All question use Likert scale 1 – 7 (1: do not agree at all / not at all ... 7: very much agree / very much). The questions used for latent variables (factors) and their loadings are shown in Tab. 1.

**Tab. 1: Latent variables construction and factor loadings**

|                  | Question  | Sample estim | Boot estim | t_stat | Pvalue |
|------------------|---|--------------|------------|--------|--------|
| Uni_Support      | The atmosphere at my university inspires me to develop ideas for new businesses.  | 0.856        | 0.856      | 26.048 | 0      |
|                  | There is a favorable climate for becoming an entrepreneur at my university.   | 0.93         | 0.93       | 76.431 | 0      |
|                  | At my university, students are encouraged to engage in entrepreneurial activities.  | 0.866        | 0.866      | 35.619 | 0      |
| Entre_Courses    | The courses and offerings I attended...<br>...increased my understanding of the attitudes, values and motivations of entrepreneurs. | 0.884        | 0.883      | 41.577 | 0      |
|                  | ...increased my understanding of the actions someone has to take to start a business.   | 0.891        | 0.891      | 40.105 | 0      |
|                  | ...enhanced my practical management skills in order to start a business.  | 0.874        | 0.874      | 39.909 | 0      |
|                  | ...enhanced my ability to develop networks.   | 0.776        | 0.771      | 15.624 | 0      |
|                  | ...enhanced my ability to identify an opportunity.  | 0.784        | 0.781      | 16.867 | 0      |
| Plans_Creation   | I am usually able to protect my personal interests.   | 0.893        | 0.774      | 3.137  | 0.001  |
|                  | When I make plans, I am almost certain to make them work.   | 0.871        | 0.785      | 3.932  | 0      |
|                  | I can pretty much determine what will happen in my life.  | 0.574        | 0.543      | 1.83   | 0.035  |
| Attractiveness   | Being an entrepreneur implies more advantages than disadvantages to me.   | 0.866        | 0.865      | 29.947 | 0      |
|                  | A career as entrepreneur is attractive for me.  | 0.951        | 0.95       | 84.709 | 0      |
|                  | If I had the opportunity and resources, I would become an entrepreneur.   | 0.892        | 0.891      | 38.705 | 0      |
|                  | Being an entrepreneur would entail great satisfactions for me.  | 0.956        | 0.956      | Inf    | 0      |
|                  | Among various options, I would rather become an entrepreneur.   | 0.948        | 0.948      | Inf    | 0      |
| Entre_Skills     | Your level of competence in performing the following tasks...<br>Identifying new business opportunities                             | 0.857        | 0.857      | 31.929 | 0      |
|                  | Creating new products and services  | 0.868        | 0.868      | 38.727 | 0      |
|                  | Managing innovation within a firm   | 0.862        | 0.862      | 26.452 | 0      |
|                  | Being a leader and communicator   | 0.701        | 0.696      | 11.348 | 0      |
|                  | Building up a professional network  | 0.861        | 0.86       | 33.635 | 0      |
|                  | Commercializing a new idea or development   | 0.822        | 0.821      | 22.541 | 0      |
|                  | Successfully managing a business  | 0.872        | 0.871      | 40.424 | 0      |
| Decision_BeEntre | I am ready to do anything to be an entrepreneur.  | 0.93         | 0.93       | 65.265 | 0      |
|                  | My professional goal is to become an entrepreneur.  | 0.94         | 0.94       | 77.212 | 0      |
|                  | I will make every effort to start and run my own business.  | 0.948        | 0.949      | 78.059 | 0      |
|                  | I am determined to create a business in the future.   | 0.949        | 0.949      | 78.834 | 0      |
|                  | I have very seriously thought of starting a business.   | 0.95         | 0.95       | 62.47  | 0      |
|                  | I have the strong intention to start a business someday.  | 0.937        | 0.937      | 59.322 | 0      |

Source: own processing

All loadings are statistically significant, so the latent variables can be considered well describing the answers of respondents.

## 2. Results of the Research

The model was estimated using the open source Matlab PLS-SEM Toolbox\_2\_4. This toolbox provides complete model estimation and also the all necessary statistical test. Its disadvantage is that the user must have commercial Matlab 2015a or higher and be perfectly familiar with its syntax.

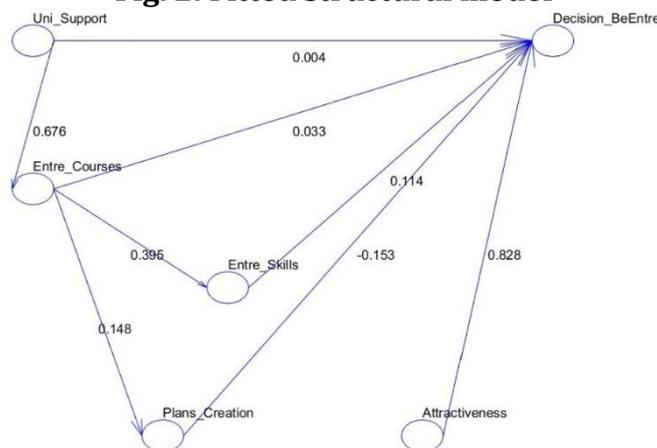
The overall model assessment is measured by Standardized Root Mean Square Residual (SRMR) = 0.0676 < 0.08 so the recommended value is satisfied. The model measurement is shown in the Tab. 2. The overviews of results are in Tab. 2 and Fig. 2.

**Tab. 2: Model measurement**

| Construct        | Construct Reliability |                      |                       | Convergence Validity | Discriminant Validity     |
|------------------|-----------------------|----------------------|-----------------------|----------------------|---------------------------|
|                  | Cronbach Alpha        | Dillon-Goldstein rho | Dijkstra-Henseler rho | AVE                  | Fornell-Larcker Criterion |
| Uni_Support      | 0.8603                | 0.9151               | 0.8660                | 0.7825               | Satisfied                 |
| Entre_Courses    | 0.8983                | 0.9245               | 0.9114                | 0.7109               | Satisfied                 |
| Plans_Creation   | 0.7286                | 0.8308               | 0.8969                | 0.6287               | Satisfied                 |
| Attractiveness   | 0.9564                | 0.9665               | 0.9620                | 0.8525               | Satisfied                 |
| Entre_Skills     | 0.9282                | 0.9420               | 0.9390                | 0.6998               | Satisfied                 |
| Decision_BeEntre | 0.9748                | 0.9794               | 0.9753                | 0.8882               | Satisfied                 |
| <i>Recommend</i> | >0.7                  | >0.7                 | >0.7                  | >0.5                 |                           |

Source: own processing

**Fig. 2: Fitted structural model**



Source: own processing

As the estimator of confidence intervals was used the bootstrap technique (10000 replications), which is robust against the data distributions. The bounds of confidence

intervals for direct effects on the significance level 5% are in columns Lower and Upper bounds.

**Tab. 3: Results overview**

|                                    | Direct Effects Inference (Path Coefficients) |            |        |        |             |             |          | Indirect Effect | Total Effect |
|------------------------------------|--|------------|--------|--------|-------------|-------------|----------|-----------------|--------------|
|                                    | Sample estim                                 | Boot estim | t_stat | Pvalue | lower bound | upper bound | Sing     |                 |              |
| Uni_Support -> Entre_Courses       | <b>0.676</b>                                 | 0.679      | 13.673 | 0      | 0.581       | 0.774       | +        |                 | 0.676        |
| Uni_Support -> Plans_Creation      |  |            |        |        |             |             |          | 0.0998          | 0.0998       |
| Uni_Support -> Entre_Skills        |  |            |        |        |             |             |          | 0.2667          | 0.2667       |
| Uni_Support -> Decision_BeEntre    | <b>0.0039</b>                                | 0.005      | 0.066  | 0.474  | -0.114      | 0.118       | <b>0</b> | 0.0377          | 0.0416       |
| Entre_Courses -> Plans_Creation    | <b>0.1477</b>                                | 0.155      | 1.314  | 0.096  | -0.053      | 0.404       | <b>0</b> |                 | 0.1477       |
| Entre_Courses -> Entre_Skills      | <b>0.3945</b>                                | 0.398      | 4.74   | 0      | 0.233       | 0.558       | +        |                 | 0.3945       |
| Entre_Courses -> Decision_BeEntre  | <b>0.0335</b>                                | 0.033      | 0.531  | 0.298  | -0.086      | 0.16        | <b>0</b> | 0.0223          | 0.0558       |
| Plans_Creation -> Decision_BeEntre | <b>-0.1526</b>                               | -0.138     | -2.47  | 0.007  | -0.319      | -0.072      | -        |                 | -0.1526      |
| Attractiveness -> Decision_BeEntre | <b>0.8282</b>                                | 0.827      | 17.396 | 0      | 0.747       | 0.933       | +        |                 | 0.8282       |
| Entre_Skills -> Decision_BeEntre   | <b>0.1136</b>                                | 0.109      | 1.771  | 0.039  | -0.012      | 0.24        | <b>0</b> |                 | 0.1136       |

*Source: own processing*

The column Sign in Tab. 3. shows the sign of direct effect – four of them are statically zero, three are positive and one is even negative. The whole model explains 80 % of variability of Decision\_BeEntre. For overview of all variabilities of latent variables explained by the model see Tab. 4.

**Tab. 4: R-square**

| Construct        | R2     | R2adj  |
|------------------|--------|--------|
| Entre_Courses    | 0.4570 | 0.4527 |
| Plans_Creation   | 0.0218 | 0.0140 |
| Entre_Skills     | 0.1557 | 0.1489 |
| Decision_BeEntre | 0.8081 | 0.8002 |

*Source: own processing*

### 3. Discussion

The decision to become an entrepreneur depends strongly on the subjective latent variable Attractiveness – total effect is 0.828. Other latent variables do not have the influence or even have negative influence (Plans\_Creation). The Uni\_Support influences Entre\_Courses and its influences the Entre\_Skills, but all of them do not influence the Decision\_BeEntre. So we can state the first result: the university (UWB) has no effect to decision to become an entrepreneur of its students. The second, most surprising result is

that the ability to create and implement own plans has slightly negative effect on the decision to become an entrepreneur. The expected effect was highly positive because only the people with appropriate personal characteristics can become successful entrepreneurs. The entrepreneur must be persistent and assiduous in implementing the plans and visions.

To correctly evaluate these results, we have to compare the GUESSS questionnaire with another surveys which are focused on entrepreneur activities. There exist several world famous surveys, especially the US provenience Panels Study on Entrepreneurial Dynamics, Eurobarometer Survey on Entrepreneurship and Global Entrepreneurship Monitor (GEM). GEM is the worldwide and longest time running survey project focused on motivations and attitudes of people actively preparing the start of their own business. In addition, it is focused also on the people they started their own business in a last few years and still manage it. The researches based on GEM methodology show that the personal characteristics like self-confidence and also skills are related with the start of the business, e. g. (Lukeš, Jakl, 2012), (Lukeš, Zouhar & Jakl, 2015). The respondents of these questionnaires were the people who really started their own business in a few last years or they really prepare for this (they have made concrete steps). But the respondents of GUESSS were students, they mostly do not run their own business. So the decision of become an entrepreneur (Decision\_BeEntre) is not real decision, rather it is just the wish – what I want to do right after graduation and five years after that. This interpretation of the results of our structural equation model can be supported by the highest influence of Attractiveness on Decision\_BeEntre and close to zero influence of another constructs.

## **Conclusion**

This article is focused on the evaluation of chosen part of questionnaire with relevant data. These questionnaires were answered by students at the University of West Bohemia in the first half of the year 2016. The selected part of questionnaire was analysed through the structural equation modelling. The results show that the university environment and courses, which could support the students' entrepreneurial activities, has no effect on the UWB students' wish to start their own business/to be an entrepreneur. The estimated structural equation model helped us to recognize that the students' answers on questions in the construct decision to become an entrepreneur are only their wishes what they want to do right after and five years after studies. These students' wishes are not based on their personal characteristics, skills and abilities but only on the attractiveness of entrepreneurship. So we can conclude that their real future decision will be with highest probability different from their answers here in GUESSS questionnaire. We claim that the data set of UWB students' answers cannot be used as appropriate prediction of their real future decision to start own business.

## Acknowledgment

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## Perspectives of Human Resource Management in Czech SMEs

### **Abstract**

The purpose of this paper is bring a view of perspective in human resource management (HRM) processes in selected Czech companies from the CEO and HR managers point of view. Moreover it points out specifics of HRM in SMEs and analysis differences between HRM activities in SMEs and large companies. Human Resource management is critical to competitive success, especially in SMEs it has to face various constrains and limitations. The analysis of HRM in Czech companies was done on data collected within selected Czech companies (People management forum members as a main HRM managers association) in April 2015. As it was expected based on the literature overview in small companies HR processes are often less developed than in small and large companies. On the other hand some results may indicate that small companies have started to develop knowledge regarding the importance of HR in the company. Results brought in this paper contribute to the debate about importance of HRM from different perspectives and show which activities are crucial part of HRM in Czech companies.

### **Key Words**

*Human resource management, small and medium sized enterprises, CEO, HR manager, HR processes*

**JEL Classification: J53, M54, O15**

## **Introduction**

Human resource management (HRM) is concerned with all aspects of a searching for potential candidates and an employment and management of employees in organizations. It covers mainly activities of strategic HRM, human capital management, knowledge management, corporate social responsibility, organization development, resourcing (workforce planning, recruitment and selection and talent management), learning and development, performance and reward management, employee relations, employee well-being and the provision of employee services (Armstrong, 2011).

Companies can improve their profitability and productivity with the proper utilization of intellectual capital, (Pal and Soriya, 2012). Human resources (human capital) is one of the variables in the study of intellectual capital. It is an important element to be developed because the knowledge has become a capital for increased competitive advantage.

Moreover, previous studies have claimed that human capital affects the performance of SMEs (Khalique et al., 2013; Abdullah and Sofian, 2012; Sharabati and Bontis, 2010; Ahmad and Mushraf, 2011).

It has been known from the past that a lack of understanding of HRM issues and their importance in the operation of successful business has impacted many small firms. Inadequate and inefficient management of HR of firms have often resulted in low productivity and high dissatisfaction and turnover among the employees (Mathis et al., 1991).

As Harney (2014) points out SMEs specifically have a number of unique characteristics which are likely to have specific human resource (HR) implications. Depending on the size of a company, HR challenges will be different; however, the means of resolving many critical issues can be similar. It is crucial for organizations to clearly communicate their purposes and mission to all employees and for HR professionals to have a plan for supporting the organization in achieving corporate objectives through its people, their human resources (Kerin, M., 2015). In other study SMEs have been found to be innovative in HRM and have largely similar HR practices to their large firm counterparts (Golhar and Deshpande, 1997).

From the analysis of the literature, it is possible to identify some general trends in labour management in small firms. It appears that the employment relationship is influenced and shaped by the spatial and personal proximity between owner-managers and their employees with an emphasis therefore on the social relations of production (Marlow, 2006).

## **1. HRM in SMEs: Overview of previous survey**

Human resource management in SMEs has become a discussed topic in last three decades. SMEs have their specifics which often differ from the HRM approach of large companies. In small firms, where resources are likely to be scarce, there may be a very small number of formal professionals or a HR departments. The difficulty of recruiting and retaining employees increases due to the lack of financial resources, and an increased reluctance to engage in costly or restrictive practices (Carson, 2004).

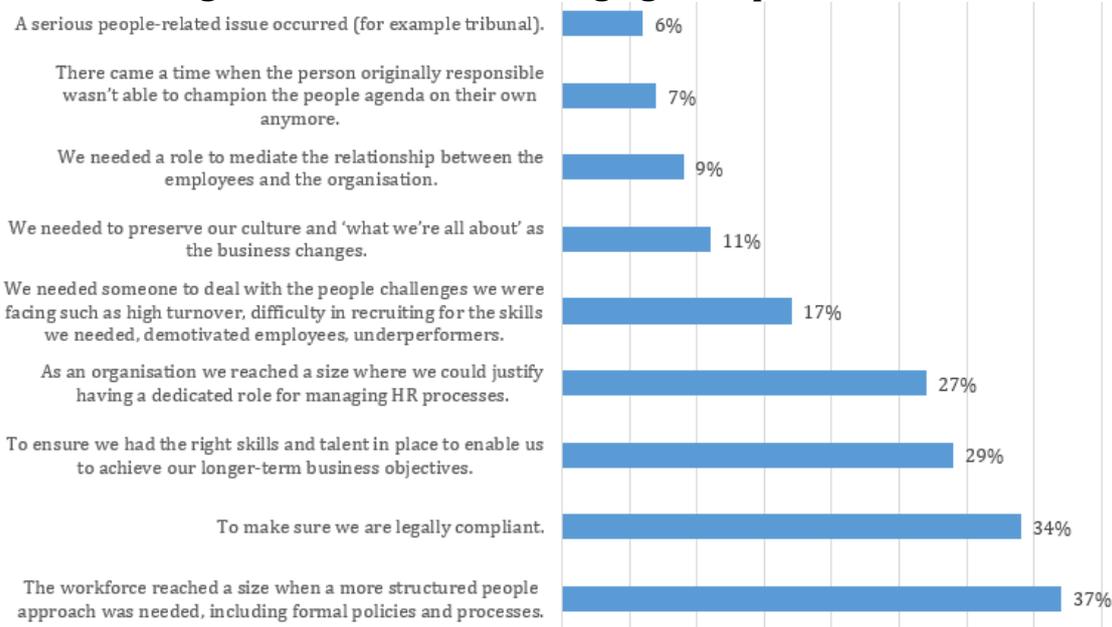
There have been many studies worldwide dealing with the specifics of HRM in SMEs since the 80<sup>s</sup>. In a study in Desphande et al., 1994, 100 HRM managers of small and large manufacturing firms were questioned about the situation in their HRM. In nine important workforce characteristics, this study indicated that small and large companies have the same workforce characteristics. However, these characteristics were more critical in small firms. About the external sources of recruitment, the research found out that small firms do not often use this. On the other hand, this study observed that many personnel practices of small and large firms were similar (Desphande et al., 1994).

The study provided by Little already in 1985 examined HR functions in 275 small firms employing fewer than 100 employees. This study found that typically the owner of a firm with less than 50 employees handled the HR function himself, while 62 percent of the firms with 51 to 100 employees had a full-time HR manager (Little, 1986). Such situation keeps similar trends nowadays too..

Hornsby’s et al. (1990) study asked 341 small businesses located in the United States in 1990. This survey found out that sixty-one percent of the firms appraised their employees’ performance and goal setting (62%) and rating scales (59%) were the most utilized methods. A goal setting was rated as the most effective of the surveyed methods. Also, the appraisal data was mostly used for compensation (55%), determining training needs (52%), and employee development (52%). Another result was that ninety-four percent of the firms provided some form of training for their employees. Coaching was by far the most utilized training method (71%). Less than half the firms used any of the other training approaches provided in the survey (HORNSBY, J. et al., 1990).

Another recent survey was the Research Report by Chartered Institute of Personnel and Development in 2015. The survey was based on data from a 2014 CIPD survey of SMEs, which asked 578 senior decision-makers from SMEs across the UK a variety of questions about the HR role in their organization and their people management approaches. In addition, questions were posed at SME networking events, conferences and workshops as well as in 20+ case study organizations. The survey focused on the selection of five core issues, which all revolved around how to make maximum impact as an HR professional in an SME.

**Fig. 1 - Main reasons for bringing in HR professionals**



Source: CIPD research report – 2015

The first result was that the likelihood of an SME employing someone in an HR role increases with organization size. The percentage of organizations that have at least one person in an HR role is 81% in medium-sized, 47% in small and 29% in micro enterprises. According to this report, some enterprises employ an HR consultant for a number of days each month, some employ a part-time HR professional and others established a full-time role. Another relevant point is that the HR professional had another aspect to their role, such as finance. The research revealed that it is important to understand the background of the role being created as this will help set the scene for what the owner/founder expects of HR professional. The 290 senior decision-makers in SMEs that have an HR professional, answered about the main reasons for hiring an HR professional. The result revealed that there are many different reasons for hiring an HR professional, but the main reason is that the workforce had reached a size when a more structured people approach was needed, including formal policies and processes. Other reasons are to become legally compliant and to ensure they have the right skills and talent in place to achieve longer-term business objectives (see Fig. 1).

The survey found out that CEOs see some benefit in HR, but many of them have a more limited view of what it can add to their business. In addition, the research advises the HR professionals to follow some steps to overcome this view of the CEOs regarding HR in general. First, the HR professional needs to understand the business that they are working in. This action allows to the HR professional to make positive contributions to strategic business discussions, not simply be the 'HR' person. Also, look for a constructive solution to an HR issue and accept that for many HR solutions the HR professional cannot always show an immediate financial "return of investment".

## **2. Methods of Research**

The topic of HRM processes in SMEs and perspectives of HR managers and CEO was analysed also based on primary data collected in 2015. The primary data collection was carried out in April and May 2015 in cooperation with the People Management Forum (PMF) organisation. People Management Forum is a professional non-profit organization founded in 1993, it unites people interested in individual, team and organizational development from both general and professional public, mainly HR specialists. Nowadays more than 250 organizations are our members. . The concept framework of the survey was the research of the perspectives of HRM from the CEO and HRM specialists' point of view. As respondents members of the PMF were contacted. the largest employers in the Liberec Region, identification of major The quantitative research done via SurveyMonkey questionnaire was used to achieve its objectives to find out the opinion about HRM processes from perspective of CEOs and HR managers. In total, more than 200 respondents were contacted and 84 questionnaires were filled in. From those 85% were HR specialists and 15% of CEO. An online electronic query, the so-called CAWI was used as the data collection method, because it is targeted and not too time- and money-consuming. The information from the respondents was collected via an email-sent link on behalf of the PMF organisation. Prior to sending out the email with the link, all of the respondents were later contacted by phone and asked to fill in the questionnaire.

**Tab.1: Overview of respondent 's roles**

| Job title  | Small | Medium | Large |
|------------|-------|--------|-------|
|            | %     | %      | %     |
| HR manager | 11%   | 85%    | 85%   |
| CEO        | 67%   | 8%     | 33%   |
| Other      | 22%   | 8%     | 67%   |

*Source: authors' own survey*

A structured questionnaire with 19 questions was used as the primary data collection tool. The respondents provided their specific details in the first section. In the next section they were answering questions related to the use of HR processes, its importance, HR strategy, challenges and key performance indicators (KPI) in HR. Main results were presented at the annual PMF conference for HR specialists in May 2015. Perspectives of HRM processes in selected large, medium and small Czech companies in 2015. As Little in the study found out that very often small companies don't have a HR manager and the responsibility of the HR activities are performed by the CEO. Medium and large companies however already have an HR manager to perform the activities (Little, 1986). Table 2 shows how important are HR challenges in companies based on the size of companies. All companies identify as the most important retention of key employees and connection of HR strategy with objectives and needs of a company.

**Tab. 2: Opinion of the importance of key HR challenges for the success and development of Czech companies in next 2 years**

| Topic  | Small | Medium | Large |
|--|-------|--------|-------|
| Retention of key employees                                       | 1.7   | 1.5    | 1.9   |
| Connection of HR strategy with objectives and needs of a company | 1.7   | 1.7    | 2.0   |
| Recruitment of new employees                                     | 2.4   | 1.7    | 2.2   |
| Identification and management of talents                         | 2.1   | 2.0    | 2.2   |
| Employer branding management                                     | 1.7   | 2.0    | 2.4   |
| Planning and cost management in HR                               | 2.6   | 1.9    | 2.6   |
| HR business partnering   | 2.6   | 2.0    | 2.7   |
| Active implementation of current trends in HR                    | 2.9   | 3.5    | 3.0   |
| Flexible working hours and "work-life balance"                   | 2.0   | 2.9    | 3.2   |
| Using of social media  | 3.3   | 3.2    | 3.5   |
| Outsourcing of selected HR processes                             | 4.0   | 4.0    | 4.3   |

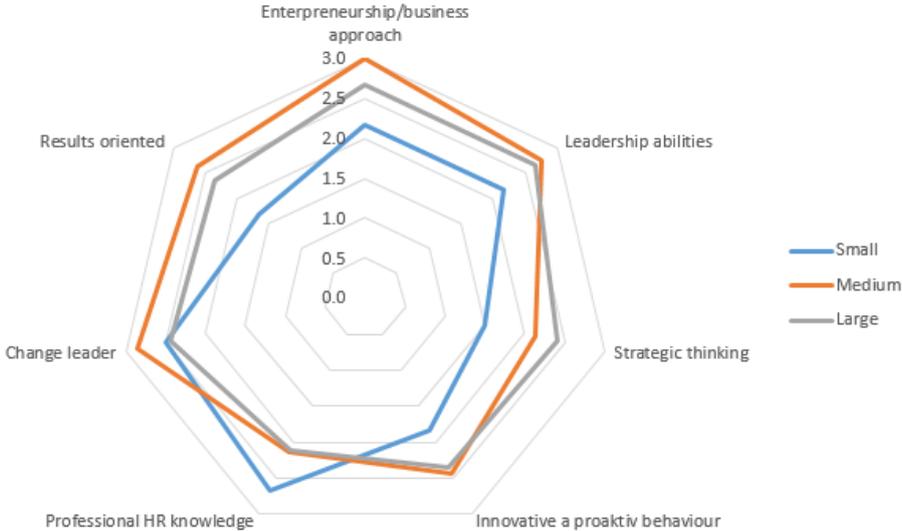
*Source: authors' survey*

One means the most important, 6 not important. On the other hand using of social media and outsourcing of selected HR processes were identified with the lowest importance. Table 2 shows a comparison of these challenges based on the size of company respondents. The biggest difference is in flexible working hours in small companies and medium and large companies.

As the most important key competencies of current HR managers of Czech companies was identified strategic thinking and business approach (see Fig. 1). Comparing results based on the size of a company, for large companies HR professional knowledge is the most

important. On contrary for SMEs business approach and leadership abilities are the most important.

**Fig. 2: Comparison of key competencies of current HR manager**



Source: authors' survey

Comparing HR processes in general (see Fig. 2) the survey may indicate that large companies use more and have more contact with HR activities. As an example, most of the large companies follow information about the influence of HR activities on a total economic result and use key performance indicators. However, even if the difference is small, in the topic about HR strategy shared with all managers, large firms perform this activity less than SMEs. Based on the literature overview expected results in large companies would be to get the lowest averages in all indicators as these companies usually have enough potential for HRM.

However, in some factors the survey indicated surprising results that small may not have a lack of HR activities of a difference when compared with medium and large companies (see Tab. 3 and 4).

**Tab. 3: Comparison between SMEs in importance of topics in HR processes**

| Topic                     | Small | Medium | Large |
|---------------------------|-------|--------|-------|
| Planning of sources       | 2.1   | 1.5    | 2.7   |
| Recruitment and selection | 2.3   | 1.6    | 1.9   |
| Evaluation of performance | 2.0   | 2.5    | 2.6   |
| Training and development  | 2.1   | 2.1    | 2.6   |
| Talent management         | 2.6   | 2.9    | 3.0   |
| Remuneration and benefits | 2.9   | 2.6    | 2.5   |

Source: authors' survey

**Tab. 4: Comparison of HR professional and CEO's view of HR processes in 2015**

| Question   | CEO            | HR             | Difference        | CEO            | HR             | Difference        |
|--|----------------|----------------|-------------------|----------------|----------------|-------------------|
| <b>How important "strategic partner" are in your opinion for top management dept.?</b>     | <b>Average</b> | <b>Average</b> | <b>SME</b>        | <b>Average</b> | <b>Average</b> | <b>LARGE</b>      |
| HR   | 2.0            | 2.8            | -0.8              | 1.5            | 2.4            | -0.9              |
| Production   | 3.0            | 3.2            | -0.2              | 1.0            | 2.5            | -1.5              |
| Sales  | 1.8            | 1.6            | 0.2               | 1              | 2.2            | -1.2              |
| Marketing  | 2.7            | 2.3            | 0.4               | 1.5            | 2.9            | -1.4              |
| Logistics  | 3.8            | 3.1            | 0.7               | 4.0            | 2.8            | 1.2               |
| Finance  | 2.3            | 1.6            | 0.8               | 1.0            | 2.0            | -1.0              |
| <b>How important are in your opinion these HR processes?</b>                               | <b>Average</b> | <b>Average</b> | <b>Difference</b> | <b>Average</b> | <b>Average</b> | <b>Difference</b> |
| Planning of sources  | 2.5            | 1.4            | 1.1               | 2.5            | 2.7            | -0.2              |
| Recruitment and selection  | 2.3            | 1.7            | 0.6               | 2.0            | 1.8            | 0.2               |
| Evaluation of performance  | 1.8            | 2.7            | -0.9              | 1.0            | 2.7            | -1.7              |
| Training and development   | 1.5            | 2.7            | -1.2              | 1.5            | 2.5            | -1.0              |
| Talent management  | 2.3            | 3.2            | -1.0              | 2.0            | 3.0            | -1.0              |
| Remuneration and benefits  | 2.8            | 3.0            | -0.3              | 1.0            | 2.6            | -1.6              |
| <b>Evaluate KEY COMPETNCIES of current HR manager</b>                                      | <b>Average</b> | <b>Average</b> | <b>Difference</b> | <b>Average</b> | <b>Average</b> | <b>Difference</b> |
| Entrepreneurship/business approach   | 1.8            | 2.7            | -1.0              | 2.0            | 2.7            | -0.7              |
| Leadership abilities   | 2.3            | 2.6            | -0.4              | 2.0            | 2.6            | -0.6              |
| Strategic thinking   | 1.0            | 2.0            | -1.0              | 1.0            | 2.4            | -1.4              |
| Innovative a proactive behaviour   | 1.5            | 2.1            | -0.6              | 1.0            | 2.3            | -1.3              |
| Professional HR knowledge  | 2.8            | 2.7            | 0.0               | 1.5            | 2.0            | -0.5              |
| Change leader  | 2.3            | 2.7            | -0.5              | 1.5            | 2.3            | -0.8              |
| Results oriented   | 1.5            | 2.4            | -0.9              | 1.0            | 2.4            | -1.4              |
| <b>The importance of key HR challenges for the success and development in next 2 years</b> | <b>Average</b> | <b>Average</b> | <b>Difference</b> | <b>Average</b> | <b>Average</b> | <b>Difference</b> |
| Recruitment of new employees   | 2.3            | 2.1            | 0.1               | 2.5            | 2.1            | 0.4               |
| Identification and management of talents   | 1.8            | 2.0            | -0.3              | 1.5            | 2.1            | -0.6              |
| Outsourcing of selected HR processes   | 3.8            | 4.5            | -0.8              | 4.5            | 4.4            | 0.1               |
| Flexible working hours and "work-life balance"   | 1.8            | 2.8            | -1.0              | 4.0            | 3.2            | 0.8               |
| Using of social media  | 3.5            | 2.4            | 1.1               | 4.0            | 3.5            | 0.5               |
| Connection of HR strategy with objectives of a company                                     | 1.3            | 1.6            | -0.4              | 1.0            | 2.0            | -1.0              |
| Employer branding management   | 1.5            | 2.0            | -0.5              | 2.0            | 2.4            | -0.4              |
| Retention of key employees   | 1.3            | 1.6            | -0.3              | 2.0            | 1.8            | 0.2               |
| HR business partnering   | 2.5            | 2.1            | 0.4               | 1.0            | 2.7            | -1.7              |
| Cost management in HR  | 2.8            | 1.9            | 0.9               | 3.0            | 2.7            | 0.4               |
| Active implementation of current trends in HR  | 3.3            | 3.0            | 0.3               | 2.5            | 3.0            | -0.5              |

*Source: authors' survey*

### 3. Discussion and conclusion

The paper brings an interesting evaluation of HRM processes from the perspective of HR specialist and CEO and identifies differences in the level of HRM in selected Czech companies (People Management Forum member). As Harney (2014) points out the

overview of HRM in SMEs has indicated both the complexity and value of exploring HRM in SMEs. Arguably, greater attention to SMEs may have pre-empted areas only recently finding prominence in HRM including the importance of management philosophy, local commitment and factors facilitating employee engagement. Even if the survey in 2015 in selected Czech companies done by the author and PMR has its limitations (there was not a random sample representing the situation in all Czech companies), its results support the previous literature findings.

As it was expected based on the literature overview in small companies HR processes are often less developed than in small and large companies. On the other hand some results may indicate that small companies have started to develop knowledge regarding the importance of HR in the company. This study was taken as a support of a general view about the differences in the level of HRM processes in SMEs as well as different perspectives of CEOs and HRM specialists. In order to understand and have a better view of HR in small, medium and large companies more detailed study with a bigger and representative sample needs to be done in the future.

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## Wages of ICT Professionals in Area of North-East

### Abstract

The wage trend in European and other economics reflects their economic boom or stagnation. The wages of ICT Professionals – information and communication technology professionals (ICT) – represent a special part of the wage trend. These professionals are highly sought-after because they bring innovations into the business sector, not only in terms of key corporate processes but also in terms of other areas, such as reporting, data warehouses, etc. In this area as well, the Czech Republic joined the developed countries of the European region. This article analyzes the trend in the wages of ICT Professionals, specifically in the Liberec region, the Hradec Králové region and the Pardubice region, i.e. in NUTS II Northeast. Our analysis was conducted for real gross wages during the past 11 years, between 2005 – 2015. For our research, we used the Czech Statistical Office's data showing the trend in the number of ICT Professionals divided into ICT Specialists and ICT Technicians. To analyze the wages of ICT Professionals, we also used data from a sample survey that Trexima, s.r.o. conducts for the Ministry of Labor and Social Affairs on a yearly basis. Our analysis shows considerably higher wages in the Prague region, which are higher by more than 20% as compared to the average of the Czech Republic. Another interesting thing is that the wages of women in the same work category are lower by 20% than those of men.

### Key Words

*human capital in ICT, wages in ICT, ICT Professionals, ICT Technicians, ICT Specialists, NUTS II – North East*

**JEL Classification: J24, M21**

## Introduction

In order to purposefully exploit the potential of modern information and communication technologies in all economic activities, it is necessary to know them well and to have qualified professionals in all branches of the economy. Qualified workers working with information technologies can be in general referred to as ICT Professionals. The classification of professions divides ICT Professionals into two main groups – ICT Specialists (CZ\_ISCO 25) and ICT Technicians (CZ\_ISCO 35). To put it simply, ICT Specialists develop new technologies and related concepts, including procedural and managerial ones, while ICT Technicians operate and support these systems as IT user support technicians, web technology administrators or telecommunications technicians.

The trend in the number and structure of ICT Professionals depends to some extent on the progress of the information society in various states and regions (Doucek 2009; Fischer, Novotný, and Doucek 2015; Hanclová, and Doucek 2012). However, it is not only the number of ICT Professionals but also their ICT expertise that is important (Maryska, Novotný, and Doucek 2010). The expertise and competences of individual ICT professions are analyzed e.g. in (Doucek, Maryška, and Novotný 2014; Helfert, Doucek, and Maryska 2013; Nedomová, Doucek, and Maryska 2015). The number, competences and education of ICT Professionals in the Czech Republic are analyzed e.g. in (Dorčák, and Delina 2011; Doucek, Maryska, and Novotný 2013; Pavlíček 2013). The achieved level of education and the wages of ICT Professionals show the importance and recognition of ICT in the economy. Wages are one of the key premises that in return affect the willingness to learn and motivate students to study ICT-oriented fields and thus to increase the number of ICT Professionals in the economy. They are analyzed e.g. in (Marek 2010; Marek, Doucek, and Nedomová 2016; Hanclová 2006).

This article analyzes the real gross wages of ICT Professionals in the selected regions of the Czech Republic and is based on two principal factors, i.e. on the number and share of ICT Professionals from the total number of the working population in the CR and on the statistics of real gross wages and their growth (Hanclová, Doucek, Fischer, and Vltavská 2015; Marek 2010). The article analyzes the trend in the real gross wages of ICT Professionals divided, based on the ISCO classification, into ICT Specialists (CZ\_ISCO 25) and ICT Technicians (CZ\_ISCO 35) and includes gender characteristics. The analysis covers mainly NUTS II Northeast - the Liberec region, the Hradec Králové region and the Pardubice region. To compare these regions with other regions of the Czech Republic, we also provide relevant information for Prague, the average for the Czech Republic and the average for the regions of the Czech Republic without Prague.

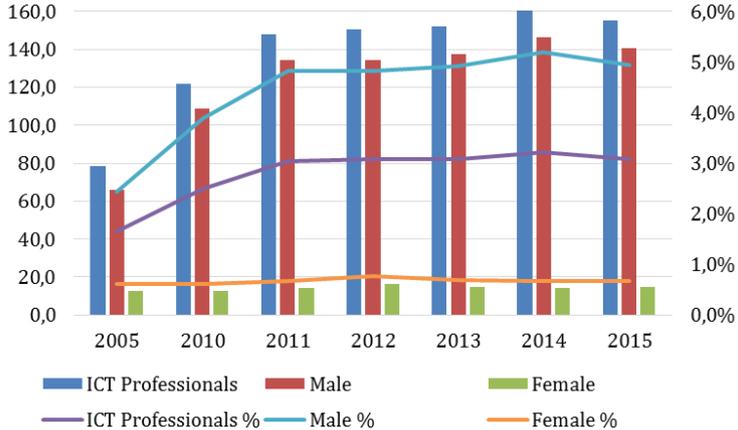
## **1. The Number of ICT Professionals in the CR – Trend**

In the past eleven years, the Czech economy joined the world's developed economies, including all the advantages and problems that come with it. This fact can also be proven by the level of involvement of the Czech Republic into the European Union not only based on the wide selection of provided services but also based on the number of ICT Professionals (Finardi, Fischer, and Mazouch, 2012; Hanclova and Doucek, 2012). The number of ICT Professionals in the Czech Republic keeps growing in the long term (Fig. 1), except for a small fluctuation in the year 2015, and even the economic crisis in 2008 did not stop this positive trend (Nedomová, Doucek, and Maryška, 2015).

The drop in the number of ICT Professionals in 2015 is a result of a combination of two factors. The first factor is the expansion of new types of ICT services, i.e. cloud computing. In this case, the client data administration is transferred to data service providers and ICT Professionals are concentrated in large companies that provide these specialized services at the detriment of ICT Professionals in small companies specializing mainly in technical professions (Fig. 2, Fig. 3). We can see a similar trend in public administration authorities as well, where - in spite of growing digitalization - the number of professionals is not

increasing very much. The second, but smaller, factor is the outsourcing of ICT services from abroad to branch offices of foreign companies (e.g. T-Mobile, Skoda Auto, a.s., etc.). The highest number of ICT Professionals in the Czech Republic was in 2014 - a total of 160,400 ICT Professionals, of whom 146,100 were men and only 14,300 were women. This trend by ICT Professionals category is shown in Fig. 2 and Fig. 3 below.

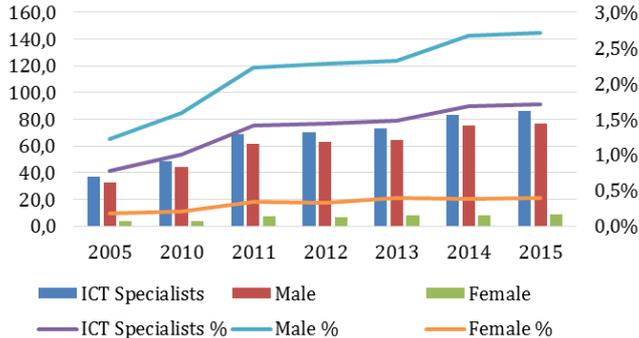
**Fig. 1: Share of ICT Professionals from the Total Number of Employed Persons in the Czech Republic**



Source: authors' own calculations, data from [CZSO, 2017a]

Fig. 2 shows the trend in the number of ICT Specialists in the Czech economy. We can see that their number kept growing during the entire analyzed time period, although at a different rate. The years of 2011 – 2013 show a lower growth rate, which is a consequence of the fading economic crisis. The year 2014 shows an increase in the number of ICT Specialists. This trend is especially obvious in the number of men (in 2015, 86,000 men – approximately 2.7% of working men in the CR, but only 8,800 women – approximately 0.5% of working women in the CR).

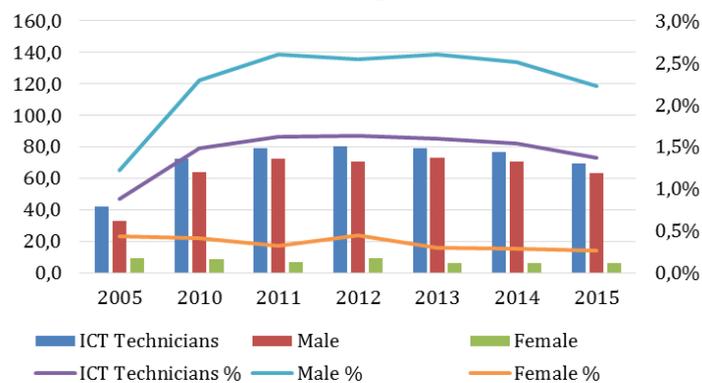
**Fig. 2: Share of ICT Specialists from the Total Number of Employed Persons in the Czech Republic**



Source: authors' own calculations, data from [CZSO, 2017a]

On the other hand, a significant drop in the number of ICT Technicians, which is shown in Fig. 3, confirms their lower demand in the Czech economy due to the concentration of ICT services in large centers.

**Fig. 3: Share of ICT Technicians from the Total Number of Employed Persons in the Czech Republic**



Source: authors' own calculations, data from [CZSO, 2017a]

The number of ICT Technicians started dropping already in 2012 and especially dropped between 2014 and 2015. In 2015, the number of ICT Technicians actually dropped below 70,000.

## 2. Problem Formulation

The goal of this article is to analyze the wages of ICT Professionals in NUTS II Northeast (the Liberec region, the Hradec Králové region and the Pardubice region). We compared these wages with the average wages of ICT Professionals in Prague, the Czech Republic and the Czech Republic without Prague. When analyzing the wages of ICT Professionals, we mainly focused on:

1. The number of ICT Professionals in the Czech economy by men, women and ICT profession;
2. The trend in real gross wages in NUTS II Northeast by men, women and ICT profession.

Our research is based on longtime scientific work at the Faculty of Informatics and Statistics, which has focused on human resources in ICT for ten years now.

## 3. Methodology

For this article, we analyzed the data from publicly accessible databases of the Czech Statistical Office, Eurostat, OECD and the World Bank. In addition, we used the open data

available on the website of the Ministry of Labor and Social Affairs of the Czech Republic. For our research and analysis of the real gross real wages of ICT Professionals in the NUTS II “Severo-východ”, we used the methodology of ICT professions classification – CZ ISCO. The classification of ICT Professionals is provided below.

### 3.1 ICT Specialists and Technicians

Based on the generally used methodologies, such as CZ\_ISCO, ICT work positions are divided into two basic groups of professions (CZSO, 2017a):

- a) ICT Specialists and (CZ ISCO 25).
- b) ICT Technicians (CZ ISCO 35).

More detailed job descriptions of individual ICT profession groups are provided in (CZSO, 2017a).

### 3.2 Data Collection

To calculate the real wages in the structure mentioned above, we used data from a system that regularly monitors employee earnings and work hours in the Czech Republic. These data include information from regular statistical surveys called the “*Average Earnings Quarterly Survey*,” which are included in the statistical surveys program announced by the Czech Statistical Office in the collection of laws for the relevant calendar year. The gross monthly wage in our data file was calculated as a multiple of hourly earnings in the second quarter and the average monthly work hours for each year. The average work hours were rounded off to a whole number. The size of the analyzed sample of ICT Professionals gradually increased from over 8,000 in 2000 to over 48,000 in 2015. The size of the sample group for the Czech Republic increased from one million to over two million.

### 3.3 Inflation Rate

The inflation rate is another factor that impacts the findings. The trend in the inflation rate during the analyzed time period is shown in Tab.1.

**Tab. 1: Average Inflation Rate**

| Variable %/Year               | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Average Annual Inflation Rate | 2.8  | 1.9  | 2.5  | 2.8  | 6.3  | 1.0  | 1.5  | 1.9  | 3.3  | 1.4  | 0.4  | 0.3  |

*Source: (CZSO, 2017b)*

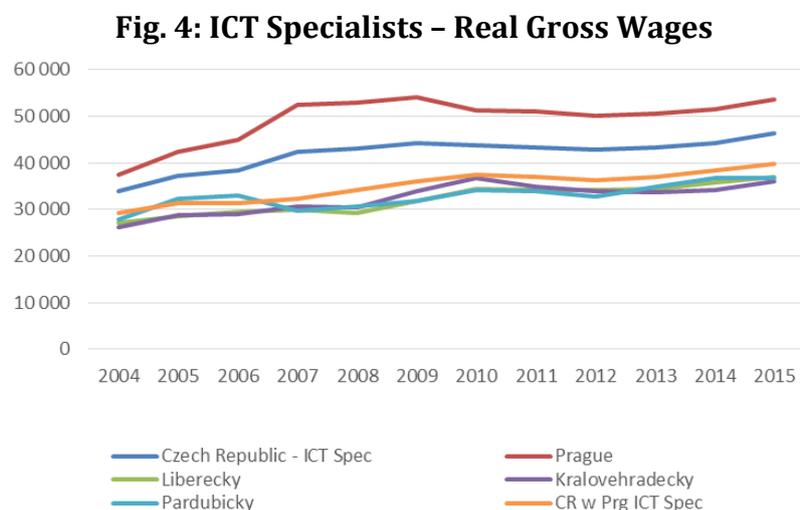
We converted the nominal wages to the wages in 2015, using the inflation rate for individual years. We processed the data in MS SQL Server 2008 and MS Excel 2015.

## 4. Results

The overall results of the analysis of the wages of ICT Professionals are presented in this article based on analyzed criteria in selected regions. We analyzed the trend in real wages (wages adjusted for inflation) finally by ICT profession group and gender.

### 4.1 ICT Specialists

As expected, our analysis of the real gross wages of ICT Specialists shows that the highest average wages were in the Prague region. Our analysis also discovered an interesting fact - real gross wages dropped after 2009 and remained below the level of wages in 2009 during the entire analyzed time period. This is true for Prague only. The wages in other analyzed regions show a much slighter drop, but in 2015 reached or even surpassed the wages of the pre-crisis period.



Source: authors' own calculations, data from (MPSV ČR, 2016)

The drop in the wages in Prague and thus also in the average wage in the Czech Republic was caused by the economic crisis. On the other hand, the increase in the wages in the analyzed regions between 2008 – 2010 was a result of the local shortage of professionals in practically all professions (the Czech National Bank – ČNB, 2017). The growing trend in the wages of ICT Specialists was confirmed in 2015 as well. The wages of ICT Specialists in all regions of NUTS II Northeast are similar; the highest wages in 2015 were in the Liberec region and the Pardubice region.

### 4.2 ICT Specialists – Male

As expected, our analysis of the real gross wages of male ICT Specialists shows that the highest average wages were in the Prague region. Our analysis also discovered an interesting fact - real gross wages dropped after 2009 and remained below the level of

wages in 2009 during the entire analyzed time period. This is true for Prague only. The wages in other analyzed regions show a much slighter drop starting in 2010, but in 2015 reached the level of the wages of the pre-crisis period. An interesting fact is that the absolute size of real gross wages in Prague exceeds that in other regions by approximately 50 – 70%.

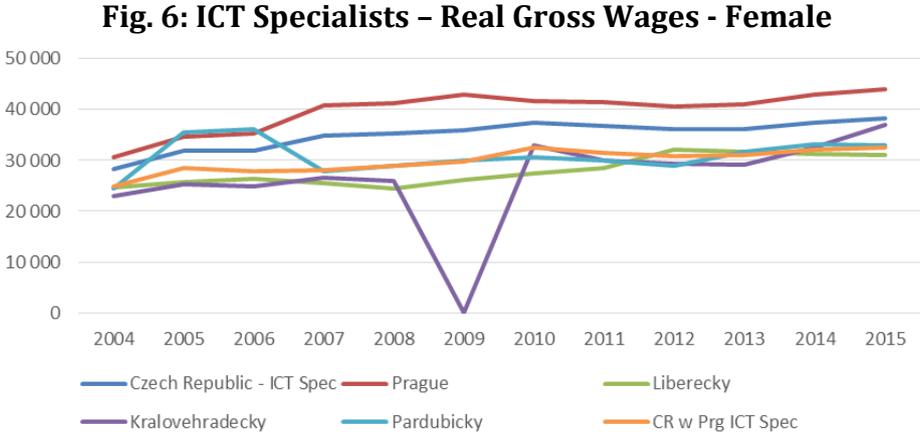
The analysis of the trend in real gross wages in the regions shows the lowest real gross wages in the Hradec Králové region (35,852 CZK), while the real gross wages in the Pardubice region (37,340 CZK) and in the Liberec region (37,930 CZK) are almost equal.



Source: authors' own calculations, data from (MPSV ČR, 2016)

### 4.3 ICT Specialists – Female

The trend in the real gross wages of female ICT Specialists in the analyzed regions is very similar to that of male ICT Specialists, with the only difference that their real gross wages are lower by approximately 20% than the real gross wages of male ICT Specialists. However, these data are not very reliable due to the low number of subjects in individual regions included in the analysis.



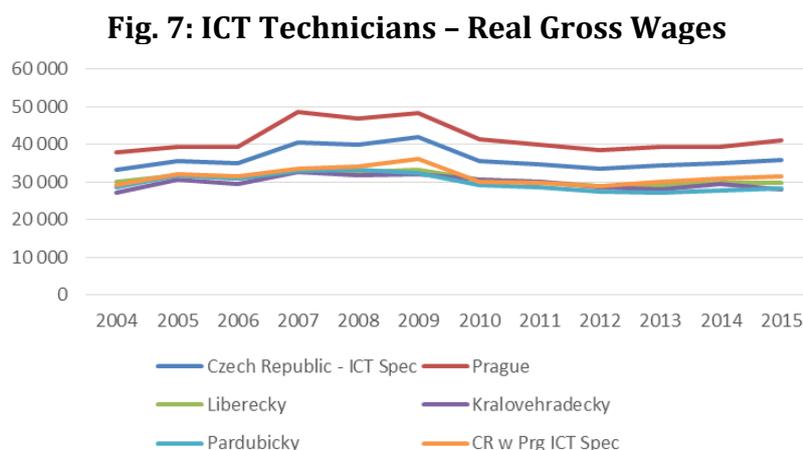
Source: authors' own calculations, data from (MPSV ČR, 2016)

Note to Fig. 6: We had no relevant data for the Hradec Králové region for 2009.

The increase in the real gross wages of female ICT Specialists in the Hradec Králové region between 2013 and 2015 (in 2015 – 36,977 CZK) may be a result of their small number; the very small number of analyzed subjects (approximately 40) makes this information very sensitive to changes. The wages of female ICT Specialists in the Pardubice region (32,952 CZK) reached the all-state average without Prague (32,634 CZK), while the wages of female ICT Specialists in the Liberec region lagged behind (31,025 CZK).

#### 4.4 ICT Technicians

The trend in the real gross wages of ICT Technicians is completely different from that of ICT Specialists. The real gross wages of ICT Technicians dropped in all analyzed regions. As expected, the highest drop occurred in Prague, which essentially affects the average for the Czech Republic. However, an interesting fact is that the analysis for the Czech Republic without Prague shows a very similar drop in these wages, although the regions of NUTS II Northeast showed no major drop in these wages. Based on an additional analysis, we discovered that this drop had been caused by the drop in the real gross wages of ICT Technicians in the South Moravian region that employs a considerable number of ICT Technicians.



Source: authors' own calculations, data from (MPSV ČR, 2016)

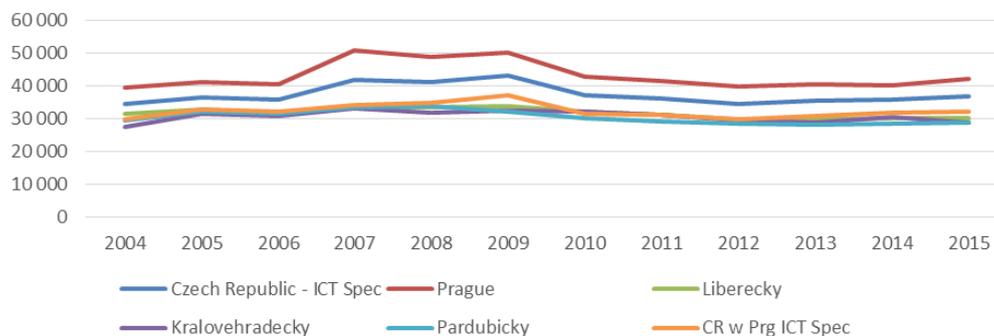
The real gross wages of ICT Technicians kept dropping between 2009 (due to the economic crisis) and 2012. This trend ceased in the Liberec region, while continuing in the Pardubice region and the Hradec Králové region. In the year 2015, the average real wage of ICT Technicians amounted to 29,866 CZK in the Liberec region, 28,165 CZK in the Liberec region and 28,025 CZK in the Hradec Králové region.

## 4.5 ICT Technicians – Male

There is no dynamic growth in the share of male ICT Technicians on the total number of the working population as in the case of ICT Specialists Fig. 3. The individual regions also show a similar low growth rate. In comparison to ICT Specialists, the trends in ICT Technicians are more stabilized.

The trend in the real gross wages of male ICT Technicians is similar to that of male ICT Specialists. The only difference is in their absolute size, which in the case of male ICT Technicians is between 30,000 to 50,000 CZK. An interesting fact is that the size of real gross wages in 2015 is similar to that in 2004. Therefore, we can say that, although we keep hearing about a major shortage of ICT Technicians and their ever-growing earnings, the reality is different.

**Fig. 8: ICT Technicians – Real Gross Wages - Male**



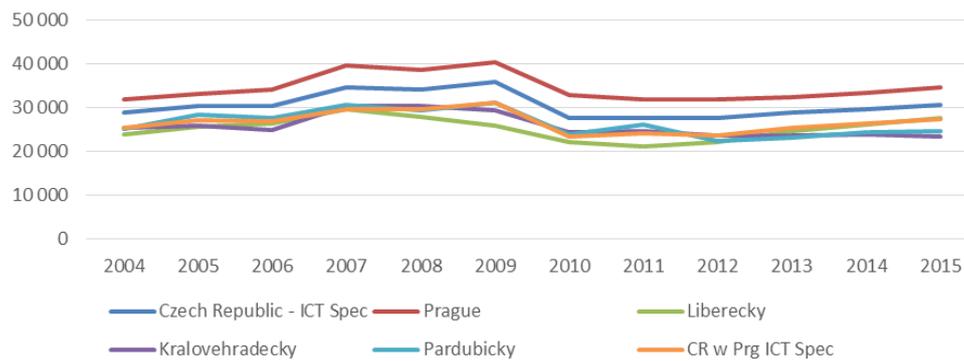
*Source: authors' own calculations, data from (MPSV ČR, 2016)*

Contrary to the number of ICT Technicians, the real gross wages of ICT Technicians show a growing trend starting in 2013. The only exception is the Hradec Králové region between 2014 and 2015. In the year 2015, the average real gross wage amounted to 30,160 CZK in the Liberec region, 29,030 CZK in the Hradec Králové region and 28,943 CZK in the Pardubice region.

## 4.6 ICT Technicians – Female

As expected, the real gross wages of female ICT Technicians in Prague were higher than in other regions by approximately 20%. We can say that the trend in the wages of female ICT Technicians is not in line with the situation regularly reported in the press and media and that their real gross wages remained almost the same during the analyzed period.

**Fig. 9: ICT Technicians – Real Gross Wages - Female**



Source: authors' own calculations, data from (MPSV ČR, 2016)

The real gross wages of female ICT Technicians dropped in 2007 in all regions and went up only in 2011 in the Pardubice region. Their real gross wages went up in the Liberec region from 2011 to 2015 (27,754 CZK) and surpassed the average of the Czech Republic without Prague (27,547 CZK). Thanks to the increase between 2014 and 2015, the Pardubice region with its average real gross wage of 24,636 CZK placed second. The lowest real gross wages of female ICT Technicians were in the Hradec Králové region - 23,513 CZK.

## Conclusions

Our analysis of the number of ICT Professionals in the Czech Republic provides the following conclusions:

- a) The number of ICT Professionals in the Czech Republic kept growing between 2005 and 2014; their total number dropped by 3.31% in 2015 as compared to 2014. The number of male ICT Professionals represents approximately 5% of all men working in the CR, while the number of female ICT Professionals represents not quite 1% of all women working in the CR.
- b) The drop in the number of ICT Professionals was caused by the drop in the number of ICT Technicians. The number of ICT Professionals started dropping in 2012. The 2012/2013 drop was very small (1.12%), the 2013/2014 drop was 2.78% and the 2014/2015 drop represented already 10.4%. Based on our analyses, the number of ICT Technicians dropped mostly because of the expansion of cloud computing services and the concentration of workplaces where ICT Technicians are employed. Another factor causing the drop in the number of ICT Technicians is the growing outsourcing of information system maintenance and operation and the growing number of created and operated cloud computing centers.
- c) The number of ICT Specialists kept growing both in men and women. We consider this fact very positive for the Czech economy since these professions represent an added value for the information systems implemented in businesses.

Our analysis of the wages of ICT Professionals in NUTS II Northeast provides the following conclusions:

- a) The average wages of ICT Professionals in the CR are significantly affected by the wages in the Prague region. The difference between the Prague region and the analyzed regions of NUTS II Northeast is approximately 25%.
- b) Trends in the wages in the analyzed regions are very similar, but not always similar to those in the Prague region or to the trends in the average wage in the CR. This fact is obvious especially in the years of 2007 – 2009, i.e. in the pre-crisis period. During this time period, there was a major increase in the wages of ICT Professionals in the Prague region, while the wages of ICT Professionals in the regions of NUTS II Northeast went up only slightly and not until 2009 and 2010. In the Prague region, the wage trend of 2007 – 2009 was followed by a drop in 2010, while the wages in the regions of NUTS II Northeast did not drop but stagnated.
- c) In many cases, the real gross wages of ICT Specialists in the analyzed regions of NUTS II Northeast reached their pre-crisis level, which, however, is true neither for Prague nor for ICT Technicians.
- d) Changes in the growth of real wages between 2014 and 2015 indicate that the real wages of ICT Professionals could go up. This trend can be confirmed or disconfirmed by additional analyses of data from 2016.

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## Impact of Gender and Personality Traits (BFI-10) on Innovativeness

### Abstract

The paper investigates whether gender and/or personality traits influence innovativeness, based on questionnaire (N=264, conducted in December 2016-January 2017) among university students from the Czech Republic.

The Big Five Inventory (BFI); a self-report inventory designed to measure five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, openness to experience) was used. A general linear model was used to analyze impact of gender and BFI on innovativeness.

It is a replication. Results confirm that all but agreeableness had significant impact on self-perceived innovativeness: according to a linear regression model, extraversion, conscientiousness, neuroticism, openness to experience, and gender influence self-perceived innovativeness. Impact of extraversion, conscientiousness, and openness to experience is positive. Impact of neuroticism is negative. And men rate their innovativeness higher than women, controlling for personality traits.

### Key Words

*innovativeness, personality traits, gender, empirical research, quantitative methods*

**JEL Classification: O31**

## Introduction

There is increasing body of literature on innovation and innovativeness (innovativeness is the capacity to innovate, the degree in which it can be done, while innovation can be understood as a result of innovativeness; both innovation and innovativeness are key factors of a good and successful entrepreneurship). The paper investigates whether gender and/or personality traits influence innovativeness. Recently, impact of the Big Five Inventory personality traits (Costa and McCrae 1992) on consumer innovation success was investigated by Stock, von Hippel and Gillert (2016). According to Fursov, Thurner and Nefedova (2017), investigation of influence of personality traits on innovativeness is "[a] new and emerging stream of literature now."

Stock, von Hippel and Gillert (2016) provide a literature review supporting their hypotheses why innovativeness should be influenced by personality traits. According to

Feist (1998), Rothmann and Coetzer (2003), Sung and Choi (2009) and Wolfradt and Pretz (2001), openness to experience and extraversion are positively linked to creativity. With regards to conscientious, e.g. Rothmann and Coetzer (2003) found a positive link while e.g. George and Zhou (2001) a negative one. In some studies, there was found a negative link between creativity and neuroticism (Rothmann and Coetzer, 2003) and agreeableness (King, Walker and Broyles, 1996).

Stock, von Hippel and Gillert (2016) tested multiple models and they found that:

- a) 1<sup>st</sup> stage – ideation – was influenced by openness to experience and gender,
- b) 2<sup>nd</sup> stage – prototyping – was influence by extraversion, conscientiousness and gender, and
- c) 3<sup>rd</sup> stage – a) peer-to-peer diffusion and b) commercial diffusion – were both influenced by conscientiousness.

Therefore, it is realistic to expect that most likely openness to experience, extraversion, conscientiousness and gender may turn out to be significant also in the analysis presented in this paper.

Begley and Ellis (2012) discovered that only six of selected 53 high-profile papers could be reproduced in the field of cancer biology. In the field of psychology, Open Science Collaboration (Nosek et al., 2012) project replicated 100 investigations of which 39 matched the original results and another 24 were at least "moderately similar" to findings of the original experiments. Therefore, replications are necessary in order to figure out whether findings hold under any conditions.

The research presented in this paper can be considered as a replication of a part of Stock, von Hippel and Gillert (2016) model, and of (Sudzina, 2016). The goal is to see whether the identified relationships hold even if fewer items are used to measure the Big Five Inventory than Stock, von Hippel and Gillert (2016) used and innovativeness is measured differently than Stock, von Hippel and Gillert (2016) did.

The rest of the paper is organized as follows: The next section describes the questionnaire and the analysis, the following section contains results, and the final section summarizes the findings.

## **1. Methods of Research**

Data were collected in December 2016-January 2017 using an on-line questionnaire. Respondents were 264 university students from the Czech Republic, of whom 117 were male and 147 female. All students of several courses were asked to fill in the questionnaire. Using a convenience sample may lead to a bias, e.g. all respondents can be either high or low in a particular characteristics and due to low variance in this

characteristics, this characteristics may not be identified as significant in the sample, although it is significant in the whole population.

SurveyXact was used for the questionnaire. The questionnaire was split into two pages and it contained also questions which were not used in the analysis presented in this paper. Independent variables were on the first page, and the dependent variable was on the second page. Seven respondents stopped after the first page and one respondent provided arbitrary high numbers as answers for multiple open-ended questions - this row was excluded from the analysis. So, the effective sample size was 256.

The dependent variable was measured using the instruction "Please indicate to what degree you agree with the following statement: I consider myself innovative" on a 1-5 Likert scale where 1 meant strongly disagrees and 5 stood for strongly agree.

Stock, von Hippel and Gillert (2016) used Costa and McCrae's (1992) instrument to measure the Big Five Inventory; the instrument contains 50 statements. The research presented in this paper is based on the newer version of the questionnaire (Rammstedt and John, 2007) which contains 10 statements. Validated translation to Czech by Hřebíčková et al. (2016) was used. The instruction was to rate "How well do the following statements describe your personality" with statements "I see myself as someone who..."

- |   |   |
|---|---|
| 1. ... is reserved,                     | 6. ... is outgoing, sociable,           |
| 2. ... is generally trusting,           | 7. ... tends to find fault with others, |
| 3. ... tends to be lazy,                | 8. ... does a thorough job,             |
| 4. ... is relaxed, handles stress well, | 9. ... gets nervous easily,             |
| 5. ... has few artistic interests,      | 10. ... has an active imagination       |

on a 1-5 Likert scale where 1 meant strongly disagrees and 5 stood for strongly agree. Extraversion was calculated as an average of the 1<sup>st</sup> (reversed-scored) and the 6<sup>th</sup> answer, agreeableness as an average of the 2<sup>nd</sup> and the 7<sup>th</sup> (reversed-scored) answer, conscientiousness as an average of the 3<sup>rd</sup> (reversed-scored) and the 8<sup>th</sup> answer, neuroticism as an average of the 4<sup>th</sup> (reversed-scored) and the 9<sup>th</sup> answer, and openness to experience as an average of the 5<sup>th</sup> (reversed-scored) and the 10<sup>th</sup> answer. Cronbach alphas for personality traits will not be reported since the Big Five Inventory-10 (Rammstedt and John, 2007) was not constructed with this statistic in mind.

A general linear model (GLM) was used to analyze impact of gender and of five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, openness to experience) on innovativeness. A multivariate approach to testing was used. Parameter estimates tables will be provided (instead of ANOVA-style tables) in order to be able to see signs of parameter estimates (not only p-values). The results should be equivalent to a multiple linear regression model estimates in case the dummy variable is set to 1 for male and to 0 for female.  $R^2$  and  $R^2_{adj}$  are provided in order to be transparent about how much a model explains though it may be significant. SPSS software was used for all the tests.

## 2. Results of the Research

Parameter estimates for the general linear model analyzing impact of gender and of personality traits on self-perceived innovativeness are provided in Tab. 1.

**Tab. 1: Parameter estimates for the full model**

| Parameter              | B              | Std. Error | t      | Sig. | Partial Eta Squared |
|------------------------|----------------|------------|--------|------|---------------------|
| Intercept              | 1.612          | .448       | 3.599  | .000 | .049                |
| Extraversion           | .238           | .052       | 4.613  | .000 | .079                |
| Agreeableness          | -.049          | .059       | -.822  | .412 | .003                |
| Conscientiousness      | .128           | .057       | 2.226  | .027 | .020                |
| Neuroticism            | -.100          | .047       | -2.109 | .036 | .018                |
| Openness to experience | .207           | .053       | 3.880  | .000 | .057                |
| Gender = male          | .330           | .104       | 3.169  | .002 | .039                |
| Gender = female        | 0 <sup>a</sup> | .          | .      | .    | .                   |

*Source: authors' calculations in IBM SPSS 22*

Legend: a. This parameter is set to zero because it is redundant.

With regards to the explanatory power,  $R^2 = .208$ ,  $R^2_{adj} = .188$ ,  $p$ -value  $< .001$ . All but agreeableness have significant impact on self-perceived innovativeness. Carlson and Wu (2012) suggest to exclude independent variables that are not significant. Parameter estimates for the submodel without agreeableness are provided in Tab. 2.

**Tab. 2: Parameter estimates for the streamlined model**

| Parameter              | B              | Std. Error | t      | Sig. | Partial Eta Squared |
|------------------------|----------------|------------|--------|------|---------------------|
| Intercept              | 1.424          | .385       | 3.702  | .000 | .052                |
| Extraversion           | .240           | .052       | 4.661  | .000 | .080                |
| Conscientiousness      | .131           | .057       | 2.294  | .023 | .021                |
| Neuroticism            | -.098          | .047       | -2.070 | .039 | .017                |
| Openness to experience | .205           | .053       | 3.848  | .000 | .056                |
| Gender = male          | .339           | .104       | 3.274  | .001 | .041                |
| Gender = female        | 0 <sup>a</sup> | .          | .      | .    | .                   |

*Source: authors' calculations in IBM SPSS 22*

Legend: a. This parameter is set to zero because it is redundant.

With regards to the explanatory power of the streamlined model from Tab. 2,  $R^2 = .205$ ,  $R^2_{adj} = .189$ ,  $p$ -value  $< .001$ .

## 3. Discussion

The explanatory power of the full model is  $R^2 = .208$ ,  $R^2_{adj} = .188$ , and the model per se is significant ( $p$ -value  $< .001$ ). In (Sudzina, 2016), the model per se was not significant ( $p$ -value = .247),  $R^2 = .046$ ,  $R^2_{adj} = .011$ . The explanatory power of the full model cannot be directly compared to results obtained by Stock, von Hippel and Gillert (2016) because they used logistic regression, not linear regression.

In this paper, all but agreeableness had significant impact on self-perceived innovativeness. While in (Sudzina, 2016), openness to experience and agreeableness had the lowest p-values, and when a bivariate test was used, only openness to experience was borderline significant (p-value = .071),  $R^2 = .019$ ,  $R^2_{adj} = .013$ . Extraversion, conscientiousness, openness to experience, and gender were significant at least in one of three stages of innovation process investigated by Stock, von Hippel and Gillert (2016). Like in this research, they did not find impact of agreeableness to be significant. Unlike in this research, they did not find impact of neuroticism to be significant. Considering estimates of effect size, this is in a way consistent with our findings - neuroticism has partial eta squared of .017, while other significant variables from our model have partial etas squared or .021 or more. Non-parametric methods tend to weaker, and since Stock, von Hippel and Gillert (2016) used logistic regression, this could be reason why they did not identify neuroticism as significant.

## **Conclusion**

The aim of the paper was to replicate analysis of impact of gender and of personality traits on self-perceived innovativeness. According to a linear regression model, extraversion, conscientiousness, neuroticism, openness to experience, and gender influence self-perceived innovativeness. Impact of extraversion, conscientiousness, and openness to experience is positive. Impact of neuroticism is negative. As for gender – men rate their innovativeness higher than women controlling for personality traits. Results are to a large extent consistent with those of Stock, von Hippel and Gillert (2016) who found that: ideation - was influenced by openness to experience and gender while prototyping was influence by extraversion, conscientiousness and gender.

In spite of Fursov, Thurner and Nefedova (2017) calling research of impact of personality traits on innovativeness "[a] new and emerging stream of literature", it is unclear whether this stream will continue after publication of the new version of Big Five Inventory - Big Five Inventory-2 (Soto and John, 2017) with 60 statement since 5 of them measure innovativeness.

General conclusion of the paper is, that the impact of gender and personality traits (BFI-10) on innovativeness has been replicated in spite of using a convenience sample.

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## The Cluster Effect on the Performance of Member Enterprises

### Abstract

This article deals with research into the effects of an enterprise's membership in a cluster on their financial performance. The research was conducted on three research samples. The first sample was composed of enterprises in Clutex, a cluster of technical textiles, which arose as a result of a cluster initiative in 2006. It was also one of the projects from the Operational Programme Industry and Enterprise. Enterprises that create the core of the cluster do business in industries with the following statistical classifications: NACE 13200, 13900 and 14100. The second research sample was composed of enterprises in a natural textile cluster that exists within the territories of the Liberec, Hradec Králové and Pardubice Regions (they together form the North-East Cohesion Region). The third research sample was composed of enterprises doing business in the same industries, but outside the North-East Cohesion Region. ROE indicators and indicators based on economic value added were used as criteria for assessing financial performance. The research was based on 2014 data. The research was targeted at verifying the hypothesis that enterprises in the Clutex cluster reach higher performance than enterprises in the natural cluster. And further, by analogy, that enterprises in the natural cluster are more successful than enterprises in the same industry, but doing business in other regions. However, the results of the research did not confirm the expected positive effect of the existence of clusters (institutionalized or natural) on enterprise performance. The concluding section of the report deals with the possible causes of this finding.

### Key Words

*industry cluster, natural cluster, cluster initiative, cluster of technical textiles, economic value added*

**JEL Classification: C21, R13**

## Introduction

In the current highly competitive environment, enterprises seek tools to increase their performance. One possible option is to create a cluster with other enterprises and institutions. A cluster is an association of enterprises in a certain industry, research and education institutions, and other professional organizations acting in a certain region for the purpose of knowledge exchange and cooperation on specific projects. We usually distinguish between natural clusters that arose on the basis of market effects, and cluster organizations created by a cluster initiative of an institution, mostly governmental. The

formation of clusters has been supported in the Czech Republic since 2004, first within the Operational Programme Industry and Enterprise - Clusters, which was followed by the Cooperation Sub-programme within the Programme Enterprise and Innovation in 2007-2013. The development of clusters has been supported by the Operational Programme Enterprise and Innovation for Competitiveness since 2014. CzechInvest is the management authority of the programmes.

This article tries to find out, using the selected cluster of technical textiles, Clutex as an example, whether the formation of the cluster had a positive effect on the financial performance of the enterprises within the given industry. The Clutex cluster arose in 2006 supported by the Programme Industry and Enterprise. The mission of the cluster lies in the coordination of activities and cooperation between textile and clothing enterprises, organizations dealing in research and development, universities and other entities aimed at creating optimum conditions for the transfer of technologies, and its mission is also to ensure innovation and progress in the research, development and production of technical textiles, including materials and semi-products used for their production. The cluster has its seat in Liberec and has the legal form of a registered civil association (Clutex, 2016). It associates organizations acting in the North-East Cohesion Region, which includes territories of three regions – the Liberec, Hradec Králové and Pardubice Regions. The regions also have above average participation in the textile industry from the viewpoint of the location quotient comparing employment rates in the given industry in the region and the national economy as a whole (Žižka, 2006). Therefore, the North-East Cohesion Region can also be perceived as a natural textile cluster. This means that there are textile enterprises coexisting there which are included in both clusters (natural and institutionalized), and enterprises which do not participate in the activities of the Clutex cluster. This situation creates favourable conditions for comparing the performance of both options. And a sufficient period (10 years) has passed since the formation of the Clutex cluster, which should show whether or not an institutionalized cluster has a favourable effect on the performance of its member enterprises.

This article aims to find out whether enterprises involved in a cluster of technical textiles reach better financial performance than enterprises doing business in the same industry, but which are not members of a cluster organization. Non-member enterprises are classified into two groups: enterprises present in the same region, and thus being part of a natural textile cluster, and enterprises acting outside the region. Return on equity and economic value added were selected as the criteria used to assess financial performance.

## **1. Literature Review**

The concept of cluster is, to a certain extent, a new stream in economic thinking (Zaušková, 2010). The idea of associating enterprises in a cluster is based on Alfred Marshall's work; he dealt with the development of industrial districts at the end of the 19<sup>th</sup> century (Belussi & Caldari, 2008). With regards to districts, Marshall identified positive externality in concentrated and mutually interconnected enterprises and industries. The externality was particularly caused by flows of knowledge between

enterprises, specialized output and services from supporting industries and a geographically combined labour market (OECD, 1999). In the 1990s, the idea of industrial districts was followed by Michael Porter, who transformed it into the theory of clusters in which he tried to understand the issue of enterprise strategy at the regional level (Irawati, 2012). Porter perceives a cluster as a geographically close grouping of mutually interconnected enterprises, specialized suppliers, service providers and associated institutions in a specific industry as well as enterprises in related branches that compete with each other, but also cooperate, have common characteristics, and also complement each other (Porter, 1998).

Clusters can arise naturally through an interconnection of enterprises in a given region; they exist regardless of whether the enterprises are aware of it or not. Such clusters are called natural or Porterian. A cluster can also be created as a result of an organized effort known as a cluster initiative. When clusters are being formed, a combination of both alternatives may exist (Pavelková et al., 2009). A cluster initiative is an organized effort targeted at founding clusters and increasing the growth and competitiveness of the clusters in the region, and are made up by cluster enterprises, government, or the research community (Solvell, Lindqvist & Ketels, 2003). One of the main roles of cluster initiatives lies in strengthening the bonds and spill-over effects within the cluster. Cluster initiatives reach this objective by enhancing the awareness of the common issues which enterprises in the cluster must face, and by creating efficient tools to facilitate interaction between the assets (Becattini, Bellandi & De Propriis, 2009). They may be established prior to the formation of a cluster itself and their task is to improve the process of the cluster's formation, or they can be intended to develop existing cluster activities (Perret, 2013).

The formation and development of cluster groups offer all involved entities a great number of benefits that are reflected particularly in a growth in efficiency, productivity and innovation activities, and thus help to increase its members' performance and competitiveness. Clusters have the potential to disturb competition by increasing the productivity of the enterprises in a cluster through driving innovation in the region's industry (Tsakalerou & Katsavounis, 2013). It has also been proved that a positive correlation exists between the size of a given region and labour productivity at the enterprise level. The productivity of enterprises goes up when they are localized in conurbations and large regions (Balog, 2016). A cluster simply interconnects all the basic ingredients – resource availability and the individuals' objectives for the purpose of reaching competitive success, and shares the idea of proximity, network and specialization. Clusters stimulate and promote cooperation among entrepreneurs. They stimulate competitive pressure, even between indirect competitors or non-competitive participants (Bialic-Davendra, 2011). Clusters also make access to seeking trading partners, funding and employees easier for their enterprises (Damborský & Wokoun, 2010).

The performance of clusters can be managed and measured in various ways; there is a relatively large number of methods described in literature. The most frequently used methods to measure the performance of a cluster include, according to Pavelková et al.

(2009): the performance model of cluster initiatives, a model developed by the Canadian National Research Council, the British attitude to cluster evaluation, cluster evaluation by the Scottish Enterprise, the Norwegian Cluster Benchmarking Model, Balanced Scorecard, economic value added, and multidimensional methods of evaluating clusters and cluster initiatives.

## 2. Methods of Research

The research was conducted from July 2016 to January 2017. The MagnusWeb commercial database (Bisnode, 2016) was used as the source of accounting data. The numbers of employees were taken from the same source. The research process can be divided into the following phases.

1. **The creation of a list of evaluated enterprises** – based on the list of Clutex cluster members. During the analysed period, the cluster had 33 members with very heterogeneous activities. Besides textile enterprises, among the cluster members were also research institutes, textile and clothing associations, and university and trading organizations, which means both business and non-business entities. As the research focused on the evaluation of the cluster members' financial performance, only business entities were included in the research. For the purpose of comparing the enterprises' performance between regions, it was necessary to define a relatively homogeneous core of the cluster. Based on an analysis of the individual cluster members' business activities under the NACE classification, enterprises in NACE industries 13200, 13900 and 14100 were identified as the core of the cluster. The number of enterprises in the cluster with such business activities was 19; they formed the first research sample. The second research sample was composed of enterprises with identical business activities acting in the Liberec, Hradec Králové and Pardubice Regions which were not members of the Clutex cluster. The number of those enterprises was 275. The third research sample was composed of enterprises with identical business activities acting in other regions of the Czech Republic, outside the North-East Cohesion Region. The number of those enterprises was 1,430.
2. **The collection of financial statements** – with regards to the above-mentioned enterprises, it was necessary to obtain data from Balance Sheets and Profit/Loss Statements for 2014 (many enterprises had not yet published their 2015 statements in the Commercial Register). Unfortunately, not all enterprises fulfil the statutory obligation to publish selected data from Balance Sheets and Profit/Loss Statements in the Collection of Deeds. In regards of the first research sample, we managed to get financial statements from 18 enterprises (out of the total number of 19), the rate of success related to the second research sample was 118/275, and that related to the third sample was 473/1430.
3. **Obtaining the numbers of employees** – the MagnusWeb database was used for obtaining data on the enterprises' employees in 2014. Where a range was stated, the middle of the range was used for making further calculations. Where the value for 2014 was missing, the latest available information was used. In case of a zero number

of employees declared by an enterprise, one employee was included in the calculation (the owner working as a self-employed person).

4. **Calculating economic value added** – with regards to enterprises with available financial statements, economic value added was calculated in accordance with the Ministry of Industry and Trade (MPO) methodology (2015). To calculate the EVA indicator, the MPO uses a procedure based on equity capital in which EVA is defined as a product of equity capital **E** and spread (return on equity **ROE** minus alternative cost of equity capital  $r_e$ ), see formula (1). EVA, and possibly spread, was determined for each member enterprise of the cluster and for the cluster as a whole (by combining enterprise data). For making a comparison of enterprise performance between the samples, EVA was linked with the production and number of employees. Furthermore, the **ROE**,  $r_e$  and spread indicators were compared between the samples. The indicators could only be determined for enterprises with positive equity capital. Therefore, it was necessary to exclude enterprises with zero or negative equity capital from the samples (there was one enterprise in the first sample, 24 enterprises in the second sample, and 112 enterprises in the third sample).

$$EVA = (ROE - r_e) \cdot E \quad (1)$$

5. **Making a comparison of the characteristics of individual research samples** – the differences between the medians of values of the above-mentioned indicators were compared for the three samples using the non-parametric Mann-Whitney-Wilcoxon *W* test. The Mann-Whitney-Wilcoxon *W* test was selected because of the fact that the Shapiro-Wilk test had proved that at least one of the examined indicators did not have normal distribution. The following hypotheses were tested:  
 H1: Business entities in the Clutex cluster show better performance than business entities in the same industry in the North-East Cohesion Region (in the natural cluster) that are not members of the Clutex cluster.  
 H2: Business entities in the Clutex cluster show better performance than business entities outside the North-East Cohesion Region and the Clutex cluster.  
 H3: Business entities in the natural textile cluster show better performance than business entities acting outside the North-East Cohesion Region and the Clutex cluster.  
 The zero hypothesis assumes that the medians of both samples are identical.  
 The hypotheses were tested using the STATGRAPHICS Centurion XVII software; all tests were conducted at a significance level of  $\alpha = 5\%$ .

### 3. Results of the Research

Table 1 shows that the Clutex cluster associates medium-sized and large enterprises. The average number of employees in a member enterprise is substantially higher than in textile enterprises acting outside the institutionalized cluster (regardless of whether in the North-East Cohesion Region or other regions of the Czech Republic). Enterprises in all research samples reached positive accounting profitability in the reference year as

measured by the ROE indicator. However, after taking all costs of capital into consideration, the profitability expressed with the EVA indicator was negative. Productivity expressed as economic value added per employee was logically negative as well. This mostly occurred in enterprises in the institutionalized cluster, which corresponds to a higher average number of employees in the Clutex cluster.

**Table 1: Basic characteristics of the research samples (2014)**

| Indicator  | Klastr Clutex<br>(sample 1) | Natural cluster<br>(sample 2) | Other enterprises<br>(sample 3) |
|--|-----------------------------|-------------------------------|---------------------------------|
| Number of enterprises<br>(sample)                        | 17/18                       | 94/118                        | 361/473                         |
| The proportion of<br>enterprises with negative<br>equity | 0.0556                      | 0.2034                        | 0.2368                          |
| The average number of<br>employees                       | 230.0000                    | 61.7447                       | 39.6731                         |
| Median EVA/Production                                    | -0.0193                     | -0.0051                       | -0.0104                         |
| Average EVA/Production                                   | -0.0053                     | -0.0313                       | -0.0288                         |
| SD EVA/Production  | 0.0501                      | 0.2667                        | 0.2987                          |
| Median EVA/Employee<br>(,000 CZK)                        | -37.7631                    | -17.9155                      | -10.2041                        |
| Average EVA/Employee                                     | -11.4266                    | -72.3611                      | -48.4609                        |
| SD EVA/Employee  | 240.8578                    | 742.5747                      | 471.2407                        |
| Median ROE   | 0.0728                      | 0.0762                        | 0.0947                          |
| Average ROE  | 0.1249                      | 0.0982                        | 0.1138                          |
| SD ROE   | 0.3651                      | 0.0917                        | 0.1594                          |
| Median $r_e$   | 0.1177                      | 0.1561                        | 0.1513                          |
| Average $r_e$  | 0.1350                      | 0.1505                        | 0.1544                          |
| SD $r_e$   | 0.0744                      | 0.1738                        | 0.1811                          |
| Median Spread  | -0.0447                     | -0.0632                       | -0.0503                         |
| Average Spread   | -0.0100                     | -0.0523                       | -0.0406                         |
| SD Spread  | 0.3726                      | 0.1965                        | 0.2413                          |

*Source: authors' calculations in MS Excel*

The differences between the medians of the examined indicators are not statistically significant at the 5% alpha level (see Table 2).

**Tab. 2: Mann-Whitney (Wilcoxon) W-test to Compare Medians (P-Values)**

| Indicator      | Sample 1 - Sample 2 | Sample 1 - Sample 3 | Sample 2 - Sample 3 |
|----------------|---------------------|---------------------|---------------------|
| EVA/Production | W = 793 (0.9868)    | W = 3167 (0.8238)   | W = 16136 (0.5644)  |
| EVA/Employee   | W = 836 (0.7650)    | W = 3545 (0.2796)   | W = 18181 (0.2852)  |
| ROE            | W = 768 (0.8028)    | W = 4132 (0.8331)   | W = 3067 (0.9982)   |
| $r_e$          | W = 896 (0.4251)    | W = 3615 (0.2127)   | W = 18265 (0.2498)  |
| Spread         | W = 761 (0.7588)    | W = 2969 (0.8221)   | W = 17121 (0.8925)  |

*Source: authors' calculations in Statgraphics Centurion*

This means that the research did not confirm the hypothesis that enterprises in an institutionalized cluster reach better results than enterprises in a natural cluster and enterprises outside the cluster. It is also possible to reject the hypothesis that enterprises

in a natural cluster show higher performance than enterprises doing business in other regions. The possible reasons for that are dealt with in the following chapter.

## **4. Discussion**

The results of the research did not confirm the expected positive effect that an enterprise's membership in a cluster would have on their financial performance as stated in most literature sources (e.g. Balog, 2016, Tsakalerou & Katsavounis, 2013). Several reasons for this may exist. It may be a specific matter of a single cluster and industry. The Clutex cluster itself is unique by the fact that it associates medium-sized and large enterprises. There is a higher proportion of small and medium-sized enterprises in the other clusters. It is also necessary to take into consideration that the analysis was only conducted for one year. The results of the research could have been different if the research had examined the trend of enterprise performance in the defined research samples in a longer time series. Although 2014 was the year in which the Czech economy had recovered from the previous recession, there could have been a certain delay in the given industry. It is also possible that the member enterprises' performance was low at the beginning of the cluster's existence, and it gradually improved as a result of the cluster's formation. However, it is a fact that the Clutex cluster has existed for more than 10 years, which is a period that is sufficiently long to prove a positive effect of cluster membership on the involved entities' performance. It is also a fact that one of the largest and most successful textile enterprises in the region (JUTA Dvůr Králové) is not a member of the Clutex cluster. All these questions constitute considerable areas for further research which exceeds the possible scope of this conference's paper.

## **Conclusion**

This article dealt with research into the expected effects of enterprises' membership in a cluster on their financial performance as quantified by economic value added and return on equity. The research was conducted on the Clutex textile cluster, whose business activities are within the territory of the North-East Cohesion Region. This is a region with of textile industry tradition lasting more than a hundred years; despite the decline in traditional textile production in the 1990s, it still has accounts for an above-average concentration of employment in the industry. Therefore, it can be considered to be a natural textile industry cluster. Some of the enterprises in this natural cluster are included in the Clutex cluster that arose based on a cluster initiative and with the support of the Operational Programme Industry and Enterprise.

The results of the research conducted on 2014 data did not confirm the hypothesis that member enterprises of the Clutex cluster reach higher performance compared with enterprises in the natural cluster or enterprises from the same industry outside the natural cluster. The profitability measured with the traditional ROE indicator and economic value added was almost identical in all samples.

In terms of further research, an area for the examination of enterprise performance over a longer period of time is opened; it should begin about two or three years after cluster activities have started and continue up to the present. However, it is possible that the textile industry is specific, and contributions by the cluster existence will not be proved in it. It may result from the fact that one very important enterprise in the industry is not a member of the Clutex cluster. Further research will try to discover the reasons why that enterprise is a non-member in the cluster. It is also desirable to conduct research using the same methodology on clusters in other industries, and examine the possible effects that the industries have on the success of cluster activities.

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## **The Symbiosis of Economics and the Social Doctrine of the Church in Family Business**

### **Abstract**

A specific feature of the educational process at Catholic University is the implementation of the social doctrine of Church into teaching economics and management. It is a reflection of the influence of Christianity on development of economic thought. Family business combines both market operators – businesses and households. The paper explains the symbiosis of economics and the social doctrine of the Church on the example of a family business in tourism in the High Tatras. Tourism is more than any other production industry demanding of human factor quality. We do not mean only an ability to provide demanded goods and services but to feel our job as our mission. To provide customers the gift of heart and religion. Economic effectiveness of this approach can be confirmed by an example of a family business in the area of private accommodation provision without hospitality or catering services. We are sure that application of interdisciplinary approach within the scope of university education by connection of economic theory knowledge, social doctrine of Church and practical experience will bring positive effects in the development of tourism not only in family businesses but will encourage the growth of tourism in this specific destination as well.

### **Key Words**

*economics, social doctrine of the Church, family business, tourism*

**JEL Classification: M14, Z30**

## **Introduction**

Cross-disciplinary approach is nowadays considered to be a norm of university education quality. Economy can be defined as the oldest art but the youngest science. First economic views could be found not only in writings of ancient Greek thinkers but many centuries before, for example in The Old Testament Genesis. Christianity benefits for economic thinking development are much more important than we realize and are willing to admit. Significant reflection of modern Christianity on economic course of events in the 18<sup>th</sup> and 19<sup>th</sup> century is the social doctrine of Church. Its origin is related to Rerum novarum encyclical of pope Lev XIII., which was published in 1891. A specific feature of catholic universities is implementation of knowledge resulting from the Social doctrine of Church into teaching economic and managerial subjects. In this way catholic universities differ from other colleges and at the same time they enhance students' knowledge and form their system of values.

From the historical point of view a family business is the oldest form of companies. In global market environment there are family businesses which were established a couple centuries ago. Slovakia lags behind in traditions related to family businesses activities especially due to historical and economic reasons. Development of family businesses mainly in a form of small licences during the first republic was stopped for several decades due to existence of centrally controlled economic system which excluded private property. After 1989, the change of political and economic system caused that small and medium sized companies were established again and some of them were returned to original owner's families and did their business in the area of trade, services, agriculture, manufacturing, etc. A part of this process is also development of family business in tourism. The paper presents symbiosis of economic knowledge and social doctrine of Church by bringing the example of a particular family business in tourism. It points out to meaningfulness of connecting economy and social doctrine of Church not only in theory but in practice as well.

## **1. Methods of Research**

Based on intersection of economic knowledge and social doctrine of Church the aim of this paper is to offer an alternative view on family business in tourism. Primary heuristic basis results from studies and analysis of secondary sources including relevant economic literature, social doctrine of Church and theory of tourism and family business. Method of description is applied to characterize the intersection of economy focused on family business and anthropometric social doctrine of Church. By deduction and synthesis we connect knowledge concerning family business with emphasis on specifics of tourism. But the key method is empirism which is used to process primary sources obtained and resulting from two years experience of doing business in the area family business in tourism. Significant contribution of the paper is not only to present meaningfulness of economy and social doctrine of Church connection during university studies but also practical reflection of this knowledge from the point of view of family business.

## **2. Research results**

Family business is defined as a business which meets at least one of the following criteria (Frieswick, In Strážovská, 2008):

- the owner considers his business to be a family business,
- he intends to transfer it to one of his close relatives,
- also other family member or members work in the business as its employees and they participate in the managerial process.

Establishment of a family business follows the same legislative and legal conditions as setting up of other business unit. In general there are two forms of family businesses – a sole family business and family trading partnership. Sole family business is a business

of physical entity based on the Trades Licensing Act without any partners. Apart from the business owner also other family members work there. When a family business employ other members of the family the same rules as for employment other people are to be kept. Family trading partnership is established by family members and follow provisions of the Commercial Code which applies to all legal entities (Strážovská, 2008). Family and non-family business compete on the market regardless of their ownership structure and they fight for more and more demanding customers. Companies have to monitor the market all the time and become adapt to changing conditions. Vitality of a family business is to some extent limited by existence of two different worlds – a family and business. These two systems are governed by different logic and values: mutual cooperation at the side of family and competition at the company and business side (Koráb, 2008). It is extremely difficult to separate family emotions from business rational needs. But on the other hand mutual dependence can be seen here. Utilization of family business strengths such as: specific atmosphere and feeling of family membership, higher motivation – since they really work for themselves, effort to build family tradition in a particular business area, providing family members better conditions for self-realization and especially higher flexibility in a family business, means its ability to respond to changes much quicker and a permanent ability to improve quality of production; and since business management is identical to its owners this creates better conditions for making decisions, accepting and executing changes resulting from immediate needs (Strážovská, 2008). The changes in laws, legislation, education, innovations and information and communication technology implemented by the government and their impacts have a direct influence on business management and performance. (Čepelová – Bernatík, 2013)

Also the conception of socially responsible entrepreneurship becomes more important for a family business. This philosophy results from the change of view concerning business activities from accomplishment of higher and higher profits to business activities based on social, environmental and economic pillars. The goal is to achieve sustainable, transparent and responsible company growth. The reason or meaning of this philosophy is in keeping legal requirements and adequate satisfaction of needs of all the concerned groups (Kokavcová, 2012). Vinczeová (2016, s. 145) states that more and more companies integrate social responsibility to their marketing strategies being aware of the fact that also in such a way they can achieve increase of their productivity and financial performance. Social responsibility of companies is carried out first of all by bigger companies and multinational corporations. The above mentioned author also states that the socially responsible behaviour is in positive correlation between invested financial resources and economic effectiveness. In the area of small and medium sized businesses and particularly in family businesses it is possible to **substitute** this process by combination of basic microeconomic knowledge and application of principles of social doctrine of Church.

Social doctrine of Church at the Catholic University has its natural position in teaching managerial and economic subjects. It is its own specific feature by which it differs from other colleges and at the same time enriches human system of values. Nowadays, when we bear consequences of incorrect political and economic decisions and are involved into the globalization process in a positive and negative word, meaning the existence of social

doctrine of Church is perceived much more intensively. There is a person behind each decision of any economic subject and it depends only on him/her to what measure his thinking and acting will be in agreement with principles of social doctrine of Church. The social doctrine of Church results from Jewish-Christian conception concerning origin of man and conception of moral responsibility in relations to universal good – God. We perceive the depth of this conception connected with anthropocentric focus of philosophical perception of society and a man within its frame (Madziak a kol., 2015). Love for the truth, whose witness Christ was due to in his earthly life but above all due to his death and resurrection presents fundamental power of a real growth of each human and all human race. Love – “caritas” – is exceptional power which encourages people to participate bravely and high-mindedly in the area of justice and peace. It is power which has its origin in God, everlasting Love and absolute Truth. Everyone finds his good by acceptance of the plan which God has for him to fulfil entirely: human finds his truth in this plan and by its acceptance he becomes free (Benedikt, 2009). Individual desire for good becomes a human quality which he owns himself and so it becomes his desire in social extent of his responsibility for his own life as well as for the society. Basis, which social doctrine of Church uses are fulfilled in the idea of love and become real in human personal life through his existence and acting. The above mentioned values are key values also for the owners of the family business Vila Anna in the High Tatras.

### **3. Discussion**

Private accommodation at Vila Anna is a part of the family house with three housing units. A married couple Jana and Michal Pitek are the owners of Vila Anna. The owners’ family live in the largest housing unit – 137 m<sup>2</sup>. Other two housing units – apartment 1 (42 m<sup>2</sup>, max 2 persons) and apartment 2 (70 m<sup>2</sup>, max 5 persons) are the subject of family business. Apartments renting is realized based on the trade permission certificate no. 740-31605 which allows provision of “Accommodation services excluding hospitality activities”. Total capacity of apartments is seven persons and their basic equipment includes a completely equipped kitchen bathroom, free wi-fi internet connection and free parking places next to Vila Anna. It is natural to provide bed-clothes, towels and bath towels and toilet articles. It is not allowed to smoke in both apartments and they are not pet-friendly ones. For families which have small children the owners provide a cot and a special chair for feeding children. There are maps and advertising materials in the apartments. All necessary information is provided by the owners of apartments at any time during guests’ stay. Also some additional services are provided, e.g. a possibility to buy a ski-pass and aqua-pass – GoPass directly from the accommodation providers. This process is ensured by B2B selling in cooperation with a key subject of tourism in the High Tatras, Tatry Mountain Resorts, a.s.

Due to the fact that the person responsible for family business has also a full-time job out of the place of living, provision of private accommodation requires cooperation of family members – owners’ parents, husband and two already adult children. This is a typical small family business. Mutual cooperation and participation of family members is not determined by permanent labour relations or other labour relation contracts. The reason

of this family business activities is continuing in traditions of owners' parents, positive relations towards tourism and creation of working opportunities aimed at establishment of business for owners' children. Mutual cooperation and participation of three generations naturally strengthen family relations.

As to price strategy of this family business its purpose is to ensure repayment of a mortgage, which was necessary to build the house. Prices for accommodation services naturally depend on actual relation between demand and supply and on periods – season and off-season ones. Apartments prices are calculated per one night. An average price for the apartment 1 in off-season period (April, May, June, October, November, December – untill Christmas) is 30€/apartment/night. During main seasons the price is 40€/apartment/night and during Christmas and Easter the price is 50€/apartment/night. Apartment 2 average price during off-season period is 50€/apartment/night, during main seasons it is 70€/apartment/night and during Christmas and Easter the price is 90€/apartment/night. Thanks to an internet portal [www.booking.com](http://www.booking.com) it is possible to modify the prices according to demand and supply relations and apartments actual occupancy. Average apartments occupancy in 2015 and 2016 was from 45 % in off-season periods to 90 % during main seasons.

The most remarkable success of this family business are the results of satisfaction provided by the guests based on [booking.com](http://booking.com). internet portal. According to 34 assessments of comparable accommodation facilities in the High Tatras location, private accommodation facility Vila Anna won the first position and its final ranking was 9.9 (Piteková, 2016). Based on the total accommodation assessment we can say that the clients are mostly satisfied with the personnel. Clients really appreciate personal approach and willingness to help and advise. There are a lot of accommodation facilities in Slovakia but not everybody appreciates clients and do them a favour. But such behaviour not only keeps permanent clients but attracts new ones who decide to stay in Vila Anna due to positive and high ranking assessment. The owners are sure that they achieve this assessment not only thanks to basic economic knowledge but to a specific approach to clients as well. And social doctrine of Church is a key theoretical source. Theory of tourism is almost perfectly and carefully formulated in relation to norms of behaviour towards visitors. In an adequate way it complements economic theory which beside other issues deals with economic effectiveness of households and companies in relation to market cycle. In the case of family business there is a more intensive connection between these two basic market subjects. Success in business activities is immediately visible in a level of ability to satisfy basic and additional needs of household members. Social doctrine of Church inspires and in a suitable way complements economic theory and supports economic effectiveness of business. And this is a double truth especially for family businesses in tourism.

We can feel presence of God love in encyclics of Social doctrine of Church. Their main idea and purpose of all effort is a human and his dignity. All economic activities should focus on a human. All of us should act so that we can stand in front of the Lord and so that everyone feels enriched and happier after meeting us. Tourism brings a lot of opportunities for behaving like that. We certainly claim that this is one of the basic

conditions of economic effectiveness of tourist trade establishments. This task is a little bit simpler in smaller family businesses, family members involved in business management try hard to “retain” relations to clients.

Recommendations based on two years experience with running a family business in tourism:

- a. Time and smile – nowadays almost each visitor lives in a pleasant environment -high quality food, possibilities to use time effectively even at home, as well as adequate household equipment – kitchen, TV set, wi-fi, etc. When they change the place of living they expect to get something more during their free time – additional value. The High Tatras offer a lot of opportunities for recreation, they present a key destination of tourism in Slovakia. Since visitors are fed up with consumerism they expect simple “stroke of soul”. They are eager for time of accommodation provider, his smile, willingness, for trivialities which make them smile and due to which the day becomes unforgettable and beautiful. We live in a very fast era and what we remember for a long time are - apart from Christmas, Easter holiday and nice family events - our holiday experiences. In a positive sense of word we are energized by them during the next year. Tourism must at first include passion and heart and only then it comes to making money. Time devoted to clients in a form of helpful and respectful behaviour with a smile is an investment bringing immediate return.
- b. Big trivialities – low costs with a huge added value and finally also with revenues. We provide a few examples:
  - A client sends a text message that he will be late since he got stucked in a traffic jam. It usually happens in summer season when courses take turns. Our immediate reaction to this situation is that we bring two cans of beer to the fridge in an apartment. Its purchase price is 1€, but its helpfulness value for clients after their arrival + smile and welcoming – incalculable.
  - We cook and bake for a six member family. It does not cost anything to put four pieces of still warm fresh cake on the plate or to bring two portions of meal, if it is tasteful. But a client must feel - and we are sure he does - that this is not an act of calculation but an act causing happiness in heart since we can serve somebody, we can make somebody feel happy. Do not be afraid of including emotions to business in tourism. Positive energy is transmitted to customer satisfaction and we can feel it not only in economic effects but at first in subjective feelings of happiness and meaningfulness of our acting.
  - Weekend stays. If clients arrive on Thursday or Friday and leave on Sunday we block a night from Sunday to Monday (if there is not any other reservation) and we offer clients a late check-out, i.e. they can use the apartments till Sunday evening. After skiing or hiking they can take a shower, have lunch or dinner and only then go home. But big accommodation facilities of course cannot afford it. Added value of such a service is doubled. On one hand satisfaction of clients and on the other one the family celebrates Sunday because they do not have to clean apartments then.
  - Helpful approach. We usually see when our clients are coming back from the tour or trip. “By accident” we go out, say hello and ask what their day was, we

recommend next trip or a good place where to have an excellent dinner. Again low cost but high added value, which gradually reflects in economic revenues.

- Price discount directly on the spot. Vila Anna is located close to Šrobar institute, where parents with their sick children arrive for medical controls. There are almost no possibilities to rent an apartment just for one night in this surrounding and if yes, the price is really very high since some accommodation providers are aware of the fact that mother with her children have no other opportunity but to accept what is offered. This situation is an example of logical consequences of microeconomics knowledge in practice – theory of demand elasticity. But if we involve our heart into business and we see that accommodation is needed for a mother with her sick child, we are able to assume her social status and financial situation. No money can show and reflect expression in mother's eyes when we provide one night accommodation for free or at minimum cost.

Especially in this regard the position of family business is very important. Parents own and manage the business, involve their children in different activities and in this way they prepare basis for continuation of doing business in this area. Doing family business supports strengthening of family relations, willingness to help each other and has a substantial educational aspect. For many years we hear about the high quality of services in tourism for example in Austria but at the same time we know that more than 90 % tourist trade establishments are small and medium sized family businesses. If in a family business love is implemented not only among family members but also in relations to guests or visitors, the whole tourism destination is reformed in a positive sense of word. Value of family is the highest and the most meaningful what we can wish. If we are able to transfer this value into the relation between clients and tourist services provider it will definitely help to increase economic effectiveness of family businesses. Based on experience of owners of businesses in the area of tourism we can state that symbiosis of economic knowledge and specifics of social doctrine of Church in management of family tourist trade establishments brings only positive economic consequences. Result of this approach is evaluation by clients equal to 9.9. This is an extraordinary important feedback. No hotel in the High Tatras achieved such evaluation, because although many hotels offer better rooms' equipment, better additional services, invest more financial resources in marketing and in comparison to Villa Anna have better location in relations to Smokovec centre, they do not have a chance to devote so much time to clients as they do in this family business with lower capacity. Even it is not difficult and time consuming to invest in emotional positive experience of a client, it is very demanding for many providers of services in tourism as well as for residents of tourist destinations.

## **Conclusion**

The purpose of our education activities at the Department of Management at the Faculty of Education of the Catholic University is to form minds and hearts. Love for God and fellow feeling are basic attributes not only of Christianity but of social doctrine of Church as well. We educate managers, economists but above all we try to raise good people.

Tourism is more than any other industry demanding human factor quality. We do not mean only an ability to provide demanded goods and services but to feel our job as our mission. To provide customers the gift of heart and religion. Economic effectiveness of this approach can be confirmed by an example of a family business in the area of private accommodation provision without hospitality or catering services. We are sure that application of interdisciplinary approach within the scope of university education by connection of economic theory knowledge and social doctrine of Church and practical experience will bring positive effects in the development of tourism not only in family businesses but will encourage the growth of tourism in this specific destination as well.

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## Spare Parts Inventory Optimization Methods

### Abstract

The contribution is focused on optimization of spare parts inventory in organizations. The goal of the long term research of the authors is to reduce the costs related to keep spare parts in the stock. The literature research explains the concept of inventory management, costs and risks associated with that, inventory management models, differentiation of inventory, determination managing inventory levels and the importance of optimizing spare parts inventory for a company operating in a highly competitive environment. The main chapter describes in detail the concept of spare parts inventory management in the selected company with a focus on established processes, the inventory level, parts availability and costs associated with that. As a result of the pilot survey in organizations the pros and cons of the current spare parts inventory management are summarized, so as the recommendations for optimization with the selected methods. Main ideas for stock management and logistics in general for all spare parts inventories are to detect the failure modes that occur on the products and their periodicity and conflict them with bill of material, conflict them with the lead times of the spare parts, calculate the stock reposition point regarding each part and find the optimal method to set the minimum stock limit and re-order point of spare parts.

### Key Words

*spare part, organisation, maintenance, supply, management system, store*

**JEL Classification: C44, C53**

## Introduction

„Spare parts are the lifeblood of operational reliability and plant capacity.“ (Slater, 2012) Inventory management of spare parts is primarily a requirement for their availability. While the required availability is 95 % for conventional material stocks, spare parts inventory management aims to ensure virtually 100 % availability of critical spare parts (Hladík, 2014).

A special feature of spare parts is their sporadic consumption, which is often combined with a long delivery time and a high purchase price. In some specific cases, spare parts are consumed sporadically but in large batches of hundreds to thousands of pieces, typically spare parts for repairs of larger technological units, e.g. conveyor systems. This type of demand is referred as lumpy demand.

The goal of this contribution is to find a method for inventory management of spare parts and proposing optimization measures lead to a simplified and more precise control of spare parts inventories. Spare parts will be accurately recorded, stored in appropriate locations, duplicate item management will be avoided, records will be kept on all movements to better evaluate stock control phenomena, predict future consumption, and determine the optimal stock of the stocks.

## 1. Literature Review

The relationship between maintenance optimization and spare parts inventory is a topical topic of research in this area, as evidenced, for example, by the study (Cai et al., 2017) or the author (Hladík, 2014) or the book (Legát et al., 2016). In larger organizations, there are tens of thousands of spare parts worth up to billions of CZK, for example (Legát et al., 2016). The article (Arts, 2013) focuses on establishing more accurate cost estimates in this area. The text (Lari, 2002) focuses on quality management systems in this context. This idea, due to imperfect maintenance, is considered, but the text of authors (Morais et al., 2015) is linked to the consequences of accidents (see Adedokun et al., 2014). The study (Peimbert-Garcia et al., 2016) is developing a new maintenance cost model overall. The possibilities for improving the control of spare parts are presented by Slater (2012).

Emphasis is placed on cost savings when balancing between max and min spare parts. Systemically, it is the determination of the spare parts policy of the publication (Cai et al., 2017). The state of aggregation is determined by Arts (2013). The core of disagreements according to the publication (Morais et al., 2015) are human errors in maintenance. The increase in maintenance costs is, according to the study (Adedokun et al., 2014), due to poor quality construction and product manufacturing. Nearly 80 % of the maintenance discrepancies in the study (Morais et al., 2015) account for a significant proportion of human factor errors and a poor relationship to quality control with regard to maintenance. The major disparities include: poor selection of part material, poor repair of the part, breach of part warranty etc. The basic feature of the device is its performance and maintenance has a low return according to the article (Peimbert-Garcia et al., 2016), which does not approve the management of the organization.

One solution is to predict the service life, from which a common model of maintenance and spare parts is created. The failure threshold and the safety criterion in the publication (Cai et al., 2017) are also considered. Supporting decision-making in this area highlights and recommends testing by corrective and preventive measures by the author (Lari, 2002). Emphasizing opportunities from the point of view of maintenance costs is the basis of the proposed model in the article (Peimbert-Garcia et al., 2016).

Methodologically, tools such as: the generic algorithm, the method of Monte Carlo by Cai et al. (2017), the hereditary methods by the author (Arts, 2013), the analysis of the standards requirements by the author Lari, 2002), the detailed analysis of publications of Morais et al. (2015), methodological adherence to planning rules together with staff qualification, resources, testing, stakeholder confidence and budget control and quality improvement measures in the text (Adedokun et al., 2014) and model according to the article (Peimbert-Garcia et al., 2016), methodical consistent compliance with rules and calculation by the author (Slater, 2012), analysis of maintenance relation and condition of spare parts in the organization according to the author Hladík (2014).

## **1.1 Inventory Management Methods Suitable to Spare Parts**

Krever (2005) considered mainly mean and variance of demand during lead time. The author uses two variables of demand as a function of time. Single Demand Approach (SDA) and Periodic Demand Approach (PDA). Croston (1972) proposes an alternative method which separates the estimation of intervals between demands of the amounts demanded in each occurrence. Bootstrapping techniques for intermittent demands (Willemain, Smart and Schwarz (2004) assess the demand distribution during lead-time, considering Rego and Mesquita (2011) through Croston's method, and concluded that the latter is superior when the average interval between demands is greater than 1.25 time periods (time bucket). Syntetos and Boylan (2001) pointed out a bias in the original Croston's model and proposed a correction that gave rise to the SBA (Syntetos-Boylan Approximation) model.

A more accurate approach for intermittent demands was developed by Krever (2005) to compute the mean and variance of demand during the leadtime. In their approach, known as Single Demand Approach (SDA), as opposed to the more traditional Periodic Demand Approach (PDA) with time buckets, three random variables are used: amounts demanded during the lead-time, time intervals between demand occurrences, and the lead-time itself.

Ghobbar and Friend (2003) compared 13 forecasting techniques to aircraft parts demand and proved the superiority of the techniques: weighted moving average, double exponential smoothing, and Croston's method. Similar results were presented by Regattieri et al. (2005). Eaves and Kingsman (2004) evaluated spare parts demand forecasting techniques in the case of British air-force (RAF), including SBA and Croston's method, and demonstrated the superiority of the SBA method to a certain service level.

## **2. Research Methodology**

Another important feature is the great diversity of characters for spare parts control. The four main characteristics of the spare parts management defined: the value of spare parts, specificity of spare parts, the demand, criticality of spare parts.

The criticality of spare parts, sometimes the risk of spare parts, is a criterion that characterizes the impact of the spare parts deficit on the operation of the enterprise. The cost of missing critical piece may well exceed the cost of storing this piece. For this reason, common control tools, such as ABC analyzes, can be insufficient to control spare parts inventories. In practice, there are a considerable number of criteria for assessing the criticality of the spare parts.

Two approaches can be used to evaluate criticality. Expert assessments where operational specialists (usually maintenance staff, or production departments or Supply Chain Management (SCMs)) will evaluate the criticality of the spare parts based on their experience. It is important to note that this assessment should be done by some methodology, not intuitively, which often leads to a significant frontloading trend. Quantitative calculation when the spare parts criticality is evaluated from the data available in the enterprise information system. According to Legát et al. (2016), it is advisable to combine both of these ways. A key role for determining the optimum level of spare parts stocks is the determination of the insurance stock.

The following methods for spare parts inventory optimization have been tested:

## **2.1 The method of determining demand at the level of 50 % of demand during the acquisition period (M1)**

It is a simple determination of insurance stock of 50 % of average consumption (demand) for an average period of uncertainty (see equation 1). The method is relatively inaccurate, it does not take into account demand and supply variability. As Graham further points out, security reliability requirements may be changed for critical parts by increasing the insurance stock ratio, for example by 20 %.

$$x_p = 0.5 \bar{p} \bar{t}_p \quad (1)$$

where  $x_p$  is safety stock,  $\bar{p}$  average consumption per time unit,  $\bar{t}_p$  average lead time of the spare part.

## **2.2 Method based on fuse coefficient (M2)**

The essence of this method is to determine the safety stock based on the fuse factor. The security coefficient is usually used on the basis of a specific score range of criteria for determining the safety stock. The result is calculated from the relationship (2):

$$Z_p = M_{pl} \times k_j \quad (2)$$

where  $M_{pl}$  is average annual consumption,  $k_j$  is coefficient of insurance and  $Z_p$  amount of the supply.

The advantage of this method is that it is very simple and does not require special mathematical or statistical knowledge or software. The disadvantage is that it is not possible to cover the whole range of factors influencing inventory management by one universal scoring scale and it is necessary to have different variants of the scoring scale or protection coefficients for specific cases. Considering that this method relies in part on a subjective evaluation of the criteria and that the protection coefficient may not accurately capture short-term deviations in the supply chain, it is more likely to be recommended for less important category items.

### **2.3 The method of determining the insurance stock by means of a standard deviation of the size of the need and the length of the acquisition period and the average size of the need (M3)**

This is a simple, approximate method because the standard deviations of demand are added together, in practice they can be partly represented by 3. equation. Additionally, the possible fluctuations in supply are not taken into account. For this reason, this method is more suitable for category B and C items.

$$x_p = K(\sigma_p + \bar{p}\sigma_m) \quad (3)$$

where  $x_p$  is safety stock,  $\bar{p}$  average consumption per time unit,  $K$  is safety factor,  $\sigma_p$  standard deviation of consumption and demand and  $\sigma_m$  standard deviation of uncertainty interval.

### **2.4 Method of determination of the insurance stock by means of a standard deviation of the size of the need and the length of the purchase period and the average size of the need and the delivery period (M4)**

This method addresses the shortcomings of the previous method, considering the combined effect of volatility in demand and the length of the uncertainty interval, see equation (4). At the same time, part of the safety stock to cover fluctuations in supplies represents the safety stock to cover fluctuations in demand. This is a fairly complex method, which is suitable for a higher computational effort to apply to Category A items and critical inventory items.

$$x_p = K\sqrt{\bar{t}_n\sigma_p^2 + \bar{p}^2\sigma_{tn}^2} \quad (4)$$

## 2.5 Method of determining the insurance stock by means of a standard deviation of the size of the need during the purchase period; simplified calculation for random demand (M5)

This method is suitable for items with non-stationary demand, which may be a typical spare parts case. It uses exponential alignment with  $\gamma$  (see equation 5) for the time series. Equalizing constant  $\gamma$  can generally take values in the interval  $<0.1>$ , the higher the value of the constant, the more behaving demand more non-stationary. For example, the optimum value of the constant is determined by the average square error criterion MSE.

$$x_p = K\sigma_p \sqrt{t_n} \sqrt{1 + \gamma(t_n - 1) + \gamma^2 \frac{t_n + (t_n + 1)(2t_n + 1)}{6}} \quad (5)$$

## 3. Results of the Research

Segmentation of inventories allows a differentiated approach to their management and cost-effective use of enterprise resources. Depending on the inventory classification, the models of their control, the frequency of checking the accuracy of the basic parameters for their level control and the prediction of consumption are selected. These parameters include, for example, delivery time, batch, step price, nature of consumption (frequency and quantity), part time of use, warranty period.

**Tab. 1: Basic variables – consumption of the selected spare part**

| Manufacturing Plant |  | Plant 1 | Plant 2 | Sum    |
|---------------------|--|---------|---------|--------|
|                     | Variable                                   | unit    | Pieces  | Pieces |
|                     | Safety factor                              | N/A     | 2.326   | 2.326  |
|                     | Average month consumption                  | pcs     | 0.083   | 0.583  |
|                     | Standard deviation of consumption          | pcs     | 0.282   | 0.717  |
|                     | Average uncertainty interval               | month   | 0.450   | 0.481  |
|                     | Standard deviation of uncertainty interval | month   | 0.443   | 0.357  |
|                     | Average uncertainty interval               | pcs     | 0.449   | 1.255  |
|                     | Safety Stock rounded                       | pcs     | 1       | 2      |

*Source: authors' own calculations*

To verify the different methods of determining the insurance stock, 5 representative methods were chosen, which were tested on selected stock item with specific criticality and consumption characteristics (see Tab. 1). As best suited to the high stability of supply and the complexity of the calculation, the M4 method, which determines the insurance stock by means of a standard deviation of the size of the need and the length of the purchase period and the average size of the need and the delivery time (optimal criterion), was assessed. As a result of this research, it was found that, in the case of centralization, data clearing and the correct setting of insurance stocks, a significant reduction in spare parts stocks and related costs could be achieved.

The M4 and M5 methods were determined as the most appropriate method for determining of safety stock (see Tab. 2). The time course of the spare parts stockpiles

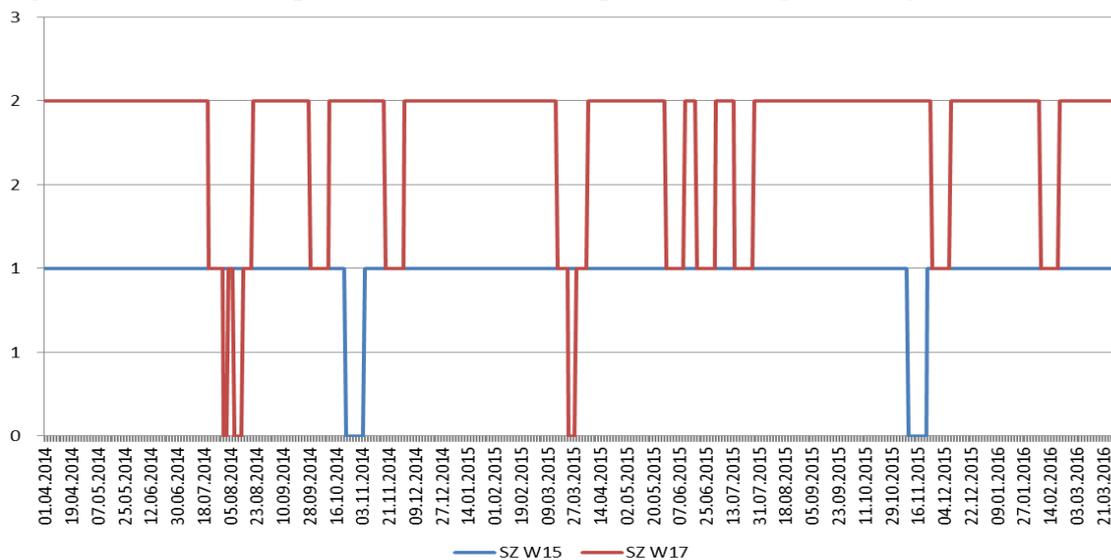
by the M4 method for the 24-month decentralized inventory management is shown in Figure 1.

**Tab. 2: - Comparison of safety stock for selected spare part with methods M1-M5**

| Manufacturing Plant | Plant 1      | Plant 2      |
|---------------------|--------------|--------------|
| Method              | Safety stock | Safety stock |
| M1                  | 1.0          | 1.0          |
| M2                  | 1.0          | 1.0          |
| M3                  | 1.0          | 2.0          |
| M4                  | 1.0          | 2.0          |
| M5                  | 1.0          | 2.0          |

Source: authors' own calculations

**Fig. 1: Time consumption of the selected part - setting of safety stock with M4**



Source: authors' own calculations

## 4. Discussion

As authors such as Cai et al. (2017) point out that their stock model differs in the different life stages of working with spare parts, that is, initial and continuous. Therefore, a coupling model is required. The lack of ability to support decision-making on technical systems in organizations is highlighted by quality management systems such as the text (Lari, 2002). A question about the study (Adedokun et al., 2014) is how to comply with the rules of spare parts management in the real-world environment over the long term? By increasing the quality of the parts and the maintenance carried out, there is a need to further minimize the number of major accidents with regard to the publication (Morais et al., 2015). According to publications such as Slater (2012), common disagreements are repeated in organizations - unknown inventory items, unknown causes of increase in storage items, unknown status of items, problems with inventory records, and security. The author (Hladík, 2014) mentions the problem of the lack of direct responsibility of maintenance staff for purchasing and the difficult identification of warehouse

components in organizations. This is done through the existence of sophisticated inventory optimization methods and the use of the appropriate SW. From a methodological point of view, it should be noted that the generally analytical approach in determining the size of the safety stock is problematic (consumption is usually non-stationary). For this reason, the safety stock of such items is usually determined by simulation.

It is therefore necessary to realize that quality constructions and technologies in the pre-production stage also have a basis for spare parts. Although management systems are perceived as enterprise-wide, their linkages to maintenance work seem more demanding. Theoretical studies are applied to more sophisticated mathematical solutions. Business practice, however, as evidenced by the above research, requires rather simple and quick solutions. The human factor appears to be the key to a successful solution. Due to the high cost of sensors for diagnostics of the equipment, the combination of maintenance after the breakdown and preventive maintenance will be considered first. This is the most common approach to maintenance of equipment in domestic organizations today.

## **Conclusion**

Due to the specificity of this type of inventory, classical inventory management models can not always be applied to spare parts. The research potential lies in the lack of professional domestic and foreign literature in this field. In practice, there is a lack of inventory management in most of the enterprise, although there is a huge potential to save acquisition, storage and other costs. This can be achieved by setting up an efficient ordering method, setting the minimum levels, and spare stock safety with the help of a model.

Organizations should not buy inexpensive parts without relevant certificates, which also helps to increase the level of spare parts safety. Keep track of inventory items and identify them. Organically ensure reliable and accurate receipt and dispensing of spare parts from the warehouse. The warehouse should be managed by the maintenance department. Taking care of the spare parts criticality rating, for example, according to the book (Legát et al., 2016) concerning the price of the spare parts, the delivery time of the spare parts can be significantly changed due to the changes in the substantial organization environment, the life of the spare parts (due to its failure rate). As well as on the internal management of the spare parts in the organization and the cost of downtime in the organization (due to unavailability of SP from failure or failure to deliver). Future research of the authors will be focused on spare parts segmentation methodology and creating automated planning tool for determining reserve and order levels and cost-optimal order quantities.

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## Mobile vs. Desktop Targeting of Multimedia Advertisements on Facebook

### Abstract

Multimedia advertisements on social networks become the inseparable part of digital content consumption. They represent a significant source of revenue for marketers and the service providers themselves. Multimedia ads provide multiple possibilities for content customization a moreover for choosing the characteristic of the target group. The targeting characteristics include for example geographical location, age, sex, interest, type of operation system and type of device. The last mentioned has come to the fore in the last few years due to the increased number of smartphones and other mobile devices. Selecting mobile or desktop targeting of multimedia ads represents nowadays a very discussed topic. Marketers argue whether the desktop advertisement is still effective enough or whether they represent a throwback considering the growing number of mobile users. In the following paper, we are going to test the effectiveness of mobile vs. desktop multimedia ads on the social network Facebook which at the moment has the biggest mobile advertising platform. The sets of video advertisements will be tested on the specific group of users belonging to the millennial generation that is the most represented among the mobile users. For the testing purposes, we chose a target group future applicants for college while at the same time assigning as a product the offer of tertiary education. The performance of individual advertisements will be assessed based on the metrics from Facebook ads manager and from Google analytics. All leads originating from individual campaigns will be further tracked using UTM based (Urchin Tracking Module) description links.

### Key Words

*Facebook advertising, multimedia ads, desktop and mobile targeting, new media, Facebook canvas, advertising effectiveness*

**JEL Classification: M37, M31**

## Introduction

The fast development of the new media transformed the Internet into a new environment that is currently being referred to as "participatory culture" where the customer not only contributes to the creation of digital content but also sets the tone and manner of communication. This newly created "cooperation" manifests itself the strongest with the millennials and generation Z who grew up surrounded by interactive digital media and understand the value of the digital distribution. Along with the evolving content the ways new media is created and consumed today change as well. Due to this emerging trend, mobile video consumption has grown significantly. Report created by Animoto states that

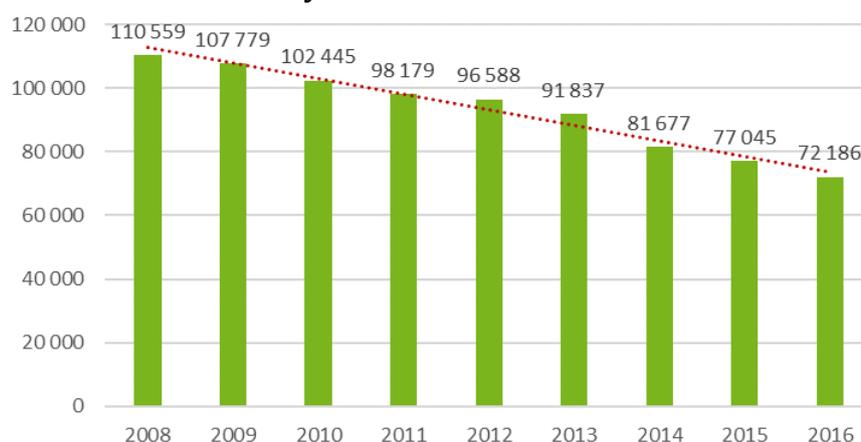
48% of millennials view videos exclusively using their mobile devices (Wang et al., 2016). This shift toward mobile distribution is also supported by the increasing importance of mobile advertising which is slowly becoming a mainstream channel for digital advertising in general. For example, revenues from mobile advertising represented 84% of Facebook’s advertising revenues and 81% of total revenue in the 2 quarter of 2016. Mobile advertisements contributed to the 90% of Facebook’s revenue growth since 2012 when the company built its mobile advertising platform while desktop ads remain flat. However, despite the stagnation desktop ads represents a very important source of revenue for Facebook and for those who use them as a marketing tool. Lately, there has been a debate whether desktop ads on Facebook may be still considered as an efficient tool regarding the entrance of the millennial generation on the market as customers able to purchase offered products. Leading blogs and online marketers present contradictory conclusions (Socialbakers, 2017).

In the following paper, we are going to test the efficiency of desktop and mobile targeting of Facebook ads in the context of the millennial and Z generation. In order to stay within the predefined borders of the target group and at the same time to exclude the variable *purchasing power* (which may not be applicable for the generation Z yet), we tested the different ad sets on potential university applicants assigning as the product the offer of tertiary education in the Czech republic.

## 1. Description of the market with tertiary education

There are currently 68 universities in the Czech Republic, of which 26 are public, 2 are state and 40 are private (MŠMT, 2017). In general, the market with tertiary education is a highly competitive environment in terms of the number of potential applicants. At the moment, the number of students the colleges are willing to enroll is approaching the number of secondary education graduates. The average acceptance rate in college in the Czech republic is 67.75% and keeps growing (AMOS, 2016).

**Fig. 1: Evolution of secondary education absolvents between 2008 nad 2016**



Source: authors’ own representation, data from (NÚV, 2017)

In 2016, 72 186 students completed their secondary education. Moreover, the number of secondary school graduates has a decreasing trend. For example, in 2015, only 77 045 students completed their secondary education and in 2014 it was 4000 more (81 677). The development of the number of secondary school graduates in the period from 2008 to 2016 is displayed in the figure above.

In the previous three years, many Czech colleges started to implement online marketing campaigns consisting mainly in the creation of commercial video clips that were subsequently distributed online via social networks and Youtube. Universities often prepare these videos themselves with a minor professional help, using mostly their students as actors and production team members. In many cases, these videos also reflect the low budget that universities have for individual videos. For example, Brno University of Technology has a limit 200,000 CZK per video campaign. Mendel University in Brno, whose video Do you want to live it? is part of a campaign named Study your way, invested in its online campaign hundred thousand crowns. According to the spokesman, Jan Turčíněk, the budget did not exceed 400 000 CZK. (Mocková, 2016)

In the case of colleges/universities, it does not apply that bad publicity is still publicity. Bad advertising in the case of a university is simply bad advertising. College, or any other school is an educational institution and has an important social role, and thus there are different demands on the communication promoting educational products and services. Humor and response on social networks should not be the only goal for college campaigns. Poor quality video spot can even discourage applicants from pursuing their future studies at the institution. The biggest mistake is that there is a lack of communication about why the school actually does the video and what the video tells about the institution. In addition, video clips often present unrelated content and are overly long.

## **2. Target group**

In the last decade, cell phones have been the most frequent type of information technology in Czech households. Thanks to the advanced functionalities, the number of Internet users have been growing simultaneously with the number of smartphones. In addition, laptops are gaining more popularity too. According to the latest available data published by the CZSO (Czech Statistical Office), there are 206 mobile phones per 100 households. Mobile phones are used by 98% of individuals over the age of 16. Last year (2016) more than 3.1 million Czech households (73% of the total) were equipped with a personal computer which represents a 25% increase since 2010. In the recent years, the type of device in use has changed. Until 2013, classical desktops dominated in Czech households. Last year, portable computers become more popular representing 75% of all households possessing a computer.

In 2016, three-quarters of individuals (6.6 million people) older than 16 years used the Internet. Interestingly, the number of Internet users exceeds the number of computer users. This is mainly due to the booming of smartphones and other portable devices that are more often used to access the internet. It can be assumed that the Internet categories

in combination with mobile devices will soon become a widespread technology used across all age and education categories. Individuals of 16-24 years of age are predominant among mobile internet users (CZSO, 2016).

Adapting online activities to mobile users becomes increasingly important. StatCounter's statistics show that 51.3% of users browse the internet from table or mobile phone while 48.7% of users remain faithful to desktop computers. *"It should be a wake-up call especially for small businesses, tradesmen, and professionals to make sure their websites are mobile compatible. Many older websites are not,"* commented Aodhan Cullen, Managing Director of StatCounter. Michal Buzek, head of the analytical department of Seznam.cz, is more cautious in interpreting the results of the analysis, although he does not doubt that there is a strong mobile-centered trend. *"StatCounter declares that it measures 2.5 million websites around the world in different countries, but when we look at its numbers for individual countries, it does not feel so trustworthy for me, ..."* he says and compares the numbers with the results from the NetMonitor project which performs audited measurements for the Czech Republic. *"StatCounter has a sample of thirty million users for the Czech Republic and NetMonitor about eight billion. When I look at the comparison of the two statistics, the shares of these different devices are different."* Buzek explains. StatCounter statistics for the Czech Republic indicate that mobile phones and tablets are used to access the Internet by 12.64% of the population while desktop computers are used in 87.36% of cases. *"According to NetMonitor, the statistics for mobile devices are a little bit more optimistic. Mobile devices represent approximately 28 – 29 % of mobile accesses from which mobile phones make 22% and tablets about 5%"* he adds. (Brousil, 2016)

### **3. Formulation of the hypothesis**

Although mobile advertisements constitute the main source of revenues, the experts agree that this doesn't mean you should completely cut desktop advertising out of the equation. However, when creating Facebook advertising campaigns, the experts recommend thinking mobile first. According to a study comparing desktop vs mobile results collected during the last quarter of 2015 presented by Socialbakers, the most prestigious blog on social media, the mobile advertisement spent was significantly higher than desktop. The skewness toward mobile, however, does not necessarily mean that the performance was also better. Socialbakers state that in this particular case mobile advertisements had a higher click-through rate and a lower cost per click (CPC) than desktop, which implies the following hypotheses.

#### **Hypotheses 1: Mobile advertisements have better click-through rate than desktop.**

Studies comparing the advantages and disadvantage of mobile vs. desktop advertising focus also on the ability of the chosen type of advertisement for the achievement of marketing goals. Many of these suggest that desktop advertising is better suited for longer or rich content such as videos, HTML5, flash, etc. Desktop ads are also more relevant for generating leads that require filling out the forms on the landing page and for more

complex tasks. Some results also point out that desktop ads might help the marketer get the user's undivided attention. On the other hand, mobile advertising seems to be more efficient for companies that wish to engage with their audience, use landing pages and microsites and who want share call-to-action messages. Marketers should pay attention that their landing pages are responsive and that their campaign images are optimized for mobile displays. Based on these statements we formulate another hypothesis to test.

**Hypotheses 2: Desktop ads are more suitable for complex tasks whereas mobile advertisements for immediate action.**

## **4. Testing the efficiency of video advertisements**

### **4.1 Preparation of video spots**

For the purposes of our testing, we created 4 advertising spots of about 30 seconds in duration. The Sony Alpha IIs digital camera was selected to record source videos that were subsequently post produced. Canon Lens EF 16-35mm 1:28 L II USM was chosen as the main lens for shooting. A reduction ring was used to reduce the differences between the Canon lens and the Sony camera lens. The shooting took place in Full HD (1920 x 1080) with 60 frames per second (Frame Per Seconds). The 3-axis DJI Ronin Camera Stabilizer has been selected for seamless operation and fast-paced shooting. Thanks to its own sensors, this device can stabilize the camera in the Ronin bracket by balancing the external pulses of the electric motors. It was necessary to record only 3 seconds of the resulting image, which was subsequently adjusted in various editing environments to the final length of the commercial spot. The source video was shot in the AVCHD format.

The AVCHD format was developed for high-definition digital video cameras when recording an HD (high definition) signal using high-efficiency compression coding technology. The MPEG-4 AVC / H.264 format was used to compress video data, and the Dolby Digital or Linear PCM system is used for the compression of audio data. The MPEG-4 AVC / H.264 format is capable of compressing images at higher efficiency than conventional image compression formats. (SonyAlpha, 2017)

The post production of the video spots was divided into two main stages: video postproduction and sound postproduction. During the first stage, the video material was cut and undergone a color correction. The main idea behind the commercial spots was to slow down the original shots to get an interesting visual effect of camera movement and a smooth slow motion of the decorative flying elements in the video. With the SLOW-MOTION effect, the Twixtor plug-in was used, which thanks to its high-quality image interleaving for slow-motion images can maintain excellent picture quality even when the original shots are significantly slowed down. These editions were done in the Adobe Premiere Pro video editor where all the spots have been finalized.

In terms of audio track, the commercial spots were supplemented with a background music and a voiceover. All soundtracks were edited using the Ableton and Cubase software. The spoken word sequence was recorded at a sampling rate of 48 kHz at a 24-bit depth. As an audio interface, a MOTU UltraLite sound card with SPD / IF input was used. The recording microphone was a large membrane condenser microphone JZ47. The microphone signal was amplified by the BAE 1073MP preamp, and the analog signal was converted to digital using the LUCID 88192 AD converter and the SPD / IF output was sent to the MOTU audio diffuser input. The original monologs of the actors were used in one of the clips. The monologs had to undergo further editing consisting in the elimination of the noise and dynamic equalization through plugins from the companies Waves and Universal Audio.

The commercial spots also featured animated outro rendered vector graphic elements. These vector elements were drawn and edited in the Adobe Illustrator vector editor and then imported into the After Effects animation software from Adobe. In the created sequence, the imported elements were animated and colorized, the transparency of some of them was changed and some of the parts of the resulting composition were masked. The animated composition was then connected via the virtual link to Premiere in the top video layer. In the last step, final brightness and color correction was done and the video spot was exported to the desired formats MP4 and MOV.

## **4.2 Different ad sets for mobile and for desktop**

In order to measure the performance of mobile vs desktop advertisements, we set up for each video spot 2 ad sets: one targeting mobile users and one targeting desktop audience (8 ad sets in total). For all ad sets the target audience remained the same (except the type of device of course). We choose an age span corresponding to the millennials generation and at the same including potential applicants for college (19-23 years of age). We also added same regional restrictions receiving thus a target group of 180 000 Facebook users. The campaigns were running for a three weeks period.

Desktop ad sets were redirected on an official university website containing important information specifically selected for potential applicants. On the other hand, we decided to use a special landing page for mobile ads. In order to avoid any responsivity issues, the Facebook canvas format was selected. Facebook canvas is a new advertising format that the social network is currently testing. Canvas is a very interactive and rich type of advertising that combines pictures, videos, texts, and links, it is full-screen, optimized for mobile devices and can be paired with a selected ad set. Canvas allows creating even more engaging and more creative content that captivates the users at first glance. The main advantage is the fast loading of the canvas page, which is up to 10 times faster than on a regular mobile site, on both platforms, Android and iOS. Canvas page may be created via Canvas Editor which is to be found in the Publishing Tools on the facebook page. Once created, Canvas Editor will generate a specific URL that is subsequently used to create the ads and measure web clicks and web conversions.

Canvas is very easy to use for the mobile users by clicking, rotating and swiping with their fingers. In addition, they do not have to leave Facebook at all. Canvas helps marketers to provided to the customers highlighted information about the products they are trying to sell. To summarize, canvas represents a specific Facebook landing page that can be added to any advertising format. Canvas allows setting different targeting options, such as the type of device or the operating system. Canvas-based ads are no more expensive than standard Facebook ads. Another advantage of the Facebook canvas is that it is highly customizable and can be customized in many ways. Different components such as captions, photos, call-to-action buttons, carousel format, text, video and more may be added on the page. The selected components may also be edited and arranged in any way. For our testing, we created four canvas format landing pages, each containing different video spot. Except for this distinction, all the landing pages contained the same information, had exactly the same layout, and a call-for-action button "apply" and an external link to the official university website.

All leads originating from individual campaigns were tracked using UTM based (Urchin Tracking Module) description links. The traffic was then further analyzed in Google Analytics in terms of visit duration and number of clicks recorded for the "apply to study" link.

## 5. Results

In order to analyze the efficiency of Facebook advertisements on different devices (mobile vs. desktop) we compared the results first for the pairs of ad sestis (same video, different device) and then across all eight commercials. In the following table, we summarize the final advertising results retrieved from Facebook Ads Manager and from Google Analytics based on UTM links.

**Tab. 1: Final results from desktop and mobile campaigns**

| Name of the campaign  | FB reach        | Number of clicks | Click rate  | Call-to-action button / link | Campaign effectiveness (call-to-action/number of click) |
|-----------------------|-----------------|------------------|-------------|------------------------------|---|
| MI_vojta_canvas       | 17032           | 68               | 0.4         | 12                           | 17.65   |
| MI_honza_canvas       | 17410           | 206              | 1.18        | 32                           | 15.53   |
| MI_misa_canvas        | 20621           | 249              | 1.21        | 20                           | 8.03  |
| MI_rozhovory_canvas   | 15720           | 84               | 0.53        | 15                           | 17.86   |
| <b>Average canvas</b> | <b>17695.75</b> | <b>151.75</b>    | <b>0.83</b> | <b>19.75</b>                 | <b>14.77</b>  |
| MI_vojta_desktop      | 16598           | 21               | 0.13        | 8                            | 38.09   |
| MI_honza_desktop      | 11769           | 67               | 0.57        | 21                           | 31.34   |
| MI_misa_desktop       | 7956            | 56               | 0.7         | 18                           | 32.14   |
| MI_rozhovory_desktop  | 6009            | 43               | 0.72        | 7                            | 16.28   |
| <b>Average</b>        | <b>10583</b>    | <b>46.75</b>     | <b>0.53</b> | <b>13.5</b>                  | <b>29.46</b>  |

*Source: Facebook ads manager, Google Analytics for www.budking.cz*

If we look more closely at the advertising results within each of the pairs we may see those canvas ads had a bigger reach and a higher number of clicks. The average values were

significantly different (average reach for canvas 17695.75 and for desktop 10583) which was even more striking for the number of clicks – 151.75 for canvas and 46.75 for the desktop. However, when taking into consideration the click rate, the span is narrower 0.83 for canvas and 0.53 for the desktop. These three metrics represent the level to which the ads managed to penetrate the chosen target group. Obtained results thus proved the first hypotheses that **mobile advertisements have indeed a better click-through rate than the desktop ones.**

The performance of individual ads may be measured by the number of conversions which are in this case represented by the number of click on the call-to-action button and call-to-action link. Both of these values (button and link) were retrieved from Google Analytics based on the UTM links. Obviously, the number of conversions originating from canvas ads were higher which is not surprising considering the wide reach these advertisements had. However, the average effectiveness values suggest an opposite trend. Desktop adds performed much better in terms of triggered action which was in this case represented by clicking on the apply link/button (14.77 for canvas and 29.46 for desktop).

If we take into consideration that applying for college represents an important decision rather than a spontaneous reaction and that filling out the application form requires a lot of personal data we may assume that users still prefer desktop computers for such tasks. This assumption is also supported by the campaign results that shows better effectiveness for desktop ads and thus confirm the original hypotheses H2 that **desktop ads are more suitable for complex tasks whereas mobile advertisements for immediate action.**

## Conclusion

Research results presented in this paper confirmed the general shift of multimedia consumption toward mobile devices. Mobile Facebook video ads performed better in terms of audience reach and click-through rate. Higher audience reach validates the assumption that most of the millennial generation uses mobile devices. On the other hand, mobile ads showed lower effectiveness than desktop targeted video spots. Desktop ads generated more clicks on the call-to-action features which were in this case represented by an *apply to study* button and *apply to study* link. Since the application for college does not represent a spontaneous action, the preference of desktop computers to proceed with such a step may be accounted to the easier operability of desktop computers when it comes to more complex tasks such as filling out various forms or browsing for detailed information. Despite the higher frequency of use of mobile devices as means to consume Internet content, our advertising results suggest that desktop still remains a very important source of marketing conversions even for the millennial generation, especially when the offered product is not a matter of an impulsive buy.

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## The Strategic Human Resources Management in SME Sector

### Abstract

Strategic approach to human resources management enables a consistent use of modern tools for managing human resources in an enterprise. This allows enterprises to achieve close integration of the different systems of human resources management and increase their effectiveness. Effective activity in the strategic dimension requires involvement of all entities operating in the area of the personal function, i.e. managerial staff at all levels, employees, trade unions or personal counselling companies. The aim of this paper is to identify the strategic dimension of human resources management of SME as presented in literature on the subject. Further part presents findings of empirical studies, which enabled verification of the hypotheses and formulation of conclusions. The findings presented in this paper were obtained during the implementation of the project entitled "Tendencies and challenges in strategic managing SME in Silesian Voivodeship". The aim of the studies was to diagnose the state of strategic management and human resources management taking into account its impact on the functioning of small and medium enterprises operating in Silesian Voivodeship and to indicate improvement areas of the model under diagnosis. One of the specific objectives of the studies was to diagnose the state of the process of strategic management of human resources and to identify fundamental problems. In this area, the main hypothesis was formulated: The enterprises analysed do not have comprehensive strategies for management of human resources.

### Key Words

*strategy, human resources management, SME sector,*

**JEL Classification: M12, M19, M50**

## Introduction

Management through strategies is a philosophy of an organisation. Strategic activities are nothing else than implementation of strategic plans and the concepts contained in them. In other words, a strategy is a statement of a number of activities of an enterprise aimed at developing or maintaining competitive advantage. A strategy of human resources management as one of functional strategies has to harmonize with the strategy of an organisation. Like other functional strategies, personnel strategies are also located in a specified hierarchy of objectives, missions and strategies of an organisation. Thus,

personnel strategies have to be reflected in specific plans and personnel decisions, as they fulfil a fundamental role in an organisation's attempts to achieve specific objectives, and thus success (Listwan, 2003).

Management of human resources based on a strategy of an organisation is connected with identification and elimination of problems existing in an organisation and its environment, actions based on decisions that have a significant impact on the concept of employment and development of staff and mutual personal relations. Actions based on specific strategies force the use of appropriate management systems. Sometimes, it will be pressure on inventiveness, invention, at other times on experience or routine.

The aim of this paper is to identify the strategic dimension of human resources management of SME as presented in literature on the subject.

## **1. Literature overview**

A strategy of human resources management is an aspect that addresses how an enterprise will implement its objectives through people, strategic measures and integrated rules for the operation. It is based on three postulates (Armstrong, 2010):

1. human resources fulfil a strategic role in ensuring success to an organisation and are one of the main sources of its competitive advantage.
2. human resources strategies should be consistent with the economic plans of organisations,
3. individual human resources strategies should be consistent with each other so that they strengthen each other.

A human resources management is not only strategic planning, but above all the implementation of tasks which are in line with an organisation's strategy as well as all strategic decisions and actions of HR specialists in cooperation with other managers of an organisation (Guest, 1997) Any decisions have a long-term impact on an organisation's actions and its future success. For strategic management of human resources to be effective, a few basic principles should be taken into account (Armstrong, 2010): human resources are of significant importance for the implementation of the existing general objective, human resources are taken into account in the process of developing a strategy of an organisation, the existing effective and constant relationships ensure the inclusion of activities connected with human resources in the decision making process, at all levels of an organisation, concepts initiated in the area of human resources are connected with the needs of an organisation; human resources management is responsible for decisions and actions based on which an organisation undertakes economic activities.

Small and medium enterprises are not miniatures of big organizations (Smolarek 2008, p.58.). These entities are governed by other action rules and they focus on other values responding to external stimuli in a different way. In the case of many SMEs, making use of new possibilities is the only strategy of the owner (Skibiński and Sipa, 2015, p. 431). The

work process is usually determined by personal relationships and connections of company owners (Lemańska-Majdzik, 2013, p.55). Knowledge and skills of the human resources department staff are strengthening the personnel involvement, what in a large extent contributes to the organization effectiveness (Nowicki, 2010). The research shows that HR staff skills and competences strengthen the human resources management process and they can constitute the element of the company strategic decisions (Sheehan, De Cieri, Cooper, Brooks, 2016, pp.161-181).

A strategy-based management of human resources in SME is a conscious choice of prospective objectives and rules for operation in the area of human resources. It reflects an organisation's plans as to how people should be managed. Consistent and integrated decisions, a clearly defined set of expected skills of human resources and a defined model for their management are necessary for an organisation to achieve an expected competitive advantage (Lipka, 2000).

According to A. Poczowski (2008), a human resources management strategy is a consistent system of actions that involve setting long-term objectives, formulating principles, plans and programmes focused on the creation and use of human capital of an organisation, guaranteeing it the achievement and maintenance of competitive advantage. The task of the human resources department is to make sure that people are committed, effective and constructive. It has to recognise relationships between employees and the employer, find out what motivates or demotivates employees and thus impact the success of the whole organisation (Reilly and Williams, 2009).

The implementation of a human resources strategy comprises four stages (Lipka, 2000):

1. Strategic assessment of human resources.
2. Formulation of a human resources strategy based on an organisation's strategy.
3. Definition of sub-strategies for human resources, implementation of changes in the area of human resources and their control.

In order to fulfil their role, human resources strategies should cover strategic actions of all the functions in the area of human resources management, such as: employment planning, recruitment, selection, interpersonal communication, motivation and assessment, organisational culture and labour costs. Based on the individual functions of human resources, the so-called sub-strategies are created, which have to be consistent with each other and in line with the strategy of an organisation (Lipka, 2000).

While developing a human resources strategy, one should not forget about ethical issues in the context of those involved in the matters of an organisation, i.e. employees, owners, managerial staff and local community. In the process of human resources management, of importance is the aspect of human relations, security issues, interpersonal communication, involvement and maintenance of balance between work and private life. While developing strategies, the human factor should be taken into account. Strategies should not ignore people's aspirations and needs. People whose needs have been satisfied are more motivated to work more effectively and work safer (Armstrong, 2010).

Considering the specificity of strategic human resources management in small and medium enterprises, the number of employees as well as resources, which a company can allocate to the implementation of the human resources policy, should be taken into account. Small and medium enterprises employ relatively small number of employees, what causes that the employed staff must perform many tasks, which in big companies are generally implemented by hired specialists (Dzieńdziora, 2010, p. 35).

Owners and management of small and medium enterprises are usually involved in direct executive activities what causes that they do not have enough time and even competences for effective company management. The development of leadership in small and medium enterprises requires connections with many instruments of human resources management. Then it affects the quality of personnel management, internal relations, work satisfaction and in consequence the staff fluctuation (Sheehan, 2014, p. 545).

The next characteristic feature of human resources management in small and medium enterprises is small formalization; in fact it is forced by provisions of law. Activities flexibility causes that procedures are created and changed during the course of a company functioning.

## **2. Methods of Research**

The findings presented in this paper were obtained during the implementation of the project entitled "Tendencies and challenges in strategic managing SME in Silesian Voivodeship". The aim of the studies was to diagnose the state of strategic management and human resources management taking into account its impact on the functioning of small and medium enterprises operating in Silesian Voivodeship and to indicate improvement areas of the model under diagnosis. of the specific objectives of the studies was to diagnose the state of the process of strategic management of human resources and to identify fundamental problems. In this area, the main hypothesis was formulated: The enterprises analysed do not have comprehensive strategies for management of human resources. The following detailed hypotheses were also formulated: H1. The enterprises analysed have a development strategy in place, but operational employees are not sufficiently familiar with it is. H2. The strategy is implemented in an inappropriate way.

In order to obtain reliable results, literature studies were complemented by analysis of original data obtained in a quantitative study using a questionnaire survey with a survey questionnaire as the research tool. The questionnaire was addressed to 1000 randomly selected employees of small and medium enterprises located on the territory of Silesian Voivodeship (Poland) between November and December. The survey resulted in 356 completed questionnaires, of which 320 completely and correctly completed questionnaires were accepted for further analysis.

The employees surveyed worked in micro-enterprises, i.e. employing 0-9 people (69.4 %), small enterprises, i.e. employing 10-49 people (27.2 %) and in medium-sized enterprises, employing 50-249 people (3.4 %). These companies operated on the

domestic (50.3 %), local (26.9 %), regional (17.5 %), and foreign markets (5.3 %). 320 people participated in the survey, with females constituting 38.8% and males – 61.2%.

Regarding the age of researched companies, the largest group was the group of companies established in the period of 1990-2000 (47.2 %). Most companies were established in 1996 (dominant – 1996). In the period of 2001-2010: 29.1 % of companies were established. In 1989 and earlier there were established 13.1 % of companies but the rest 10.6 % of companies appeared in 2011 and later.

The respondents had higher education (45.6 %), secondary education (39.7 %) or vocational education (14.7 %). As far as the age is concerned, employees aged 40-49 (43.1 %) and 30-39 (25.0 %) dominated. People aged up to 29 made up 20.9 %, those aged 50-59 – 7.5 %, whereas those above 60 constituted 3.4 %.

### **3. Results of the Research**

The employees surveyed claimed that the enterprises in which they worked had a vision of future development. 19.1 % of those surveyed confirmed that the enterprise employing them had such a vision in the form of a specific project, whereas 49.1 % thought that their institution had such a vision, but these were not specific projects, but only plans that have not been fully thought out. 31.9 % of respondents indicated lack of such a vision. These results correspond with those referring to the possession of strategy by the companies surveyed. In most cases, employees of the companies where the staff are familiar with the vision of the future are also aware of the existence of the strategy and know its assumptions. In turn, in those cases where there is no vision, there is also no strategy or employees are not aware of it.

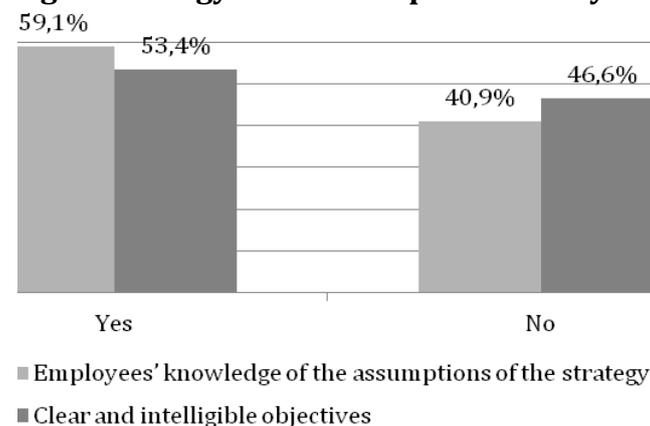
In 73.4 % of cases, companies have a developed strategy of action, whereas in 26.6 % of cases they do not have such a strategy in place (235 questionnaires were accepted for further analysis, in which the respondents indicated the existence of a strategy).

Over half (59.1 %) of those surveyed know the basic assumptions of the strategy developed and implemented in their companies. In the remaining 40.9 % of cases, these assumptions are not known (fig. 1). Taking into account the division of respondents into employees fulfilling managerial and operational functions, we should notice that employees in managerial posts know the assumptions of the strategy in 79.0 % of cases, whereas in 21.0 % of cases they are not familiar with them. In the case of employees in operational posts, these assumptions are known to 31.5 % of those surveyed, whereas 68.5 % do not know them. The objectives arising from the strategy are assessed by employees as formulated in a clear and comprehensive way (53.4 %), whereas the remaining 46.6 % think that the objectives do not meet these criteria, and they are unclear and unintelligible.

The developed strategy usually covered the period shorter than 1 year and for the period of around 1 year (58.3 %). According to 35.7 % of respondents, strategies were prepared for a period of 2-3 years, whereas according to 6.0 %, they covered a period longer than 3 years.

In the area of a strategy for human resources management, 66.4 % of those surveyed indicated the existence of such a strategy, whereas the remaining 33.6 % indicated its lack. Respondents working in enterprises which have developed a strategy for managing human resources, most often indicated that this strategy referred to the area of motivation and remuneration (71.2 %), staff selection (59.0 %), employees' development and improvement of their skills (57.1 %), and staff appraisal (48.7 %). Staff planning is an area of the strategy for human resources management that was relatively least often indicated (14.7 %).

**Fig. 1: Strategy in the enterprises surveyed**



*Source: authors' own calculations, data from (2016)*

Another question concerned issues connected with the implementation of a strategy, namely: do the tasks aimed at the achievement of the objectives have their addressees in the company (i.e. was the responsibility for the completion of the different tasks defined)? 32.3 % of respondents gave a positive answer to this question, whereas 67.7 % - a negative one.

The extent of the participation of line managers in human resources management compared with the year preceding the survey (i.e. 2015) did not change (57.0 %), increased (16.6 %), and decreased (10.6 %). In the rest 15.7 % of cases, it was difficult for respondents to give the correct answer.

## 4. Discussion

Half of the companies surveyed have developed a strategy of action. However, it is often informal. Similar findings were obtained by Smolarek (2008), who examined the area of strategic planning in small enterprises in Poland. Moreover, we can also see the lack of

procedures connected with the implementation of the strategy. Although over half of those surveyed (59.1 %) knew the basic assumptions of the strategy, this percentage is definitely too small, as these assumptions should be known by all the employees, not only part of them. What's more, employees fulfilling managerial functions were more familiar with these assumptions than employees fulfilling operational functions (hypothesis H1 was confirmed). Thus, a large percentage of respondents (46.6 %) do not understand the objectives formulated, which may in turn indicate failure to properly implement the strategy. One of the basic conditions of an appropriate implementation of a strategy is to ensure that employees that will implement it understand its objectives. If employees do not understand the objectives, it is difficult for them to contribute to their achievement through appropriate performance of tasks. As pointed out by Deal and Kennedy (1982), Lachiewicz & Zakrzewska-Bielawska (2005), in order to survive every organisation has to possess and develop its own set of objectives, assumptions and principles, which impact every day behaviour of people in the workplace. This is one of the basic conditions of the functioning of an enterprise. Yet, as other studies, conducted by Smolarek & Dzieńdziora (2012) show, enterprises operate based on intuition. Although they carry out a process of planning, in the case of around half of them the strategies prove to be ineffective, which is often a result of errors in the implementation of the strategy. It is thus worth paying attention to the problems connected with the implementation of a strategy in enterprises.

Strategies in the companies surveyed usually cover the period of 2-3 years. Strategies for such a period have to be more general due to changeability of the environment, therefore a very important issue and at the same time an important condition for an organisation to achieve its objectives is to make these strategies specific and cascade them to tasks, which have specific addressees. However, in most enterprises surveyed (57.3%) the tasks do not have their addressees. This is highly worrying, as it suggests inappropriate implementation of the strategy and may lead to failure to achieve an institution's objectives which are very important from the perspective of implementing economic goals. This confirms hypothesis H2.

Numerous authors, including D. Lewicka (2010), stress that a strategy in the area of human capital and an enterprise's strategy have to be interrelated. The companies surveyed have a separate human resources strategy within their general strategy, but this is not a comprehensive strategy covering all the areas of human resources management. Their strategies refer only to selected areas, which most often include: staff appraisal, employees' development and improvement of their skills as well as motivation and remuneration. We can see the lack of a clear strategy for human resources management that would be clear-cut and defined necessary instruments of human resources management in an enterprise. Analysis of research findings in similar areas shows that today's enterprises struggle with the problems of modern management of human capital. For instance, a report by H. Król (2007) highlights the lack of a formally written strategy for human resources management, which in many cases is a consequence of the lack of an overall strategy of an enterprise. Strategies for human resources management are very brief and rarely implemented in a systemic way.

## Conclusion

For human resources management in small and medium enterprises to fulfil its strategic aspect, it should be implemented in close connection with the strategy of an enterprise. The process of human resources management in SME has to be adjusted to the structure of an organisation, result from its objectives, so that an organisation can fully implement its strategic plans and achieve success and competitive advantage on the market. A guarantee of success is an accurately developed policy of human resources management based on earlier analyses of the existing procedures and possessed human resources.

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## Social Entrepreneurship: Insight into Content

### Abstract

Social entrepreneurship is today seen as a dynamic, innovative and entrepreneurial movement using business model where economic activity is provided in order to fulfill social mission and common social value. The purpose of this article is to open and extend existing research on social entrepreneurship. The paper undertakes an analytical examination of social entrepreneurship with a special emphasis on the Czech Republic and its common use conditions. Despite the fact that there is growing interest in the social entrepreneurship, still there is limited understanding about social entrepreneurship activities, scope, size or current state of social enterprises. There is also variety in understanding of the social entrepreneurship concept. The text concludes with a discussion about the research work relating the social entrepreneurship phenomenon. It tries to complement existing knowledge when providing analysis and research under the Czech social entrepreneurship eco-system conditions. The observation encompasses several aspects of the social entrepreneurship mainstream initiative and the results are grounded on decomposition of social entrepreneurship core attributes and their characteristics. The paper mentions factors that are constraining potential action, more precisely development, of social enterprises. It may be mentioned: (i) public awareness of the concept, (ii) access to finance, (iii) legislative framework, or (iv) lack of specialized knowledge.

### Key Words

*Social entrepreneurship, social enterprise, research,*

**JEL Classification: L31, L26**

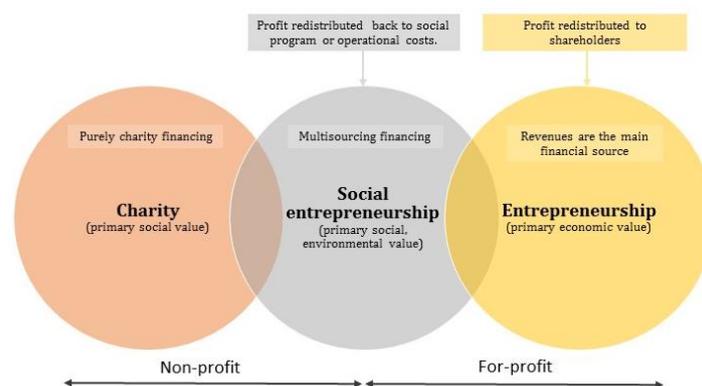
## Introduction

Social entrepreneurship has been a topic of academic inquiry for nearly 20 years (Short et al., 2009). Currently, it is a field of serious research. Anyone who is interested in the concept may be wondering what exactly social entrepreneurship is and how does it develop. Is it more radically different approach to the business of doing good (Peredo, McLean, 2006), or is it an approach how to adopt a mission to create and sustain social value (Dees, 1998)? Social entrepreneurship initiatives can be described as an important tool that tackles social challenges. There is a variety of attitudes on social entrepreneurship and social entrepreneurs. Scholars discuss several opinions. Waddock and Post (1991), Dees (2007) or Zahra et al. (2009) speak about innovative and reform approach with common mission and ambition to solve social problems. Other scholars focus more on further research, such as effort for scaling-up stages of social enterprises (André, Pache, 2016), (Lyon, Fernandez, 2012) or for social entrepreneurship process

modeling (Weerawardena and Mort, 2006), (Santos, 2012). Perhaps one of the most elaborate concepts of social entrepreneurship is work of Mort, Weerawardena and Carnegie (2003) or Mendell, Nogales (2009). Mort, Weerawardena and Carnegie (2003) discuss that social entrepreneurship is a multidimensional construction that is formed by intersection of a number of defining characteristics. Mendell and Nogales (2009) explain this concept more pragmatic as an innovative business model that contributes to labor market integration, social inclusion and economic development when balancing social and economic objectives.

The characteristic of entrepreneurship and social entrepreneurship varies. The position of social entrepreneurship can be described as a position in between traditional business and charities (EY, 2014). There is certain discrepancy between the traditional business attitude and the social business concept. The main driver of business is reaching planned financial goals. However, social entrepreneurship attitude is based on reaching certain social value by using social, environmental and economic principle. The social entrepreneurship area can be described as a hybrid part of traditional for-profit and non-profit environment. The position describes figure 1.

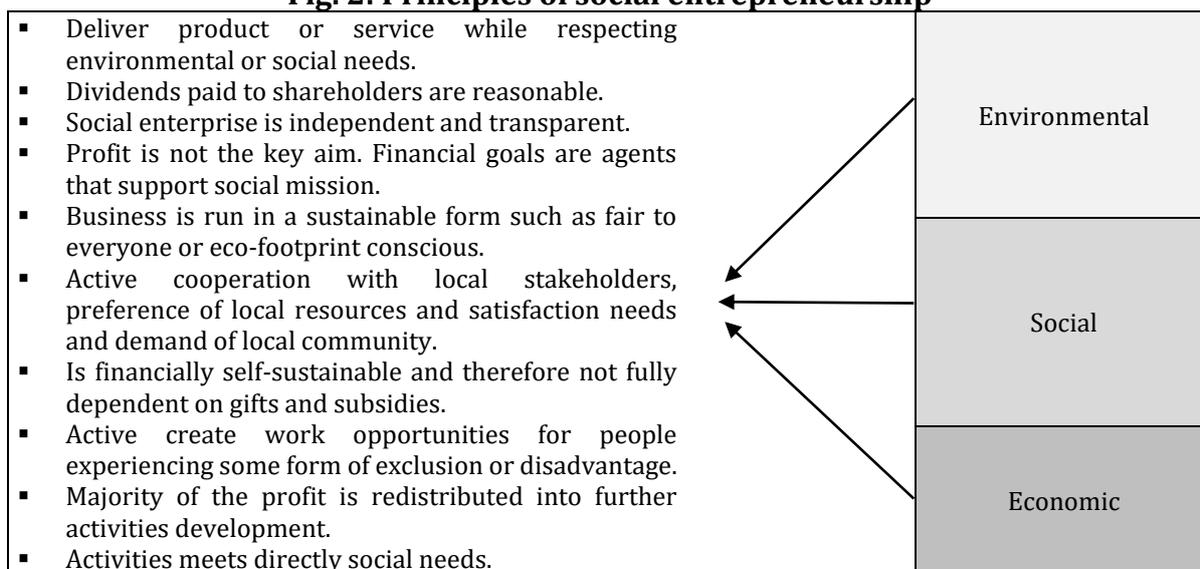
**Fig. 1: Social entrepreneurship position**



*Source: own*

So, what makes social entrepreneurship social entrepreneurship? And what is the essence that make this approach so promising and popular? There are many reasons for wanting to be clear about what principles is social entrepreneurship about. The concept in general is encompassing a wider range of activities: providing social purpose ventures to communities, developing social value proposition, start-up with new innovative business models that is meeting social and economic objectives. Some of these practices are uniquely new, however many of them have been around for a long time and finally they have reached a critical attention (Mair et al., 2006). The basic principles of social entrepreneurship are summarized in Fig. 2.

**Fig. 2: Principles of social entrepreneurship**



Source: own, (OECD, 2006), (EY, 2014)

## 1. Social entrepreneurship in the framework of the Czech Republic

Different countries have different social entrepreneurship coverage specifics and attitudes to social entrepreneurship initiatives (Sekliuckiene and Kisielius, 2015). In the Czech Republic are several institutions that support social entrepreneurship and enterprises (e.g. such as TESSEA, P3, Ministry of Labor and Social Affairs or Agency for Social Integration). Social entrepreneurship is not defined in the national legislation. As the closest legislation to deal with should be mentioned Business Corporations Act no 90/2012 (where social cooperative as one institutionalized form is defined), or Employment Act no 435/2004. However, there is currently strong intention to deal with this issue and a separate act has been discussed. TESSEA (Thematic Network for Social Economy) has develop a definition and indicators of social enterprise that are widely accepted by various stakeholders.

There is no systematic public support policy for social entrepreneurship activities. The only one systematic support is provided for WISE (Work Integration Social Enterprise). WISE represents a systematic financial support from Labor Office (with regional differences) when employ healthy disabled people. Otherwise, the tendency is to use various grants and project opportunities. As a good news can be considered increasing support interest from side of large companies. Nevertheless, setting national policy framework for social entrepreneurship is difficult not only in the Czech Republic but also in the majority of the EU countries (EC, 2015). And where policies exist, they differ in scope, coverage and content.

The number of social enterprises in the Czech Republic is still raising. Based on the largest platform dealing with social entrepreneurship (Ceske socialni podnikani, 2017) there is currently evidence of 237 social enterprises. The number may vary because of the missing legislative definition. Basic demography and key eco-system players of Czech social enterprises sums up table 1.

**Tab. 1: Social enterprises demography and their eco-system**

|   |  |
|---|--|
| <b>Number of SE</b>                     | <ul style="list-style-type: none"> <li>• 237</li> </ul>  |
| <b>County with highest number of SE</b> | <ul style="list-style-type: none"> <li>• Prague (1<sup>st</sup> place)</li> <li>• Southern Moravia (2<sup>nd</sup> place)</li> <li>• Central Bohemia (3<sup>rd</sup> place)</li> <li>• Ústí region (4<sup>th</sup> place)</li> </ul>   |
| <b>Field of activity</b>                | <ul style="list-style-type: none"> <li>• Gardening, cleaning services (1<sup>st</sup> place)</li> <li>• Food industry (2<sup>nd</sup> place)</li> <li>• Wholesale (3<sup>rd</sup> place)</li> <li>• Recreation, culture (4<sup>th</sup> place)</li> </ul>  |
| <b>Target group</b>                     | <ul style="list-style-type: none"> <li>• People with health disabilities (1<sup>st</sup> place)</li> <li>• Long-term unemployed (2<sup>nd</sup> place)</li> <li>• Ethnic minorities (3<sup>rd</sup> place)</li> <li>• Youth and young adults in difficult situations (4<sup>th</sup> place)</li> </ul>   |
| <b>Revenue streams</b>                  | <ul style="list-style-type: none"> <li>• Public funds: (i) public contracting, (ii) grants and subsidies</li> <li>• Private funds: (i) trading activity, (ii) rental income on assets, (iii) fees including membership fees, (iv) donations, (v) sponsorship, (vi) others</li> </ul>   |
| <b>Legal forms</b>                      | <ul style="list-style-type: none"> <li>• Ltd liability company (1<sup>st</sup> place)</li> <li>• Public benefit organizations (2<sup>nd</sup> place)</li> <li>• Civic association (3<sup>rd</sup> place)</li> </ul>  |
| <b>Eco-system key players</b>           | <ul style="list-style-type: none"> <li>• Advising, information support: P3 – People, Planet, Profit; Via Foundation; Union of Czech and Moravian Productive Cooperatives; HUB Praha; ACSR; local consultants of Ministry of Labor and Social Affairs</li> <li>• Research institutions, development monitoring, policy makers: TESSEA, universities, local parts of public institutions, Ministry of Labor and Social Affairs, Ministry of Industry, Agency of Social Inclusion under the Cabinet Office</li> <li>• Finance providers (example of key sources except of own costumers, EU funds): Ministry of Labor and Social Affairs, ČSOB, Česká spořitelna Foundation, Vodafone Foundation</li> </ul> |

*Source: Ceske socialni podnikani (2017), (EC, 2015) and own*

## 2. Research

The most valuable source of information are social enterprises themselves. In 2016 was provided a survey among social enterprises. Together 125 social enterprises were asked, when 51 of them responded (41%). When consider the number of social enterprises known in 2016 (approx. 210), overall 21% of existing social enterprises got in touch. Following tables sum up the main gained results. Table 2 describes respondents from regional and legal form perspectives. Results are compared to overall information available on the Czech and EU database.

**Tab. 2: Respondents: region and legal form**

| Region/Legal form   | Cooperative | Public benefit organization | Ltd liability company   | Other                                     | Total                               |
|---|-------------|-----------------------------|-------------------------|---|-------------------------------------|
| Prague  | 2           | 5                           | 6                       | 1   | 14                                  |
| Southern Moravia  |             |                             | 3                       |   | 3                                   |
| Hradec Králové  |             | 3                           | 1                       |   | 4                                   |
| Moravian-Silesian   |             | 3                           | 4                       |   | 7                                   |
| Olomouc   | 1           |                             | 3                       |   | 4                                   |
| Pardubice   |             | 1                           |                         |   | 1                                   |
| Pilsen  |             | 2                           |                         |   | 2                                   |
| Central Bohemia   |             |                             | 1                       | 2   | 3                                   |
| Ústí  | 1           | 1                           | 3                       |   | 5                                   |
| Vysočina  |             |                             | 2                       |   | 2                                   |
| Zlín  |             | 1                           | 4                       | 1   | 6                                   |
| <b>Total</b>  | <b>4</b>    | <b>16</b>                   | <b>27</b>               | <b>4</b>                                  | <b>51</b>                           |
| <b>Comparison: 3 most commonly used legal forms in the CZ</b> |             |                             |                         |   |                                     |
|   | ×           | ✓ 2 <sup>nd</sup> place     | ✓ 1 <sup>st</sup> place | 3 <sup>rd</sup> place = civic association |                                     |
| <b>Comparison: 3 most commonly used legal forms in the EU</b> |             |                             |                         |   |                                     |
|   | ×           | ✓ 3 <sup>rd</sup> place     | ×                       | ✓ 2 <sup>nd</sup> place                   | 1 <sup>st</sup> place = association |

Source: own, Ceske socialni podnikani (2017), (EC, 2015)

Social enterprises are active in various business areas. However, some of them are more preferred. In this case the most preferred fields of activity were (ranking from highest number): gardening (7 respondents), culture and recreation (6 respondents) and accommodation, catering industry (5 respondents). In comparison to the EU data there is clear difference in preferred fields of activity. The most preferred activities on the EU level is: education, health and social work, community and social services (EC, 2015).

The concept of social entrepreneurship is not hot news. In Czech conditions got this concept stronger attention approximately after year 2000 and later. The majority of observed social enterprises were established after 2000 (mostly in 2011 and 2012). Several reasons can led to making decision about establishing social enterprise. Respondents were asked to give their impulse about such decision (see table 3 – more choices were available to choose)

**Tab. 3: Reasons to establish social enterprise**

| Impulse(s) that lead to establishment of SE                 | Total |
|---|-------|
| Own experience  | 25    |
| Dissatisfaction with local environment                      | 22    |
| Seems like a good idea                                      | 15    |
| Impulse from the side of target group                       | 13    |
| Experience from family or close friends                     | 5     |
| Call for giving opportunity people with health disabilities | 1     |

Source: own

One of the most important part in social enterprises life are employees. They are agents who help to fulfil the social mission, or they even represent the sense of the settled social

mission. Employees structure and other details are basic facts which is good to observed in order to follow up social enterprises development. Respondents were asked to give information to their structure (more options were available to choose) and also to their increase, decrease during past 2 years and reason for such development.

**Tab. 4: Target groups**

| Disadvantage Target Group                      | Total |
|--|-------|
| Health Disabilities                            | 37    |
| Young and young adults in difficult situations | 15    |
| Long-term unemployed                           | 12    |
| Socially excluded groups                       | 12    |
| Ethnic minorities                              | 8     |
| Homeless people and ex-offender                | 5     |
| People taking care of family members           | 4     |
| Drug addicted people                           | 3     |

Source: own

Table 4 describes employment development during past 2 years. Respondents were also asked to state reasons for such development. In all situations the answer was related to increase/decrease revenues and grants/subsidies.

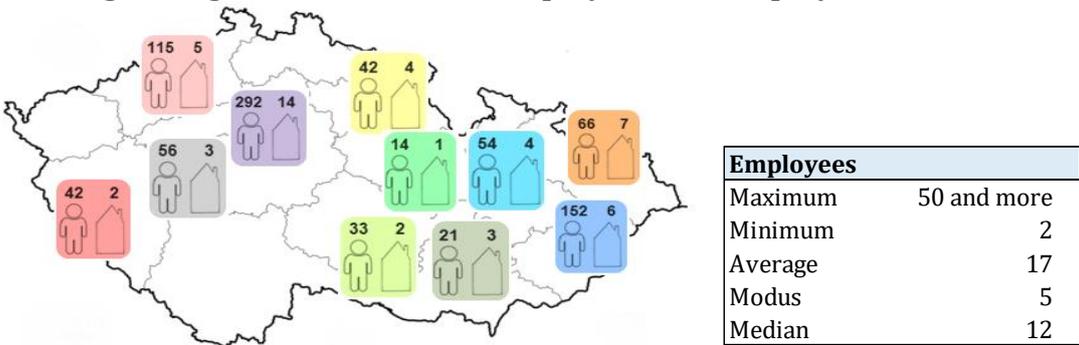
**Tab. 5: Employment development in 2014 and 2015**

| Employment rate in      | 2014 | 2015 | Total     |
|-------------------------|------|------|-----------|
| increase - increase     | ↑    | ↑    | 16        |
| increase - stagnation   | ↑    | →    | 1         |
| stagnation - increase   | →    | ↑    | 10        |
| stagnation - stagnation | →    | →    | 12        |
| stagnation - decrease   | →    | ↓    | 7         |
| decrease - stagnation   | ↓    | →    | 4         |
| decrease - decrease     | ↓    | ↓    | 1         |
| <b>Total</b>            |      |      | <b>51</b> |

Source: own

Furthermore, employees number and regional allocation describes figure 3.

**Fig. 2: Regional allocation of employees and employees number**



Source: own

Balancing financial sources and finding the right mix of sources is one of the key challenge for social enterprises. Table 7 provides quite positive information regarding these facts.

**Tab. 7: Financial situation**

| Revenue stream | Total     | Financial situation             | Total     | 3 most importance financing sources |
|----------------|-----------|---------------------------------|-----------|-------------------------------------|
| Increase       | 31        | Financial situation is balanced | 24        | Revenues                            |
| Stagnation     | 16        | Financial surplus               | 18        | Public contracting (labor office)   |
| Degrease       | 4         | Financial loss                  | 9         | Grants and subsidies                |
| <b>Total</b>   | <b>51</b> | <b>Total</b>                    | <b>51</b> | <b>x</b>                            |

*Source: own*

When providing socially oriented entrepreneurial activities each actor has to face several development barriers. Table 8 sums up the most important based on respondents opinion and completes data with information on the EU level.

**Tab. 8: Barriers of social enterprise**

| Barriers   | Total | EU level |
|--|-------|----------|
| Lack of finance/difficult access to finance      | 35    | ✓        |
| Lack of marketing experience                     | 25    | x        |
| Lack of business opportunities                   | 22    | x        |
| Difficulties with employees                      | 16    | x        |
| Lack of specialist business development services | 13    | ✓        |
| Lack of supportive legislative framework         | 10    | ✓        |
| Absence of time                                  | 9     | x        |

*Source: own, (EC, 2015)*

### 3. Discussion

The concept of social entrepreneurship has found a place in business. It has become popular across various stakeholders. From the international one perspectives, social entrepreneurship is a serious topic for academic and professional discussions and it holds a place in the curriculum of schools (and not only business schools). However, in the Czech framework there is still space for more intensive and organized support in this whole eco-system. There are institutions and associations devoted to implementing socially entrepreneurial ventures and providing background for social entrepreneurs as much as getting interested parties familiar with the concept. Still, there isn't such well-organized eco-system in comparison to some EU countries. There are several similarities with the overall EU experience – such as some similar legal forms or some mostly mentioned barriers to development of social enterprises. Otherwise, in the Czech conditions may be observed differences to the EU scope. Especially, when considering field of activity, or legislative framework. People, who are active in this branch has to show a lot of entrepreneurial courage and dedication to fulfill their mission. Usually, their decision is based on their own experience or dissatisfaction with their environment. Dedication to the social mission is unfortunately not enough. Social enterprises have to handle successful financial situation and overcome barriers on their way to development. The current survey

proofs several previous researches results, e.g. (EC, 2015) or (Prochazkova, 2016), that mention the necessity for multi-sourcing financing and existence of several critical barriers. Both factors may be considered as key facts and must be considered as critical aspect on the way to success. Especially, marketing experience and lack of business practices belong to frequent troubles. Naturally, one of the key recommendation is to focus strongly on this gap and cooperate with specialists in this branch (only 6 respondents do have specialist on marketing). However, besides these barriers as a positive fact can be consider mostly positive (or at least balanced) financial situation. This fact and other tend to show that Czech social enterprises are expected to growth, even there are still several obstacles to follow this way.

## **Conclusion**

Social entrepreneurship attracts worldwide attention for several years. The concept is nothing spectacular new, the social approach in doing business has been provided by some entrepreneurs for ages. However, now is the time when the idea of such business concept is on the front burner. There is a constantly effort to find definition of social entrepreneurship. Scholars, support institutions (such as Ashoka or Schwab Foundation for Social Entrepreneurship) or even social entrepreneurs try to describe this kind of activity and person who provides it. Famous social entrepreneur Muhammed Yunnus speaks of an activity where the entrepreneur is not interested in profit maximization and is socially-objective driven. The objective of the business should be achieved through creating and supporting sustainable business enterprise. Schwab Foundation describe very nicely social entrepreneurs as a combination of the characteristics represented by Richard Branson and Mother Teresa. However, what is clear is that social entrepreneurship is dynamic entrepreneurial movement. There is general consensus that this concept is gaining in strength not only in Europe but worldwide. To track and learn this development understanding and monitoring of these activities is necessary. This paper mentions and finds characteristics of social entrepreneurship and try to track their essence in their real eco-system conditions. It gives impulses to further research questions based on provided theoretical and practical information.

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## Section III

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# Process and Risk Management





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## The Evolution of International Strategies in English Universities

### Abstract

The internationalisation of universities has become an increasingly topical issue with, inter alia, growing numbers of students seeking higher education (HE) across national borders. There has been much discussion of the implications of internationalisation for HE policy and for nation states; however, internationalisation has not been investigated from a strategic organisational perspective. A pilot study of four English universities was undertaken via a process of document review and semi structured interviews. A modified form of Grounded Theory was employed to analyse the outcomes of the document reviews and the interviews. The results indicate that international strategies in the four English universities have gone through three phases, as their approaches to this phenomenon have matured and progressed from operational to strategic. The findings have led to the development of a model which conceptualises the main stages of the internationalisation of English (and, by implication, UK) universities. The possible consequences of Brexit for the model are discussed. Future research will seek to investigate universities' international strategies in other national HE contexts.

### Key Words

*Internationalisation; strategies; universities; UK; Brexit*

**JEL Classification: M16**

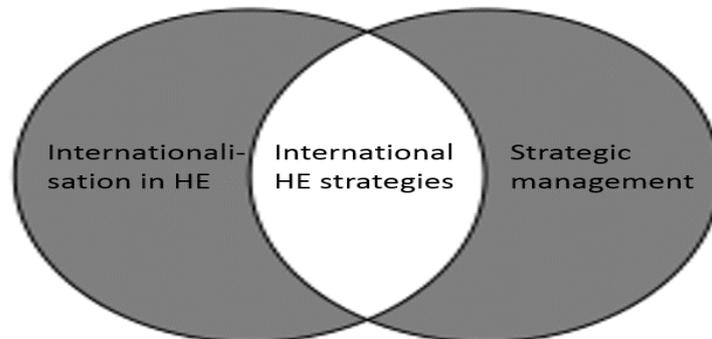
## Introduction

'Internationalisation' in higher education (HE) has been investigated in terms of its context, benefits, challenges and implications. Yemini and Sagie (2015) found that the subject of 'internationalisation in higher education' had almost the same number of publications as the broad subject of 'higher education' between 2001 and 2006. Although the percentage of publications on both increased between 2007 and 2014, research on 'internationalisation in higher education' increased more rapidly compared to 'higher education', which reflects its growing importance as a phenomenon.

However, there has been a lack of research investigating internationalisation from a strategic organisational perspective. This study aims to explore the development of international strategies in English universities. It does not seek to generalise to a wider geographical context. Indeed it is believed that the different institutional and historical contexts in other Western, as well as Central and Eastern European, countries provides a prima facie case for further research. Since, however there are many issues and

developments in common in terms of the international strategies of universities worldwide, the model which is developed, via an inductive methodology, may be applicable in other countries. It should be emphasised that the focus of the study is at a university strategic level and it does not investigate department or module level internationalisation initiatives (Fig. 1).

**Fig. 1: The research context**



*Source: authors' own research*

The term 'internationalisation' has become widely used in higher education since the 1990s. There is a large number of different perspectives on internationalisation; its purposes, practices, and implications. Arum and van de Water (1992, p.202) referred to international education as "the multiple activities, programmes and services that fall within international studies, international educational exchange and technical cooperation". Soderqvist (2002, p. 29) defined internationalisation as "a change process from a national higher education institution to an international higher education institution leading to the inclusion of an international dimension in all aspects of its holistic management in order to enhance the quality of teaching and learning and to achieve the desired competencies". However, these definitions focused only on the international student academic experience and assumed, implicitly and explicitly, that teaching and research are the sole functions of the education system (Knight, 2013).

Subsequently, internationalisation as a concept and a practice has broadened due to an increasingly diversified international student population, to include inter alia both the academic and social experiences of students (Wadhwa and Jha, 2014; Yemini, 2015). It has also increasingly focused on non-student issues, such as research collaboration and staff experience (Jacob and Meek, 2013). Yemini (2015) defined internationalisation as "the process of encouraging the integration of multicultural, multilingual, and global dimensions within the education system, with the aim of instilling in learners a sense of global citizenship". This definition used specific terms that showed a recognition of the importance of cultural and language barriers in an attempt to integrate international students so that they become prepared to act as "global citizens" in an interdependent world.

At one time, the International Office was responsible for all international activities in HEIs (Curtis, 2013). This was understandable since internationalisation was primarily associated with international student recruitment and mobility (Fielden, 2011). However,

the definition of internationalisation now includes international partnerships and collaborations, the international student and staff experience, as well as international research, and it has become a descriptive term to define the university's mission, strategy, culture, and structure (Middlehurst, 2008). Indeed, internationalisation now aims to widen and integrate international activities across the whole university and it is becoming an important part of universities' institutional strategies, while encompassing the still significant role of the International Office (Fielden, 2011; Curtis, 2013).

The internationalisation of HE has become crucial for its competitiveness and sustainability. Academic institutions are paying great attention to it – both as an idea and an agenda. This has translated into the active development of strategies, policies, programmes and infrastructure that has made universities into institutions that take internationalisation seriously. A variety of internationalisation policies and practices have been employed and developed in HEIs, on their home campuses and abroad, to implement their internationalisation plans, such as recruiting international students (Huang, Raimo, and Humfrey, 2016), internationalising the curriculum (Pandian, Baboo and Mahfoodh, 2016), promoting international research mobility (Jacob and Meek, 2013), promoting intercultural capabilities (Stier, 2006) and opening up branch campuses in other countries which are designed to attract students who are not able to travel overseas for education (Wilkins and Huisman, 2012; Shams and Huisman, 2016). Nevertheless, the adoption of an 'international strategy' by HEIs is a relatively recent development and one which has been examined rarely from a strategic perspective.

However, the adoption of an international strategy does not necessarily mean that a university is internationalised. Although some universities have been found to have an international strategy, their strategies are not always supported by the adoption of internationalisation practices such as the redesign of teaching practices and the internationalisation of the curriculum to fulfil international students' needs. Indeed there may be a gap between international strategy formulation and implementation (Koutsantoni as cited in Warwick & Moogan, 2013). Therefore, it is important to examine what universities do to be 'internationalised'.

The broadening of the definition of the term 'internationalisation' reflects its increasing importance to universities as a concept and as a set of activities. Although internationalisation can be considered to be an input to various other activities in a university, including teaching and research, it has become increasingly important as a performance measure (or to be more precise, a set of performance measures) in its own right. This is reflected in various international league tables such as the Times Higher Education, the Shanghai Jiao Tong index and the QS star system (Hoyler and Jöns, 2013). As a consequence, universities have begun to develop explicit international strategies, or at least an international dimension to their overall strategy. Although some recent studies in this field focus on how UK universities manage internationalisation, a strategic organisational perspective has not been widely discussed in the literature. Therefore, this study examines different institutional strategic periods in order to evaluate the development of these strategies.

## 1. Methods

A pilot study of four English public universities in the UK HE sector was conducted during the 2015-16 academic year. There was a long list of different universities that could have been chosen to participate in this research. A non-probability purposive sampling technique (theoretical sampling) was applied to choose the universities to be interviewed (Marshall, 1996). A convenience sample was identified from established contacts. The universities were all located in the north of England and ranged in size from 17,000 to 30,000 students. Three of them were former polytechnics (technical universities); one of them had been a university for over one hundred years.

A qualitative approach, using in-depth semi-structured interviews and document review, was adopted. Although the interviews were time-consuming to conduct and analyse, they provided rich insights which could not be obtained from large survey samples. As the research questions relate to strategic information, interviewees needed to be senior managers. Each interview lasted approximately two hours and it followed a general framework of questions. The documents which were reviewed included the strategic plans, the international strategies and the websites of the universities.

The exploration of the most recent international strategies in four different English universities, in order to identify the similarities and differences between them at one point in time, was the main research focus (spatial variation). However, a new issue emerged during the data collection and data analysis phases due to the need to collect more data about the universities' previous strategies and to investigate further the development of their international strategies over time. Thus, a comparison between international strategies at each university over three consecutive strategic periods was an additional focus (temporal variation). Supplementary questions were designed, pretested and sent via email to the participants following the initial interviews.

The development of an international strategy as part of the University's overall strategy was a key point of interrogation. The four universities were asked about how 'internationalisation' featured within the University's strategy during three consecutive strategic periods (strategic period 3 refers to the most recent strategy). They were given three options to choose from (Not at all – Mentioned – Foregrounded). 'Not at all' and 'mentioned' refer to internationalisation not being mentioned at all or being mentioned/featured underneath some of the other aspects of the university's strategy, whereas foregrounded refers to internationalisation as a key aspect of the university's strategy and to having an international strategy in a separate document. In all cases, these responses were in line with other documentary evidence from each university.

## 2. Findings

The data analysis suggests that three developmental phases which demonstrate the extent to which the universities' international strategies are embedded in their overall

strategies can be identified in the international strategic trajectory in English universities (Fig. 2). Different universities will have completed each phase at a different historical point in time.

**Fig. 2: Trajectory of English universities' international strategies**



*Source: authors' own research*

Internationalisation starts as a group of initiatives which did not previously feature in a university's strategy and is controlled and promoted by operational managers (eg. Head of the International Office). In the second stage, internationalisation practices increase and are mentioned in the strategy, but not foregrounded, and they are controlled and monitored by middle managers (eg. Director of International Development). In the third stage, internationalisation is widened to include more international elements and became a core strategic priority which is managed by senior managers (eg. Pro-Vice Chancellor, International). The diagram does not assume that each university will necessarily go through every phase in a linear fashion and, in fact, some universities might move backwards, at least for a time. In fact, each of the four universities in this study went through the three phases differently in terms of both the time frames and the appearance of some of the characteristics, but they all made a similar journey.

### **3. Discussion**

Although, it is not possible to assess the significance of a historical event until some years later, it is clear that Brexit is a very significant event in the history of the UK and may possibly be the most significant one since the Second World War. It is clear also that it is part of a more widespread growth in populism in the political development of Western countries. Since Brexit is itself an internationally orientated event, it could lead to a fourth phase in the internationalisation of English (and UK) universities, particularly given the emphasis on the emergence of a "Global Britain" post Brexit. However it is also possible that it could lead to a reversal of the internationalisation of UK universities. Moreover,

and in line with our recent findings, it is likely that different universities may undergo different trajectories in the new international context post Brexit.

## Conclusions

This pilot study of four English universities identifies the importance of ‘time frame’ in the trajectory of their international strategies. This has led to the development of a conceptual model (Figure 2) which outlines the strategic trajectory of internationalisation in English universities and how it has emerged from a number of separate initiatives to become a strategic objective. It also identifies the changes which have taken place in each of three phases of the universities’ international strategies. The model will be used in the study of a larger sample of English universities.

The results of this study can contribute to managing potential strategic changes in practice in universities and the conceptual model developed can be used as a roadmap for the internationalisation of universities. By using this model, universities can identify where they are and where they want to be; and hence what actions need to be taken to drive forward their international strategies. It remains to be seen whether or not Brexit will lead to the development of a fourth phase in the trajectory of the international strategies of English universities.

Future research should attempt to identify whether or not this model can be applied to other countries. As was noted at the start of the paper, the recent history of Central and Eastern Europe means that the evolution of the internationalisation process has been different in a number of respects. Indeed, every country, wherever they are located, has its own specific national historical and cultural characteristics. Therefore, it would be interesting to see to what extent the three phases which have been identified in an English context are also applicable elsewhere.

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## Modeling of Incapacity for Work in the Czech Republic

### Abstract

Demographical forecasts<sup>1</sup> of the Czech Statistical Office (CZSO) demonstrate a significant decrease of economic active people proportion because of ageing population. At the same time, the Ministry of Health of the Czech Republic has announced<sup>2</sup> that the number of years spent in good health has been decreasing since 1962. To the contrary, life expectancy increases, therefore the number of years spent in illness rises as well and in this way it does not contribute to quality of life. Thus it means a certain burden on social and health care system and economics. On that account the state should be interested in health of employees, because only then does their physical and mental effort invested in the production of goods and services bring an economic profit for the country. To research health of workforce in the Czech Republic, an economic-statistical model is used to evaluate relations between the utilization of incapacity for work and wages, unemployment and life expectancy. Together with this, the model compares an economic assessment of wage loss due to the utilization of sick leave by the classification of professions and by the International Classification of Diseases and Related Health Problems regarding age, regional or gender structure of employees. The aim of this paper is to describe current situation, as well as, based on the built models, to identify the deviations which could indicate causes of utilization of incapability to work.

### Key Words

*incapacity for work, health care system, workforce, correlation, regression*

**JEL Classification: C21, R13**

## Introduction

The Czech Republic is a country with lower amount of production factors (i.e. lower economic power) so it is essential to use them efficiently and actively in order to raise the economic level of our country. The fundamental element of economic growth is the quality of these factors (Soukup, 2010). Labour is one of the primary factors of production. Human activity is the power that transforms natural resources into useful consumer goods. Human resources gain strategic importance in contemporary world. Thus it is

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<sup>1</sup> <https://www.czso.cz/documents/10180/20567167/402013u.pdf/3cdc1b6f-9334-429e-99e6-f72b4047bee3?version=1.0>

<sup>2</sup> [http://www.mzcr.cz/verejne/dokumenty/zprava-o-zdravi-obyvatel-ceske-republiky2014-\\_9420\\_3016\\_5.html](http://www.mzcr.cz/verejne/dokumenty/zprava-o-zdravi-obyvatel-ceske-republiky2014-_9420_3016_5.html)

substantial to invest not merely in technologies but in people as well. Investments in education and development of human resources belong among the most efficient contributions. However, based on the statistical and demographic indicators of population health and life expectancy, the social interest should also focus on prevention and elimination (or at least reduction) of incapacity for work.

## 1. Methods of Research

The first set of analyses is based on the multiple regression method. This procedure is designed to draft out a statistical model describing the impact of two or more quantitative factors  $X$  on dependent variable  $Y$ . The decision about significance of the whole model proceeds from the F-test statistic. The individual factors are judged by the standard T-tests.

Our model is considered as linear in its basic form  $Y = \beta_0 + \beta_1X_1 + \beta_2X_2$  where  $\beta_0$  is a constant expressing probable value of dependent variable in case of zero impact of other factors;  $\beta_1$  and  $\beta_2$  are coefficients of examined factors impact;  $X_1$  is the factor of unemployment and  $X_2$  is the factor of wages (Anderson, 2010). The analyses are created for the time period of 2011-2015 and separately year by year to follow possible trends and changes. Our results would show only the years 2011 and 2015 as an illustration.

Next method to test the independence of numeric variables is the test of correlation coefficient  $r(X,Y)$  (Anděl, 2007). The correlation coefficients measure the strength of the linear relationship between two variables on a scale of  $-1$  to  $+1$ . The larger the absolute value of correlation, the stronger the linear relationship between these two variables. Low P-Values (less than 0.05 if operating at the 5% significance level) correspond to statistically significant correlations. All the data have been provided by the Institute of Health Information and Statistics of the Czech Republic (UZIS) and the Czech Statistical Office (2016a, 2016b, 2016c, 2016d).

## 2. Results of Research

The results of the first research are finally divided into the separate subsets because the influence of the capital city Prague are considered as too distortive. The analysis of the whole dataset is shown in the Tab. 1:

**Tab. 1: Multiple regression for sickness per policyholder (all data)**

| Parameter    | Estimate (P-Value) |                  |                   |
|--------------|--------------------|------------------|-------------------|
|              | 2011-2015          | 2011             | 2015              |
| Constant     | 79.4300 (0.0000)   | 79.1000 (0.0000) | 101.9000 (0.0000) |
| Unemployment | -0.0743 (0.0553)   | 0.0277 (0.6777)  | -0.0774 (0.2915)  |
| Wages        | -0.0018 (0.0000)   | -0.0020 (0.0000) | -0.0025 (0.0000)  |

*Source: authors' calculations in Statgraphics Centurion XVII*

The F-Ratio for the time period of 2011-2015 is 7.63 with the P-Value 0.0011 which approves the significance of the whole model. The factor of unemployment is not significant in this model.

**Tab. 2: Multiple regression for sickness per policyholder (without Prague)**

| Parameter    | Estimate (P-Value) |                  |                  |
|--------------|--------------------|------------------|------------------|
|              | 2011-2015          | 2011             | 2015             |
| Constant     | 41.0000 (0.0000)   | 65.2800 (0.0154) | 82.3000 (0.0008) |
| Unemployment | -0.1169 (0.0006)   | 0.0019 (0.9811)  | -0.0946 (0.2049) |
| Wages        | -0.0002 (0.4915)   | -0.0013 (0.2146) | -0.0017 (0.0294) |

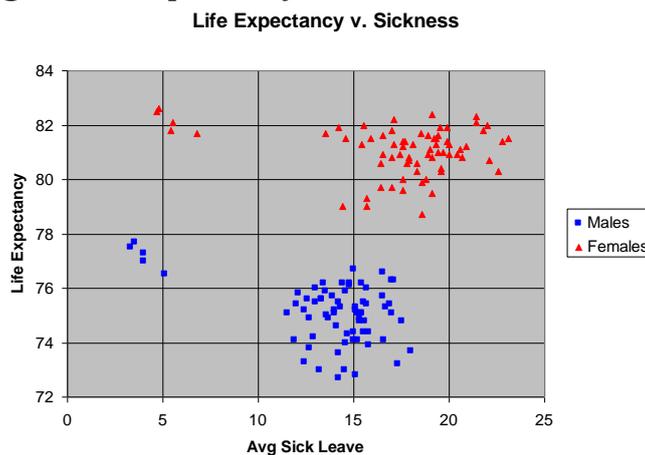
Source: authors' calculations in Statgraphics Centurion XVII

The F-Ratio for this time period is 0.0011, therefore this model (and also year by year models) appears to be significant. The factor of unemployment is remarkable for the whole time period but not year by year. However, the wage factor in this model is statistically insignificant because it is dominant only in the Prague region.

Secondly, the independence of life expectancy ( $Y$ , in years) and sickness ( $X$ , in days per policyholder) is tested by correlation coefficient. The analysis is processed for males and females in a separate way. For males  $r(X,Y) = -0.451$ , P-Value = 0.000. Hence the variables are not independent with negative correlation. From the data as well as from Fig. 1 it is apparent that there is a set of influential points in the left upper corner of the plot, Prague in particular. When this set is excluded, then  $r(X,Y) = -0.025$ , P-Value = 0.841, the variables are independent. Only for Prague  $r(X,Y) = -0.939$ , P-Value = 0.018 and just like for the whole country, it is negatively correlated. Because of statistically significant relation in these two cases, a simple linear regression model has been estimated:

- the Czech Republic:  $Y = 79.71 - 0.6314 \times X$
- Prague:  $Y = 77.36 - 0.1605 \times X$

**Fig. 1: Life Expectancy v. Sickness in 2010–2015**



Source: authors' own calculations, data from UZIS

All the parameters remain substantial in both models, i.e. not equal to zero. Concerning females, the correlations are as follows:

- the Czech Republic:  $r(X,Y) = -0.201$ , P-Value = 0.095
- Prague:  $r(X,Y) = -0.848$ , P-Value = 0.07
- regions except Prague:  $r(X,Y) = -0.2$ , P-Value = 0.11

Due to the fact that the hypotheses of independence have been accepted, the regression models have not been estimated.

Furthermore, the relationship between age and length of sick leave is analyzed. The age has been grouped into eleven, five year intervals. The average length of the incapacity for work has been calculated for each interval.

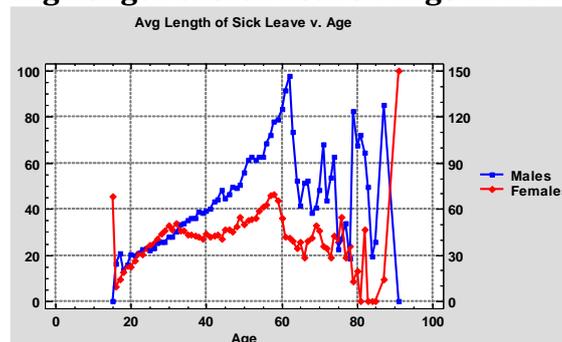
**Tab. 3: Age v. Average Length of Sick Leave (in days)**

| Age Group                 | 01    | 02    | 03    | 04    | 05    | 06    | 07    | 08    | 09    | 10    | 11    |
|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Sick Leave Males</b>   | 15.54 | 21.43 | 24.29 | 30.67 | 36.78 | 42.91 | 48.00 | 60.74 | 72.06 | 85.85 | 46.39 |
| <b>Sick Leave Females</b> | 21.78 | 29.43 | 40.76 | 47.75 | 42.16 | 42.43 | 48.41 | 53.90 | 65.46 | 45.39 | 38.18 |

Source: authors' own calculations, data from UZIS

For males, the values are as follows:  $r(X,Y) = 0.56$ , P-Value = 0.00. For females there is  $r(X,Y) = 0.27$ , P-Value = 0.03. As the P-Value is less than 5 %, the variables are positively correlated according the assumption.

**Fig. 2: Avg Length of Sick Leave v. Age in 2010–2015**



Source: authors' own calculations, data from UZIS

### 3. Discussion

The existing literature mentions certain number of possible determinants of incapacity for work (Leyland, 2016). The factors may be divided into many different ways based on different approaches to this issue. There are micro and macro factors taken into consideration, internal or external powers, natural, as well as social causes, etc. Osterkamp and Röhn (2005) generally define two groups of contributing factors: a) natural causes, e.g. general health situation, b) behavioral reactions to macroeconomic conditions, such as unemployment or possibility to work outside the official labour market, and to the design of institutions, such as generosity of granting sick leave.

This topic has already been analyzed in the Czech Republic by Jeřábková (2010, 2011). She examined the time series of incapacity for work particularly by the index analysis trying to reveal the trends and determinants. Our approach considers two economic factors – wages and unemployment. The Czech Republic is a country with really valuable difference between the capital city region (Prague) and other regions in most of the socioeconomic indicators. Thus it is interesting whether employees in their individual indifference analyses consider a loss of finance or even their job. Besides, it is important to examine unexplained part of this phenomenon which is affected by other factors. The social aspect is definitely seen in age and gender of employees. According to the OECD data, in 2014 life expectancy at birth was 2 years lower in the Czech Republic compared to the EU28 average (OECD/EU, 2016).

## Conclusion

This article is a part of the complex project that aims to identify factors influencing sickness, analyze its impact and interaction and last, but not least, suggest appropriate instruments to reduce this negative phenomenon in the Czech Republic. These factors having an impact on incapacity for work in the Czech Republic are different for the Prague region and for other regions. The capital city is significantly affected by the wage factor (also wage level is entirely different). Remaining regions seem to consider the impact of possible unemployment (it is different compared to Prague) (see Table 2). There is a substantial element of average sickness caused by other factors. As it can be seen from the growing value of model constant parameter, the average number of days when employees are incapable to work in the time period of 2011 to 2015 had risen (see Table 1).

The authors are aware of the fact that the impact of sickness on life expectancy is distinct in relation to the gender of employees. There is not any significant correlation of life expectancy and sickness with females, whereas males report distinct dependence in Prague, other regions as well as the whole country itself. Prague shows very strong negative correlation (-0.939), males life expectancy in other regions is also negatively affected by sickness. However, the intercept and the slope of regression function are rather lower in comparison to remaining parts of the Czech Republic. This means that life expectancy is lower in capital, on the contrary it is not reduced so much by sickness of employees.

Second field of research is the relation between the age of patient and the length of sick leave. It is naturally assumed that the older patient is, the longer incapability occurs. To verify this assumption, the test of correlation coefficient has been performed, by gender again. In general, the correlation is significant and positive. The maximum is reached in the group 10 for males, in the group 9 for females (see Table 3 and Fig. 2). Then the length of sickness decreases.

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## **Approach to Information Risk Management in Accounting Departments of Selected Group of SMEs**

### **Abstract**

Risk management represents the significant part of the company treasury management. Its tools are used by both managers and operational staff to ensure the permanent control of the business processes that enable smooth running of the business. One of the parts of risk management is represented by the relatively new scientific discipline, information risk management. Tools provided by this discipline are usually used by the company employees in the specific situations related to the occurrence of any risky events such as operational error of support staff or software failure. One of such events may be the implementation or innovation of the information system used by the company that have to be considered by its management. This article aims to identify, analyse, explain and summarize approaches of further defined group of companies to information risk management and to the use of its tools. First part of this article is focused on the literary research in the area of information risk management, based on its legislative framework represented by ISO/IEC 27005:2011, respectively ČSN 36 9790 – Information technology – Security techniques – Information security risk management. The next part describes one of the conducted researches, its conditions, course of research and research results. It is a qualitative research that is intended to be used as the base for further research of the quantitative nature. Research consequences are mentioned at the end of this article.

### **Key Words**

*accounting, information management, risk management, information system, SMEs*

**JEL Classification: M150**

## **Introduction**

Current market is defined as a very competitive place. All companies try to succeed in such an environment. To reach their aims and to compete in the market, they are usually forced to use many tools provided by economic disciplines like financial management, accounting, risk management and also information management.

The discipline mentioned as the last one was established as a relatively individual area of research. Definition of information management can be found in various literary sources. More recent sources such as Švarcová and Rain (2012), Bytheway (2015) or AIIM (2014) define information management as the discipline that focus on "the ability of organizations to capture, manage, preserve, store and deliver the right information to the right people at the right time." In order for this definition to be used, criteria such as

inclusion of electronic and physical information, use of various sources (data, paper documents, electronic documents, audio, social business, video and others) or use of various channels of information delivery must be met.

The theoretical background of information management is formed by informatics, information science, system analysis, system engineering and managerial disciplines. Its establishment is related to many circumstances like the need to address in detail the issue of information management and risks associated with their management (Doucek, 2010) and also the development of technology. A lot of IT managers deal with the possibilities of system failure in case of an emergency or a crisis situation that can interrupt critical business activities of the company (Podaras, Antlová, Motejlek, 2016).

Currently, companies use to ensure their activities a wide range of information systems. These systems represent the information base of the company that can be used in all activities mainly in the decision making that is made easier by their use. It is recommended, in accordance with ISO/IEC 27005:2011 (2011), respectively ČSN 36 9790 (2008), to focus the process of risk management on the implementation of operational activities and to apply it to the whole information security management system (ISMS).

Extension of the use of information systems is a response to corporate change and new approaches in managing business processes, which can be, in accordance with Sodomka (2006), Molnár (2000) or Veyrat (2016), divided to internal (fully controlled by management) and external (not fully controlled by management). Following list represents the further division of business processes to:

- a) management processes,
- b) key processes,
- c) supporting processes.

Supporting process is defined by Pavelka and Klímek (2000) or Harmon (2003) as the process with no added value, no external customers and no generated revenue, process that does not take place across the company. According to Monk and Wagner (2013), among these processes can be included:

- a) financial accounting,
- b) management and cost control,
- c) planning and budgeting,
- d) cash-flow management.

Each system of economic processes management has to meet the requirements given by the current competitive environment and has to be based on the information derived from the above mentioned supporting processes. Business information systems can be classified according to their practical applications. The most often used information systems are Enterprise Resource Planning systems (ERP) that are focused on internal

business processes management. The most significant applications are applications such as: production, logistics, human resources and economics (financial accounting).

Companies that provide the offer of its products or services on the current market need to have an overview of all business activities, their funding and future investment opportunities. They want to use information more efficiently, but their information management systems are often set inappropriately. Individual parts of information system may be focused only on the performance of activities of the departments for which they were created. This causes the data to be relatively isolated. In such a situation, it is not easy to provide information to managers or employees in other departments that should cooperate. Information management can help to improve the cooperation of individual departments of the company, to implement an appropriate information system, to set strict rules for entering data into the system, to create a system of regular reports, to facilitate the creation and availability of printed reports, to adjust appropriately the approaches to individual parts (modules) of information system and to train the responsible staff.

By Hicks (2007) or Paquet (2013) each company that does not use the tools of information management and possibilities that are offered to it by technological resources is likely to be unable to sustain its position in current competitive environment. In spite of this fact, according to the information gained during the conducted research, described in following parts of the article, not all companies deal with information management and furthermore, there are no changes expected in the future in this area.

## **1. Methods of Research**

In this part of the article, the conducted qualitative research is described. This research was based on the method of expert interviews, which took place during 2016. Their main aim was to identify to what extent is information risk management included among other business processes by companies from selected research sample. The verified hypothesis was, among other things, the low level of inclusion of information risk management into the business activities of selected business entities. This research represents the initial part of a broader study that currently includes also the quantitative research which gives answers to questions related to the use of the tools of information management by larger research sample. The core of this article is the description of conducted qualitative research, quantitative research and its outputs may be used in author's other publishing activities, but it shouldn't be used now, because all outputs are not summarized and assessed yet.

In the context of the qualitative research, 40 business units were asked to participate in the interviews. A lot of addressed companies assessed the asked questions as too detailed and decided to give up participation in the interviews because of the concern of misuse of their sensitive internal information.

Final research sample consisted of professionals in the field of accounting and information technologies working in small and medium-sized enterprises (SMEs). Organizational structure of addressed SMEs had to meet these requirements:

- a) existence of accounting/economic department,
- b) use of information system,
- c) company operates in West Bohemia.

Information to the analyzed issue was provided by 15 business entities. Representatives of the enterprises were asked questions related to information management and risk management with respect to information system used by the company. With respect to the existence of three different approaches to information management, the ICT-Centered Approach, the Information-Centered Approach and the People-Centered Approach, defined by Morabito (2013) or Šidlichovská (2011) and to the aim of the research, were questions addressed to respondents within the expert interviews directed to three main areas: company information system in general, information system used by the economic/accounting department specifically and information risk management.

Respondents were also asked to prepare a brief risk analysis in the area of information risk management. This analysis was not provided by all addressed companies. Even so, information about used information system and its weak points was gathered and summarized.

In the context of conducted qualitative research were analyzed risks that exist in the companies in relation with the use of specific information systems. Possible impacts of analyzed risks to processes ensured by selected business units and their reduction or elimination were examined. In the cases, where respondents provided also information necessary for the risk register creation, the chart based on those information was created. Risk assessment was done mainly with respect to the methodics described by the ČSN 36 9790 - evaluation of assets, evaluation of threats and vulnerabilities and creation of the matrix with risk values (see Tab. 1).

**Tab. 1: Risk assessment – matrix in accordance with the ČSN 36 9790**

| Value of asset | Threat probability     |          |      |          |          |      |      |          |      |
|----------------|------------------------|----------|------|----------|----------|------|------|----------|------|
|                | Low                    |          |      | Moderate |          |      | High |          |      |
|                | Level of vulnerability |          |      |          |          |      |      |          |      |
|                | low                    | moderate | high | low      | moderate | high | low  | moderate | high |
| <b>0</b>       | 0                      | 1        | 2    | 1        | 2        | 3    | 2    | 3        | 4    |
| <b>1</b>       | 1                      | 2        | 3    | 2        | 3        | 4    | 3    | 4        | 5    |
| <b>2</b>       | 2                      | 3        | 4    | 3        | 4        | 5    | 4    | 5        | 6    |
| <b>3</b>       | 3                      | 4        | 5    | 4        | 5        | 6    | 5    | 6        | 7    |
| <b>4</b>       | 4                      | 5        | 6    | 5        | 6        | 7    | 6    | 7        | 8    |

*Source: authors' work in accordance with (ČSN 36 9790), 2017*

Categories used for evaluation of assets were: 0 – negligible value, 1 – low, 2 – medium, 3 – high and 4 – very high value (an important asset). Categories used for threat valuation were: L – low probability, M – moderate probability, H – high probability. Categories used

for vulnerability valuation were: L – low probability, M – moderate probability, H – high probability.

There could be more risks to one asset. The same risk could appear in relation to different assets. Asset in this study means any process ensured by accounting department. Risk categories were set in accordance with ČSN 36 9790 and divided as follows:

- |  |     |   |
|--|-----|---|
| a) Acceptable risk (Low level of risk) | 0-2 | A |
| b) Medium risk level                   | 3-5 | M |
| c) High level of risk                  | 6-8 | H |

## 2. Results of the Research

The rate of inclusion of risk management to business processes differ company to company. The most respondents stated that there was no information management and no use of its tools in the company they work in. A more detailed study of the situation has shown that all analyzed companies use information management and have modified method of risk management in general. Risks are managed on the base of intuition without deeper knowledge of information management theory and terminology.

In the monitored companies, sufficient attention is paid to technical equipment. Almost all companies provided detailed information about used hardware components. Information system is used for a long time, companies use mainly ERP systems that are selected mainly with respect to company requirements for outputs (user interface, data speed, compatibility with other systems, module interconnection and others). Further criteria for the selection of information system are price, availability of service or references by other system users. Data security is limited to the field of technical equipment in most analyzed companies. The trend of including the human factor tracking was confirmed in just a few companies. Human-related risk security still has no sufficient attention. The companies expect that monitoring of information risks related to the human factor is not necessary, because possible negative intervention made by employee is solved by set ERP system.

In most companies is for activities of economic/accounting department used the module of ERP system. Problems related to its use are mostly of an operational nature. In particular, the difficulties arise in connection with ensuring the functionality of technical equipment. Service is provided either by companies (themselves) or in cooperation with the IS supplier.

11 respondents know the word "information management" and its meaning. 7 respondents use the information management and its tools, but it is rather an approach focused mainly on information and communication technologies. 10 respondents work with information risk analysis. In many companies is intuitively used the methodics IPR (Identification of risks and processes) described by ISO 31 000 (ČSN 31 000) and ISO 36

9790 (ČSN 369790). Risk level categories for the purposes of the conducted qualitative research were set in accordance with ČSN 36 9790 and divided as was stated in the instructions given in the previous part of the article. The following chart (see Tab. 2) summarizes risks defined by 9 respondents of the research, who provided information for risk analysis.

**Tab. 2: Risk levels in individual analyzed companies**

| Risk categories             | Analyzed companies - amount of risks identified in individual risk categories |   |   |   |   |   |   |   |   |
|-----------------------------|---|---|---|---|---|---|---|---|---|
|                             | 1   | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| <b>A - acceptable (low)</b> | 2   | 1 | 1 | 2 | 1 | 0 | 0 | 2 | 0 |
| <b>M - medium</b>           | 1   | 1 | 0 | 3 | 1 | 1 | 3 | 2 | 2 |
| <b>H - high</b>             | 5   | 4 | 2 | 4 | 4 | 4 | 2 | 5 | 3 |

*Source: authors' own research, 2017*

The greatest amount of identified risks belong to the category „high level of risk“ with expected significant impact to business activities. Acceptable risks have occurred in 9 cases. Other identified risks belong to the category „medium level of risk“. Identified risks are usually of operational nature. Only in a few cases were identified risks related to the unintentional modification of information. Most often were identified risks such as inadequate software update (risk rating H, M) or inappropriate communication settings.

Following chart (see Tab. 3) summarizes information relating to the approach of individual companies to information management.

**Tab. 3: The extent of inclusion of information management among business activities of analyzed companies**

| Respondent        | Respondent knows the term „information management“ | Information management is used by the company | Company prepares the risk analysis | Expectation of the use of information management in future |
|-------------------|--|---|------------------------------------|--|
| Respondent no. 1  | no   | no  | no                                 | no   |
| Respondent no. 2  | yes  | no  | no                                 | no   |
| Respondent no. 3  | no   | no  | no                                 | do not know  |
| Respondent no. 4  | yes  | no  | yes                                | -----  |
| Respondent no. 5  | no   | no  | yes                                | -----  |
| Respondent no. 6  | yes  | yes   | yes                                | -----  |
| Respondent no. 7  | yes  | yes   | yes                                | -----  |
| Respondent no. 8  | no   | no  | yes                                | -----  |
| Respondent no. 9  | yes  | no  | no                                 | no   |
| Respondent no. 10 | yes  | yes   | no                                 | -----  |
| Respondent no. 11 | yes  | no  | yes                                | -----  |
| Respondent no. 12 | yes  | yes   | yes                                | -----  |
| Respondent no. 13 | yes  | yes   | yes                                | -----  |
| Respondent no. 14 | yes  | yes   | yes                                | -----  |
| Respondent no. 15 | yes  | yes   | yes                                | -----  |

*Source: authors' own research, 2017*

### 3. Discussion

As was stated in the part called Methods of research, this article focuses on the qualitative research conducted as the first phase of a broader study which should consist also of the quantitative research. The questions used in the assessed questionnaires were based on the outputs of the qualitative research described in this article. Because of the fact that the summary of the results of qualitative research is not available yet, there is no possibility to present it as a whole, but some findings mediated by the quantitative research are mentioned in this part of the article too.

Both types of research confirmed that price still represents the most significant criterion for information system selection in SMEs, but emphasis is put also on its quality. Companies have already realized that acquisition or improvement of an information system represent long-term investment that can move business processes forward (purchase of suitable system) or it can make the work more difficult (purchase of inappropriate information system). With respect to information gathered while asking about technical equipment and used IS in general, it can be written that data security in analyzed companies is limited to the technical equipment area. Mentioned types of data security tools were antivirus and network firewall. Many respondents also mentioned backup. It can be discussed if it is better to have the own employee for the information system management or if it is better to use the services of an external supplier of such services. It depends on many factors from the type of a company to its financial situation. Problems related to the information system are not so common and if they occur, they are usually of an operational nature. In general, analyzed companies are satisfied with the used IS. Similar responses were recorded while asking about information system used by the economic department specifically.

After assessing the outputs of both conducted researches, the author concludes that in the SMEs in West Bohemia still prevails the approach to information management focused on information and communication technologies. It can be deduced that managers are beginning to realize the need to include the human factor in the view of information management. The approach, which according to Morabito (2013) is the best one, the People-Centered Approach, has not yet been achieved.

Analyzed risk registers included in many cases risks like inadequate software update or inappropriate communication settings. These risks were considered, by the large part of analyzed companies, as risks that can be addressed or prevented. In this respect, activities aimed at improvements of some business processes have already been developed.

This research and its output have to be understood as the first part of a broader study. The second phase is focused on more detailed information gathering that can answer questions related to the same three issues as those set by the qualitative research: company information system in general, information system used by the economic/accounting department specifically and information risk management. This research is of a quantitative nature with greater amount of respondents, confirms the findings of the qualitative research and brings new findings.

## Conclusion

There is currently visible change in the described approaches to information management. Managers interest moves from focusing on information and communication technologies towards information and human capital. Managers are already aware of the need to include so-called soft factors in information management. This trend is also visible in the conditions of the Czech Republic, respectively on the selected research sample, but the ICT-Centered Approach in SMEs still prevails.

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## **CFEBT Method as a Tool of Decreasing Information Asymmetry in Accounting and as a Part of Internal Controlling Systems**

### **Abstract**

The paper deals with the possibilities of using CFEBT approach to identify potential risks of manipulated financial statements beyond their true and honest view of accounting including accounting mistakes and frauds. The existing research has verified the hypothesis of identifying the risk of manipulation of financial statements in the case study for 5 accounting periods with a CFEBT score in the condition of Czech accounting regulations and international standards of accounting recording (IFRS) in case studies of particular accounting units, as well as in the case studies where the techniques of creative accounting window dressing off-balance sheet financing were used. The CFEBT results of the study cases were subsequently verified and compared with the results of Beneish and Jones Non-discretionary Accruals models in conditions of Czech accounting regulations and international standards IFRS. The following paper further analyses and assesses the CFEBT approach to techniques and tools to identify risks of manipulated financial statements or tools for decreasing information asymmetry among the users of financial statements, with the use of main methods of creative accounting and accounting frauds in CFEBT model, Beneish's model, Jones' model of non-discretion accruality in comparison with the results of Altman's model of financial health of a business corporation.

### **Key Words**

*risk of manipulated financial statements, accounting errors and fraud, CFEBT model, fair and true view of accounting*

**JEL Classification: G32, G33, C35**

## **Introduction**

The financial statement represents a significant source of information for users of financial statements, i.e. the owners, Corporate Governance, potential investors, the state, creditors, customers and the public. They are meant to inform truly and honestly about the financial state of an accounting unit, about its efficiency, structure of the property, sources of financing and equity capital structure. From the variety of interests and targets of particular groups of users of financial statements and creators of financial records represents the risk of manipulation with accounting records within the real picture limited by given national accounting legislation. On the one hand, people using accounting records as the main source of information request top quality of the records, while on the

other hand it is impossible to ignore various influences and motivations of the creators which significantly affects the content of particular items of records. Regarding the information asymmetry acting among record creators and users, it is necessary to search for tools and possibilities enabling its decrease, or identification of risk of the reliability of the presented accounting records. If an accounting unit significantly distorts data of financial statement or presents false data and thus infringes a true and fair view of accounting, it is imposed with sanctions not only according to the law of accounting, but also consequences of criminal law and action basis of discretion of data on the state of management must not be forgotten. Therefore, it is important that users of financial statement are able to assess the risk of manipulation with accounting or are given tools for assessing this risk. This article aims at extending the current knowledge and methods in this field and offer the possibility to decrease information asymmetry for users of accounting records and management (persons Corporate Governance) by means of the approach of the CFEBT score and a modified version score CFEBT as a tool of internal and external control mechanisms. This aims to assess the risk of financial records in the context of their reliability from the viewpoint of a true and fair view of accounting.

## **1. Methods of Research**

In 2014, Ernst & Young (EY) published a summary of several international studies on fraudulent cases and corruption called "Drive for revenue growth ignores risk of prosecution for senior executives". (EY, 2014) The research was carried out in 43 countries including the Czech Republic with the aim of analysing how either individuals (internal auditors, top managers (Corporate Governance), lawyers) or major companies manage risk of potential frauds and corruption.

The research findings indicate that shadow accounting still persists as a significant problem in Europe. The highest probability of intentional unlawful modification of financial statements within the EU region was traced back to the Netherlands, Belgium and France. In addition, Czech companies often underestimate the risks of potential fraud or corruption during the acquisition process which can eventually lead to legislative problems and can even ruin the whole investment. To better illustrate the situation, only 9% of all acquisitions have undergone the process of forensic due diligence. The 14<sup>th</sup> international research by EY was done in 62 countries with 2825 participants interviewed, including the Czech Republic. (EY, 2016) According to the economic crime development study conducted by Pricewaterhouse Coopers (PWC), 5128 subjects within 99 countries were included in 2014 and 6337 participants from 115 countries were present in 2016 including 79 from the Czech Republic. (PWC, 2016) Another interesting finding shows that almost 42% of all fraudulent cases are discovered outside the internal control mechanisms indicating that Czech companies still rely heavily on traditional methods of fraud detection which are mostly outdated and fail to efficiently discover the problematic issues. The most recent prevention mechanisms works with data analysis where the detection of suspected areas use transactions as a part of an internal controlling system mainly represented by an internal audit or controlling.

Chartered Institute of Management Accountants has issued a risk management guide that stresses the possible management reaction plan to fraud discovery, fraud prevention and defines the potential areas susceptible to fraud and supports it with a fraud reporting case study (CIMA, 2009). Prevention and detection of accounting fraud is also covered in a publication by Dave Tate where the author presents typical operations through which accounting fraud can be done in 15 major risk areas such as liabilities, expenses, increase assets, cost of goods sold or equity (Tate, 2011).

Fraud exposure and possible ways of prevention are mentioned in a publication by Steve Dawson, where the author relies on the fact that an effective anti-fraud system of the accounting unit include risk assessment, control activities, information, communication, anti-fraud environment and monitoring (Dawson, 2015), for aspects of decision-making with regard to capital structure see(Černíková, 2014).

Pamela S. Manton in her book “Using Analytics to Detect Possible Fraud” provides case studies of four companies. The financial statements of the selected companies were subjected to examination via the individual tools and techniques appointed to examine accounting fraud. These case studies include the following techniques: Liquidity ratios, profitability ratios, horizontal analysis, vertical analysis, cash realized form operations, analysing cash realized from operations to net income from operations, the Beneish M-Score model, Dechow-Dichev Accrual Quality, Sloan’s Accruals, Jones Non-discretionary Accruals, The Piotroski F-Score model, Lev-Thiagarajan’s 12 Signals, Benford’s Law, Z-score analysis, Correlation, Regressions analysis (Mantone, 2013). Another approach to the detection of increased motivation to manipulate financial statements is the Beneish M score which was created for financial conditions by Professor Daniel Beneish Messod at the Indiana University in Bloomington, USA (Bell, 2009)

The CFEBT score method was analysed on the accounting units through pre-made case studies. In addition, the case studies with intentionally deformed financial statements were created in the environment that corresponds to the Czech Accounting Standards (CAS) and International Financial Reporting Standards (IFRS). The results of the CFEBT score were compared to the results of different methods and models including the selected creditworthiness model.

Accounting statements are tested in selected case studies during certain accounting periods using the following models:

The **CFEBT model** is defined as follows:

$$CFEBT = \frac{\sum_{t=1}^5 CF_t - \sum_{t=1}^5 EBT_t}{\sum_{t=1}^5 EBT_t} \times 100 \quad (1)$$

where  $\Delta CF$  is an increase of cash flow in period  $t$ , EBT is earnings before taxes in period  $t$ .

If  $CFEBT \geq materiality$ , there is a high risk of breaching a true and fair view of the accounts.

Materiality, significance ranges between 5 and 10%, taking into account the individual circumstances of the entity, as it did during the audit of financial statements by an external auditor. If  $CFEBT \geq \text{materiality}$ , there is a high risk of breaching a true and fair view of the accounts (Drabkova,2013).

**The Beneish Model** is a mathematical model used for financial models. It contains eight variables that can detect manipulation of accounting data. These are based on statements calculating the M score. M-score was created by Professor Beneish-Messod.

M-score calculation:

$$M = -4.84 + 0.920 DSRI + 0.528 GMI + 0.404 AQI + 0.892 SGI + 0.115 DEPI - 0.172 SGAI + 4.679 TATA - 0.327 LVGI \quad (2)$$

where  $DSRI$  = days' sales in receivable index in the  $t$  and  $t-1$  period,  $GMI$  = gross margin index as the ratio of gross margin and sales in the  $t$  and  $t-1$ ,  $AQI$  = asset quality index,  $SGI$  = sales growth index,  $DEPI$  = depreciation index,  $SGAI$  = sales and general and administrative expenses index,  $TATA$  = total accruals to total assets in the  $t$ -period,  $LVGI$  = Leverage index of total debts to total assets in the  $t$  and  $t-1$ .

M-score of less than  $-2.22$  indicates that a company has not manipulated the financial statements in the accounting period. M-score greater than  $-2.22$  signals that the company will likely be a manipulator.

The Beneish Model represents a different perspective on the manipulation of accounting data. When an entity reaches the M-score higher than  $-2.22$ , calculated from the above eight variables, the model assumes that it is probable that the entity has manipulated accounting data for the accounting period or is strongly motivated to manipulate accounting data, see (Bell,2009).

*Jones Non-discretionary Accruals* tests the indiscrete gains compared to the value of total assets in one period being lower than in other periods. Then, on the contrary, the model shows higher discretionary expenses of further periods. Such situation can infer a possible manipulation.

$$\left(\frac{1}{TA}\right) + \left(\frac{\text{Revenue}_{\text{current year}} - \text{Revenue}_{\text{prior year}}}{\text{Total assets}_{\text{current year}}}\right) + \left(\frac{\text{Property,plant, equipment}_{\text{current year}}}{\text{Total assets}_{\text{prior year}}}\right) \quad (3)$$

**Altman Z-score Model** – Professor E. I. Altman created a model (1968) which has the goal of differentiating companies with a high probability of default from those that do not bear such risk.

For the companies that are not publicly traded, it is possible to use this type of Altman model:

$$Z\text{-score} = 0.717*x_1 + 0.847*x_2 + 3.107*x_3 + 0.420*x_4 + 0.998*x_5 \quad (4)$$

where:  $x_1$  = net working capital / total assets;  $x_2$  = retained profit / total assets;  $x_3$  = EBIT / total assets;  $x_4$  = equity / total debts;  $x_5$  = total revenues / total assets.

Retained profit = profit funds + past earnings + recent earnings (within the current accounting period)

If the Z-score is bigger than 2.90, the company displays a good financial situation. In the case that the score results within the 1.2 to 2.90 range, it falls into the grey zone category. If the Z-score is below 1.2, the company is facing possible bankruptcy in the future. Recent research has tried to verify the hypothesis whether there is a close relationship between profit and cash flow within a 5-year horizon. In other words, whether the sum of the values tend to provide more or less the same result. Then the CFEBT model was designed and tested in order to reveal the possible risk of forged financial statements on the selected creative accounting case studies within the environment of the Czech Accounting Standards. (Drábková, 2013), (Drábková, 2015), (Drábková, 2016).

This paper analyses and evaluates the test results of the CFEBT score case studies as well as a modified version of the CFEBT score aimed at identifying financial statements manipulation in the form of accounting mistakes and frauds which greatly disrupt the explanatory power of financial statements and its ethical status within the environment of CAS and IFRS.

## **2. Results of the Research**

### **2.1 Case study - Manipulation of Financial Statements in CAS Environment within Five Accounting Periods**

In the case study of the selected accounting unit, the methods of creative accounting such as windows dressing and off-balance sheet financing were used in the second option A (with the aim to maximize both EBIT and the value of assets ) and option C (with the aim to minimize both EBIT and the value of assets or maximization of costs)

Financial statements of option A and option C were tested by the CFEBT score method in 5 subsequent accounting periods. The results are then compared with the Beneish M score model. Finally, the non-discretionary accruals are tested by Jones' Non-discretionary Accruals and by the Z score creditworthiness model.

**Tab. 1: Profit/loss and cash flow increment for the A option in 5 accounting periods**

| Option A           | 1 <sup>st</sup> year | 2 <sup>nd</sup> year | 3 <sup>rd</sup> year | 4 <sup>th</sup> year | 5 <sup>th</sup> year | Σ     |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-------|
| VH (EBT) thous.CZK | 30576                | 31660                | -41205               | 1999                 | 1117                 | 24147 |
| CF thous.CZK       | 0                    | 2785                 | 6889                 | 1805                 | 3594                 | 15073 |
| Cash               | 0                    | 2785                 | 9674                 | 11479                | 15073                |       |

*Source: own processing*

Tab 1: total CFEBT score = 37.6% - it significantly exceeds materiality, i.e. there is a high risk of manipulated financial statements in terms of Czech accounting regulations. M-score is of -0.83, which is higher than -2.22. According to this M-score, manipulation with the financial statements is likely in the 1<sup>st</sup> year. The Beneish Model thus confirmed the CFEBT model in conditions of Czech accounting standards.

**Tab. 2: Jones Non-discretionary Accruals for the A option in 5 accounting periods**

| Accounting item | 1 <sup>st</sup> year | 2 <sup>nd</sup> year | 3 <sup>rd</sup> year | 4 <sup>th</sup> year | 5 <sup>th</sup> year |
|-----------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Jones Accruals  | x                    | 0.196                | -1.266               | 0.669                | 0.182                |
| Result          | x                    | x                    | high risk            | high risk            | high risk            |

*Source: own processing*

In Table 2 option A shows ambivalence of Non-discretionary Accruals in the monitored accounting periods, years 2 – 5. The Non-discretionary Accruals dropped in the 3<sup>rd</sup> year which resulted in significant growth of discretionary accruals in the following year. Here the model detects possible manipulation of the profit throughout all accounting periods.

**Tab. 3: Profit/loss and cash flow increment for the option C in 5 accounting periods**

| Option C          | 1 <sup>st</sup> year | 2 <sup>nd</sup> year | 3 <sup>rd</sup> ear | 4 <sup>th</sup> year | 5 <sup>th</sup> year | Σ     |
|-------------------|----------------------|----------------------|---------------------|----------------------|----------------------|-------|
| VH(EBT) thous.CZK | 2539                 | 5150                 | 4948                | 1369                 | 700                  | 14706 |
| CF thous.CZK      | 0                    | 2785                 | 6889                | 1805                 | 3594                 | 15073 |
| Cash              | 0                    | 2785                 | 9674                | 11479                | 15073                |       |

*Source: own processing*

Tab 3 shows the CFEBT score of 2.5% in the 5 monitored accounting periods. This figure is lower than stated materiality, thus the CFEBT score detects a low risk of manipulation of accounting statements beyond a true and fair view of accounting in CAS conditions.

M-score of Beneish model for option C revealed that the entity that pursues the objective of achieving a true and fair view of the financial statements amounted to the M-score of -2.26, which is lower than -2.22. The Beneish Model here confirms the CFEBT model with the fact that the entity is not a manipulator in the 1<sup>st</sup> year in conditions of Czech accounting standards.

**Tab. 4: Jones Non-discretionary Accruals for option C in 5 accounting periods**

| Accounting item            | 1 <sup>st</sup> year | 2 <sup>nd</sup> year | 3 <sup>rd</sup> year | 4 <sup>th</sup> year | 5 <sup>th</sup> year |
|----------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Property, plant, equipment | 10000                | 11000                | 11000                | 11000                | 11000                |
| Jones Accruals             | x                    | 0.708                | 0.569                | -0.237               | 0.476                |
| Result                     | x                    | x                    | low risk             | high risk            | low risk             |

*Source: own processing*

Option C shows relatively stable non-discretionary accruals in the 2<sup>nd</sup>, 3<sup>rd</sup> and 5<sup>th</sup> years (accounting period) while in the 4<sup>th</sup> year non-discretionary accruals dropped. This decrease is likely to indicate earnings manipulation or the method of “income smoothing” or accounting fraud.

As the Czech accounting standards concerning cost and revenues do not strictly record the principle of the content taking precedence over the form, this information can be seen as complementary in terms of Czech accounting standards, particularly for understanding underlying accounting data and processes of management accounting by the managers of Corporate Governance in the extended concept to refine the calculation of deferred taxes based on the economic substance of financial data

**Tab. 5: Altman Z-Score for options A and C in 5 accounting periods**

| Accounting period    | Z score                       | Z score                       |
|----------------------|-------------------------------|-------------------------------|
|                      | variant A                     | variant C                     |
| 1 <sup>st</sup> year | 1.7 Grey zone                 | 2.9 Grey Zone                 |
| 2 <sup>nd</sup> year | 1.4 Grey zone                 | 3.2 good financial situation  |
| 3 <sup>rd</sup> year | 1.2 Grey zone                 | 2.9 Grey Zone                 |
| 4 <sup>th</sup> year | 1.0 at risk of bankruptcy     | >2.9 good financial situation |
| 5 <sup>th</sup> year | >2.9 good financial situation | >2.9 good financial situation |

*Source: own processing*

The outcomes of Table 5 for option A of Altman Z-score enables us to determine the relevant financial health of the corporation from the accounting statement. A significant risk of manipulated accounting statements can be identified on the grounds of inconsistent results of particular accounting periods. Altman Z-Score for option C records a business corporation in the grey zone in the 1<sup>st</sup> and 3<sup>rd</sup> years of evaluation while for these two years the value of the Z-Score amounted to the threshold of 2.9, as a Z-score above the threshold indicates the good financial health of a business corporation. In subsequent years (the 2<sup>nd</sup>, 4<sup>th</sup> and 5<sup>th</sup> years), the Z-Score reports financial health above the threshold of 2.9. The positive outcome of the assessment of financial health is significantly affected by the proposed business corporation that is not burdened by obligations that would threaten the business activity of the corporation. At a general level of the Altman model of assessed positive outcomes of the good financial situation, the question is whether the stability of the results of this model is to some extent caused by the manipulation of accounting items of assets, liabilities or income on which the model is based.

## 2.2 Case study – CFEBT score of the accounting unit before liquidation in terms of CAS and IFRS

The following case study analyses the different possibilities of detecting the manipulation of financial statements in terms of the Czech Accounting Standards and IFRS. A sample accounting item (corporation) meets the condition of a loss of more than five million CZK in the first accounting period and its financial statements are provided within the Czech accounting standards for six accounting periods between 2008 and 2013 are available. At the same time the corporation's liquidation took place in the year after the analysed period, i.e. in 2014.

**Tab. 6: CFEBT score in 2008 - 2013**

| Years                    | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | Sum    |
|--------------------------|-------|-------|-------|-------|-------|-------|--------|
| VH (EBT) in thous. CZK   | -7547 | -8935 | -5979 | -4752 | -1776 | -8502 | -37491 |
| CF Accrual in thous. CZK | 136   | -91   | 6738  | 1065  | -2251 | -1727 | 3734   |
| CF in thous. CZK         | 136   | 45    | 6783  | 7848  | 5597  | 3870  | 24279  |

*Source: own processing*

The CFEBT score figures of the monitored accounting unit detect 110%. 110% of the value is thus well above the consideration of materiality of 5-10%.

To evaluate the risk of manipulated financial statement beyond their true and fair view of accounting in compliance with IFRS and CAS, an analysis of the development of risk items and the discrepancy between the development and cash flow stated in the financial statement should be done. Experts or auditors subsequently assess the difference in figures as either the natural risk of financial system or the risk of manipulated financial statements beyond the legislative standards.

The analysis of the financial statement EBT and decrease or increase of cash flow in the accounting unit from 2008 to 2013 identifies the risk of potential manipulation which infringes the true and fair view of financial statements with possible results contributing to the underestimation of financial profit or overestimation of financial losses. Subsequently, they were modified by the EBT and cash flow differences in non-financial items. The final modified CFEBT score was lowered to 21%.

## 2.3 Case study – CFEBT score of the accounting unit with the profit over 7 m. CZK in terms of CAS

In this case study a risk analysis was performed using selected models; the Beneish model, the CFEBT model, the Jones Non discretionary Accruals model and selected bankruptcy models to detect accounting frauds in specific case studies of a selected accounting unit. The given entity was processed using a case study for the period of five years. Furthermore, the entity made a profit of more than seven million CZK and does business in the service sector in years 2009 - 2013.

**Tab. 7: EBT and CF Accrual in the years 2009- 2013**

| Years                                      | 2009  | 2010  | 2011 | 2012 | 2013 | Sum   |
|--|-------|-------|------|------|------|-------|
| ∑ VH (EBT) in mil. CZK                     | 11560 | 10594 | 9160 | 8663 | 7161 | 47138 |
| CF Accrual in mil.CZK+corporate income tax | 3455  | 5925  | 8818 | 5870 | 3361 | 26799 |
| CFEBT score (before modification)          | x     | x     | x    | x    | x    | 43%   |

*Source: own processing*

Table 7 presents the results of detecting manipulation risk in the financial statements through the CFEBT model in the accounting periods of 2009 to 2013. The CFEBT revealed high levels above the materiality in CF and EBT accruals in the years of 2009 to 2013. After calculating the value of the CFEBT model, it represents 43% of the value, and thus well above consideration materiality of 5-10%. Therefore, it is necessary to analyse the development of risk items above the mentioned guidelines of the discrepancy between development and cash flow items reported in the financial statements.

The value of the modified CFEBT was significantly reduced from 43% to 6%, to a considered materiality within the true and fair view of accounting. Users of financial statements who need to decide about the credibility of financial statements in terms of CAS and IFRS can be advised to perform a more detailed analysis of risk items within the accounting and take into account the specifics defined by the true and fair view of the accounts of the national accounting systems.

**Tab. 8: Beneish M score in 2008 - 2014**

| Years                                 | 2009/2008 | 2010/2009 | 2011/2010 | 2012/2011 | 2013/2012 | 2014/2013 |
|---------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| M-score (8 variable model)            | -2.58     | -2.35     | -3.4      | -2.81     | -14.52    | -4.08     |
| If M > -2.22, likely is a manipulator | low risk  |

*Source: own processing*

Table 8 reveals the entity's results of the Beneish M-score between 2009 – 2014. In these years the M-scores were reported at the level of less than -2.22 and the years were assessed as low risk with an improbable earnings manipulation.

**Tab. 9: Jones' Non discretionary Accruals for period 2009 - 2013**

| Accounting item            | 2009  | 2010     | 2011     | 2012     | 2013      |
|----------------------------|-------|----------|----------|----------|-----------|
| Total assets               | 32871 | 3297     | 33158    | 3294     | 32351     |
| Revenue                    | 30417 | 28820    | 26549    | 25533    | 25140     |
| Property, plant, equipment | 11519 | 12098    | 11792    | 11121    | 10323     |
| Jones' analysis            | x     | -0.030   | -0.052   | -0.296   | 96.444    |
| Result                     |       | low risk | low risk | low risk | high risk |

*Source: own processing*

Table 9 tests accrual principle using Jones' Non discretionary Accruals in financial periods 2009 - 2013. Jones' Non discretionary Accruals reveals a significant fluctuation identified in 2013 which resulted from the assets growth of 29,057 m. CZK and the merger with other business corporations.

## Conclusion

The case studies tested the CFEBT score and its modified form for different accounting units with intentionally manipulated financial statements by the methods of creative accounting within the conditions of CAS and IFRS. The risk of manipulated financial statements within the CFEBT score was compared to other models and attitudes together with the Altman Z-score model.

The CFEBT model is considered to be a basic comprehensive view of the financial statements and the links between them. The model traces the development of the statements and links them to more accounting periods (optimally in five years) and analyses the links between cash flow and profit.

Modified CFEBT score presents a detailed test which may become an effective part of the anti-fraud programme of internal controlling systems. The awareness of the risks of financial statements improves the efficiency of corporate internal controlling systems and lowers the information asymmetry between the owners and Corporate Governance. The asymmetry can emerge in proficiency, quality and structure of the information provided, the attitude to the information and especially by the motivation of people.

The modified version of the CFEBT model respects the individuality of the accounts of a sample entity and substantially eliminates the diversity of national accounting systems such as the Czech accounting standards, IFRS and US GAAP.

We believe that the suggested CFEBT model may be used by auditors to identify risks of accounting fraud in accordance with ISA 240 or by any user of accounts for testing financial statements. Its modified version may be used as a detailed test for auditors to identify risk, particularly in the application of an audit judgement in assessing audit risk, in audit planning and in testing different items in the financial statements as a part of an anti-fraud system for an internal control system of an accounting entity.

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## Maintenance Management Support Using the Grey Relational Analysis

### Abstract

Grey relational analysis can be, in addition to known applications, used also for decision making in where various factors, for which we cannot guarantee their accuracy due to various reasons, are evaluated. Issues of equipment maintenance planning and management are a typical example, where the best of several available variants are searched for the solution of optimising tasks. For instance, the selection of the best variant of determination of the preventive maintenance interval must take into account several factors, in relation to which, however, the completeness or certainty of necessary data cannot be always provided. The grey relational analysis is used in this paper on the grounds of multiple attribute decision making approaches for solving a specific maintenance task. The organization has due to the temporary reduction of orders the option to shut down a certain number of equipment. Thus, equipment on which the maintenance will be performed at the time of unused capacities can be selected out of the group of equipment with the determined preventive maintenance interval. The task of selecting the equipment for maintenance does have its limitations in form of determined group of equipment with their parameters and is also determined by a particular time window – the interval of temporary reduction of capacities. Not only the history of operation and maintenance of equipment, but also the need and efficiency of their further utilisation, are taken into account in the task solving process with real data. It concerns a combination of data of both certain and uncertain nature. Results obtained by means of the grey relational analysis are compared with conventional multicriteria analysis approach without taking uncertainties into account and both advantages and disadvantages of reached different solutions are discussed.

### Key Words

*production management, scenario analysis, qualitative choice models, grey numbers*

**JEL Classification: L11, B41, C25, D24**

## Introduction

The present era of hyper-competitiveness places increased demands on organizations for the performance of processes, but it cannot be understood only in the sense „to produce more“. Multi-dimensional view of the issue of performance is necessary, i.e. to search for synergies not only in the utilisation of business opportunities and technical innovations, but also in the humanisation of work, greening of work and so on.

Effect of synergy is an effect of the management system when two parties having different opinion as to the solution of complex challenges and issues succeeded in finding a decision resulting in significantly better result than individual alternatives of both parties. It is an innovative way towards the “third alternative” (Covey, 2013). Such effective solution is possibly only when partnership parties are willing to come outside the borders of their own conventional ideas and accept the creation of a reality better than the previous one. The principle of synergy can constitute a key to large and extraordinary increase of productivity; it offers achievement of more dynamic and more innovative improvements in the solution of a constructive conflict.

Issues of maintenance management differ in relation to the type of equipment and intensity of its usage. The most frequently occurring task in the maintenance of equipment with mechanically stressed parts is the effective planning of the interval of periodical preventive maintenance in order to maintain the readiness of the equipment at the highest possible level (Lihai, 2014). Various random influences cause that the system of maintenance management is perceived as system with uncertainty caused by the incompleteness and inaccuracy of information (Hong-Fa, 2012). A specific case of maintenance management can occur in case the production capacity is relieved for a certain time as a result of production dynamics change. In such case, the production planning can be combined with non-planned maintenance of equipment, whereas the most effective combination of operated and not operated equipment from the perspective of production and maintenance must be chosen. The complexity of obtaining input data and relatively high degree of uncertainty of several factors requires for the selection of suitable equipment an approach that belongs to the field of grey systems theory, or, to be more precise, the grey relational analysis.

## **1. Methods of Research**

The grey system theory represents a relatively new methodology based on the scientific principle of simplicity, which focuses on the study of issues in which the lack or uncertainty of information appears (Zavadskas, 2015). The grey relational analysis (GRA) is an important approach of grey system theory, which evaluates a set of alternatives in terms of decision criteria, which can be used in the form of grey decision making also for making a decision, which evaluates various parameters of discrete data. It is based on the comparison of degree of similarity between pairs of factors. This makes easier also the solution of issues for which the completeness of necessary data cannot be provided, or issues solved in uncertain environment. Literature shows many applications of the grey decision making, for instance as a tool for classification of the level of sustainability of production organisations (Golinska, Kosacka, Mierzwiak, & Werner-Lewandowska, 2015), but also combining and integrating of various approaches of the grey theory systems with other approaches, e.g. Pakkar mentions grey relational analysis, analytic hierarchy process and data envelopment analysis (Pakkar, 2016).

The methodical procedure of solving the task of maintenance management was inspired by the research (Kuo, Yang, & Huang, 2008), (Feng & Xiaohui, 2009), who dealt in their works with various approaches to the solution of multiple attribute decision making.

Let's assume that  $Y$  is a universal set and  $y$  has a relationship to this set. The grey number of the set  $Y$  can be defined as  $y = [a, b]$ , where  $a$  is the lowest value,  $b$  represents the highest value; or for  $m$  variants and  $n$  factors the  $i$ -th variant can be expressed as  $Y_i = (y_{i1}, y_{i2}, \dots, y_{ij}, \dots, y_{in})$ , where  $y_{ij}$  is the performance of factor  $j$  in the variant  $i$ . Steps of the decision making process solution using the grey relational analysis consist of the following sequence: grey relational generating (grey normalisation), reference sequence definition, grey relational coefficient calculation and finally grey relational grade calculation, from which for instance the ranking of variant solutions can be made in the case of multiple decision.

The grey relational generating provides the transformation of factors influencing the solution and expressed in various units to a unified form. At the same time, the property of factors expressing their position in the task solution must be taken into account. Three positions of factors are eligible:

The-larger-the better factors:

$$x_{ij} = \frac{y_{ij} - \text{Min}\{y_{ij}, i = 1, 2, \dots, m\}}{\text{Max}\{y_{ij}, i = 1, 2, \dots, m\} - \text{Min}\{y_{ij}, i = 1, 2, \dots, m\}} \text{ for } i = 1, 2, \dots, m \text{ and } j = 1, 2, \dots, n \quad (1)$$

The-smaller-the better factors:

$$x_{ij} = \frac{\text{Max}\{y_{ij}, i = 1, 2, \dots, m\} - y_{ij}}{\text{Max}\{y_{ij}, i = 1, 2, \dots, m\} - \text{Min}\{y_{ij}, i = 1, 2, \dots, m\}} \text{ for } i = 1, 2, \dots, m \text{ and } j = 1, 2, \dots, n \quad (2)$$

The-closer-to-the-desired-value-he-better factors:

$$x_{ij} = 1 - \frac{|y_{ij} - y_{ij}^*|}{\text{Max}\{\text{Max}\{y_{ij}, i = 1, 2, \dots, m\} - y_{ij}^*, \text{Min}\{y_{ij}, i = 1, 2, \dots, m\}\}} \quad (3)$$

for  $i = 1, 2, \dots, m$  and  $j = 1, 2, \dots, n$

The result of the first step should be by means of using equations (1), (2) and (3) standardised performance values  $x_{ij}$ , which are now in the interval  $\langle 0, 1 \rangle$ , where the value 1 represents the best value of the factor. A comparable set of values of performance of the examined factor is thus obtained for each variant.

The grey relational coefficient is calculated in the second step. This coefficient determines how close  $x_{ij}$  is to the reference sequence of performance values, which is  $X_0$  in form  $(x_{01}, x_{02}, \dots, x_{0n}) = (1, 1, \dots, 1)$ . Grey relational coefficient between  $x_{0j}$  and  $x_{ij}$ :

$$\gamma(x_{0j}, x_{ij}) = \frac{\Delta_{\min} + \xi \Delta_{\max}}{\Delta_{ij} + \xi \Delta_{\max \square}} \text{ for } i = 1, 2, \dots, m \text{ and } j = 1, 2, \dots, n \quad (4)$$

The grey relational grade (GRG) can be calculated using the grey relational coefficient, GRG represents the level of correlation between the reference sequence and the comparability sequence.

$$\Gamma(X_0, X_1) = \sum_{j=1}^n w_j \gamma(x_{0j}, x_{ij}) \text{ for } i = 1, 2, \dots, m \quad (5)$$

The coefficient  $w_j$  represents the weight of factor  $j$  and usually depends on the structure of factors in relation to the solved issue and is determined by the decision maker. Values of the grey relational grade can be used for instance for the ranking of variants, where the best variant is the variant with the highest value of GRG.

## 2. Maintenance issues in the environment of changing production dynamics

According to Liu, Forrest and Yang (Liu, Forrest, & Yang, 2012), basic characteristics of grey systems include the incompleteness and inadequacy in their information. In case of maintenance system, the issue of the incompleteness of information represents especially the history of failures, their parameters and causes of occurrence, i.e. information on the system's behaviours. Inaccuracies in data are represented in maintenance systems by difficulties associated with the prediction of consequences of failures for the production.

**Tab. 1: Variants of admissible combination of machines**

| Variant | Machines left in operation | Machines put into temporary downtime |
|---------|----------------------------|--------------------------------------|
| V 01    | 1 - 2 - 3 - 4              | 5 - 6                                |
| V 02    | 1 - 2 - 3 - 5              | 4 - 6                                |
| V 03    | 1 - 2 - 3 - 6              | 4 - 5                                |
| V 04    | 1 - 2 - 4 - 5              | 3 - 6                                |
| V 05    | 1 - 2 - 4 - 6              | 3 - 5                                |
| V 06    | 1 - 2 - 5 - 6              | 3 - 4                                |
| V 07    | 1 - 3 - 4 - 5              | 2 - 6                                |
| V 08    | 1 - 3 - 4 - 6              | 2 - 5                                |
| V 09    | 1 - 3 - 5 - 6              | 2 - 4                                |
| V 10    | 1 - 4 - 5 - 6              | 2 - 3                                |
| V 11    | 2 - 3 - 4 - 5              | 1 - 6                                |
| V 12    | 2 - 3 - 4 - 6              | 1 - 5                                |
| V 13    | 2 - 3 - 5 - 6              | 1 - 4                                |
| V 14    | 2 - 4 - 5 - 6              | 1 - 3                                |
| V 15    | 3 - 4 - 5 - 6              | 1 - 2                                |

*Source: operation's records*

An example of solving the task which combines requirements and production is the task of temporary downtime of equipment. There is set of six machines available in the monitored production section in the planning period, from which we need only a certain number to fulfil orders for the following period. Fulfilment of orders will require machine work of 320 hours, which must be performed within one week. With production capacity of two-shift operation of machines, 4 machines are sufficient to fulfil orders (80\*4 machine hours); two machines can be put into temporary downtime for needs of maintenance actions. Machines have relatively similar production (patterning) options, they are at various levels of their service lives and they also have different history of failures. Fifteen variants can be considered for the selection of machines for production/maintenance (see Tab. 1).

With regard to requirements for the achievement of synergy, the selection of the most suitable variant should respect factors not only from the area of maintenance, but also the need of operation in order to fulfil tasks. Factors (see Tab. 2) are based on the Overall Equipment Effectiveness approach and are determined so as not be in conflict. Several data related to the performance with regard to a certain factor can be determined only incompletely or by estimate.

**Tab. 2: Characteristics of factors for the determination of a suitable variant**

| Factor | Factor Identification                     | Unit                      | Orientation    |
|--------|---|---------------------------|----------------|
| F1     | Interval until necessary maintenance      | operating hours           | less is better |
| F2     | Previous failure rate (downtime machines) | percentage                | more is better |
| F3     | Expected maintenance duration             | standardised time (hours) | desired value  |
| F4     | Accessibility of machines for operators   | meter                     | less is better |
| F5     | Dustiness of environment                  | miligram                  | more is better |
| F6     | Ambient lighting                          | lux                       | less is better |

*Source: authors' research*

Detailed characteristics of factors F1 to F6:

F1 – Interval until the necessary maintenance of machines put into temporary downtime is the time (in operating hours) remaining until the date of the following planned periodical maintenance. *Factor measurability*: records of the date of the last periodical maintenance and calculation of time until the next planned periodical maintenance (given by the maintenance standard) with the expected 5-day work week and 16-hour daily operation.

F2 – Previous failure rate of machines put into downtime is the percentage ratio of idle time of machines to their total available operating time (in machine hours), or the reversed value of idle time percentage. *Factor measurability*: records of idle time hours of machines and determination of the ratio of such idle time hours to the total operating time for the last planning period.

F3 – Expected duration of maintenance action is time (in standardised hours) for the performance of periodical maintenance activities. *Factor measurability*: determination of

the standard time for the performance of actions with regard to the failure rate, physical or moral wear and tear of individual maintained parts of the monitored machines.

F4 – Accessibility of left machines for operators is the distance (length of walk) the operator must make during regular inspection walk to machines left in operation. *Factor measurability*: determination of the length of walk (in metres) for cyclic inspection moving of operator to individual machines when performing routine operating activities.

F5 – Dustiness of the environment as the factor of product quality. Dustiness of the environment adversely impacts not only the volume of idle time of machines, but also the quality of finished textile products. Drifts of textile dust can cause deterioration of quality of large flat textiles. Dustiness in the locality of individual machines is affected by the position of the machine, distance from the exhaust equipment etc. *Factor measurability*: weight of dust collected during exhausting dust from machines in downtime after the end of shift (in case of absence of continuous cleaning of machines) and idle time due to clogging of functional mechanisms with dust.

F6 – Ambient lighting as the factor of effective time of machine preparation to work. Ambient lighting can differ between individual machine positions and affects the speed of preparation of machine for a new production range. Better lighting quality means for instance higher speed of slipping yarn on riders etc. *Factor measurability*: average intensity of lighting measured in lux on three places on the machine at the height of 1.5 m from machines in downtime.

Data for individual factors (see Tab. 3) were determined from records (maintenance) or specific measurements were performed with varying accuracy for the purpose of solving this task.

**Tab. 3: Qualitative data for machine alternatives**

|         | Interval | Failure | Duration | Accessibility | Dustiness | Lighting |
|---------|----------|---------|----------|---------------|-----------|----------|
| Variant | F1       | F2      | F3       | F4            | F5        | F6       |
| V 01    | 1 350    | 5.6     | 77       | 90            | 0.0901    | 987      |
| V 02    | 700      | 11.4    | 89       | 80            | 0.0611    | 1 040    |
| V 03    | 850      | 10.8    | 96       | 70            | 0.0718    | 981      |
| V 04    | 950      | 8.3     | 75       | 80            | 0.0817    | 1 133    |
| V 05    | 1 100    | 7.7     | 82       | 105           | 0.0924    | 1 074    |
| V 06    | 450      | 13.5    | 94       | 70            | 0.0634    | 1 127    |
| V 07    | 880      | 10.7    | 87       | 115           | 0.0760    | 1 193    |
| V 08    | 1 030    | 10.1    | 94       | 140           | 0.0867    | 1 134    |
| V 09    | 380      | 15.9    | 106      | 105           | 0.0577    | 1 187    |
| V 10    | 630      | 12.8    | 92       | 70            | 0.0783    | 1 280    |
| V 11    | 1 600    | 4.6     | 59       | 90            | 0.0848    | 976      |
| V 12    | 1 750    | 4.0     | 66       | 115           | 0.0955    | 917      |
| V 13    | 1 100    | 9.8     | 78       | 80            | 0.0665    | 970      |
| V 14    | 1 350    | 6.7     | 64       | 80            | 0.0871    | 1 063    |
| V 15    | 1 280    | 9.1     | 76       | 90            | 0.0814    | 1 123    |

*Source: records and authors' measurement*

Weight stipulated by a group of 3 experts (maintenance manager, operation manager, quality manager) was determined for factors. Individual factors were assigned weights: interval 0.20; failure: 0.15; duration: 0.26; accessibility: 0.15; dustiness: 0.14; lighting: 0.10. Sum of weights is 1.00.

### 3. Results of the Research and Results Discussion

Results of the first step, the standardisation, are shown in table 4. According to the presented methodology, respective formulas (1), (2) or (3) were used on the grounds of characteristics (see Tab. 2). The value  $x_{ij}=1$  means the best performance of the factor for the given variant.

**Tab. 4: Results of grey relational generating for machine alternatives**

|      | F1     | F2     | F3     | F4     | F5     | F6     |
|------|--------|--------|--------|--------|--------|--------|
| V 01 | 0.2920 | 0.1345 | 0.8846 | 0.7143 | 0.8571 | 0.8072 |
| V 02 | 0.7664 | 0.6218 | 0.6538 | 0.8571 | 0.0899 | 0.6612 |
| V 03 | 0.6569 | 0.5714 | 0.3846 | 1.0000 | 0.3730 | 0.8237 |
| V 04 | 0.5839 | 0.3613 | 0.8077 | 0.8571 | 0.6349 | 0.4050 |
| V 05 | 0.4745 | 0.3109 | 0.9231 | 0.5000 | 0.9180 | 0.5675 |
| V 06 | 0.9489 | 0.7983 | 0.4615 | 1.0000 | 0.1508 | 0.4215 |
| V 07 | 0.6350 | 0.5630 | 0.7308 | 0.3571 | 0.4841 | 0.2397 |
| V 08 | 0.5255 | 0.5126 | 0.4615 | 0.0000 | 0.7672 | 0.4022 |
| V 09 | 1.0000 | 1.0000 | 0.0000 | 0.5000 | 0.0000 | 0.2562 |
| V 10 | 0.8175 | 0.7395 | 0.5385 | 1.0000 | 0.5450 | 0.0000 |
| V 11 | 0.1095 | 0.0504 | 0.1923 | 0.7143 | 0.7169 | 0.8375 |
| V 12 | 0.0000 | 0.0000 | 0.4615 | 0.3571 | 1.0000 | 1.0000 |
| V 13 | 0.4745 | 0.4874 | 0.9231 | 0.8571 | 0.2328 | 0.8540 |
| V 14 | 0.2920 | 0.2269 | 0.3846 | 0.8571 | 0.7778 | 0.5978 |
| V 15 | 0.3431 | 0.4286 | 0.8462 | 0.7143 | 0.6270 | 0.4325 |

*Source: authors' calculations*

In line with the grey relational analysis methodology, the next step was the calculation of the grey relational coefficient (4) as compared to values of reference sequence and subsequently the grey relational grade calculation taking into account weights of individual factors (5). Results are shown in two parts of table 5. The left part (see Tab. 5) shows results of grey relational coefficient calculation; the right part shows results of grey relational grade calculation.

**Tab. 5: Results of grey relational coefficient and grey relational grade**

| Variant | Grey relational coefficient |        |        |        |        |        | Grey relational grade |
|---------|-----------------------------|--------|--------|--------|--------|--------|-----------------------|
|         | F1                          | F2     | F3     | F4     | F5     | F6     |                       |
| V 01    | 0.4139                      | 0.3662 | 0.8125 | 0.6364 | 0.7778 | 0.7217 | 0.1042                |
| V 02    | 0.6816                      | 0.5694 | 0.5909 | 0.7778 | 0.3546 | 0.5961 | 0.1002                |
| V 03    | 0.5931                      | 0.5385 | 0.4483 | 1.0000 | 0.4437 | 0.7393 | 0.1003                |
| V 04    | 0.5458                      | 0.4391 | 0.7222 | 0.7778 | 0.5780 | 0.4566 | 0.1010                |
| V 05    | 0.4875                      | 0.4205 | 0.8667 | 0.5000 | 0.8591 | 0.5362 | 0.1058                |
| V 06    | 0.9073                      | 0.7126 | 0.4815 | 1.0000 | 0.3706 | 0.4636 | 0.1103                |
| V 07    | 0.5781                      | 0.5336 | 0.6500 | 0.4375 | 0.4922 | 0.3967 | 0.0898                |
| V 08    | 0.5131                      | 0.5064 | 0.4815 | 0.3333 | 0.6823 | 0.4555 | 0.0825                |
| V 09    | 1.0000                      | 1.0000 | 0.3333 | 0.5000 | 0.3333 | 0.4020 | 0.0998                |
| V 10    | 0.7326                      | 0.6575 | 0.5200 | 1.0000 | 0.5235 | 0.3333 | 0.1062                |
| V 11    | 0.3596                      | 0.3449 | 0.3824 | 0.6364 | 0.6385 | 0.7547 | 0.0806                |
| V 12    | 0.3333                      | 0.3333 | 0.4815 | 0.4375 | 1.0000 | 1.0000 | 0.0912                |
| V 13    | 0.4875                      | 0.4938 | 0.8667 | 0.7778 | 0.3946 | 0.7740 | 0.1077                |
| V 14    | 0.4139                      | 0.3927 | 0.4483 | 0.7778 | 0.6923 | 0.5542 | 0.0879                |
| V 15    | 0.4322                      | 0.4667 | 0.7647 | 0.6364 | 0.5727 | 0.4684 | 0.0963                |

*Source: authors' calculations*

Ranking of individual variants can be made on the grounds of results of the grey relational grade calculation. In order to verify the influence of approach to the solution of this task of maintenance management by means of the grey relational analysis, results in table 6 show also results obtained by classic approach.

**Tab. 6: Results of grey relational analysis for machine selection problem**

| Variant | V01 | V02 | V03 | V04 | V05 | V06 | V07 | V08 | V09 | V10 | V11 | V12 | V13 | V14 | V15 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| GRA     | 5   | 8   | 7   | 6   | 4   | 1   | 12  | 14  | 9   | 3   | 15  | 11  | 2   | 13  | 10  |
| MCA     | 7   | 6   | 8   | 5   | 3   | 2   | 10  | 13  | 12  | 4   | 15  | 14  | 1   | 11  | 9   |

*Source: authors' calculations*

Results (see Tab. 6) clearly show that by using the grey relational analysis for the solution of the decision making issue concerning the selection of suitable machines for maintenance during downtime we obtained different results than by using the multi-criteria analysis (MCA) without taking the uncertainty into account (according to GRA the best variant is V06, according to MCA the best variant is V13). The result must be perceived as recommendation in both cases. From the practical perspective, variant 6 has the biggest advantage in the factor of accessibility of operated machines and need of maintenance of machines in downtime. The disadvantage of the variant 6 is in relatively high dustiness affecting machines in operation. Variant 13 has the biggest advantage in factual match of the maintenance duration with the planned downtime, the disadvantage is in timing the maintenance action (interval), which would be used relatively too early for machines put into downtime.

## Conclusion

Improvement of maintenance management is an area where there is still a potential for further improvement in majority of production organisations due to the complicated

nature of obtaining relevant data as well as the complexity of operation process description. A whole range of random phenomena affects maintenance works and that brings significant complications, for instance for the calculation of their standards (Šlaichová, 2013). One of the areas of innovation is also the application of innovative approaches in decision making processes of maintenance. If data typical for their uncertainty are combined with the need to fulfil production tasks, decision making with grey numbers should be used. The grey relational analysis allows taking into account in decision making also those factors that would not be taken into account in multi-criteria analysis, which does not enable usage of grey number due to the uncertainty and incompleteness of such factors.

The presented example using actual practical task with concrete data and requirements showed that different results can be reached by decision making by “classic” approach neglecting the uncertainty and innovative approach based on the decision making taking into account uncertainty by means of grey relational analysis. The optimisation of the operating space may be approached by any sophisticated way, but there are always economic, environmental or ergonomics benefits, in optimal case their synergy.

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## Application of Stochastic Dominance in Stock Preselection

### Abstract

In the paper, we propose to apply stochastic dominance approach as a tool for stock preselection. In the empirical part, we utilize the stock market data, more concretely two datasets consisting of components from two indices: Dow Jones Industrial Average and Standard & Poor's 500. We compare the out-of-sample performance of the stochastic dominance preselection approach to the performance of rather naive strategy to invest equal fraction of available funds into each stock (1/n strategy). We found out that by applying the first order stochastic dominance we obtain similar results as in the case of 1/n strategy – there is neither significant reduction of the number of preselected stocks nor the difference in return, maximum drawdown or Sharpe ratio. For higher order stochastic dominances there is a significant reduction of preselected stocks quantities and the reduction is greater for larger dataset. However, except DJIA dataset in the case of daily portfolio rebalancing, there is no significant improvement of the performance compared to 1/n strategy – lower drawdowns are compensated by lower returns.

### Key Words

*stochastic dominance, portfolio optimization, stock selection, backtesting*

**JEL Classification: G11, G17**

## Introduction

Although the cornerstone of modern portfolio theory was set by Markowitz in 1952, the portfolio optimization problem is unending research topic of both academics and practitioners. The portfolio optimization problem can be characterized as the problem to choose the assets the portfolio should consist of and to determine their weights in such a portfolio. Starting with Markowitz, there were published many models and proposed many approaches in the field of portfolio optimization, for the summary see e.g. DeMiguel et al. (2009). The models can be applied on the dataset of all available assets or the first step can be the preselection. For instance, in Giacometti et al. (2015) the preselection is performed in the way that only 100 (liquid) stocks with the highest (historical) performance ratio are considered. Also from practical point of view, we want to limit the number of assets in the portfolio as more assets means higher transaction costs (in the case of periodical rebalancing).

In the paper, we compare the out-of-sample performance of the stochastic dominance preselection approach to the performance of rather naive strategy to invest equal fraction of available funds into each stock (1/n strategy). The comparison is performed in two datasets, DJIA and S&P 500, in period from January 2003 until April 2017.

## 1. Preselection Strategies

The naive 1/n strategy can be simply described as the equal distribution of funds in all available assets. Mathematically, we could formulate 1/n strategy as follows,

$$\mathbf{v} = \mathbf{1}_n \cdot \frac{1}{n}, \quad (1)$$

where  $n$  is the number of assets available to invest in and  $\mathbf{v}$  is the vector of relative weights. It was documented in the literature that investors use simple rules similar to naive strategy in order to create portfolios: Benartzi and Thaler (2001) found that people allocate their resources equally, Huberman and Jiang (2006) documented that people allocate their pension contributions equally among the selected funds. In addition, DeMiguel et al. (2009) showed that actually this naive strategy is not bad.

The strategy does not require any optimization – weights are determined independently of past observations. Thanks to the simplicity and low costs of implementation, the 1/n strategy should serve as a benchmark for academics, who are proposing new portfolio optimization models, as well as for people responsible for actively managed funds.

On the other hand, stochastic dominance (henceforth SD) is a method that allows us to rank random variables based on their distribution functions. The knowledge of only some characteristics (such as mean, variance, etc.) is not sufficient in this case and the knowledge of the distribution function is necessary. For practical application of the method, we will approximate the distribution function (population) by the observed historical returns (sample). Stochastic dominance may be of the first, second or higher orders. For a more detailed description see Levy (2015), Post et al. (2014) and Branda and Kopa (2016) for first, second order SD and higher orders SD respectively. In the further text we explain only first and second order SD.

Further, we assume two random variables  $X$  and  $Y$ , i.e. the returns of two assets, and we determine whether  $X$  dominates  $Y$  according to the stochastic dominance of the chosen order. For extension to more assets the pair comparisons are made for all pairs of assets and non-dominated assets are determined, i.e. those that are not dominated by any other asset.

Stochastic dominance of the first order (first order stochastic dominance, FSD) is defined as follows. The random variable  $X$  dominates the random variable  $Y$  if for all  $x$ :

$$F_X(x) \leq F_Y(x), \quad (2)$$

and there is at least one  $x$  for which strict inequality holds. Second order stochastic dominance (SSD) can be defined as follows. The random variable  $X$  dominates the random variable  $Y$  if for any  $x$ :

$$\int_{-\infty}^x F_X(z) dz \leq \int_{-\infty}^x F_Y(z) dz \quad (3)$$

and there is at least one  $x$  for which strict inequality holds. FSD implies SSD. The opposite statement is not true. So, if we select the group of non-dominated assets there would be less assets under SSD than under FSD.

Stochastic dominance is the current topic that is often discussed in the connection with portfolio optimization, see e.g. Kopa and Post (2009, 2015). In this paper we analyse a simple application of SD – based on historical returns we find the group of non-dominated stocks, i.e. we use the stochastic dominance method for preselection of the stocks.

## 2. Strategies Backtesting

In the previous section we described the portfolio (pre)selection strategies, particularly naive 1/n strategy and preselection based on SD. In this section we describe the backtesting of these strategies on rolling window basis (i.e. with periodical rebalancing). Starting with the initial wealth  $w_0=1$  at the beginning of the analysed period, we can recursively compute the out-of-sample returns  $r_t$  and wealths  $w_t$  over the analysed period,

$$r_t = \sum_{i=1}^n r_{i,t} \cdot v_{i,t} \quad (4)$$

$$w_{t+1} = w_t \cdot \left( 1 + \sum_{i=1}^n r_{i,t} \cdot v_{i,t} \right) \quad (5)$$

where  $r_{i,t}$  are ex-post observed returns and  $v_{i,t}$  are the weights of particular assets at time  $t$  (portfolio composition). These weights are obtained on the basis of naive 1/n strategy applied on: i) all available stocks and ii) only non-dominated stocks in the period from  $t-1$  until  $t-m$ . The transaction costs are not assumed in (4) and (5).

From the out-of-sample returns and ex-post wealth evolutions we can analyse the strategies' performance. There are many ways in which we can evaluate the strategies. In the paper we focus on the following measures: i) wealth at the end of the analysed period (henceforth wealth), ii) average annual return (henceforth return), iii) maximum drawdown (henceforth MD) and iv) Sharpe ratio (henceforth SR). It is clear that the return

corresponds to the wealth and both represent the reward for the investor. On the other hand, the maximum drawdown represents the risk. The last measure represents the classical ratio of reward and risk.

### 3. Results of the Research

The utilized datasets consists solely of the stocks incorporated in one of the American stock market indices – Dow Jones Industrial Average (henceforth DJIA) and Standard & Poor’s 500 (henceforth S&P 500). In the first dataset, we assumed all the components of the index as of April 8, 2004, except the stocks of General Motors (ticker GM) due to the unavailability of the data. In the second dataset, we assumed all the components of the index as of December 31, 2015 except those for which we were not able to obtain long enough historical time series. Thus, the datasets consist of 29 stocks (DJIA) and 414 stocks (S&P 500). Historical data of the stocks included in the datasets were obtained from Yahoo Finance website over the period from January 2003 until April 2017 (3,587 daily and 744 weekly observations for each stock). However, the out-of-sample period begins on April 9, 2004, thus out-of-sample period consists of 3,267 daily returns and 677 weekly returns.

For both datasets we compared the out-of-sample performances, i.e. the measures described in the second section, both assuming daily portfolio rebalancing and weekly portfolio rebalancing. We compare the results of preselection by means of SD versus naive  $1/n$  strategy. In SD approach we approximate distribution functions by previous 250 daily returns (daily rebalancing) or 52 weekly returns (weekly rebalancing). The computations were performed in Matlab and source codes can be found in Kresta (2016) and author’s webpage.

The results obtained in the smaller DJIA dataset are shown in Tab. 1. Concerning daily data, application of SD preselection improves the results in the case of second and third order SD – both final wealth and average return increases and maximum drawdown decreases (by 24 p.p.), also Sharpe ratio increases. When applying FSD, the results are the same as without the preselection. Actually, most of the time all the stocks were considered under FSD, see Tab. 2. When considering fourth order SD, we can see that the reward (final wealth and average return) decreased compared to  $1/n$  strategy, but also maximum drawdown decreased.

**Tab. 1: Out-of-sample results for DJIA database**

| Strategy        | Daily data |        |        |       | Weekly data |        |        |       |
|-----------------|------------|--------|--------|-------|-------------|--------|--------|-------|
|                 | Wealth     | Return | MD     | SR    | Wealth      | Return | MD     | SR    |
| $1/n$           | 3.242      | 9.42%  | 58.31% | 0.036 | 5.435       | 13.89% | 50.79% | 0.107 |
| FSD             | 3.241      | 9.42%  | 58.31% | 0.036 | 5.501       | 13.99% | 50.39% | 0.109 |
| SSD             | 3.589      | 10.27% | 34.32% | 0.045 | 4.698       | 12.62% | 50.86% | 0.110 |
| third order SD  | 3.641      | 10.39% | 32.07% | 0.048 | 2.710       | 7.96%  | 47.50% | 0.083 |
| fourth order SD | 2.858      | 8.37%  | 32.07% | 0.039 | 2.637       | 7.73%  | 45.04% | 0.081 |

*Source: authors’ calculations in Matlab*

If we analyse the results of weekly rebalancing, we can see that except FSD, for which the results are similar to 1/n strategy, the final wealth and return decreased and the maximum drawdown was similar to 1/n strategy. Also, the Sharpe ratio generally worsen for the preselection strategies. One can conclude that the results worsen, however, it is important to mention that following the preselection strategies there is a significant asset reduction, see Tab. 2. While following 1/n strategy we invest in all 29 stocks each day/week, doing preselection by means of SSD we invest on average in 8/6 stocks each day/week and maximum number of stocks the portfolio is composed of is 19/21 for daily/weekly data. For higher orders SD, there is even higher reduction.

**Tab. 2: The number of assets in portfolio (DJIA database)**

| Strategy        | Daily data |        |      |               | Weekly data |        |      |               |
|-----------------|------------|--------|------|---------------|-------------|--------|------|---------------|
|                 | Min.       | Median | Max. | St. deviation | Min.        | Median | Max. | St. deviation |
| FSD             | 27         | 29     | 29   | 0.22          | 15          | 28     | 29   | 1.78          |
| SSD             | 1          | 8      | 19   | 3.09          | 1           | 6      | 21   | 3.32          |
| third order SD  | 1          | 3      | 9    | 1.46          | 1           | 2      | 8    | 1.35          |
| fourth order SD | 1          | 2      | 8    | 1.16          | 1           | 2      | 7    | 1.05          |

*Source: authors' calculations in Matlab*

When assuming larger dataset, i.e. 414 stocks in our S&P 500 dataset, we obtain the results as shown in Tab. 3. The reduction of the stocks' number is depicted in Tab. 4. Again, the results of FSD are similar to the 1/n strategy, although the reduction is significant in the case of weekly data. For second and higher orders SD, we can observe decrease in final wealth (and average return) and only a small decrease in maximum drawdown. Also, there is no significant increase in Sharpe ratio. However, although the results are not better than in the case of naive 1/n strategy, there is a significant reduction of the number of stocks in portfolio. Applying SSD we invest on average in 28/21 stocks and the maximum is 62/43 stocks compared to 414 stocks in the case of naive 1/n strategy. For higher orders SD we invest only in 3 stocks on average.

**Tab. 3: Out-of-sample results for S&P 500 database**

| Strategy        | Daily data |        |        |       | Weekly data |        |        |       |
|-----------------|------------|--------|--------|-------|-------------|--------|--------|-------|
|                 | Wealth     | Return | MD     | SR    | Wealth      | Return | MD     | SR    |
| 1/n             | 5.560      | 14.03% | 50.65% | 0.046 | 5.435       | 13.89% | 50.79% | 0.107 |
| FSD             | 5.574      | 14.05% | 50.43% | 0.047 | 5.501       | 13.99% | 50.39% | 0.109 |
| SSD             | 3.710      | 10.55% | 56.06% | 0.043 | 4.698       | 12.62% | 50.86% | 0.110 |
| third order SD  | 2.809      | 8.23%  | 39.67% | 0.043 | 2.710       | 7.96%  | 47.50% | 0.083 |
| fourth order SD | 2.303      | 6.59%  | 40.30% | 0.035 | 2.637       | 7.73%  | 45.04% | 0.081 |

*Source: authors' calculations in Matlab*

**Tab. 4: The number of assets in portfolio (S&P 500 database)**

| Strategy        | Daily data |        |      |               | Weekly data |        |      |               |
|-----------------|------------|--------|------|---------------|-------------|--------|------|---------------|
|                 | Min.       | Median | Max. | St. deviation | Min.        | Median | Max. | St. deviation |
| FSD             | 365        | 406    | 414  | 8.80          | 178         | 311    | 412  | 44.39         |
| SSD             | 6          | 28     | 62   | 9.10          | 2           | 21     | 43   | 7.19          |
| third order SD  | 1          | 3      | 17   | 2.53          | 1           | 4      | 14   | 2.41          |
| fourth order SD | 1          | 3      | 16   | 1.94          | 1           | 3      | 11   | 2.01          |

*Source: authors' calculations in Matlab*

## Conclusion

The problem of finding a proper portfolio composition is in the focus of both academics and practitioners. In the paper we present the application of stochastic dominance approach as a tool for stock preselection. In two chosen datasets, DJIA and S&P 500, we compare the out-of-sample performance of the stochastic dominance preselection approach to the performance of rather naive strategy to invest equal fraction of available funds into each stock (1/n strategy). Based on the obtained results, the following conclusions can be made. By applying first order stochastic dominance we obtain similar results as in the case of 1/n strategy – there is no significant reduction of the number of preselected stocks as well as there is no difference in return, maximum drawdown or Sharpe ratio. For higher order stochastic dominances there is significant reduction of preselected stocks suggested to invest in. The reduction is logically greater for larger dataset. However, except DJIA dataset in the case of daily portfolio rebalancing, there is no significant improvement of the results compared to 1/n strategy.

## Acknowledgment

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## Using Map of Traffic Conditions for Safer Road Traffic

### Abstract

Telematics applications focus on delivering the right information to the driver at the right time. Telematics systems include a variety of projects from the mandatory implementation of eCall through a test run of various projects for early warning to the concepts including artificial intelligence. The aim of this work is to improve road safety in the form of prevention. This paper proposes a solution based on the Map of Traffic conditions. The solution offers the advantage of simple implementation in new cars equipped with Connected Car technology. The method consists of using sensors that are already installed in cars in an additional way. In the paper, there are discussed related topics like user interface the way that will not affect driver's attention. Data security and communication standards are briefly discussed as well.

### Key Words

*traffic, eCall, early warning, car sensors*

**JEL Classification: D80, O33**

## Introduction

Despite the fact that the automotive industry reached manufacturing safer and more efficient vehicles in recent years, traffic accidents are responsible for thousands of lives each year. Technological progress contributes to solving these problems. This applies to communication systems and promotion of intelligent transport systems in order to improve road safety. It is expected that communication between vehicles will be able to provide drivers with more information about their surroundings, allowing them to make better decisions, which in turn will lead to increased safety. Some cars are already equipped with radars, cameras and similar devices.

### 1. Internet of Things and Connected car

The Internet of Things marks the interconnection of an almost unlimited number of objects - things - through the Internet. This is a network of large numbers of objects, consisting of sensors, sensors, transmission and other devices that collect data, communicate with each other, evaluate collected data, and on the basis of their evaluation they can act independently without active human intervention. In some cases, they will no longer need continuous interventions and instructions from people, but they will "behave" on the basis of data that they have collected or sent to them by other devices

within a common network. The Internet of Things can be used in many areas and one of them is also road transport.

For the information to pass through the loop and create a value, it must pass through the individual loop levels defined by the specific technology. The activity is monitored by sensors that pass on information, it goes through networks and standards - technological, legal, regulatory or social - allow this information to aggregate in time and space.

The term Connected Car refers to a car connected to the Internet or another network. The car can, therefore, be said to be "online". Being "online" in the case of an automobile means that it constantly communicates with the Internet and offers related services.

The first car to be named "Connected Car" was a car made in 1996 by General Motors. The company with Cadillac wanted to make the vehicles "safer". In this case, it was a vehicle connected to the data network, and the innovation was that after the airbag was detonated, a service centre was automatically dialled by the data network and called for help. Today's Connected Car is different in most technical directions, but the principle remains the same. Nowadays, Connected Car has become a trend and every car maker has a solution.

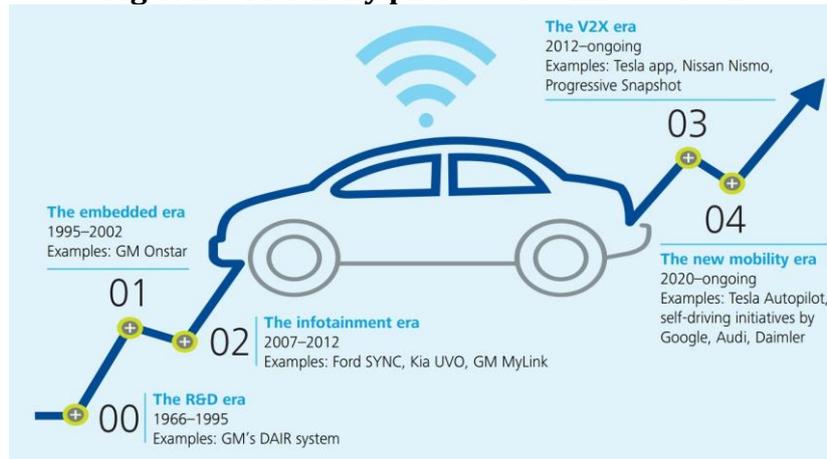
Since 1996, 21 years has passed and Connected Car has changed in many ways. From a simple emergency call to an airbag deployment, the system has gradually reached eCall functionality, thanks to which the vehicle has a "black box" with GPS data, airbag activation data and sensor data, which then sends to the emergency line. From standardised diagnostics to a service that automatically informs a pre-selected dealer in the event of a vehicle failure, which then contacts and schedules the owner, or, for example, a car-to-site web portal from his or her computer or mobile application.

Perhaps the most accurate definition of Connected Car is offered by the U.S. Department of Transportation. The definition is: "Connected car provides connectivity between accident prevention cars, cars and infrastructure for safety, mobility and environmental benefits, and between cars, infrastructure and wireless units for real-time connectivity in the long run" (US DOT, 2015).

According to Machan and Laugier (2013), Intelligent Transport Systems (ITS) not only include vehicles, but also road infrastructure components such as traffic signs, toll gates, pedestrians, and so on. According to these authors, a set of communication means should be used to communicate all these components together.

Connected Car has evolved in several phases over the last few decades. Changes are evident both in technology and in the whole "ecosystem" of the vehicle. New services are emerging at each stage and the range of available options is increasing. New business models and support technologies are also emerging. The best way to understand the current complexity of the area is to monitor the development of Connected Car since its inception. The various stages of development are illustrated in Figure 1.

**Fig 1: Evolutionary phases of Connected Car**



Source: Ninan et al., 2016

Services covered the concept of Connected Car varies from manufacturer to manufacturer. The difference between them is, however, not as striking and most of the services offered by car manufacturers are generally the same, but otherwise named. Larger manufacturers have some extra features, but basic equipment is the same and does not differ. The services offered by the Connected Car solution can be distinguished in general into three groups: Inside Vehicle Multimedia Services, Remote Access Services and Proactive Security Services.

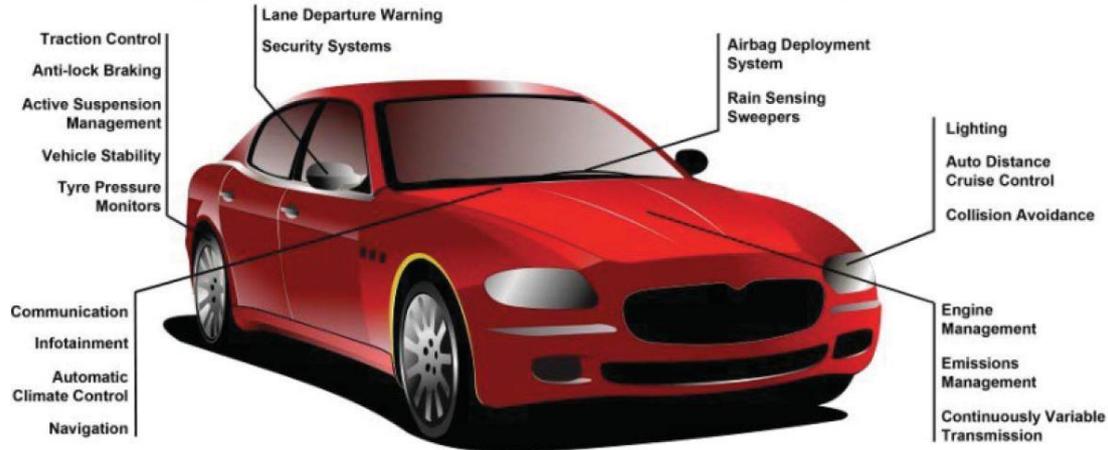
Authors Rizwan et al. (2016) designed a real-time traffic monitoring system using IoT, which uses cheap units deployed along roads every 500 or 1,000 meters. Basically, it's a classic cooperative system that uses board units, units along roads, a communications network, and a central server processing the data. Feedback is provided through a mobile app.

## 2. Map of traffic conditions

The warning method primarily described this paper use a combination with Connected Car technology to help improve the early warning situation. Vehicle traffic of some brands with servers is already underway, and there are no obstacles from a technical point of view. As previously outlined, obstacles could be more of an administrative nature.

Since cars are "smarter" than ever before, there should be an effort to incorporate their "intelligence" into the system of traffic accident prevention: Currently, data from some sensors are automatically processed without the driver's knowledge, and the driver may notice changes. But in these situations there is no time for the human response and the car responds autonomously. This situation occurs, for example, in the event of a severe braking and an attempt to prevent a skid. In addition to the instant benefit in the form of passenger safety in the vehicle, this data could be used to create the transport conditions map of the area. This would allow the sharing of information to other vehicles and in the case of unusual values anonymous sending to the central server.

**Fig 2: Some examples of ECUs installed in today's cars.**



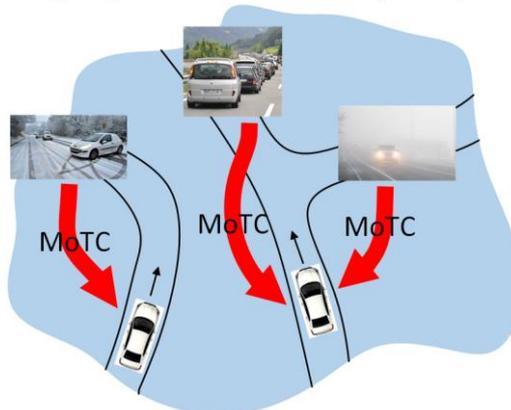
Source: Coppola, 2016

Specifically, it could be braking system (ABS) outputs, skid slip data, poor visibility information provided by vehicle cameras or rain sensor output. This system could be complemented by eCall, with the help of another channel, at the time when no accident type of accident occurred.

For communications, it is appropriate to use the vehicle communication standards SAE J2735 (DSRC), SAE J2945/1 and others. The SAE J2735 standard is intended to be used for collision warnings, making it the most suitable solution for this purpose. On the other hand, it is not possible to use exclusively WAVE technology, limited to the maximum distance between vehicles that can be transmitted (Shereen et al., 2013). The map of traffic conditions therefore allows use even where the vehicles are not distant at a distance where they can communicate with each other using WAVE technology.

**Fig 3: Using the Map of traffic conditions**

Using Map of traffic conditions (MoTC)



Source: author

The server for this service would need to be managed by the National Transport Information Center (NTIC), which would have complete traffic information that could pass on through appropriate channels. Through the NTIC server, the data would then be

sent to vehicles approaching the site with problematic traffic conditions using a suitable algorithm. Since not all vehicles are equally technologically equipped, the dissemination of information needs to be diversified. A technology described here could be used in smart cars. In older car the different technology would be used.

As mentioned earlier, cooperative systems allow vehicles to communicate with each other or with units outside the vehicle. The proposed system consists of a vehicle unit (OBU – On Board Unit) and a server. Other options depend on whether existing or new infrastructure will be used. If the vehicle had an infotainment and the driver would actively use the navigation, it would be possible to find out if the emergency site is on the planned route. If it did not, the warning would not be displayed and the driver would not dispose of it unnecessarily. In that case, the driver on the right in Figure 3 would receive only one warning instead of two.

In order for the proposed system to provide the necessary information, it must be resistant to power outages. Failure may occur on the vehicle side, but due to its energy self-sufficiency, it is unlikely. Similarly, operator-side outages are unlikely. However, there could be situations where prioritisation of the BTS station is impacted, and the mobile network will only be available for IZS components. In that case, it would be advisable to ensure that this warning system is also exempted and does not endanger the safety of road users. When designing a technical implementation, it is also necessary to follow the guidelines and standards for Connected Car framework to prevent third-party misuse or intrusion into the vehicle control system.

### **3. Interface**

Although in theory the driver should not be diverted from driving, in practice it is different. Whether it's the reason for his distraction with a passenger's conversation, listening to music, navigation information, or other audiovisual sources of perceptions, scattering occurs almost always. Therefore, viewing the proposed system warning should not at all costs seek to distract the driver. Rather, it should be appropriately integrated into the already operational infotainment of the vehicle the driver is accustomed to, and therefore less likely to distract him or her in the event of a warning than a separate alert unit (Fitch, 2014).

Design should avoid over-complexity of control, appropriately distribute the buttons for accessibility from the driver's point of view, and follow the application development guidelines issued by software companies such as Google and Apple (Young and Zhang, 2015).

Of course, the warning may not be just audiovisual, but it can also be haptic, eg. steering wheel vibration. However, it is important to take into account the setting of vehicles of different brands, so that there can be no confusion about warnings such as the lane change notice. There is also a combination of artificial intelligence that starts out in vehicles and

could properly set warnings with regard to eg. speed, vehicle noise, daytime weather, and so on.

## Conclusions

The solution involving the Map of Traffic Conditions brings benefits of easy user service, and there is no disadvantage in the form of a mobile phone alert display solution in the absence of a phone link to the vehicle infotainment. The weaknesses are again the need for administrative measures (the introduction of standards, etc.) and also the usability only for vehicles equipped with Connected Car technology. This can also be an opportunity in view of the increasing penetration of the market by this technology and also the threat if this penetration does not take place quickly.

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## Corporate Loans and Czexit on Euro-Koruna

### Abstract

The Czech Republic has recently experienced extraordinary situation on the financial market when after three years the Czech central bank left its intervention regime on the euro/Czech koruna currency pair. This action, which was labelled by foreign financial journals Czexit, had been signalized by the Czech central bank and expected in expert community. At the same time, there was predicted that after Czexit the Czech koruna shall strengthen against euro by approximately 5% in one year. One group of economic entities that may benefit from this new situation are companies which plan or planned to obtain a loan for financing their business activities. Combination of loan denominated in euros and strengthening koruna may result in decreasing interest payments. The aim of this article was, based on the data from the Czech National Bank about corporate loans denominated in Czech koruna and euros, to reveal what strategy non-financial corporations chose before Czexit regarding their debt-loan policy. There was expected statistically significant negative correlation between the amount of loans denominated in koruna and loans in euros. In order to verify this hypothesis we tested these two time series by correlation analysis. From the conducted research we can state that in the whole observed period our assumption was not confirmed. Both time series developed in similar ways. As we shortened the time series toward the end of interventions negative correlation between loans denominated in CZK and in EUR occurred.

### Key Words

*Corporate finance, currency risk management, foreign exchange forecasting and speculation, internationalization, loan.*

**JEL Classification: F31, F34, G32, M16.**

## Introduction

Usually, since 1997 the Czech central bank – Czech National Bank – within its overall monetary policy a regime on the Czech currency (Czech koruna) that is called managed floating. However, in November 2013 when Czech economy suffered by a threat of deflation, the Czech National Bank changed the regime on koruna from managed floating to managed floating with lower limit at 27.00 CZK/EUR. By this action Czech koruna weakened from 25.80 CZK/EUR to 26.97 (i.e. 4.33%). Since this moment, there appeared speculations and many analyses on the financial market when the Czech National Bank (CNB) will leave this intervention regime. In 2016 the Bank Board of CNB stated that the bank would not free the exchanged rate until the end of March 2017. This date was

interesting for speculators on the koruna as well as for Czech companies involved in international trade. The data from Czech balance of payments signaled that Czech international trade is in good condition and that is why the strengthening of koruna against euro by 5% was expected (see e.g. Patria (2017a)). One group of economic entities that may benefit from this new situation are companies which plan or planned to obtain a loan for financing their business activities. Combination of loan denominated in euros and strengthening koruna may result in decreasing interest payments as well as the whole debt.

The aim of this article is, based on the data from the Czech National Bank about corporate loans denominated in Czech koruna and euros, to reveal what strategy non-financial corporations chose before Czexit regarding their debt-loan policy.

In order to fulfil the main aim there were made following steps. First, literature review regarding loan corporate financing, financial internationalization, currency risk hedging was made. Second, necessary secondary data was collected from the CNB's ARAD database. Then the data were analysed and the research results interpreted. Finally, discussion and conclusions were made.

## **1. Literature Review**

The role of business sector for GDP growth is indisputable, because the development of high technologies and other innovations is impossible without successful corporations. The existence of business sector is, however, largely dependent on the availability of external sources of financing. According to IADB (2004) lack of external financial sources is even the main obstacle of future growth of a corporation, while important providers of external capital are mainly banks.

As proved by e.g. Virglerová et al. (2017) financial markets and banks are significant determinants of business environment (see also e.g. Belás and Sopková, 2016). Bank loans are key source of financing particularly for small and medium-sized enterprises (Howorth and Moro, 2012). Irreplaceable role of bank loans within financing of business sector also confirms e.g. Ylhäinen (2017) or Berger and Udell (1998; 2006), who state, that even the biggest companies raise funds through bank loans, though not as often as SMEs.

The main benefit of external financing through bank loans (in the opposite of external equity) is a fact, that exercise of property rights of current owners is not limited in any way by the bank loan. Besides, financing through bank loans is available even to those corporations, for which it is difficult or even impossible to obtain external debt on the public market (via bond emission).

As Calza et al. (2003) states, the volume of provided loans in economy is mainly influenced by the level of interest rates and further by the development of GDP. While the dependence of the volume of provided loans on the level of short-term and long-term interest rates is negative, the dependence of the volume of loans on the development of

GDP is positive. From the CNB's statistics (2017) there can be concluded, that long-term growing trend of the volume of provided loans in the Czech Republic was in recent years caused by the GDP growth, as well as by long-term decrease of market interest rates. The question is, if the development of the volume of provided loans denominated in CZK and EUR in recent period in the Czech Republic was influenced by possible speculation of business entities on appreciation of CZK against EUR relating expected Czexit (for the term "Czexit" see e.g. Patria (2017b)). This assumption is based on the fact, that monetary policy realized by the CNB (as well as reasons for these measures) was quite similar to those measures that were in the recent past implemented by the Swiss National Bank (SNB); particularly the use of foreign exchange interventions in order to weaken the exchange rate of domestic currency to eliminate the threat of deflation (see e.g. Jordan, 2016). Monetary policies of CNB and SNB had been in this respect compared, which led to speculation regarding the exit on foreign exchange interventions in the Czech Republic. SNB started foreign exchange interventions in September 2011 and maintained the exchange rate of CHF/EUR at the level of 1.20 until January 2015, when the SNB terminated foreign exchange interventions unexpectedly and in the short term CHF strengthened against EUR up to 30%; from the long-term perspective appreciation reached 15–20%. If the Swiss scenario was repeated after Czexit, speculators could expect the exchange rate of CZK/EUR up to 22 CZK. Enhanced CZK then would, of course, result in lowering of interest costs on the loans drawn in EUR.

Such scenario of appreciation trend on koruna would accelerate so called euroization of Czech economy. However, as Koški (2012) states, euroization that is based on speculation on future strengthening may bring certain risks to lenders and borrowers; especially when the trend turns. On one hand, different than expected trend development is not a serious problem for a company that uses a loan for natural hedging. On the other hand, a subject that uses a loan as a financial tool based on speculation is fully exposed to currency risk. That is why Koški (2012) proposes the use of risk-sharing currency clause in the creditor-debtor relationship. Some sources contain other recommendations such as (Bishev and Boshkov, 2016) who states that *"if the company does not generate income in the same currency as the loan is, repayment capacity of the loan should not exceed 50-60 EBIT of the company. In the case of depreciation, the company has the capacity to back the loan"*.

## **2. Data and Methodology**

In order to fulfil the main aim there were analysed the data obtained from the Czech National Bank (CNB), respectively from the ARAD database. We used the data about corporate loans denominated in CZK and in EUR (both expressed in CZK – this fact should not influence the research result, because, in fact, the exchange rate regime was fixed for observed periods). The data are presented on a monthly basis for Czech banks. We wanted to capture the differences, if any, with an increasingly probable end of the exchange rate commitment. That was why there were chosen three different time series. The first one contained the data from November 2013 (this was the month when interventions on koruna started) to March 2017 (the last month with available data before the

interventions stopped) – 41 observations. The second one is focused on the time series one year long before the interventions stopped (i.e. from March 2016 to March 2017) – 12 observations. And finally, the third one is only half year long (i.e. 6 observations).

For the time series analysis there was used time series correlation analysis. And because there is a serious threat of so called autocorrelation in this type of analysis, we took into account the results of Durbin-Watson test of residuals as well.

For particular analyses is used following instrumentarium,  $r_{yx}$  is the estimated Pearson product moment correlation coefficient between the variable  $y$  (loans denominated in EUR) and the variable  $x$  (loans denominated in CZK). This coefficient is tested generally at 5% significance level. Decisions are based on P-Value indicator which expresses the maximum significance level allowed to consider the value of coefficient statistically insignificant (do not reject null hypothesis). P-Value is calculated based on standard T-test statistic.

Durbin-Watson test deals with a serial correlation in the residuals. If the residuals vary randomly, the value of DW statistic should be close to 2. A small P-value indicates a non-random pattern in the residuals.

In relation to Introduction and Literature Review, we expected negative relationship between two above stated time series (the volume of corporate loans denominated in CZK and the volume of corporate loans denominated in EUR). To remind, we expected that corporations would speculate on future appreciation of Czech koruna against euro and therefore corporations would substitute loans denominated in CZK by loans denominated in EUR. That was why the tested hypothesis ( $H_0$ ) was:

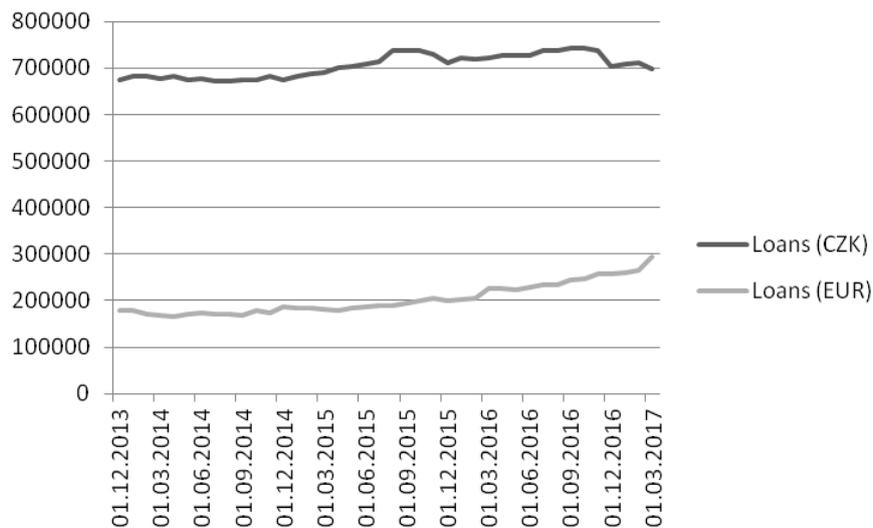
- **$H_0$ :** The volume of corporate loans denominated in EUR is not dependent on the volume of corporate loans denominated in CZK.

Alternative hypothesis ( $H_1$ ) was as follows:

- **$H_1$ :** The volume of corporate loans denominated in EUR is dependent on the volume of corporate loans denominated in CZK.

Before statistical analysis, the data were plotted in a graph. As it can be seen in the picture below (Fig. 1), both of the time series were rather increasing in time of interventions. However, at the end the situation differs. While koruna series seems to be decreasing, euro series is increasing. What is more, the euro series is growing in its end even faster than in the whole previous period. This could signalize our assumption that certain number of corporations speculate on future koruna strengthening.

**Fig. 1: Development of CZK and EUR loans in times of intervention (November 2013 to March 2017; in mil. CZK)**



*Source: authors' own processing, data from (CNB, 2017)*

In the next chapter there are analysed the data by times series correlation analysis. This step should express deeper intensions between the volume of koruna and euro corporate loans.

### 3. Results of the Research

The results of our research show certain development. In the first pair of time series (covering 41 observations) is relatively strong positive linear dependence. Correlation coefficient has approximate value of 0.6165. This correlation seems to be significant since P-Value is nearly zero per cent however non-random pattern in residuals has been found. The Durbin-Watson test statistic P-Value is also nearly zero percent. The null hypothesis is rejected at the 95% confidence level for both – Pearson correlation coefficient significance and also Durbin-Watson test of residuals.

The second data-set (with 12 observations) shows expected negative correlation. The value of correlation coefficient is about -0.6492. Although the sample size is lower, the significance of this indicator has been approved (P-Value = 0.0224). This correlation still shows signs of a possible existence serial correlation in the residuals (P-Value = 0.0004). Again, the null hypothesis is rejected at the 95% confidence level for both tests.

The third pair of time series (sample size is now only 6) reveals even stronger negative correlation with the value of correlation coefficient approximately -0.7053. However, this value is not statistically significant due to the lower size of sample. P-Value is about 11.75%. The null hypothesis can not be rejected at the 95% confidence level.

All results are recapitulated in the following table (Tab. 1).

**Tab. 1: The results of time series correlation analysis in given periods  
(volume of loans – Czech koruna vs. euro)**

| Time series period | Correlation coefficient | P-Value (correlation) | Durbin-Watson statistic | P-Value (D-W test) |
|--------------------|-------------------------|-----------------------|-------------------------|--------------------|
| 13/11 – 17/03      | 0.6165                  | 0.0000                | 0.1917                  | 0.0000             |
| 16/03 – 17/03      | -0.6492                 | 0.0224                | 0.5889                  | 0.0004             |
| 16/11 – 17/03      | -0.7053                 | 0.1175                | 1.4071                  | 0.0717             |

*Source: authors' calculations in Statgraphics Centurion XVII*

To sum it up, in the longest period (from November 2013 to March 2017) there was not proven negative correlation between observed koruna and euro time series. This can be explained by a factually fixed exchange rate of the currency pair CZK/EUR. Corporations were indifferent to the currency in which they would demand and draw a loan. And, as Durbin-Watson test shows, there might be other influences on the mutual development of koruna and euro corporate loans (in accordance with the literature review e.g., level of interest rates, development of GDP, respectively a phase of an economic cycle, etc.).

In the second period (from March 2013 to March 2017) expected negative correlation was revealed. And despite the Durbin-Watson test, we can assume that occurrence of negative relationship might be influenced by the expectation of the end of CNB's intervention on currency regime.

And finally, in the third period there was not proven statistically significant relationship between two analysed time series. However, despite its insignificance due to short period, the negative correlation between the examined time series is even stronger.

#### **4. Discussion and Research Limitations**

Our research results showed certain shift from loans denominated in CZK to loans denominated EUR. This so called euroization of the Economy is in accordance with Koški's (2012) observation in the Croatian economy. This phenomenon, however, means new challenges for companies' currency risk management. It is possible that based on speculation on future strengthening of Czech koruna against euro certain part of companies obtained a loan denominated in EUR and these companies are not involved in international trade. It means these companies are exposed to currency risk and they hardly can use natural hedging if the trend is different than expected. That is why, once at least financially internationalized, a company shall adopt new tools for risk management. For example, Bishev and Boshkov (2016) recommend that *"if the company does not generate income in the same currency as the loan is, repayment capacity of the loan should not exceed 50-60 EBIT of the company. In the case of depreciation, the company has the capacity to back the loan"*.

We are aware that there are certain research limitations. There are presented some of them. First, time series do not take into account the engagement of companies, which obtained a loan in CZK or EUR, in international trade. On one hand, we might expect quite

different results if there were only already internationalized companies in the research sample. On the other hand, the data for the whole market could reveal an attitude of all the corporations; even Czech companies that are not involved in international trade may internationalize their corporate finance. Second, we took into account bank loans only; other important debt sources (e.g. corporate bonds, which year by year play more significant role in the Czech corporate finances (see e.g. Mačí and Hovorková Valentová (2017), were omitted). Third, important role, of course, play another influences than mutual development of two analysed time series (e.g. the development of GDP, the level of interest rates in Czech Republic and in the Eurozone, lasting integration and intensive mutual trade with states, respectively, euro area firms can push for the requirements of reducing the exchange rate risk through natural hedging, which may lead to a naturally greater demand for the euro).

## **Conclusion**

CNB's exit from intervention currency regime on euro/koruna currency pair created extraordinary situation on the financial market. This article was focused on non-financial corporations, which might have utilized this situation for future currency risk management by obtaining a loan denominated in domestic (Czech koruna) or foreign (euro) currency.

Based on the data from CNB (Czech National Bank), we analysed two time series of corporate loans denominated in CZK and EUR and their mutual development in the period of currency interventions (from November 2013 to March 2017). We expected negative correlation between those two time series, especially at the end of the period, when it was more and more likely that interventions would be terminated. Based on the graphical analysis (see Fig. 1) and the following time series correlation analysis it can be concluded that in the whole period our assumption was not confirmed. In that period both time series developed in very similar ways. This may be explained by what Calza et al. (2003) states that the volume of provided loans in economy is mainly influenced by the level of interest rates and further by the development of GDP. Also the fixed currency regime on euro/koruna did not provide too many opportunities for speculations and active currency risk management. As we shortened the time series toward the end of interventions negative correlation between loans denominated in CZK and in EUR occurred (significant at  $\alpha=5\%$ ). It means that regarding the financing and currency risk management strategy companies rather obtained loans in EUR rather than in CZK. However, Durbin-Watson test showed signs of a possible existence serial correlation in the residuals.

The challenge for further research seems to be in a possible seasonal character of both time series. Thus, results of seasonal decomposition may reveal more information about behaviour of involved economic subjects.

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## Comparison of Techniques for Identification of Customer Requirements

### Abstract

Quality management is still one of the current challenges of both public and private sector organizations. All quality concepts are based on meeting customer requirements. However, these requirements must first be identified. The next step is requirements integration into an object - whether it be a product, process or system. Present study focuses on evaluation of seven techniques primarily determined to identify customer requirements. Particularly the following techniques were examined: Brainstorming, Brainwriting, Osborn checklist, List of Attributes, Laddering, Wish and Complaints analysis. All the methods were experimentally used for identification of customer requirements concerning a specific product – men’s socks. In total 7 experiments were conducted. Customers (in total 3 experiments) and experts (in total 4 experiments) were included in experiments. During experiments variables like time of a method application, number of requirements and time necessary to identify them, innovativeness of requirements and for processing purpose also number of experiments participants were monitored. The results were evaluated in a form of comparative, process, correlation and radar charts. By cluster analysis 4 groups of techniques which differ in their realization characteristics were identified. The results can be used in a decision making process concerning application of particular techniques in an initial phase of quality management – for customer requirements identification.

### Key Words

*Customer requirements, techniques, effectiveness, comparison*

**JEL Classification: L10, L15, C38**

## Introduction

Quality management process consists of several steps and one of the first ones is identification of requirements (Korenova, 2016). Requirements play an important role in quality management since they determine reference value of quality of an object (product, service, process or system) (Zimon, 2016). Quality is “a degree to which the set of own characteristics fulfils requirements” (Hrnčiar, 2003). It results directly from this definition that without knowing requirements and their character it is not possible to talk about quality management (Jiao, 2006). Requirements present expectations or needs

which any of interested parties has towards an object (most frequently towards a product). For the needs of this study a product (tangible or intangible) is considered to be the object. One of the most important interested parties is a customer – i.e. subject or a group which take the product (Hoyle, 2012). This interested party can directly or indirectly submit requirements for the product. Character of these requirements is mostly vague and it is difficult to measure them. For example, requirements concerning winter gloves can be following: comfortable, waterproof, resistant to abrasion, nice due to their features, etc. Getting to know what a customer wants or expects (i.e. what he requires) an organization acquires base assumption for purposeful processing of information aimed at systematic quality management (Homburg, 2009).

## **1. Requirements and their typology**

Requirements present a set of expectations or needs of a specific interested party towards product. Their character can vary due to the characteristics of a particular individual. However, requirements are mostly processed on a mass scale for a specific target group or customer segment (Stokes, 2000). The norm ISO 9000, which terminologically explains quality management systems introduces three categories of requirements according to the type of their submitter (Hoyle, 2012):

- a) Generally expected requirements – requirements which are usually or obviously included into product characteristics.
- b) Determined requirements – requirements which are usually included in a control document.
- c) Legislative requirements – are usually submitted by a supervisory institution or regulatory authority.

A different view concerning types of requirements was identified in the 1980s. This approach is based on the assumption that fulfilment of some requirements has a different effect on customer satisfaction or dissatisfaction (Shahin, 2013). A group of Japanese researchers found out that fulfilment of some requirements does not have effect on increase of satisfaction but their non-fulfilment causes high dissatisfaction (Witell, 2013). As one can notice in earlier studies, some requirements are natural and it is possible to identify them quite simply but identification of others is more complicated since their character is latent and a customer usually does not express them (Shahin, 2013).

### **1.1 Techniques for customer requirements identification**

Quality management theory as well as marketing theory offer a set of approaches which enable determination of customer needs, expectations or desires (Dankova, 2015). In principle there are two main categories of the techniques – quality characteristics development techniques and voice of customer (Nenadál, 2006). Quality characteristics development techniques are based on the approach when requirements are not

generated by customers themselves but by experts within an organization (Doré, 2007). Techniques belonging to Voice of Customer category (Gunasekaran, 2006) are aimed at determination of requirements by a direct form including customer participation.

## 1.2 Research gap

Contemporary spectrum of various techniques, however, brings some doubts as to their suitability. Actual expert and scientific sources describe the techniques relatively sufficiently (Nenadál, 2001), but their comprehensive comparison based on empirical approach is missing. Advantages and disadvantages of these techniques more less result from logical deduction than from experimental examination. The aim of this paper is to fill this research gap and answer the following research questions:

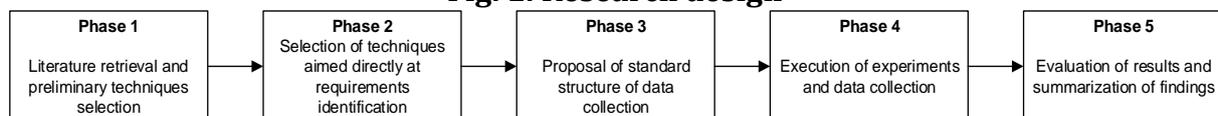
- a) What is the effectiveness of these methods with reference to effort made towards acquired information?
- b) Which methods are suitable for identification of new and innovative requirements?

To answer the above mentioned questions an experimental approach was used – practical application of particular techniques – to one product “men’s socks”. It was preceded by a selection of suitable techniques presenting research object. Methodological procedure is described in the following chapter.

## 2. Methodology

By literature retrieval totally 21 techniques serving to identify, analyse and prioritize requirements were identified. After reviewing their character this set of techniques was reduced by the techniques whose direct purpose was consequential requirements processing. Final set consisted of seven techniques which were chosen for the experiment. Experiments were proposed so that it was possible to evaluate all the techniques in a homogeneous way. Basic phases of the research design are shown in figure 1.

**Fig. 1: Research design**



*Source: authors*

Three techniques can be classified as voice of customer techniques – Brainstorming (Nenadál, 2001), Wish (Higgins, 1994) and Laddering (Jüttner, 2013). The following techniques are included among the techniques of quality characteristics development category: Brainwriting (Nenadál, 2001), List of attributes (Higgins, 1994), Osborn checklist (Higgins, 1994) and Complaints analysis (Gebrich, 2011). These seven techniques create a base for proposal of seven experiments. Three of them were

conducted and included participation of customers and four of them were participated by experts. The following variables were monitored with the aim to ensure comparability: Time necessary to explain the method, Time of each requirement identification, Number of customers/experts included to the method, Innovativeness of requirements (in categories: standard, partially innovative, innovative)

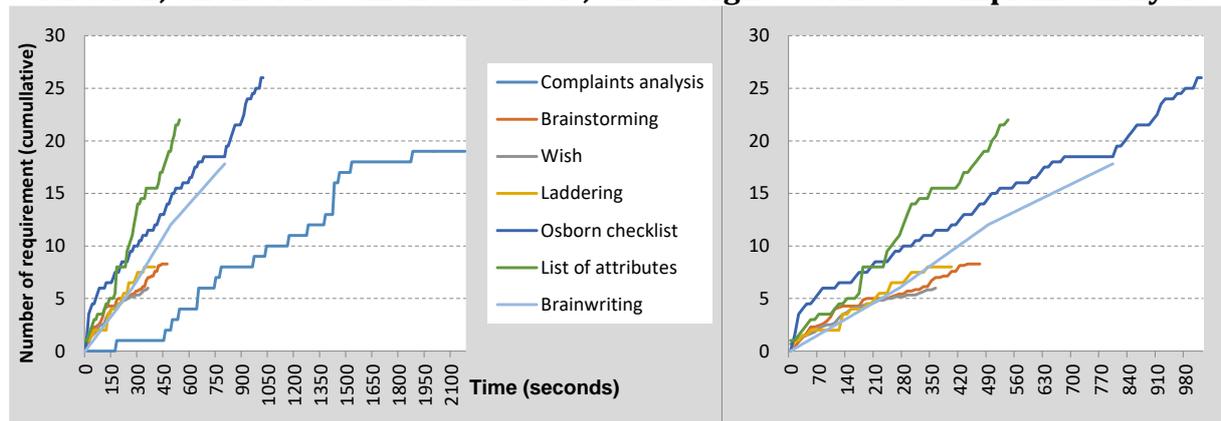
### 3. Results

In each experiment four variables were being recorded. Experiments were recorded in a form of observational sheets allowing homogeneous data acquisition and processing. One of key indicators was time aspect of requirements identification. Observers (authors of this paper) were monitoring the time in which individual requirements were identified.

#### 3.1 Comparison of methods effectiveness - relation time/number of requirements

Aspect concerning time consumption of a method is an important criterion to decide whether to use a specific technique or not (Nenadál, 2001). Nowadays time may present a barrier especially in smaller organizations with lower number of employees, working tasks are cumulated and amount of time is relatively low. Processing of techniques time consumption allows to illustrate “rough strength of techniques” – i.e. quantity of requirements identified by the technique. Since individual experiments varied due to the different number of participants, for the total comparability of the methods it was necessary to recalculate the number of identified requirements per one person. Final comparison is shown in the figure 2.

**Fig. 2: Relation between number of requirements per person and methods time duration; on the left - all the methods; on the right - without Complaint analysis**

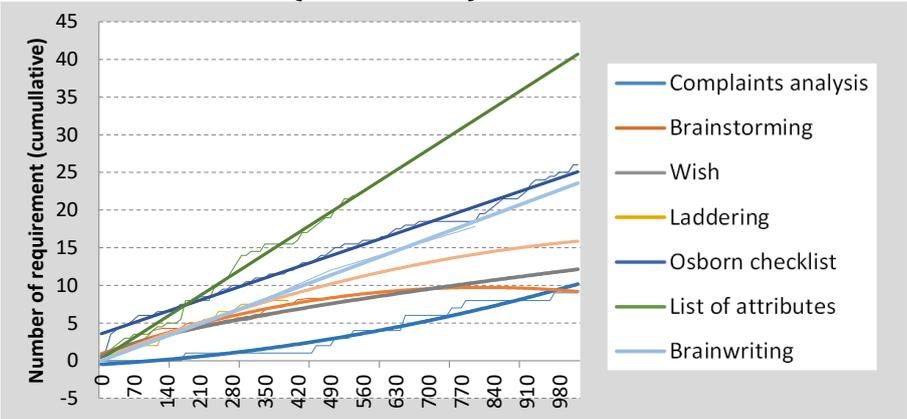


Source: authors' own calculations

In the left part of the figure 2 there is the summary of all the methods and for better readability there is the summary without Complaint analysis method in the right part. It can be seen that from the time point of view Complaints analysis technique is one of the

most difficult ones. On contrary the least time demanding technique is the Wish one. An interesting finding is that Wish, Brainstorming and Laddering show relatively equal effectiveness – i.e. relation between cumulative number of requirements and time necessary for their identification. Osborn checklist seems to be the strongest method considering the number of identified requirements in spite of the fact that its application requires more time. One of the most effective techniques is List of attributes since its curve character in the chart is the sharpest one. To make the results more transparent the relation between time and number of requirements for individual techniques was subjected to a regression analysis. In most cases linear regression was identified but in Laddering or Brainstorming power function with degressive growth was identified. It means that the number of identified requirements by using particular techniques grows rapidly at the very beginning of techniques application whereby the tempo of growth goes down with time. The results are shown in figure 3, whereby calculated regressive curves for stated methods are highlighted there.

**Fig. 3: Regression of techniques in comparison of numbers of requirements (cumulative) and time**



Source: authors' own calculations

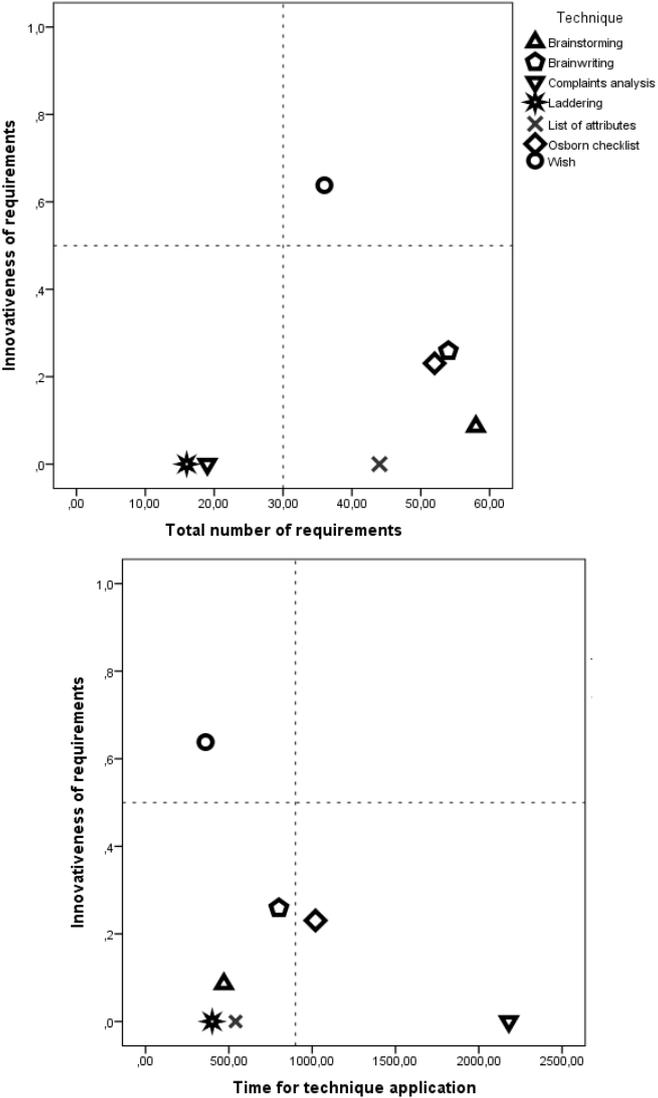
Different slope of individual curves is visible and it indicates different tempo of requirements growth. Although most curves show proportional trend of growth there are also curves whose growth has a slightly progressive character (Osborn checklist), or degressive growth (Brainstorming, Laddering). Osborn checklist has a tendency to generate most requirements in its final phase (may be determined by the order of questions) and above mentioned couple of techniques generate most requirements immediately after being applied.

### 3.2 Comparison of techniques innovative potential

The next point of methods evaluation was their innovative potential. When requirements are being identified a very frequent bias is recording only these customer requirements which are obvious at first sight and usually explicitly defined. It may present relatively strong braking effort of products improvement which is often based on identification of hidden requirements which customers do not know, but they have a character of

innovations – i.e. they considerably increase product value. Measurability of requirements innovativeness usually does not use any sophisticated metrics and is based on standard expert assessment – using point direct scoring from four experts. In submitted paper each requirement (regardless of by which technique it was identified) was ranked in one of three categories – (1) standard, (2) partially innovative and (3) innovative. Next it was possible to evaluate the rate of requirements innovativeness, based on individual rates of requirements innovativeness the average innovativeness, i.e. method innovativeness was calculated. In comparison to the number of requirements which were identified by the method and to time necessary for method application it was possible to interpret the results by two scatter plots – figure 4.

**Fig. 4: Comparison of techniques innovativeness due to total number of requirements (on the left) and time form technique application (on the right)**

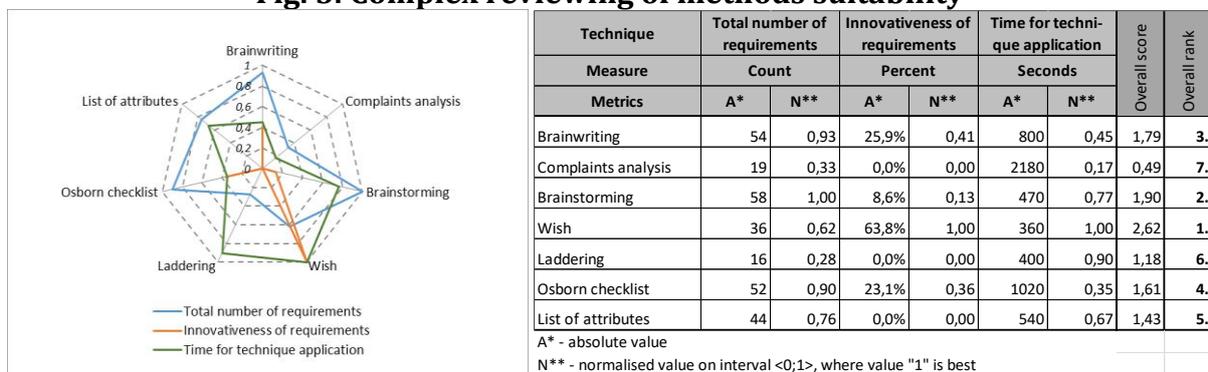


Source: authors' own calculations

### 3.3 Summary comparison of methods

Previous evaluation of methods included several different points of view. Their interpretation often led to diversified rank of suitability. For practical reasons this – at first sight – inconsistent interpretation can have cardinal effect on a decision-making process – a man is not able to choose the right method. For comparison of several criteria of suitability in more variants (in this case techniques) it is possible to use multi-criterion analysis (Hrnčiar, 2014). Results are usually interpreted by a radar chart – figure 5. For better interpretation the values were normed. In case that all the aspects shown in figure 5 are equally important the “Wish” method would be selected as the most suitable one. Brainstorming and Brainwriting would occupy hypothetical second and third place. But such ranking has its own risks. One of the highest is selection.

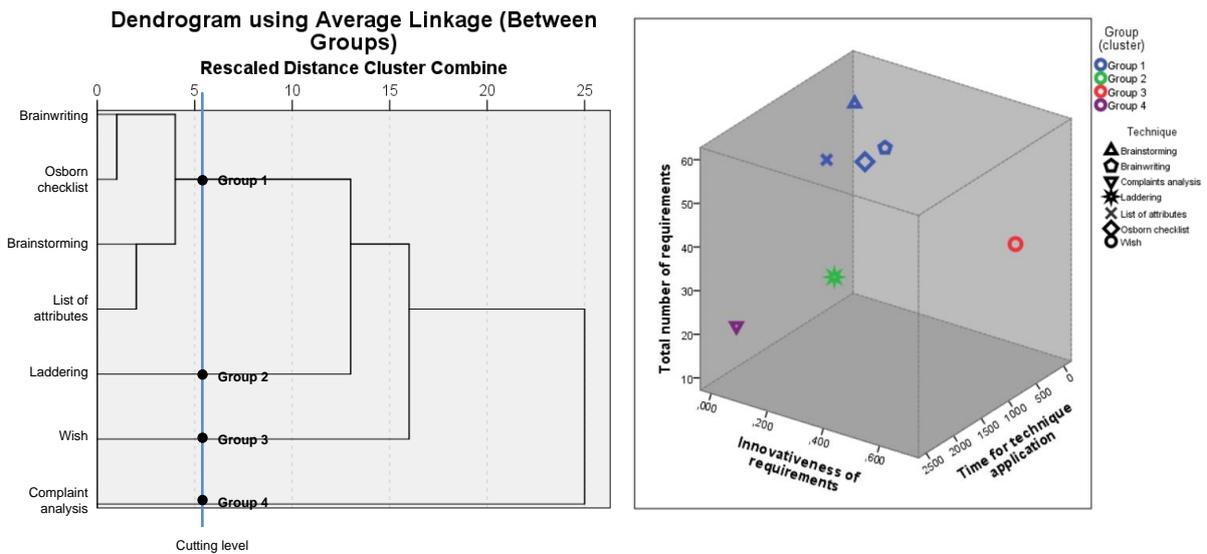
**Fig. 5: Complex reviewing of methods suitability**



Source: authors' own calculations

An individual or a group responsible for the process of customer requirements identification could by mistake select only the methods ranked in the top of the scale and consequently the other ones would not be used at all. But this way of methods would present a remarkable pitfall since each method differs from the other by its specific focusing on a type of requirements. From this point of view, it is understandable that for example Wish method has a much higher level of innovativeness of identified requirements since it directly presents its internal attribute. With the aim to get as high extraction of analysis information value as possible it would be suitable to summarise the results of methods in a simply understandable way. There are a lot of tools in the theory of statistics and one of relatively frequently used is a cluster analysis. In figure 6 there are the results of hierarchical clustering based on between-groups cluster method with squared Euclidean distance measure. Values of variables were standardized by Z-score. Cluster procedure identified 4 groups of similar methods.

**Fig. 6: Hierarchical clustering result**



*Source: authors' own calculations*

The first group contains the methods which could be called “quick and effective”. Brainwriting, Osborn checklist, Brainstorming and List of attributes belong here. These methods are able to identify a great number of mostly standard requirements within relatively short time. But they present grouped techniques which require participation of more people. If an organization has enough experts at its disposal (methods List of Attributes, Brainwriting and Osborn checklist) or has an opportunity to include in the process more customers (Brainstorming), it is possible to apply the methods from this group. Laddering method was ranked into the second group. This method is relatively quick but usually identifies only standard requirements in lower number than the previous techniques. These requirements often have a terminal character – i.e. they have a form of terminal values (e.g. desire to be exceptional, respect, value for money, etc.). These requirements can serve as a good background for targeted marketing campaign. The third group was also single-numerous and created by Wish method. It concerns a method enabling identification of great number of predominantly innovative requirements. If an organization dispose of focus group of customers and looks for ways for products innovation this technique is the proper way for ideas acquisition. The last – fourth group also contains only one method – Complaint analysis. It is a method which is the most time demanding but can be applied also individually. By content analysis of complaints, it is possible to identify critical requirements (later they can be processed by Critical incident technique). Organizations focusing on analysis of critical product failure can apply especially this method.

## 4. Discussion

Processing of information which express mental state of customer has a critical importance for quality management. One of the first phases of this process is identification of requirements which cannot be realized in several simple and even in

complicated ways – techniques. Application of each technique brings both positive and negative point of view (Hrnčiar, 2014). Examination of these two factors was the aim of this study. The results of solution resulted from the initial selection of methods and their experimental application during which a few indicators were monitored. From the methodological point of view two natural biases able to influence results character can be mentioned. The first is presented by characteristics of included groups (whether experts of customers). The second is certain level of subjectivity in reviewing methods innovativeness. On the opposite the fact that all experiments were conducted towards one object (product) supports results relevancy. Effort of an organization to increase product value for customers is natural since a financial benefit resulting from value growth is logically expected. Products value is usually increased by innovations (important improvements), which radically raise product functional or utility characteristic. Looking for innovations can be supported by structural approaches utilization and examined methods belong there. However, it is necessary to point out the fact that focusing on the product value growth by solutions of innovative character can cause inadvertence of standard or even necessary requirements. The result of nonfulfillment of such requirements could paradoxically cause effect of product value decrease (e.g. cup for coffee with “printed” thermometer brings almost no value for customer if its construction prevents its proper holding). Innovations cannot substitute standard requirements they only can complete them (Shahin, 2013). That is why comparison of techniques cannot have the “winner”, since the main criterion for their application is the purpose itself.

## **Conclusion**

The aim of submitted paper was to reduce partially a research gap, which existed in the area of these techniques evaluation from the scientific and practical point of view as well. The results can support expert discussion concerning focus of techniques for identification of customer requirements and conditions of their application.

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## Analyzing Business Process Requirements for a Software Based Execution of Business Continuity Tasks

### Abstract

Business Continuity helps organizations maintain their critical business activities at an acceptable level in the occasion of an unexpected interruption. A critical part of the business continuity management process is the Business Impact Analysis. The BIA process includes decision making regarding the recovery priority of business functions. Moreover, risk assessment of factors which may trigger business interruptions and extended information system outages is an issue of major importance in terms of business continuity. The current paper analyzes the business process requirements for a software based decision making regarding the two aforementioned tasks. The tool for specifying the business process requirements is the Business Object Relation Model which is a widely accepted and easily comprehensible approach for requirements specification, delineation and documentation.

### Key Words

*business impact analysis, business object relation model, object relation diagram, classification of critical business functions, risk assessment*

**JEL Classification: Y80, M150**

## Introduction

In the modern business environment, business continuity management (BCM) has evolved into an effective tool for ensuring the delivery of organizations' key products/services in the occasion of various disruptions (Gibb and Buchanan, 2006). Business impact analysis (BIA) is a key part of a business continuity management system (BCMS) in which "an organization's key products/services along with the critical functions and their BC related indices are determined" (Torabi et al., 2014). A crucial BIA task is the identification and classification of business functions as critical/non-critical. Multiple studies are relating the criticality ranking of business functions with their complexity. A representative example of such a study is the business continuity policy of the Rowan University (Lalovic-Hand, 2014). This is a logical conclusion due to the fact that the business oriented literature has considered complexity as an important factor in influencing organizations (Gorzen-Mitka and Okreglicka, 2015).

Apart from BIA, risk assessment (RA) is also a crucial element for understanding the organization (ISO 22301, 2012). The BCM RA identifies possible hazards which can have a major negative effect on the organizations, measures their impact and probability of their occurrence and proposes risk strategy in order to mitigate the risk of these hazards. Risk analysis can be implemented in a qualitative, quantitative and semi-quantitative form.

The primary goal of the current paper is to analyse business process requirements for a software based BIA and RA activities, via their representation through a widely accepted business requirements specification model, namely Business Object Relation Model (BORM). Part of the BORM model are the Object Relation Diagrams (ORD) through which the workflow representation is clear and comprehensible by all business stakeholders. BORM has been selected due to its advantage to involve only small number of concepts required combined with a considerable expressiveness (Merunka, 2003). Business continuity management requires the adoption of modern software tools, especially business intelligence applications like datawarehouses and data marts, in order to implement efficiently and timely the aforementioned BIA and RA tasks. The software requirements of such systems can be delineated successfully with BORM and ORD even to stakeholders who are “not *software engineering literate*” (Molhanec and Merunka, 2011). In the current paper, the selected software tool for designing ORD diagrams is the OpenPonk software, which is a free and user friendly modelling tool (Uhnák and Pergl, 2016).

## 1. Methods and Tools

### 1.1 Business Continuity Points for Recovery Complexity Estimation

The method has been recently introduced by (Podaras, 2015 Springer) as a tool for estimating the recovery complexity of a business function. The method finds its roots at the use case points method (Karner, 1993) used for software complexity estimation. The specific approach permits the non-arbitrary criticality ranking of business functions (BF). The core principle of the approach is “*the more complex the BF is, the less time should be spent on its recovery when unexpected interruption occurs*”. The main parameters of the business continuity points are the following (Podaras, 2015):

1. The Unadjusted Business Function Recovery Points (hereinafter UBFRP value)
2. The Estimation of the Technical, Environmental and Unexpected Recovery Factor (hereinafter TRF, ERF, URF values based on a set of technical, environmental and unexpected recovery factors)
3. Consideration of Simple (TRF=ERF=URF=0.85), Average (TRF, ERF, URF = 1) and Complex (TRF=ERF=URF=1.15) Recovery Scenario
4. The Adjusted Business Function Recovery Points (hereinafter ABFRP value)
5. The estimation of the Recovery Time Effort (hereinafter RTE value).

6. The current work delineates a software based criticality ranking based exclusively on the UBFRP value estimation. The UBFRP value is based on the presence of simple, average and complex Actors, of both human (Unadjusted Human Weights-UHW) and application (Unadjusted Application Weights-UAPW) types, as well as the involvement of simple, average and complex business activities in a specific business function Unadjusted Business Function Weights - UBFW). The equation which provide the UBFRP value, calculated in points, is the following:

$$UBFRP = UHW + UAPW + UBFW \quad (1)$$

## 1.2 Impact Value Levels (IVLs) for the Classification of Business Functions

Impact Value Levels, the IVL concept, has been proposed by Gibson (2014) in order to classify business functions based on their demanded recovery time. The following ranking is proposed for business functions:

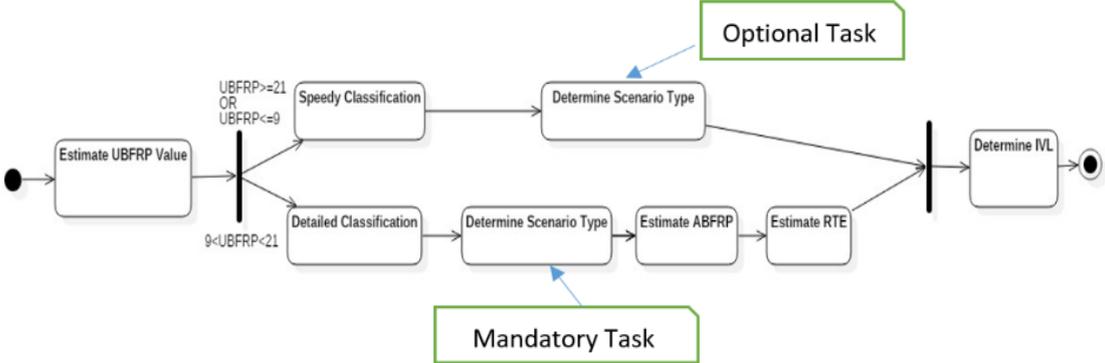
- a) IVL=L4(Level 4), where  $RTO < 168$ Hours,  $MAO = 168$ Hours, BF maybe interrupted for an extended period
- b) IVL=L3(Level 3), where  $RTO < 72$ Hours,  $MAO = 72$ Hours, BF maybe interrupted for 1 or more days
- c) IVL=L2(Level 2), where  $RTO < 24$ Hours,  $MAO = 24$ Hours, BF maybe interrupted for 1 day only
- d) IVL=L1(Level 1), where  $RTO < 168$ Hours,  $MAO = 168$ Hours, BF should be immediately recovered or operate without interruption if possible.

In order for the Business Continuity Points method to effectively enable business managers to estimate rational Recovery Time Effort (RTE), the inferred results have been compared with the proposed Rational Time Objective (hereinafter RTO) and Maximum Accepted Outage (hereinafter MAO) values (ISO 22301,2012). As a result, the RTE value helps to implement a non-arbitrary criticality ranking of a given business function, process or information system.

During the calculations of RTE values based on a dataset of more than 45 business functions of which all the recovery complexity parameters (UBFRP, TRF, ERF, URF and ABFRP) had been considered, it was realized that a general rule could be inferred and utilized for predicting the RTE interval based solely on UBFRP value. More precisely, it had been noticed that for  $UBFRP \leq 9$  points and  $UBFRP \geq 21$  points the RTE values accordingly were  $RTE > 72$  hours (IVL = L4) and  $RTE \leq 2$  hours (IVL = L1) respectively. It can be thus stated that for these UBFRP intervals the criticality ranking of a business function can be determined from the beginning (*speedy classification based on UBFRP*). For the classification of a business functions whose UBFRP interval is  $9 < UBFRP < 21$  a more advanced and complicated criticality ranking process should be followed, which includes the estimation of TRF, ERF, URF, ABFRP and RTE parameters. This occurs due to the fact that other business functions in this interval are classified as critical (IVL = L2)

and other as non-critical (IVL = L3). The representation of the general criticality ranking model for business functions based on their recovery complexity is included in the current work (see Fig. 1).

**Fig. 1: The general BF Criticality Ranking (Speedy and Detailed Classification)**



Source: authors

It should also be mentioned that for  $9 < UBFRP < 21$  the selection of recovery scenario (simple, average, complex) should be also determined (mandatory task) because different scenarios (TRF, ERF and URF) values influence the RTE and consequently the IVL classification for a given function.

**1.3 Risk Assessment as a Part of the Business Continuity Management Process**

Another important part of the business continuity management process is the risk assessment task. Miller and Engemann (2012), indicate that “Risk is the combination of the *probability of occurrence* of events and the *impacts* of events when they do occur. Risk may be expressed in several ways. When the information is qualitative in nature (e.g. probabilities being high, medium or low and impacts being high, medium or low), tabular measures may be developed”. Result of the 3x3 case just mentioned, would result in nine risk classes which can be utilized as drivers for developing the appropriate risk strategies (Aven, T. and Aven, E., 2011). The current paper delineates the business process requirements for a software based predictive and qualitative method for assessing the risk of *extended interruption of a given business function*. The approach can be used for the estimation of Time Deviation from Rational Time Objectives RTO (ISO 22301, 2012) timeframes proposed by experts after implementing business continuity exercises for the recovery of a given business function in ideal conditions.

**1.4 The BORM Model**

„BORM is based on the idea of object-oriented paradigm in conjunction with the process-based approach. As other Model-Driven Architecture (MDA)-based methodologies, BORM starts with a business-oriented specification of the problem area. Then it is step-by-step

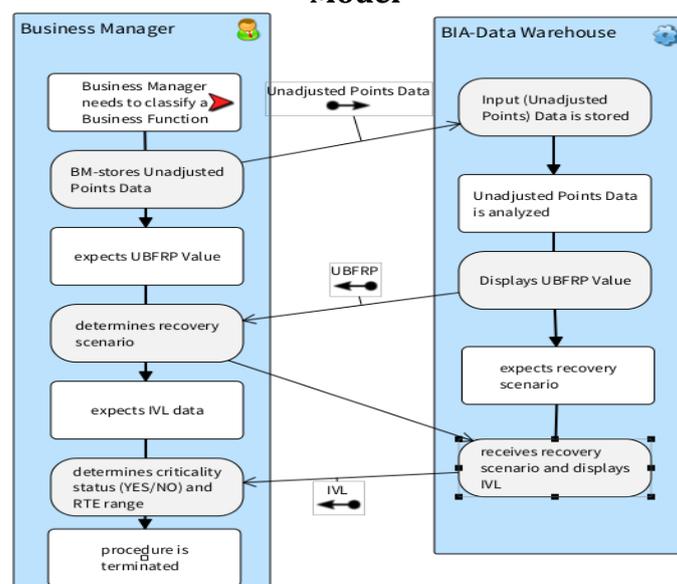
transformed into the correct software solution“ (Merunka et al., 2008). The BORM method has been in development since 1993 and has been a considerably effective and popular tool for both users and analysts. Moreover, BORM has been applied to various projects and case studies (Nedvedova, 2015, Knott et al., 2006). The Object Relation Diagram (ORD), which is part of BORM method, is utilized for depicting the criticality ranking of a core business function based on specific computations. The core elements and symbols of the BORM model which are included in the ORD Diagram are depicted in the current paper (see Fig. 2) . The most important elements of the ORD Diagram are the *States*, *Activities*, *Participants*, *Association (Communication between Participants)*, *Communication (Control flow between activities Data Flow(Exchange of information) and Transition between states* (Molhanec and Merunka, 2011).

## 2. Results and Discussion

### 2.1 Business Process Requirements Analysis for a Software Based Business Function Criticality Ranking

The criticality ranking supported by the Business Continuity Points is a so called recovery complexity based criticality ranking of a given business function due to the fact that each business function is assigned a specific Impact Value Level (IVL) based on the estimation of its Unadjusted Points (UBFRP). The following core BORM elements are necessary for specifying the business proces requirements for the criticality ranking process: Participants, Initiation, Action, Result, Activities, States, Communication, Data Flows and Associations.

**Fig. 2: ORD Illustration of the BF Criticality Ranking Process Based on the BORM Model**



Source: authors

**Participant A:** Business Manager: stakeholder who has an active role in the recovery process of any unexpectedly interrupted business function. **Participant B:** The Business Intelligence Application (Data Warehouse/Data Mart)-for efficient software based business continuity management decisions business intelligence tools are ideal, **Initiation:** Business manager needs to classify a business function, **Action:** the steps involved in the general classification process, **Result:** The proposed by the system RTE (intervals or preceding RTE values if one performs detailed classification) and Impact Value Levels. The result depends on the target variable determined by the business manager (end user) as well as on the selected recovery scenario (simple, average, complex).

## 2.2 Business Process Requirements Analysis for the Software Based Qualitative Risk Assessment for Extended Interruption of a BF

Another important part of the business continuity management process is the risk assessment task. Business Continuity experts indicate that “when risk cannot be quantified, either because the underlying information does not exist or because it is too expensive to collect, principles of risk management can still be applied” and “because business continuity management deals with events that are improbable, analyzing risks is challenging” (Miller and Engemann, 2012). The current paper illustrates a method for estimating the risk of a possible extended unavailability of an unexpectedly interrupted business function in a semi-quantitative manner.

### 2.2.1 The Proposed Semi-Quantitative Risk Framework

The method initially accepts as an input the RTO value defined by business managers, which might stem from business continuity exercises implemented in *ideal conditions*, when unexpected factors (unforeseen situations) do not influence the recovery procedure for a given business function. The quantitatively derived magnitude (weight value) as well as the qualitatively determined probability of occurrence of unforeseen factors indicate a semi - quantitative risk analysis path, where probability is based on a 5 level scale (1-5). The Risk Magnitude for a number N of specific factors is estimated according to equation (2):

$$RM = \sum_{i=1}^N W_i P_i \quad (2)$$

The weights of the factors are quantitatively estimated according to the Rank Order Centroid Method (ROC) (Barron and Barrett, 1996) and are based on formula (3):

$$W_i = \frac{1}{m} \sum_{i=1}^m \frac{1}{n} \quad \text{and} \quad \sum_{i=1}^m W_i = 1 \quad (3)$$

Formula (3) prohibits the arbitrary weight assignment of the presence for a given factor during the BF Recovery process. According to the proposed method, if RTE is the time

required to recover a business function in ideal conditions, a non-ideal recovery case should estimate the recovery time as given in formula (4):

$$RTE1 = RTE - RTE \frac{RM}{100} \text{ and } TimeDeviation = RTE \frac{RM}{100}, \quad (4)$$

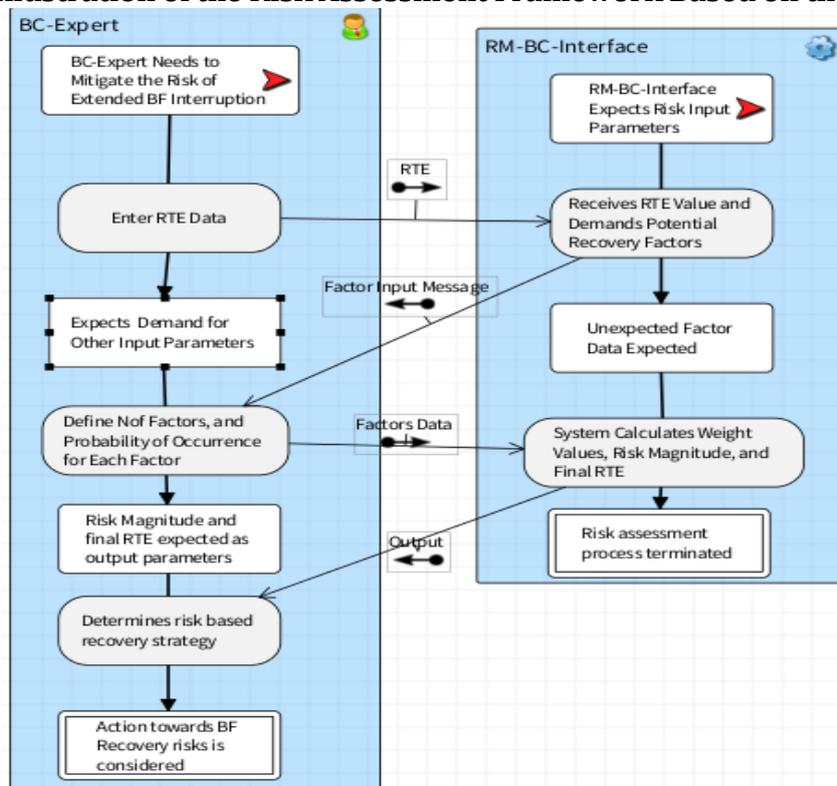
where RTE1 is the new Recovery Time.

A practical example is illustrated for the better interpretation of the approach. **Example:** If RTE= 2Hours, Number of Factors (N) = 4,  $W_{F1}= 0.521$ ,  $W_{F2}= 0.271$ ,  $W_{F3}= 0.146$ ,  $W_{F4}= 0.062$  (multiplied by 10) and we assume that Probabilities of occurrence for each factor are  $P_{F1}= 2$ ,  $P_{F2}= 5$ ,  $P_{F3}= 2$ ,  $P_{F4}= 4$  then:

$$RTE1 = 2 - 2 \frac{RM}{100} = 2 - 1.58 = 0.42 \text{ Hours}, \quad (5)$$

It should be noticed that the RM values are normalized by multiplying the weight values of each factor with 10 for obtaining more rational results ( $\sum_{i=1}^m W_i = 10$ ). The elements of the business process diagram (ORD) required for the detailed analysis of requirements for the risk assessment based RTE are in Fig. 3.

**Fig. 3: ORD Illustration of the Risk Assessment Framework Based on the BORM Model**



Source: authors

## Conclusion and Future Work

Business continuity management requires the adoption of modern software tools, especially business intelligence applications like datawarehouses and data marts, in order to implement efficiently and within short periods of time the aforementioned BIA and RA tasks. This paper illustrated the business process requirement analysis of a software oriented implementation of two crucial business continuity activities. The first activity is the software based criticality classification of enterprise business functions and the latter is the risk assessment process for mitigating the threat of a prolonged unavailability (estimation of time deviation) of a specific business function, the initial recovery time of which has been estimated based on recovery exercises that are executed in ideal conditions. The both aforementioned tasks can ensure efficiency in inferring promising and practical results for both the industrial and the scientific area. In enterprises, the specific processes can be used as drivers for a collaborative gathering of business continuity requirements with the help of BI tools such as data warehouses. The future work, which is already in progress, is the development of an integrated software tool which will involve the currently described as well as additional BCM tasks, i.e. determination about the recovery exercise type, calculation of the adjusted business function recovery points and proposal of alternative recovery scenarios.

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## A Note on Several Alternatives to Numerical Pricing of Options

### Abstract

Option pricing is a popular problem of financial mathematics and optimization due to the non-linearity in the option pay-off function and enormous sensitivity to the selection of underlying processes and input parameters. This aspect differentiates options from other derivatives. Since pricing and hedging of plain vanilla options under the conditions of Gaussian distribution (or a so called Black-Scholes model) is already well documented, it commonly serves as a benchmark for developing of new approaches and methods, which, in fact, aims on options with more complex payoffs (exotic options) and/or probability distributions that fit empirical observations about the market prices better, but for which no analytical formula is available. Obviously, being able to compare the results of the novel model with theoretically correct one is a crucial step of model testing. In this contribution we focus on numerical pricing of options. We first review well known approaches of Monte Carlo simulation and Lattice models and subsequently we formulate a Black-Scholes-Merton Partial Differential Equation, which serves as a starting point for discretization via two novel approaches, discontinuous Galerkin approach and Fuzzy transform technique. Both approaches seems to be promising especially for complex processes and payoff functions.

### Key Words

*Option pricing, numerical methods, discontinuous Galerkin, Fuzzy transform*

**JEL Classification: C21, R13**

## Introduction

Option pricing is a popular problem of financial mathematics and optimization due to the non-linearity in the option pay-off function and enormous sensitivity to the selection of underlying processes and input parameters. This aspect differentiates options from other derivatives and requires no-arbitrage arguments (for a review, see, e.g., Delbaen and Schachermayer, 2006). Since pricing and hedging of plain vanilla options under the

conditions of Gaussian distribution (or a so called Black-Scholes model, Black and Scholes (1973) and Merton (1973)) is already well documented, it commonly serves as a benchmark for developing of new approaches and methods, which, in fact, aims on options with more complex payoffs (exotic options) and/or probability distributions that fit empirical observations about the market prices better, but for which no analytical formula is available. Obviously, being able to compare the results of the novel model with theoretically correct one is a crucial step of model testing. In this paper we aim on some alternatives to numerical pricing of options (Štěpnička and Valášek, 2005; Hozman, 2012), and specifically we summarize their properties and suggest some further extensions. We proceed as follows. Sections 1 and 2 briefly summarize the foundations of option pricing and their numerical solution (Boyle et al., 1997; Cox et al., 1979), respectively. On the other hand, in Sections 3 and 4 we define two alternative approaches, discontinuous Galerkin approach and Fuzzy-transform approach, respectively, to numerical solution of option pricing problem and summarize possibilities of their usage.

## 1. Methods of option pricing

With some simplification we can distinguish *analytical* and *numerical* approaches to option pricing. While the first group of methods mostly leads to a closed-form pricing formula, which should easily provide a single number (theoretically correct option price), the second group requires utilization of more or less demanding numerical approaches and provides a good approximation of the theoretically correct price only with sufficiently high number of trials. The complexity generally depends on the type of option (its payoff function) and the kind of the underlying process (diffusion, jumps, jump-diffusion, multivariate, etc.).

Regardless the assumptions about the stochastic process, which is followed by the option underlying asset price, there are two main arguments that can be used when the option price is calculated – (1) no arbitrage argument; (2) risk neutral argument.

Following the former, we first need to construct a portfolio from the option itself and some additional risky assets, so that it will be riskless. For any portfolio, which is riskless, it holds that its return must be riskless as well. If it does not hold, an arbitrage opportunity arises (therefore we call it the *no arbitrage approach*) and anyone can earn riskless profit by investing into the portfolio (if its return is higher than riskless rate) or shorting it (if its return is lower).

Thus, if we know that a given portfolio is riskless for some particular period, we can easily calculate its value at the beginning of such period from its terminal value by simple riskless rate discounting; the reverse is also true since we can obtain its terminal value by multiplying its initial value with the riskless interest factor. Obviously, as concerns options we mostly do not know the initial value, instead, we wish to calculate it. What we know, however, is the terminal value since it is always equal to the payoff function.

The main drawback of such approach is that a given portfolio is riskless only for a very short period – as soon as some of the factors changes (underlying asset price, time, etc.), the portfolio must be rebalanced to remain riskless. Clearly, it brings additional assumptions, such as perfect markets, negligible transaction costs, infinitely divisible positions, etc.

The second approach comes from the assumption that all market participants are risk neutral. Hence, if nobody cares about the risk, there is no reason to provide excess return to those who bear it and thus, all assets should have riskless return.

Obviously, there is no such market where all participants are risk neutral. However, it was proved that it is sufficient to change the real (statistically observed) measure (commonly denoted as  $P$ ; according to the probability theory some probability measure should always be assigned to any event that might happen, such as that stock price  $S$  will be equal or higher to some  $x$ ) into the risk neutral measure (commonly denoted by  $Q$ ).

Various authors have already proved all conditions, under which the approaches mentioned above are valid, as well as their equivalency, see, for example, Harrison and Pliska (1981, 1983) and Harrison and Kreps (1979) or Delbaen and Schachermayer (2006).

## 1.1 Monte Carlo simulation

The group of methods belonging to Monte Carlo simulation approach, for the first time introduced to option pricing by Boyle (1977) and later reviewed by Boyle et al. (1997), are basically derived from the risk-neutral approach – one can proceed as follows:

1. Generate random scenarios of evolution for all underlying factors between the initial time and the terminal time (option maturity);
2. Evaluate the option payoff function at maturity and take the average;
3. Discount it to the beginning using the riskless rate.

Such approach can be easily used for a large selection of payoff functions, but is difficult to implement if some multiple decisions are to be made during the option life (it concerns especially *American* options).

## 1.2 Lattice approaches

The group of Lattice approaches also dates back to late 70's due to Cox et al. (1979) paper. The original model assumed only two stages within each time interval (therefore *binomial tree*) and thus it was apparently more 'discrete' when compared to Monte Carlo simulation. The discretization of such approach, however, allows easy implementation for American options as well as other derivatives that requires multiple decisions during the horizon. Over the time, various alternatives to the simple binomial tree have been

suggested so that now it is more proper to call the schemes of these methods as *lattices* rather than *trees*.

The lattice are basically derived from the risk-neutral approach since, similarly to Monte Carlo approach, we first construct the risk-neutral scheme of underlying factor evolution – one can proceed as follows:

1. Construct a lattice that describes all possible scenarios of evolution for all underlying factors between the initial time and the terminal time (option maturity);
2. Evaluate the option payoff function at maturity and take the average;
3. Discount it to the beginning using the riskless rate.

For both approaches mentioned above it holds that the more scenarios we create, the better approximation of the price we get. The difference, however, comes from the fact that while in Monte Carlo simulation we primary discretize the underlying asset price (the more scenarios we use, the smaller the difference between particular terminal prices is), within Lattice models we primary focus on the number of steps and thus we discretize the time interval (the more steps we have, the shorter the time interval we get).

## 2. Numerical solution of BSM PDE

In many cases, however, the conditions are so complex that it is more efficient to construct relevant partial differential equation, derived using no-arbitrage argument, accompanied by terminal (initial) and boundary conditions and solve them by some suitable numerical technique. The key idea here is based on above mentioned no-arbitrage argument – the option value should be identical to a combination of riskless bond and proper position in the underlying factors. Since the change in the option value can be expressed through sensitivities to the underlying factors and time, we can describe it easily by partial differential equation.

In simple finance, the equation is generally understood as forward (from the initial time to the maturity time with terminal conditions specified by the payoff function). On the other hand, in mathematics and whenever when more complex models must be evaluated, the equation is rather formulated as backward (we change the time and instead of terminal conditions we talk about initial conditions).

Moreover, since this concept was derived rather independently in the seminal papers by Black and Scholes (1973) and Merton (1973), it is often referred to as the Black-Scholes-Merton Partial Differential Equation (BSM PDE). Note also that R. Merton and M. Scholes received the Nobel Price for these findings (F. Black died meantime).

In the most simple case, a one-factor BSM PDE describes a plain vanilla option pricing problem when the only underlying factor is the underlying asset price (a stock  $S$ , for example), price of which follows lognormal distribution. Let  $\sigma$  be a constant volatility of

the underlying asset  $S$  price returns and  $r$  be a risk-free interest rate, also assumed to be constant over the option life. Then the price of the option  $V(S,t)$  is obtained by the following backward PDE:

$$\frac{\partial V}{\partial t} - L_{BS}(V) = 0, \quad (1)$$

where  $V:(0,S^{\max}) \times (0,T) \rightarrow \mathbb{R}$  and

$$L_{BS}(V) = \frac{1}{2} \sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS \frac{\partial V}{\partial S} - rV \quad (2)$$

with the boundary and initial conditions:

$$V(0,t) = V(S^{\max}, t) = h(S), \quad t \in (0, T) \quad (3)$$

and

$$V'(S,0) = g(S^{\max}, t) = g(S), \quad t \in (0, S^{\max}). \quad (4)$$

Let us consider  $W : H^1((0, S^{\max}) \times (0, T))$  such that  $W(S,0) = h(S)$ . Then the BSM PDE can be re-formulated as follows:

$$\frac{\partial \tilde{V}}{\partial t} = \frac{1}{2} \sigma^2 S^2 \frac{\partial^2 \tilde{V}}{\partial S^2} + rS \frac{\partial \tilde{V}}{\partial S} - r\tilde{V} + g, \quad (5)$$

where  $g = -\frac{\partial W}{\partial t} + L_{BS}(W)$  with the homogeneous Dirichlet boundary and initial conditions:

$$\tilde{V}(0,t) = \tilde{V}(S^{\max}, t) = 0, \quad t \in (0, T) \quad (6)$$

and

$$\tilde{V}(S,0) = g(S) - W(S,0), \quad S \in (0, S^{\max}). \quad (7)$$

Note that if  $\tilde{V}$  is a solution of (5), then the solution of the original BSM PDE is  $V = \tilde{V} + W$ . In order to solve the system numerically, we first need to discretize all variables, here the underlying asset price and the time.

### 3. Discontinuous Galerkin method

The discontinuous Galerkin (DG) method was developed by Reed and Hill (1973). This technique is suitable for problems with sufficiently regular as well as irregular solutions, because a DG framework originally combines the advantages of finite element method together with the discontinuous approach, for survey see Rivière (2008).

The DG method is based on piecewise polynomial, generally discontinuous approximations. From this point of view, it seems to be a very promising tool for the numerical simulation of option pricing and provides robust and high-order accurate approximations of solutions resulting from the Black-Scholes equation. Since the pricing equation (5) is closely related to the convection-diffusion equation, which exhibits parabolic and hyperbolic behavior in dependency on a proportion of the convection and diffusion parts, the numerical schemes for solving of such equation should be constructed with respect to these properties.

We construct solution  $\tilde{v}_n = \tilde{v}_n(t)$  from the finite dimensional space  $S_n^p$  consisting from piecewise polynomial, generally discontinuous, functions of the  $p$ -th order defined on  $(0, S^{\max})$ . Using a method of lines leads to a system of the ordinary differential equations

$$\frac{d}{dt}(\tilde{V}_h(t), \varphi_h) + \mathcal{B}_h(\tilde{V}_h(t), \varphi_h) = (g(t), \varphi_h) \quad \forall \varphi_h \in S_h^p, \forall t \in (0, T) \quad (8)$$

where the initial condition  $\tilde{v}_n(0)$  is given by (7),  $(*,*)$  denotes the inner product in  $L^2(0, S^{\max})$ , and the form  $B_h(*,*)$  stands for the DG semi-discrete formulation of the operator  $L_{BS}$  from (2). For more details see Hozman (2012) and Hozman and Tichý (2015) for illustration of the grid (see also Figure 1a).

Consequently, we realize the discretization in time by Crank-Nicolson scheme and obtain at each time level  $t_k \in [0, T]$  the sparse matrix equation, whose solution uniquely determines the discrete DG solution  $\tilde{v}_n \approx \tilde{v}_n(t_k)$ , see, e.g., Hozman and Tichý (2017).

### 4. 2D Fuzzy-transform approach

The fuzzy transform (F-transform) was introduced by Perfilieva (2003) as a soft computing method that is used for the approximation of functions. A generalization to two dimensional case was proposed in Štěpnička and Valášek (2005).

In fact, the F-transform approach has two steps: direct transform and inverse transform. First, the direct F-transform is used to transform a bounded real function to a finite vector of real numbers (a so called components of F-transform). Next, the inverse F-transform helps us to transform this vector back to the original real values, which means that the result of the inverse F-transform is a function that approximates the original function.

The F-transform technique has been already applied, besides others, in solving differential equations. In Perfilieva (2003) a numerical method based on the F-transform has been proposed for an ordinary Cauchy problem. The proposed technique which generalized the Euler method showed its potential for solving differential equations in comparison with numerous classical techniques. It follows that according to Štěpnička and Valášek (2005) the F-transform technique could easily be used to solve special types of partial differential equations. The numerical solution of the one-factor BSM PDE, however, needs a more complex approach. Below, on the basis of Holčapek et al. (2016) we specify a procedure derived on the basis of Crank-Nicolson time-discretization scheme.

First, let's generalize formula (2) as follows:

$$\frac{\partial V}{\partial t} = \alpha \frac{\partial^2 V}{\partial S^2} + \beta \frac{\partial V}{\partial S} - \gamma V + g, \quad (9)$$

where  $V, g: (0, S^{\max}) \times (0, T) \rightarrow R$  and  $\alpha, \beta, \gamma: (0, S^{\max}) \rightarrow R$ . Moreover, it satisfies the homogeneous Dirichlet boundary and initial conditions as described above.

To be able to apply F-transform, we need to create a fuzzy partition of the time and underlying asset price domain (we use simple uniform partition, see e.g. right part of Figure 1 reproduced from Holčapek and Tichý (2016)). Then, using Crank-Nicolson approach we rewrite generalized BSM PDE into the system of discretized equations and solve it by F-transform by replacing the functions and their derivatives in the system by F-transform components. These components can be summarized by matrix  $F$ :

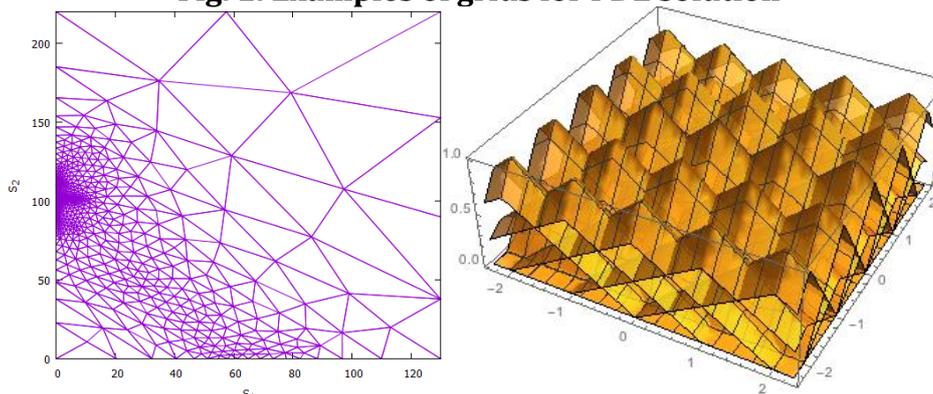
$$F = \begin{pmatrix} 0 & 0 & \dots & 0 \\ \varphi(s_2)F_{2,2} \dots F_{2,N} \\ \varphi(s_3)F_{3,2} \dots F_{3,N} \\ \dots & \dots & \dots & \dots \\ \varphi(s_{M-1})F_{M-1,2} \dots F_{M-1,N} \\ 0 & 0 & \dots & 0 \end{pmatrix}. \quad (10)$$

Finally, the approximate solution of generalized BSM PDE above can be obtained by applying inverse F-transform of  $F$  w.r.t.  $A$ ,

$$\tilde{V}(x, y) = F[f](x, y) + \sum_{i=1}^M \sum_{j=1}^N F_{i,j} A_{i,j}(x, y) \quad (11)$$

for  $(x, y) \in (0, S^{\max}) \times (0, T)$ .

**Fig. 1: Examples of grids for PDE solution**



Source: *Discontinuous Galerkin (2D projection, left, Hozman and Tichý, 2015)*  
*FT approach (uniform partition, right, Holčapek and Tichý, 2016)*

## Conclusion

In many cases, option pricing formula is not available in the closed form and some numerical approach must be adopted. In this contribution we have briefly summarized basic facts related to numerical pricing of options and subsequently two novel approaches for numerical solution of BSM PDE have been suggested. Moreover, an illustrative formulation for the case of plain vanilla option under Black-Scholes model have been proposed. While the first one, discontinuous Galerkin approach, can be useful for the analysis of complex payoff functions, including needs of decisions during option life, F-transform approach can be of interest in case of specific needs of discretization. Further research will be focused on comparison of particular approaches using experimental studies.

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## Open Innovation Model Design in the Services Industry Matching the Environment of the Industry 4.0 Philosophy

### Abstract

Open innovation is a paradigm that is determined to use external ideas, and external and internal paths to markets as the firms look to advance their technology. This idea was accepted for development of Business innovation models, which focus on the value creation logic for all stakeholders, the consideration of crucial value creating activities performed by parties external to the company like suppliers and customers. Under the Industry 4.0 concept, rapid growth in the advancement and adoption of information technology and social media networks has influenced consumers' perception on product innovation, quality, variety and speed of delivery. Accompanied by new technology, two types of innovative development are receiving more attention: service innovation and industrial big data. This paper deals with development of an Open innovation model in the services industry, which could operate under the condition of Industry 4.0 environment. The model development was based on performed three phased interviews with relevant managers as well as the later validation of its applicability.

### Key Words

*Industry 4.0, Business model innovation, Open innovation, Interview, Talent model*

**JEL Classification: L17, L25, L26, L80**

## Introduction

The main changes in companies connected to Industry 4.0 (Dujin et al. 2014) refer to: (1) final results – stress will be put on greater flexibility in the production process; (2) process – production based on the web and dynamic clusters; (3) business models – based on distributed value chains; (4) competition – based on the convergence of the borders between the industrial and non-industrial actions; (5) skills – strong emphasis will be placed on interdisciplinary thinking; (6) globalization – enterprises will be created in a more decentralized and flexible way. Goffin & Mitchel (2010) listed several characteristics of the services: intangibility, customer contact, inhomogeneity, perishability and multifaceted nature. Although the services are intangible (Cherubini, 2001), they often come together with products. This concept is called augmented service offering (Shelton, 2009). If the products are not different or when they are not similar, the service part of the augmented service offering becomes the leading part and major competitive

advantage. The importance of the innovations in services is not caused only by the service of the service sector itself. Some services play central roles in innovation processes throughout the economy, as agents of transfer, innovation support and sources of innovations for other sectors (Fagerberg *et al.*, 2006). Additionally the service innovations can be performed in other economy sectors. Concerning the trends in service innovation in the Czech Republic we can identify three main findings: (1) the increasing role of services in general; (2) the inspiration by successful leaders and (3) the return to the people in terms of human centred innovation. The greatest problems are: (1) lack of strategy; (2) low degree of creativity; (3) naivety; (3) poor implementation and (4) weak sales skills (Jiřinová *et al.*, 2015). Open Innovation, specifically in the professional services sector, is the topic of very few studies. This may be due to the fact that Open Innovation in this sector has only been appearing recently and is not necessarily labelled as Open Innovation. Golightly's report states the sector lags behind in taking up Open Innovation because of tight regulation and partly because of the extensive nature of innovation changes (Golightly, 2012). Still, more research, particularly on the topic of applying Open Innovation to the innovation processes of professional services firms, is necessary. Notwithstanding the fact that literature on the topic of Open Innovation in the service sector is scarce and there is a general consensus among academics that more research is necessary. If Open Innovation is to succeed as a new paradigm to innovation it will need to be able to be adapted to serve the service industry. Chesbrough (2011) examines the problem of applying Open Innovation in the services industry. Vargo *et al.* (2004, p.5) explains a reason for the lack of research in this field. The research in the innovation of services has been stunted by a traditional product-based focus in economics and business thinking. Accounting systems, for example, are built to precisely track inventory along the production lifecycle of a product. Important service-oriented measures like customer satisfaction, on-time delivery and employee satisfaction are not commonly found in accounting practices. Innovation in the service industry differs from that which comes into effect in the manufacturing sector. Apart from the basic differences in tangibility, consumption and storability of the end product, there are certain differences that make the services industry more suitable for applying Open Innovation. It is believed that the adoption of Open Innovation principles is closely tied with some distinct managers' characteristics and experience which facilitate transfer and exploitation of external knowledge and promote their easier conversion into Open Innovation (Pedrosa *et al.*, 2013). Open Innovation is on the agenda of many companies. This is not surprising as Open Innovation is often portrayed as a universal remedy to a company's innovation problems. Yet few companies have managed to master it. Further examples of best practices, along with academic research are still needed to develop a deeper understanding of the factors affecting Open Innovation. Theoretical modelling based on Open Innovation principles has been limited to the definition of structural categories (Gould, 2012, p.4) with minimal focus on industrial (Ozman, 2011, p.27) or cultural (Salmi *et al.*, 2010, p.21) differentiation. The conclusion made by Lee *et al.* (2010), on collaborative models being less efficient in SME's in the service industry, has led the authors to examine strictly collaborative Open Innovation models. There is little evidence that Open Innovation model to be workable in service industry has been already developed which might be considered the gap. To fill this gap the proposal of Open innovation model in the service industry was presented in this paper. Part of this research

is aimed at examining Open Innovation in the services industry. Neither was this topic addressed by foreign nor Czech academic research. It was examined that the examples of Open Innovation in the services industry are not as frequent as those in other industries. Particular focus will be directed to the professional services sector, which concentrates some of the largest service-oriented companies in the world. Open Innovation is supposed to become a powerful managerial tool which would help generate competitive advantage in various branches not only in industrial but also in service sector.

## **1. Research objectives and methods of research**

The main objective of this paper is to identify Open Innovation best practices for a professional services firm operating in Central Europe under the INDUSTRY 4.0 concept demands. The research comes out of thorough literature search to identify and reveal key progress in Open Innovation management. As for qualitative research both grounded theory and ethnographic research were used. Grounded theory was selected as the most appropriate method for the creation of the theory of business model adaptation to the condition of INDUSTRY 4.0. The contextual interview were used as a key principle for validation of the model. This method enables those under examination to recollect specific details that would be lost in a standard surrounding of focused groups. The interviews were conducted among back office employees including members of the executive committee, directors, partners, managers and consultants. In the simplest way ethnographic research can be defined as follows: *“Ethnographic research involves the use of various techniques for collecting data on human beliefs, values and practices”* (Hume & Mulcock, 2004). Interviews provided a base for gaining valuable feedback from employees who were involved in implementing the innovation program. Apart from being able to directly target these key employees, other advantages to using interviews were identified. These include the flexibility to choose questions throughout the duration of interviews and the possibility to focus on specific issues in greater detail. However, a disadvantage to interviews is the loss of anonymousness of the respondents, which can lead to distorted answers. Further research goal was Talent model validation which matches the requirements of INDUSTRY 4.0. Underlying research approach was based on *“grounded theory”*. This theory was selected as the most appropriate method for the model adaptation to the condition of INDUSTRY 4.0. Thus information excerpted from literature was combined with that obtained by interviews so that the synthesis of facts resulting in the set of corrective measures and Open Innovation models may be put into practice. The principal research question was: Is it possible to collect relevant data for defining an Open Innovation Model for the professional services industry which could be validated for practical application in the INDUSTRY 4.0 environment?

## 2. Developing Open Innovation Model procedure for the professional services industry under Industry 4.0 environment characteristics

In order to obtain key underlying data for Open innovation models elaboration an interview of key employees on current innovation practices were conducted. The interviews took place during 2015. The sample which consisted of 21 employees was divided into three sub-categories which comprised 6, 8 and 7 employees. These sub-categories referred to top management, middle management and first line management respectively. The interviews were conducted in three phases:

**Phase 1:** These interviews were focused on gaining opinions from employees holding positions in lower management and operations. This included members of the marketing team, the i-Portal administrators, Regional Data Centre Director, Service Centre teams and employees who had submitted ideas to the innovation portal. The interviews were focused on determining strengths and weaknesses of the current innovation program.

**Phase 2:** Members of the upper management were approached to share their stance on the innovation program. Interviews were conducted with the Regional Innovation Leader, Polish Innovation Leader, Regional Talent Supervisor, Chief Strategy Officer and the Regional Risk Managing Partner.

**Phase 3:** The final phase of the interviews took place once the corrective measures, open innovation recommendations and models had been proposed. The same group of top-managers and partners were addressed to validate the ideas and provide their feedback on the direction of the firm's innovation program.

The Open Innovation model was purposefully developed for service company operating in a financial business, consultancy and auditing. This company is acting in global environment, with internal decentralized structure supporting the high degree of flexibility; its business model is based on distributed value chain. All this parameters respond the features of companies connected to Industry 4.0. In this context as many as six Open Innovation models were proposed like Idea competitions - Talent model (see Chapter 3), Ecosystem model<sup>1</sup> (this model focuses on the development of a platformed product or service through a wider system of external innovators), Customer integration model<sup>2</sup> (this model devised for the professional services sector focuses mainly on collaboration with customers in the later stages of the innovation process), Supplier integration model<sup>3</sup> (The subcontractor's expertise provided valuable ideas in the product

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<sup>1</sup> The ecosystem is essentially an extensive community of external companies that are screened and recruited to develop extensions to products and services.

<sup>2</sup> Examples of customer integration in a product environment show persistent collaboration even in the earlier stages of the innovation process, such as service prototype development.

<sup>3</sup> Professional services firms use subcontractors to deliver a certain service that is outside of the company's core business.

prototyping stage), Innovation networks and intermediaries model<sup>1</sup> (this model uses internal networks of employees for gaining new ideas and outsourcing solutions to complex problems) and Internal bridges model<sup>2</sup> (this model is usually based on an online innovation platform and support employees' communication, motivation and idea quality). All these models were properly validated. Since the talent management process is one of the most challenging parts of company management, the Idea competition model – Talent model development is further presented in more detailed structure in this paper.

### **3. Practical example: The Idea competition – Talent model based on done research**

The findings show the analysed company practicing idea competitions through channels such as the I-Portal and Fast Track. Idea competitions however have not been focused on external innovators such as clients or partnering organizations. Instead, the focus has been on collecting ideas from innovative employees. A reason for this limited focus could be complicated intellectual property issues involved with collaborating with external parties. Idea competitions require the hosting organization to set out clear rules over the ownership and exploitation of intellectual property. Examples of idea competitions in companies like Kraft and Adidas have shown hosting organizations retaining the ownership of the submitted ideas. This can deter external innovators from participating. Therefore, the incentive mechanism is primarily based on intrinsic motivation, such as the challenge of participating and peer recognition. In order to lessen the risks involved with the transfer of IP in an innovation competition and target innovation partners with attractive incentives, the professional services industry should primarily focus on 'business case' innovation competitions as proposed by Lindegaard (2010, p. 173). The prospect of employment and developing ideas into service offerings could be motivators for talented innovators. Hence, the open Talent model is based on integrating idea competitions into the recruitment processes in order to attract new ideas and talent. The innovation partners collaborating in the talent model are the company's current employees and future employees.

#### **3.1 Process description**

The open talent model can be defined in the following process: (1) Define a theme to the contest; (2) Invite and attract participants; (3) Specify terms of the contract; (4) Collect and evaluate business cases; (5) Reward; (6) Develop and test service prototypes, coach innovation teams; (7) Commercialize.

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<sup>1</sup> Innovation networks and intermediaries often appear in the professional services sector and require stricter confidentiality and a stronger expert base when compared to other industries.

<sup>2</sup> Internal bridges can be regarded as the first steps of the professional services sector towards Open Innovation.

### **3.2 Criteria to be imposed on the model**

The following criteria have been selected from examples of idea competitions: (a) A creative theme exists for ideation; (b) Motivation to attract contestants; (c) Marketing and brand recognition; (d) Infrastructure to assess entries; (e) Clear rules outlining intellectual property rights; (f) Infrastructure to coach, develop and commercialize ideas.

### **3.3 Scope of the model**

An advantage to this model is its focus on one of the main pillars of the corporate strategy, which is Talent. The company under this model focuses on creating an innovative environment, which attracts talent to the company. The talent model could be valuable to integrating the innovation program into the company's recruitment and talent development programs. Validation will be focused on implementing the talent model within the current recruitment processes in the Central Europe member firm.

### **3.4 Example from other member firm**

The Australian member firm's implementation of an open Talent model in its innovation program can serve as an excellent example. A few years ago the firm hired a talented physics graduate to its Technology unit through an innovation challenge, which was aimed at university students. Here, the graduate developed an interactive SMS technology known as J-Mango. The student eventually launched his own company, but he still plays a key role in furthering many of the company's technology-based innovations. Developing the functionality into a commercial application may have started with the individual, but it was moved forward with the help of talented employees in the company. To demonstrate the effectiveness of attracting talented staff through innovation contests, the company saw the number of graduate applications to the company increase threefold from the launch of the innovation program. Not to mention success stories like these boost interest from firms wishing to have their own innovation programs consulted.

### **3.5 Validation of the model**

Validations of the model were conducted through interviews with the following partners across the region, while the very Talent model was validated by Executive committee member for quality and Innovation leader in Central Europe. Other key person who participated in validation of other models was Chief strategy officer and Innovation leader in Poland.

- Executive committee member for quality stated: „This model seems applicable. In Central Europe, most of the people hired are trained in economics, accounting, and law. Talent for innovation has certain boundaries in this sense. Other member firms, like the United Kingdom, hire psychologists, chemists, and people from different

professions and try to incorporate them into the business. This creates a multi-professional environment for innovation and new ideas. Which is absent in Central Europe. “

- Innovation leader in Central Europe stated: „Talent is a key asset in our firm and it would only make sense to target it through idea competitions and other innovation activities. It should be emphasized that good ideas do not have to come from people with degrees. I could see these competitions not only focused on students, but also on other recruitment groups“.

Finally models mentioned in this paper were accepted by key company executives, which recommended them to be applied in practice and thus processed as business case.

#### **4. Discussion and further way of research**

This paper deals with Open Innovation practice which is exemplified by cases taken from service sector. In order to make Open innovation application more feasible it is advisable to elaborate innovation models which represents adaptable framework for smoother Open innovation incorporation into company innovation process. In this particular case potential for Open innovation utilization in service sector was explored. It was proven that Open innovation concept might be applicable in service sector to bring benefits to both internal and external subjects. There are a lot of prerequisites or criteria which substantiate viability of business model. In particular Consultancy Company was chosen as a pilot project where viability of Open innovation concept was tested. First of all six Open Innovation models were devised for the professional services industry, which were further successfully validated through interviews with innovation leaders. Six proposed models represent possible approaches for future application of Open innovation in the service sector. The talent model presented in this paper shows systematic approach to the adaptation of Open innovation in a service sector company. The outcomes of the research were adapted by the company management for implementation. As a tool for the implementation the methodology of the Balanced Scorecard was recommended. Having this type of model in force the company can better utilized company intellectual capital and effectively transform it into shareholders' value. By the evaluation of interviews with innovation leaders it was proven that Open innovation models creates inevitable framework for design, elaboration and implementation of Open innovation in consultancy business. The scope of the research was limited to consultancy service sector. The output of qualitative research were not sufficient for quantitative evaluation. Therefore the further research should be extended to other parts of service sector. It is also worth recommending to incorporate feedback into the research to facilitate the implementation of corrective measures. Such a feedback will enable more precise focusing of innovation strategies.

## Conclusion

As a conclusion Open innovation represents a new paradigm in company innovation process potential of which is expected to be fully utilized in the future. Contemporary innovation management probably does not sufficiently reflect demands of Industry 4.0 process. It is provable that innovation strategies as a one of the basic tools of this philosophy are complex ones (they involve products, processes, Business models, knowledge management, job competences, Big Data, controlling etc.). Therefore it is necessary to cautiously observe the effectiveness of innovation employment in new environment, which do not arise continuously. It is necessary to confirm, if contemporary innovation management methods and accesses are in accordance with the future paradigm and when gaps in this way occur, it is necessary to immediately design new methods and verify new normative models which will ensure the transformation of innovation strategy into value creating drivers.

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## **Defining Principles of the Stakeholder Interaction Policy of an Enterprise within the Transition to Innovative Managerial Techniques**

### **Abstract**

The article is devoted to solving problems of the enterprise transition from traditional production approaches to application of innovative managerial techniques, namely the Lean Production concept. The key problem is persuading the employees on all levels to support the proposed changes. Thus, the vital part is to identify the stakeholders of the process, their interest and influence within the transition process. Developing a stakeholder interaction policy is proposed as the next step of facilitating the application of the principles of the Lean Production concept.

The article presents the approach to analyzing the stakeholders of the transition process as well as a stakeholder distribution matrix – an original tool for classifying the stakeholders according to their interests and influence on the transition process.

The case study of Hartmann – Rico, a.s. is presented, which is used to illustrate the practical application of the proposed approach and stakeholder distribution matrix.

The article defines principles of the stakeholder interaction policy of an enterprise within the transition to innovative managerial techniques. On the basis of the stakeholder analysis, a stakeholder interaction policy that takes into account influence, value, interest, and commitment of each group of stakeholders is proposed.

The main method used in the paper is the case study of the Hartmann – Rico, a.s. enterprise, including interviewing the plant managers and transition team and analyzing the stakeholders using the developed matrix and approaches.

### **Key Words**

*kaizen, lean production, stakeholder distribution matrix, stakeholder management, stakeholder policy*

**JEL Classification: D83, L22, M11, M12, M53, O31**

## **Introduction**

In conditions of the strengthening competition on saturated markets – both between local high-technology enterprises and transnational corporations – companies face the necessity to seek and select new approaches to increasing their market values (Farek et al., 2013; Kraft, Zaytsev, 2015; Kraft et al., 2009; Kraftová et al., 2013). Following the decades after such fundamental works as “Kaizen: The key to Japan’s competitive success” and “The Machine That Changed the World” were published in 1980s, the kaizen philosophy and the Lean Production concept (the LPC) have become one of the most

popular approaches to improving enterprise management systems (Imai, 1986; Womack et al., 1990; Jac et al., 2013; Dolak, Suchanek, 2015). Both the kaizen philosophy and the LPC saw their further development in (Womack, Jones, 1996; Liker, 2004). Thus, the fundamental framework and principles of the concepts were established.

The above-mentioned fundamental works offer a number of practical tools for achieving the goals of the kaizen philosophy and the LPC with new ones added by (Imai, 1997; Hobbs, 2003; Liker, 2005; Wader, 2012). The LPC was further developed into a new lean area closely linked to production – logistics – in combination with Six Sigma (Goldsby, Martichenko, 2005).

It is necessary to point out that the high effectiveness of the innovative managerial techniques in creating value for clients and identifying wasting in processes does not guarantee their unconditional support by employees and shareholders. The reason is that the principles behind the techniques differ drastically from the traditional, accustomed production systems. Researchers often recommend using 5S – the method for organizing workstations and shopfloor – as the first step of implementing kaizen and the LPC (Berezovskiy, 2013; Krishtal, Zaytseva, 2010) instead of firstly carrying out financial and strategic diagnostics of the enterprise, process and systems analysis (Cameron, Green, 2016; Zaytsev, 2015). At the same time, researchers ignore the enterprise preparation – a vital stage that ensures effectiveness of the transition to any innovative managerial technique.

Therefore, the aim of the paper is to define approaches to analyzing stakeholders of an enterprise within the development of theory and practice of innovative managerial techniques – namely, the kaizen philosophy and Lean Production concept.

In order to achieve this goal we have carried out a series of interviews in person with employees of the Hartmann – Rico, a.s. enterprise and representatives of its parent company – Paul Hartmann AG. The employees of Hartmann – Rico, a.s. included the plant manager, lean team, heads of production and logistics departments, as well as engineers and workforce at Veverská Bítýška. We have also analyzed academic research regarding the matters of the LPC implementation and stakeholder management.

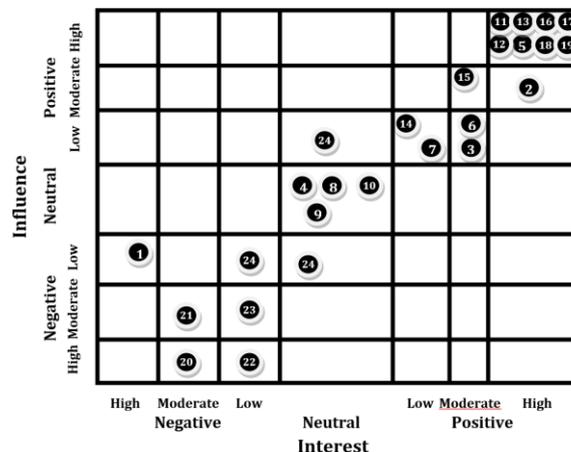
## **1. Analyzing stakeholders of the transition to innovative managerial techniques. Case of Hartmann – Rico, a.s.**

In practice, the program of transition to kaizen and the LPC is initiated by functional middle-level managers or individual members of the board of directors who possess the completeness of information as opposed to other employees. Carrying out changes with such coverage and depth often faces conscious and unconscious resistance (Cameron, Green, 2016; Estrin, 2009; Gumerova, 2010). The first step to overcome the resistance is to analyze each group of stakeholders, their influence, and possible motives. The following

criteria are proposed for assessing each stakeholder: “influence on realization of the transition program” and “interest in realization of the transition program”.

**Influence on realization of the transition program** reflects whether a stakeholder can contribute or hinder the transition to innovative managerial techniques. It can be negative, neutral (absent or minimal), or positive. Strength-wise, negative and positive influences can be weak, moderate, or high. Influence can take – functional and leadership forms. *Functional influence* – a stakeholder makes decisions within his/her authority and responsibility that can contribute, hinder, or have no influence over the transition program. *Leadership influence* – a stakeholder can influence formally or informally opinions and interests of the other stakeholders.

**Fig. 1. The stakeholder distribution matrix for Hartmann – Rico, a.s.**



- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Competitors.</li> <li>3. The Concern's subsidiaries as suppliers.</li> <li>5. The Concern's Supply Chain Management department as a customer.</li> <li>7. End consumers.</li> <li>9. Financial structures.</li> <li>11. The Concern as a managing shareholder.</li> <li>13. Plant managers of Hartmann – Rico, a.s.</li> <li>15. HRM subsystem of Hartmann – Rico, a.s.</li> <li>17. Production subsystem of Hartmann – Rico, a.s.</li> <li>19. Innovative process management subsystem of Hartmann – Rico, a.s.</li> <li>21. Engineering technologists of the main production of Hartmann – Rico, a.s.</li> <li>23. Engineering technologists of the auxiliary production of Hartmann – Rico, a.s.</li> </ol> | <ol style="list-style-type: none"> <li>2. The Concern as a supplier.</li> <li>4. Other suppliers, including the state.</li> <li>6. Medical establishments as customers, including the state.</li> <li>8. Society/community.</li> <li>10. The state as a regulator.</li> <li>12. Top management of Hartmann – Rico, a.s.</li> <li>14. Financial subsystem of Hartmann – Rico, a.s.</li> <li>16. R&amp;D subsystem of Hartmann – Rico, a.s.</li> <li>18. Logistics subsystem of Hartmann – Rico, a.s.</li> <li>20. Chief engineer/technology officer of the main production of Hartmann – Rico, a.s.</li> <li>22. Chief engineer/technology officer of the auxiliary production of Hartmann – Rico, a.s.</li> <li>24. Workforce of Hartmann – Rico, a.s.</li> </ol> |
|--|---|

Source: own

**Interest in realization of the transition program** reflects how a stakeholder views the transition to innovative managerial techniques. It can be negative (the stakeholder disapproves of the transition), neutral (the stakeholder is “indifferent”), or positive (the stakeholder approves of the transition). Strength-wise, negative and positive interests can be weak, moderate, or high. Influence can take corporate and personal forms. *Corporate interest* – a degree of conformity of the expected effects and required effort for the transition program to corporate goals and available resources of the stakeholder. *Personal interest* – a degree of conformity of the expected effects and required effort for the transition program to personal goals of the stakeholder.

To illustrate the application of the abovementioned approach we use the example of Hartmann – Rico, a.s. (Brno, the Czech Republic), subsidiary of transnational concern Paul Hartmann AG (Heidenheim, Germany). The company is the major producer and distributor of medical products on the Czech market. The results of the enterprise's stakeholder analysis are presented in the following stakeholder matrix (see Fig. 1).

## 2. Defining principles of the stakeholder interaction policy within realization of the transition program

On the basis of the stakeholder classification it is obvious that the internal stakeholders are of most significance because the key priority of the program is improving internal processes of the enterprise. The stakeholders of the lower-left quadrant present the highest threat to the program. The transition does not match their personal and/or functional goals and they possess enough capabilities to resist it. In this connexion, the transition team is to determine measures to minimize opportunities for negative influence. The chief engineer and engineering technologists of the main production were such stakeholders for Hartmann – Rico, a.s. The stakeholders with moderate/high negative influence and low negative interest are of particular interest for the transition team because their interest can be transformed into positive and it would be applied for achieving the goals of the transition to innovative managerial techniques. The chief engineer and engineering technologists of the auxiliary production were such stakeholders for Hartmann – Rico, a.s. It is obvious that the stakeholders of the top right quadrant (i.e., positive influence and interest) are of the most importance for the transition team. An ideal situation for the company when the board of directors and middle management belong to the quadrant. In the case of Hartmann – Rico, a.s. the concern, top management and most functional subsystems had moderate and high positive interest and influence.

In order to make more precise the principles of interaction with the internal stakeholders it is necessary to analyze additionally the key participants of the transition program according to criteria "value" and "commitment".

**Value** is a parameter for assessing the participant's intellectual and creative potential, aggregating such factors as knowledge, abilities, skills, and experience (KASE). Applying existing or new assessment tools, the HRMS and managers of the other departments (divisions, shopfloors, etc.) are to assess to what extent the employees that would participate in realization of the transition program possess the required level of KASE. It is also necessary to distinguish the employees with the unique competences or high intellectual and creative potential. Value is divided into "low", "average", and "high".

**Commitment** – a parameter describing the extent of the required commitment of a stakeholder to the transition program in order to realize it effectively and efficiently. It is divided into "minor", "periodic", "regular", and "constant". Commitment is compared with interest to determine the required interaction policy.

Based on the results of the assessment of the four parameters the shareholder description table is formed and used to make decisions on selecting the method of the interaction with them. Vide Tab. 1 for the description of the shareholders for the case of Hartmann – Rico, a.s.

## Conclusion

The proposed approach demonstrates that the internal stakeholders of the LPC transition process (the parent company representatives, top management, plant managers, and functional subsystems) were located in the top right quadrant – i.e., they were generally in favor and could contribute to the transition. However, the technical and production specialists, including higher-ranking engineers, regarded the LPC with suspicion. Although that is commonplace with implementing changes and the support from top and middle-level management is vital for the transition during its early stages, the principles of continuous improvement, employee engagement and the functioning of the concepts itself is highly dependant on production specialists. The reason behind it is that in the end they are the ones who are responsible for maintaining lean processes. Thus, the negative interest may present later a problem within the day-to-day lean operations unless the management takes a proactive approach to it.

The proposed approaches enable to determine major stakeholders of the enterprise, initiating implementation of the kaizen philosophy and LPC, their influence, interest, and value on the first stage of the transition program. On the basis of the shareholder description the transition team identifies risks associated with potential negative influence on the transition and compare the required commitment with the existing to determine training the required competences to employees, role distribution, and interaction policy development; creating a feedback system satisfying stakeholder needs and the transition program tasks; adapting the motivation system and key performance indicators.

**Tab. 1. Description of the shareholders of the transition program to innovative managerial techniques for Hartmann – Rico, a.s.**

| Nº | Stakeholder                             | Influence         | Value   | Interest          | Commitment | Interactions   |
|----|---|-------------------|---------|-------------------|------------|--|
| 1. | Competitors                             | Low Negative      | -       | High Negative     | -          | Protect information on the transition program  |
| 2. | The Concern as a supplier               | Moderate Positive | High    | High Positive     | Periodic   | Coordinate changes in raw material and component supply cycles<br>Request and exchange of information on the best practice in the LPC and project management |
| 3. | The Concern's subsidiaries as suppliers | Low Positive      | Average | Moderate Positive | Minor      | Coordinate changes in raw material and component supply cycles<br>Request and exchange of information on the best practice in the LPC and project management |

| Nº  | Stakeholder  | Influence     | Value   | Interest          | Commitment | Interactions   |
|-----|--|---------------|---------|-------------------|------------|--|
| 4.  | Other suppliers, including the state                     | Neutral       | Low     | Neutral           | Minor      | Coordinate changes in raw material and component supply cycles   |
| 5.  | SCM department as a customer                             | High Positive | Average | High Positive     | Regular    | Inform on the degree of implementing the LPC<br>Coordinate changes in product supply cycles<br>Acquire quality control feedback<br>Request and exchange information on the best practice in the LPC and project management   |
| 6.  | Medical establishments as customers, including the state | Low Positive  | -       | Moderate Positive | Periodic   | Coordinate changes in product supply cycles<br>Acquire quality control feedback  |
| 7.  | End consumers  | Low Positive  | -       | Low Positive      | -          | -  |
| 8.  | Society/Local community                                  | Neutral       | -       | Neutral           | -          | Prevent reputational risks due to possible downsizing  |
| 9.  | Financial structures                                     | Neutral       | -       | Neutral           | -          | -  |
| 10. | The state as a regulator                                 | Neutral       | -       | Neutral           | -          | Prevent reputational risks due to possible downsizing  |
| 11. | The Concern as a managing shareholder                    | High Positive | Average | High Positive     | Regular    | Inform on the degree of implementing the LPC, achieving set parameters, and investment expenditure<br>Coordinate the key issues of the strategy of Hartmann – Rico, a.s., based on innovative managerial techniques  |
| 12. | Top management of Hartmann – Rico, a.s.                  | High Positive | Average | High Positive     | Regular    | Train in fundamentals of the LPC<br>Inform on the degree of implementing the LPC, achieving set parameters, and investment expenditure<br>Engage into developing proposals on the key aspects of the transition to the LPC<br>Engage into solving tactical problems and tasks of the transition<br>Engage into intracorporate promotion of the LPC (leadership by example) |
| 13. | Plant managers of Hartmann – Rico, a.s.                  | High Positive | Average | High Positive     | Constant   | In-depth training in the LPC<br>Inform on the degree of implementing the LPC and achieving set parameters<br>Engage into developing the transition program to the LPC and constituent projects<br>Engage into solving tactical and operational problems and tasks of the transition<br>Engage into intracorporate promotion of the LPC (leadership by example)             |

| Nº  | Stakeholder   | Influence         | Value   | Interest          | Commitment | Interactions  |
|-----|---|-------------------|---------|-------------------|------------|---|
| 14. | Financial subsystem of Hartmann – Rico, a.s.                                      | Low Positive      | Low     | Low Positive      | Periodic   | Inform on the goals and roles within the transition program<br>Request the required financing for realizing the LPC projects<br>Inform on the economic effect of the LPC projects<br>Engage into developing methodologies for evaluating the economic effect of the LPC projects, including their impact on the value of the business, and evaluating of intangible asset “LPC” |
| 15. | HRM subsystem of Hartmann – Rico, a.s.  | Moderate Positive | Average | Moderate Positive | Periodic   | Inform on the goals and roles within the transition program<br>Engage into assessing KASE of the employees, developing training programs on the LPC and motivation programs within the new management system  |
| 16. | R&D subsystem of Hartmann – Rico, a.s.  | High Positive     | Average | High Positive     | Regular    | Inform on the goals and roles within the transition program<br>In-depth training in the LPC<br>Engage into modernizing and assessing the required changes of the equipment  |
| 17. | Production subsystem of Hartmann – Rico, a.s.                                     | High Positive     | Average | High Positive     | Constant   | Inform on the goals and roles within the transition program<br>In-depth training in the LPC   |
| 18. | Logistics subsystem of Hartmann – Rico, a.s.                                      | High Positive     | Average | High Positive     | Constant   | Engage into realizing projects and developing proposals for the transition program<br>Engage into intracorporate promotion of the LPC (leadership by example)   |
| 19. | Innovation process management subsystem of Hartmann – Rico, a.s.                  | High Positive     | High    | High Positive     | Constant   | Inform on the goals and roles within the transition program<br>In-depth training in the LPC<br>Engage into developing the transition program to the LPC and constituent projects<br>Engage into solving tactical and operational problems and tasks of the transition<br>Engage into intracorporate promotion of the LPC (leadership by example)                                |
| 20. | Chief engineer/technology officer of the main production of Hartmann – Rico, a.s. | High Negative     | High    | Moderate Negative | Constant   | Inform on the goals and roles within the transition program<br>In-depth training in the LPC<br>Assess possibility to transform negative interest and influence into positive  |
| 21. | Engineering technologists of the main production of Hartmann – Rico, a.s.         | Moderate Negative | Average | Moderate Negative | Constant   | If possible – Engage into realizing projects and developing proposal for the transition program, into solving tactical and operational problems and tasks,  |

| №   | Stakeholder  | Influence         | Value   | Interest     | Commitment | Interactions  |
|-----|--|-------------------|---------|--------------|------------|---|
| 22. | Chief engineer/technology officer of the auxiliary production of Hartmann – Rico, a.s. | High Negative     | High    | Low Negative | Constant   | intracorporate promotion of the LPC (leadership by example)<br>If impossible – Reassign or dismiss  |
| 23. | Engineering technologists of the auxiliary production of Hartmann – Rico, a.s.         | Moderate Negative | Average | Low Negative | Constant   |   |
| 24. | Workforce of Hartmann – Rico, a.s.   |                   |         |              |            |   |
|     | “Conservators”   | Low Negative      | Low     | Low Negative | Constant   | Inform on the goals and roles within the transition program<br>Train in fundamentals of the LPC Assess possibility to transform negative interest and influence into positive<br>If possible – Engage into realizing projects and developing proposal for the transition program<br>If impossible – Reassign or dismiss |
|     | “Indifferent”  | Low Negative      | Low     | Neutral      | Constant   | Engage into realizing projects and developing proposal for the transition program   |
|     | “Approving”  | Low Positive      | Low     | Neutral      | Constant   | Engage into realizing projects and developing proposal for the transition program   |

Source: own

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## Section IV

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# Transparency in the Public Sector





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## Transparent Lobbying – the Costs Connected with It

### Abstract

Lobbying transparency increase can be considered a specific public project, i.e. a systemic proposal of public funds allocation. The aim of the article is to identify the costs associated with transparent lobbying. Modern dynamic indicators which analyse costs (input) of a project and are related to its utilities (output) are reflected from the viewpoint of public project evaluation. The used CBA (Cost Benefit Analysis) method was specified on the basis of the delimitation of characteristics and attributes of transparent lobbying. The evaluation of the project is performed on the basis of the creation of a specific model of a social-economic analysis in a non-reduced form. The model works with the delimitation of quantifiable and non-quantifiable costs and benefits of the project. The basic variants of the final states were determined, namely: 1) the existence of the current legislation and 2) the project variant of lobbying transparency increase, which was further divided into 2.1) a project variant of lobbying transparency increase by means of legislation changes and 2.2) a project variant of lobbying transparency increase on the basis of self-regulation principles. From the viewpoint of costs, the second option is financially more demanding and mainly the option of implemented legislation changes. The variant by means of self-regulation can, but does not have to, be accompanied by additional costs. The first variant is not connected with any immediate financial costs. The selection of the most suitable variant will be done in relation with the presupposed acquired quantifiable and non-quantifiable benefits.

### Key Words

*transparency, lobbying, Cost Benefit Analysis, public project*

**JEL Classification: H43, D72**

## Introduction

The article has been written as an integral part of the evaluation of the project focused of lobbying transparency increase as part of the GAČR grant "Impact of Transparency of Lobbying on Democratization and Its Consequences". The aim of the article is to identify the costs associated with transparent lobbying: to determine variants for lobbying transparency increase, their evaluation and comparison from the viewpoint of quantifiable and non-quantifiable costs.

Lobbying as a term can be defined in a lot of ways. In essence, however, it always involves advancing of interests of a particular interest group in the course of a decision making process. A definition which is often considered as the most precise is that by L. Graziana (2001: 248), when: "*Lobbying is a specialised and professional representation of interests*

*by means of a wide variety of tools which in principle eliminate a corruptive change of services. It is by its nature very different from a general non-specialised representation provided by elected representatives. As a representative of particular interests a lobbyist provides information and technically-professional expertises which can be useful and sometimes decisive for defining legislative and administrative regulation.*" In addition to this, there is Schendelen's definition stating that "*Lobbying refers to the various types of unconventional behaviour of interest groups focused on achieving requested results*" (Van Schendelen, 2002: 210). In 2006, the European Commission (further just as Commission) issued a document called Green Book - European Transparency Initiative. This document formulates relatively broad definition of lobbying: "*All activities carried out with the objective of influencing the policy formulation and decision-making processes of the European institutions*" (EC, 2006: 5). Š. Laboutková and M. Žák (2010: 2) delimited the basic attributes of lobbying when "*lobbying is first of all focused on advancing interests, it is an indispensable source information and the biggest problems is to distinguish lobbying from corruption.*" Lobbying helps to articulate and advance interests of various parts of society and it is at the same an information channel by means of which the knowledge of the holders of the public power about decisive facts is improved. Affecting representatives of the public power with the aim to influence their decisions is not always transparent and according to clear rules, which brings the risk of the public interests being manipulated in favour of hidden partial interests. Strengthening the transparency of the legislation and decision making process helps to reveal the influence and the relations between lobbyists and interest groups on the one hand and public entities on the other hand to public control, which should contribute to the reduction of negative impacts often connected with lobbying, such as corruption, conflict of interests, protection and clientelism. According to OECD (2013), creating limits for transparent lobbying is essential also for the integrity of the public decision making process. Š. Laboutková and P. Vymětal (2017) propose a catalogue of currently used measures dealing directly or indirectly with lobbying regulation that support the transparency principle in general. All measures are grouped in four logical categories:

1. Direct rules focusing on lobbyists in term of lobbying activities and their behaviour, both legal and self-regulation. Those include register of lobbyists; Codes of Ethics / Codes of Behaviour for lobbyists with effective penalties; regular disclosure of lobbyists' activities; open calendars of meetings with all decision-makers.
2. Indirect provisions rule subject of lobbying (the targets of lobbying). This category mostly includes Codes of Ethics / Codes of Behaviour for Members of Parliament, Ministers, Employees in the Civil Service; revolving doors provisions (pre- and post-employment separation); open calendars of meetings (appointment diaries) of all decision-makers; Conflict of Interest regulation; declaration of (financial) assets, income and/or fact-finding trips.
3. Sunlight principles and/or anti-corruption tools are indirect also, but they are supposed primarily as a measure with a different goal rather to be linked only with lobbying and they include clear and transparent rules on legislative process; rules on Governmental decision-making and decision-making in the public sector; rules on consultations with public, civil society, interest groups, professional bodies etc.; legislative footprint and/or other declaration of consulted bodies/organizations;

programme of proposed legislative work; Open Government Data; regulation of political parties financing (limits for lobbyists donations and expenditures); freedom of information act.

4. The monitoring and sanctioning system. Here only general statements can be made – enforcement of the rules should be effective, and the penalties should force subjects to comply with the rules.

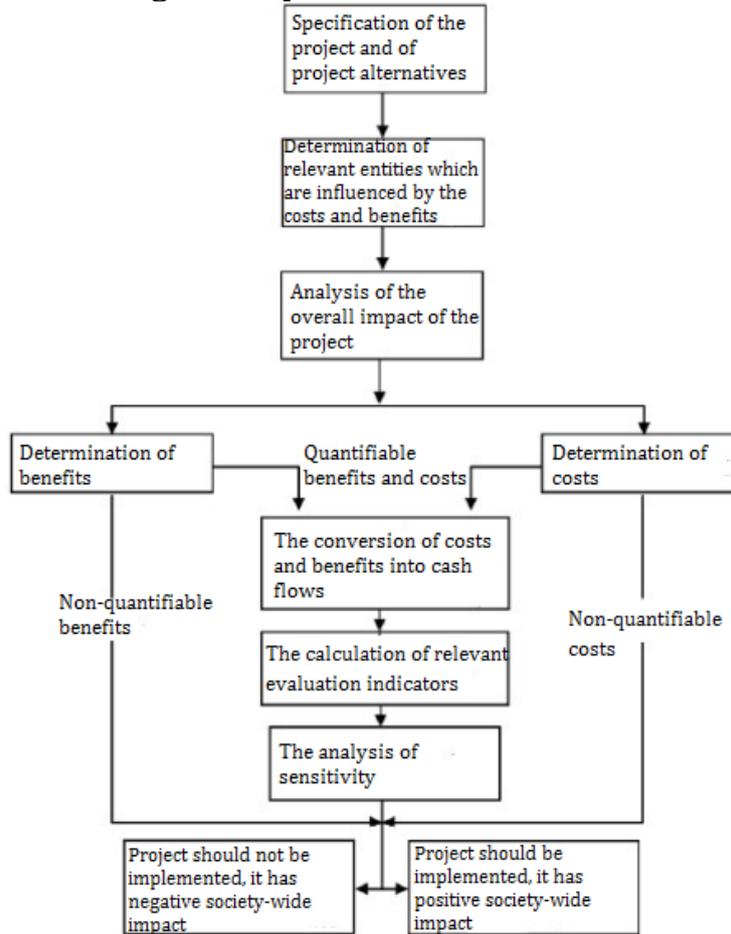
## 1. Methods of Research

Increasing the transparency of lobbying can be considered a specific public project. It follows from the definition of F. Ochrana (2004), who defines a public project as *"a systemic proposal of public funds allocation which (usually) has the character of an investment action while a public project can also be understood as a proposal of a systemic change of the funds allocation itself"*. Public projects differ from purely private ones by the fact that the public sector is always involved in their implementation to a certain extent. The classification of lobbying transparency increase among public projects corresponds also with the definition of a public project by B. Hamerníková and K. Kubátová (2004), who define a public project as *"the execution of specific concrete aims as a result of which either specific production (of assets or services) or investment units originate, or the correction of injustice towards specific groups of inhabitants on the basis of set down or generally shared criteria occurs"*. Also J. Weber (2001: 601) considers a public project to be *"a specific way of reaching a change, a temporary activity which unites and organizes the effort of different kinds of expertise invested into the creation of a unique intention (usually a product or a service)"*.

As far as the evaluation of public projects is concerned, the most commonly used one-criterion methods include economic analyses, so called cost-output methods. Input-output methods differ in the approach to the utilities and costs from the viewpoint of their assessment. It is possible to evaluate public projects and to determine their profitability by means of four basic methods: CMA (*Cost minimalisation Analysis*), CEA (*Cost Effectiveness Analysis*), CUA (*Cost Utility Analysis*) and CBA (*Cost Benefit Analysis*). In connection with the project, the possibilities of the use of the CUA and CBA methods are specified. In the case of the use of the CUA method, which is used e.g. in the area of health care, for the quantification of costs of the lobbying transparency increase and for measuring society-wide benefits representing a wide spectrum of outputs also a qualitative dimension can be used which replaces the monetary representation of effects. In the optimal case, if it is possible to express both the input and output of a project in monetary units, it is suitable to use the CBA method, namely a social-economical (wide) analysis in a non-reduced form. This method is further specified on the basis of the delimitation of the characteristics and attributes of transparent lobbying.

The procedure of the lobbying transparency increase evaluation by means of the social-economical effectiveness of the project is illustrated in the following Figure 1:

**Fig. 1: The process of CBA creation**



Source: own editing by Franc, P. (2012:48)

The first step in the evaluation is the identification of the project and its implementation alternatives. Subsequently relative effects are evaluated, i.e. costs and profits of the project, while it is necessary to avoid duplicate inclusion of one effect. Then the effects are expressed in such units so that it were possible to aggregate and mutually compare the individual effects. Based on these it is possible to calculate criteria indicators with the help of which it is possible to decide about the implementation of the project and to select the best alternative.

## 2. Results of the Research

The proposed measures of lobbying transparency increase can work individually or in mutual combination, which can intensify their effects in practice. With regards to national specificities and historical approach it is necessary to thoroughly consider which of the possible measures should be applied and in what forms so that the expected results were ensured. In connection with the evaluation of lobbying transparency increase in the Czech Republic, three basic options are delimited.

## **2.1 Option 1– the existence of the current legislation, i.e. the current state without an increase in transparency**

Retaining the current state and thus not adopting any of the measures for the regulation of lobbying and the increase in transparency of the legislation and decision making process is unsatisfactory for a number of reasons. It can be assumed that the problems of the current condition will become worse and deeper, namely (ÚV ČR, 2012):

- the lingering low transparency of the legislation process which will lead to gradually deteriorating quality of legal regulations;
- pressure coming from interests groups and aiming at reaching such legislation which would be advantageous mainly for the groups themselves;
- consequently to this, the quality of business environment will deteriorate and also the attractiveness of the CR not only for foreign investors (including the risk of international arbitrations due to breaches of agreement on the mutual protection of investments), but also for Czech companies (including the outflow of Czech companies headquarters out of the Czech Republic);
- low level of decision-making processes transparency (strategic planning, awarding tenders, etc.) in public administration (state administration and public corporations);
- low level of control over the influence on decision making of entities in public power.

This option is not connected with any immediate financial costs. Potential direct costs would arise in the case of unsuccessful international arbitrations, in the case of reduced tax income caused by the outflow of businesses from the Czech Republic, or if small business becomes more difficult to run or if the rating and evaluation of the Czech Republic by the World Bank and the International Monetary Fund worsened, which would lead to the reduction of international investments.

## **2.2 Option 2 – project option of lobbying transparency increase**

This option includes the adoption of a whole set of measures in support of legislation and decision-making processes transparency in relation to lobbying activities. The strategic aims include (ÚV ČR, 2012):

- to enable transparent protection of interests in the legislation process, also on the level of self-governments, for individuals as well as groups - i.e. to make the process of legitimate lobbying more transparent and to increase the credibility of legitimate lobbyists;
- to reduce corruptive environment in the legislation process in the CR, potentially also on the level of self-governments;
- to strengthen tools for advancing non-profit interests in civil society.

If the whole set of new measures is to be created and work, it is an expensive option. From the viewpoint of transparency, however, this option including a combination of legislation

and non-legislation processes is the most complex one. Within this option there are two possible solutions in relation to the fact whether the regulation of lobbying will be done by means of legislation changes or on the basis of self-regulation principles.

### **2.2.1 Option 2.1 – project option of lobbying transparency increase by means of legislation changes**

This option presupposes the existence of one legal regulation which would comprehensively regulate the area of lobbying control, the related legal regulations will be amended and it will include a sanction mechanism, which would ensure real enforceability. This option presupposes the establishment of a register of lobbyists based on the new law and the increase in the transparency of lobbying in accordance with the recommendation by OECD and EU activities, it further presupposes the establishment of an authority for the control and enforcement in connection with lobbying.

It is rather an expensive option when it will be necessary to proceed in such a way so that the costs did not exceed the expected social benefits. The costs will be derived from the number of legislation actions when the government annually discusses approximately 160 materials of a legislation nature, the parliament annually passes 400 - 500 legal regulations. The costs of the control of to what extent the obligations arising from the legislation regulating lobbying are observed can be calculated in relation to the presupposed agenda performed by the authority for lobbying control which includes the registration of lobbyists and the maintenance of their register, the checks of financial/annual reports, analytical, educational, consultancy and methodical activities, checks of reports on forbidden activities of lobbyists, or the imposition of correct sanctions. How time demanding the activities will be depends on the number of lobbied entities and the number of lobbyists. The number of the lobbied entities is estimated based on the number of persons in a position which authorises them to effectively influence these processes per 2000 - 3000 persons and maximally several hundreds of lobbyists. In the case of administration agendas of a similar type (so called agendas residing in records, checks and supervisions or in education) the presupposed number of entities per one officer is 300 - 1000, thus 4 - 5 should be able to perform such agenda. Other overhead and operations costs are connected with activities according to the new legislation in the area of lobbying. There will be no costs of specialized customized software for the establishment of the register as with regards to the expected number of the registered entities, commonly used office software should be sufficient.

### **2.2.2 Option 2.2 – project option of lobbying transparency increase on the basis of self-regulation principles**

This option is based on voluntariness which both in the conditions of the Czech Republic as well as in other countries is a serious disadvantage because it causes insufficient enforceability of the set down rules. Voluntary registration has proved unsatisfactory even in the EU institutions in the long run. The effective functioning of the discussed option is closely interrelated with long-lasting political and cultural traditions in some countries which are not directly transferable to the Czech environment. Codes of conduct,

voluntary registers of lobbyists, public diaries, etc. are not sufficiently enforceable at the moment because of the insufficient role of moral imperatives. These at the same time limit educational approach which purely theoretically could eventually lead to the establishment of a transparent state when legal regulations are not essentially needed.

This option can, but does not have to be, connected with costs for the state budget. This depends on to what extent the state will get actively involved in educational activities (campaigns focused on businesses, citizens and executives related to the importance and benefits of transparent lobbying), or whether everything will be left completely to non-governmental organizations or how these organizations will be supported within the grant policy (in this case indirect costs might arise). Other additional costs include certain small increases in administration load, mainly for the lobbied entities, which means state administration and public authorities.

## **Conclusion**

The aim of the article was to determine options for lobbying transparency increase, their evaluation and comparison from the viewpoint of quantifiable and non-quantifiable costs. Lobbying transparency increase can be considered a specific public project. Modern dynamic indicators which analyse costs (input) of a project and are related to its utilities (output) are reflected from the viewpoint of public project evaluation. The used CBA (Cost Benefit Analysis) method was specified on the basis of the delimitation of characteristics and attributes of transparent lobbying which are: 1) Direct rules focusing on lobbyists in term of lobbying activities, both legal and self-regulation, 2) Indirect provisions rule subject of lobbying, 3) Sunlight principles and/or anti-corruption tools and 4) The monitoring and sanctioning system. The evaluation of the project is performed on the basis of the creation of a specific model of a social-economic (wide) analysis in a non-reduced form. The model works with the delimitation of quantifiable and non-quantifiable costs and benefits. The basic options were determined which are: 1) the existence of the current legislation and 2) the option of lobbying transparency increase, which was further divided into 2.1) a option of lobbying transparency increase by means of legislation changes and 2.2) a option of lobbying transparency increase on the basis of self-regulation principles. From the viewpoint of costs, the second option is financially more demanding and mainly the option of implemented legislation changes (see Tab. 1).

**Tab. 1: The costs connected with individual variants**

|   |  |
|---|--|
| <b>Option 1:</b> current state                | None immediate financial costs<br>Potential direct costs: unsuccessful international arbitrations, reduced tax income, worsened rating and evaluation of the Czech Republic  |
| <b>Option 2.1:</b> legislation changes        | Rather an expensive option: register of lobbyists based on the new law (approximately CZK 2 million/year), an authority for the control and enforcement (approximately CZK 4 million/year)   |
| <b>Option 2.2:</b> self-regulation principles | None financial costs or immediate financial costs: educational activities (approximately CZK 1-2 million/year), grant policy (indirect costs, approximately less than CZK 1million/year), administration load (approximately less than CZK 0.2 million/year) |

Source: authors' calculations

The selection of the most suitable option will be done in relation with the presupposed acquired quantifiable and non-quantifiable benefits which will be evaluated by means of indexes and indicators of democracy, institutional quality and competitiveness.

## Acknowledgement

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## Trust and Corruption in the Czech Republic

### Abstract

The purpose of this discussion paper is to discuss the issue of corruption and trust in the context of the Czech Republic and to examine whether the generally valid model of the relationship between these two phenomena fits the Czech experience as well. We use the social capital lens to study this issue and on this basis build our discussion around two types of trust: particularised (PST) and generalised (GST) social trust. Trust and corruption are first discussed in both theoretical and empirical terms from the Czech experience before exposing them to the corruption-trust relationship model. The information about the Czech Republic has been obtained from data published by Transparency International (TI), the European Bank for Reconstruction and Development (EBRD), the World Values Survey (WVS) and the Polity IV project (CSP, 2014). The data suggest that the Czech experience is similar to that of other countries. However, the proportion between PST and GST seems to bear some importance in its explanatory value of corruption levels. Different types of corruption also have positive effect on PST and negative effect on GST. We conclude this paper by proposing directions for further research and their implications for the study of social capital in the Czech Republic.

### Key Words

*corruption, social trust, social capital, Czech Republic*

**JEL Classification: A13, D71, D73, D85**

## Introduction

The vast majority of studies across different academic disciplines agree that trust is a desirable element in human interaction and corruption is an undesirable one in societies, economies, and different environments and across different contexts (e.g. Rose-Ackerman, 2002). It is therefore essential that we study and examine these two phenomena in greater detail in order to gain as much insight as we can. This is important not only for realising where we currently stand on trust and what is the current state of corruption in society but also to learn about what leads to the current situation and thereby what it is we need to fix in order to improve the situation that would, ideally, lead to a society and an economy, institutions and business environment that are more trustworthy, and where corruption is declining.

Although this seems like a 'straight forward' exercise, the contrary is the case. As we mentioned at the beginning, the majority of studies agree that trust is good and corruption is bad, oftentimes compared to a cancer on institutions, societies, economies and

businesses; however, there are a few 'grey sheep in the herd' that suggest that trust may not be as white and that corruption may not be as black as it may seem at first glance (Uslaner, 2013). What these studies emphasise is the importance of context in the whole corruption-trust inquiry. In order to explore the meaning of these arguments and provide more narrative around them, we have selected a context that is quite unique to the trust and corruption discourse that we see these days and that is the Czech Republic.

The reason why we have selected the Czech Republic - and we would like to stress here that it is the modern Czech Republic, not a transition context, we are interested in - is its unique nature in economic and social terms (Svejnar, 2002). This, we believe is not only in the context of the Central and Eastern European (CEE) countries and countries of the former Soviet Bloc that have undergone a massive transition over the past three decades, but the Czech Republic is also unique in the global context as it has managed to adapt to the Western world in economic terms more than the majority of the countries in the CEE region and yet when we look at the social context, and especially the quality of the social capital which inevitably influences all areas of social exchange and interaction, including the business environment, the quality of which is still very poor compared to well-established Western democracies and even other countries in the CEE region (EBRD, 2011; Benesova and Anchor, 2015).

In order to explore this issue and provide the reader with a clearer picture of the quality, extent and nature of trust and corruption in the Czech Republic, this paper will first provide a brief review of literature that will allow us to position this paper in the academic literature. This will be followed by a discussion of the current state of trust and corruption in the Czech Republic which will allow us to expose the trust-corruption relationship model to the Czech experience in order to verify its working and identify any anomalies in the interaction between trust and corruption. On the basis of the observation made when comparing the Czech experience to the model of trust-corruption relationship we will then be able to propose directions for further research into corruption and trust in the Czech Republic.

## **1. Trust and Corruption**

There are a number of lenses through which trust and corruption can be explored, and the choice often depends on the academic discipline of inquiry. We are building our argument around the theory of social capital, more precisely the later form that has been developed and shaped by the work of Putnam (e.g. 1995), and in the context of trust and corruption by e.g. Uslaner (2013). The reason for this choice is twofold; firstly, social capital covers a wide array of academic literature and disciplines and therefore allows us to develop thoughts on these phenomena across a wider range of contexts; and secondly, on the other hand, it provides a tight enough guidance on the relationship between trust and corruption which is often unclear in the current literature and therefore, unless building this on the foundations that social capital provides, it would be extremely difficult to give our discussion clear boundaries which, given the limited scope of this paper, would be problematic.

It is crucial to provide a short overview of the elements of social capital that we are using as the grounds for our discussion at this point as well. Since trust is an inherent part of social capital it is not surprising that social capital probably fits its discussion and contextualisation best. Corruption is also often discussed in the context of social capital, and usually referred to as 'trust gone bad', i.e. trust being put in a bad use (Putnam, 1995; Rothstein, 2013). This link is clear but it is flawed in that it lacks depth. We need to bear in mind, that social capital is the study of links and networks between different people and on different levels of society but at the same time, it is not a network theory per se. In order to describe these inter-actions, social capital looks at what holds societies together and what separates them, and therefore makes for fractionalised environments (Halpern, 2005). Social capital is therefore often classified as bridging or bonding with either weak or strong ties - and although 'respectively' could follow, at this point, it is not that simple.

Bridging social capital has the role of social glue that binds together all people of all communities and backgrounds by creating 'bridges' between internally bonded groups which are almost always present, i.e. based on bonding social capital (Putnam, 1995). As far as the legacy goes, trust is often considered as bridging and corruption as a bonding capital but - don't hold your breath! - it gets more complicated than that, as it is not only the presence and existence of the individual forms of social capital but also the use into which they are put (Benesova and Anchor, 2015). Simply put, if trust, which is seen as one of the most positive elements of social capital, is not put in a good use and taken advantage of in one's own benefit, corruption, i.e. negative social capital occurs. These are the basics of the trust-corruption relationship which is, however, more complicated than that. In order to discuss this relationship in greater detail, we first need to discuss the types of trust and corruption in greater detail, and complement our discussion with information about these two phenomena in the Czech Republic.

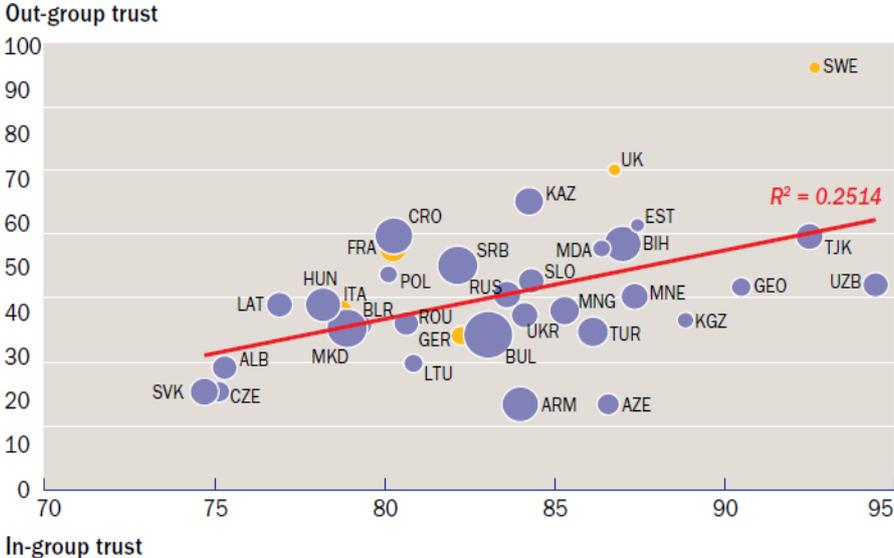
## **1.1 Trust**

Trust is a complex phenomenon that is gaining increasing attention in academic literature across a wide range of disciplines; for instance, sociology, psychology, business and management studies and economics alike have been increasingly taking trust on board in the past three decades; however, trust has been under the attention of researchers and philosophers for a much longer time (Halpern, 2005). It is perhaps due to the number of studies and different angles that researchers take in order to study trust that the definition is somewhat unclear. What is, however, apparent is that trust means different things across different contexts and therefore needs to be broken down into different types in order to be studied further and defined (Rothstein, 2013). Since ours is a study of trust in the context of social capital we make use of the following types of trust in our discussion: particularised and generalised social trust (Uslaner, 2013).

Research into particularised trust (PST) that usually refers to bonding trust is based on the following question: 'Do you trust your family and/or neighbours?' ; and generalised trust (GST), often referred to as a bridging trust is approximated by the following question: 'Generally speaking, would you say that most people can be trusted? Or that you

can't be too careful in dealing with other people?' (e.g. Halpern, 2005; EBRD, 2011; WVS, 2017). These questions vary across different surveys but not to a great extent, and are the same in terms of their approach and essence. Unlike GST, which is seen as the positive social glue that leads to more trusting, open and honest societies, PST is seen as having mostly a negative impact on society in that it leads to fractionalisation and alienation of individuals and groups often leading to social exclusion which brings other problems such as increased crime, lowered civic engagement and also corruption (Beugelsdijk and Smulders, 2003). Fig. 1 shows the position of the Czech Republic with regards to the combination of its PST and GST.

**Fig. 1: Generalised and Particularised Trust**



Source: EBRD Life in Transition Survey (2011, p.42)

Fig. 1 clearly indicates that the Czech Republic has low levels of both generalised (out-group) and particularised (in-group) trust, and together with Slovakia, its former sister-country, is at the lower end of the CEE region and also other transition and European countries. This confirms our thesis of the Czech Republic being unique in terms of its social capital. It is no coincidence that Slovakia is in a very similar position given the common history and development, i.e. experience and - it is not unreasonable to say - mentality as well (Svejnar, 2002). Trust within individuals is seen as the result of one's experience and current circumstances which is valid for societies or countries too (Glanville and Paxton, 2007). GST is often formed in clear, transparent environments such as those present in Nordic and Scandinavian countries or in Western Europe; whereas PST, which is normally present in environments with high levels of GST too but are aligned with it, is strengthened and made use of in environments where oppression and paranoia reign supreme and therefore make it difficult for people to express themselves openly and gain access to what they require in order to fulfil their essential needs (Kretschmer, 1998).

Given the historic development of the Czech Republic, it comes as no surprise that PST is much stronger and more developed than generalised forms of trust. What is surprising, however, is the comparison between PST and GST even nowadays, more than twenty

decades since the fall of the Iron Curtain during which the Czech Republic has been able to move away from the group of transition economies, and developed a democracy that has been characterised as strong and an economy that is open and involved in international and global trade (EBRD, 2011). It seems, that the Czech Republic has managed to pull together and mobilise all its resources in order to secure its place in global trade as an economic agent but on the social side it seems that the scars are deep and wounds remained unhealed to date. Indeed, the Czech Republic has managed to secure a relatively stable environment for businesses, especially due to the quality of its human capital and cheap resources in comparison with Western countries (EBRD, 2011). However what the Czech Republic offers in terms of its human capital it often lacks in terms of transparency and honesty (Lizal and Kocenda, 2001).

This issue is very often explained in terms of the development of social capital in the past when the country was under the strict reign of the Communist party, often employing the use of control mechanisms which harmed trust and created fear in the society. The setting has been often described as a 'police state' and with a centrally planned economy, it comes as no surprise that in order to get things done or for people to get what they not only wanted but often needed, they had to utilise their networks which contributed to the development of strong in-group trust (PST) and led to strong membership and a sense of belonging to these small and strongly bonded groups as members of society were often also afraid of people they knew as the chances of these being members of the STB (secret security services established to protect the regime's agenda) were not negligible (Svejnar, 2002). Similarly to these strongly bonded groups, other groups were simultaneously forming within the governance of the country itself and stemmed from membership in the Communist party (Lizal and Kocenda, 2001).

Once the old regime was over, the new president-elect Vaclav Havel, being well-aware of the current state of the society at that time, prompted people in his first presidential speech to trust by saying that 'we have to trust one another' (Flores and Solomon, 1998, p. 205). His was a request for people not only to develop trust, but to forget the past and to start from scratch. This is a difficult task to undertake, although not impossible, and could be achieved if those that are responsible for the governance of the country were able to stand as a positive example but there was one obstacle to it - social capital - and the habits that people have developed in going about their daily tasks and needs in the past (EBRD, 2011). The Czech transition can be described as a fast liberalisation and privatisation, which created unstable environments and myriads of opportunities for corruption. Politicians and often also society failed to withstand the temptations and corruption during these years became a particularly prominent issue (Lizal and Kocenda, 2001). It does not necessary mean that it increased, which is hard to tell given that data for comparison are non-existent, but with the press being freed and corruption starting to be reported, it became obvious that it was not just an issue, but that it was a major issue (EBRD, 2011).

As a result of this, trust was not only standing on wacky foundations of the past experience but it was also being increasingly shaken by the ever-present suspicion strengthened by various cases of both proven or reported corruption (e.g. Jum and CTK, 2013). This

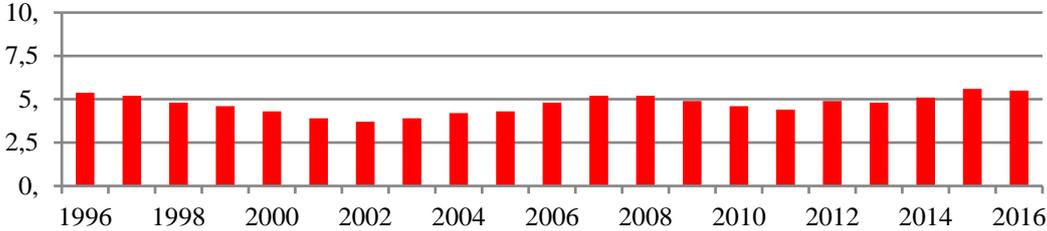
explains the low levels of GST in the Czech Republic, and prompts us to start looking at this issue and explore ways leading towards improvement. Meanwhile, PST still thrives in the Czech Republic, although it is lower than in other countries of the former Soviet bloc. This is believed to be due to the former presence of secret police and reporting services (STB) which could be members of one’s family. This would often result in family members being convicted by their own family members or someone from their closest group of friends. Indeed, the old adage ‘trust but verify’ is valid in the Czech Republic, and is sometimes valid even for the closest family members (Svejnar, 2002; EBRD, 2011).

## 1.2 Corruption

Corruption is a concept that is simpler than trust in terms of our understanding of it as it, in terms of social capital, does not have a typology per se and can therefore be - at best - classified by its context, form of transaction or agents involved in the transaction (Benesova and Anchor, 2015). The general consensus is that corruption is a negative social capital and as such it is often being perceived as opposed to trust with one definition directly suggesting that it is a breach of trust (Rose-Ackerman, 2002). In addition to this, corruption is also described as the misuse of *entrusted* power or a public office for one’s private gain (TI, 2016). Although it is not easy to agree on one definition of corruption, the one provided here seems appropriate upon excluding the word ‘public office’ as this limits corruption to a specific context and agents and therefore would cause the omission of a significant proportion of different contexts of corruption and therefore will provide only very weak foundations and limited scope for our discussion. Indeed, social capital suggests that corruption is the use of networks in a way that benefits the individual or a specific group and is not in line with the norms and rules generally accepted by a society (Beugelsdijk and Smulders, 2003).

The previous section has already described how corruption in the Czech Republic emerged after the regime change in 1989 and we can therefore now move our discussion to some particular, interesting moments in its development and its current state. Fig. 2 shows the development of corruption perceptions in the Czech Republic in the last two decades.

**Fig. 2: Corruption Perception Index: Czech Republic 1996 - 2016**

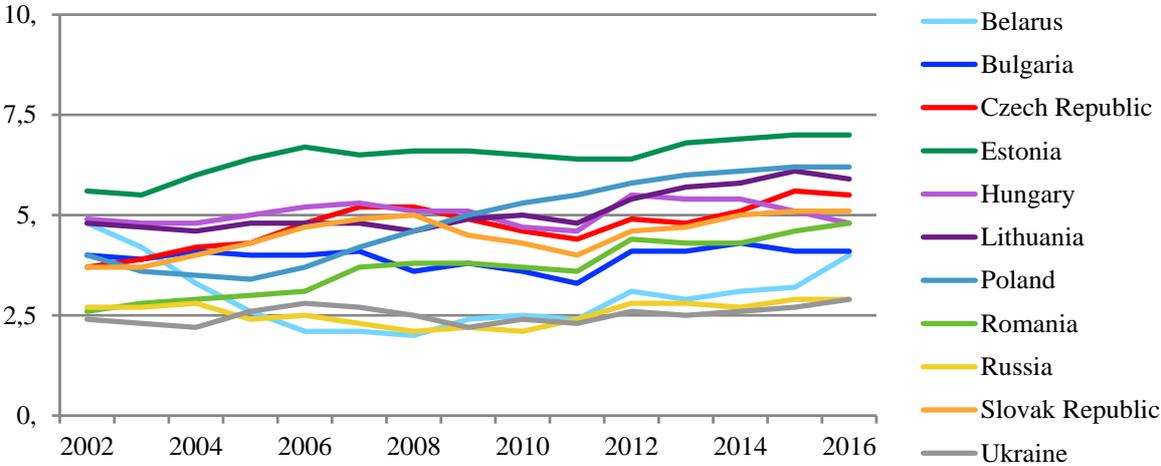


*Source: Developed by the authors, data from (TI, 2016)*

Fig. 2 shows that that the perceived levels of corruption in the Czech Republic are relatively consistent in terms of their absolute value, ranging from 3.7 in 2002 to 5.6 in

2015. This is a particularly interesting pattern in the corruption experience. The plausible explanation of the fluctuations of corruption levels might be the issue of the role of perceptions in the Corruption Perception Index which has been raised by researchers a number of times (The Economist, 2010). There have been corruption cases over the past two decades which were linked to EU subsidies and also political fractionalisation and increased investment in the country which tend to influence the corruption perception index (CPI) (Jum and CTK, 2013); and although the CPI suggests an improvement (5.6) in 2015, we can see its decline in the following year again. In order to compare the Czech case to the rest of the region, Fig. 3 provides an overview of the level of corruption of all CEE countries. The Czech Republic was ranked as 26<sup>th</sup> out of 31 European countries in results of the CPI survey published by Transparency International's CPI 2014 which is a very negative result.

**Fig. 3: Transparency International's Corruption Perception Index for CEE**



Source: Benesova and Anchor (2015)

Fig. 3 shows that the Czech Republic is not the worst performing country in the CEE region; however its score is still very low compared to Western Europe (TI, 2016). The CPI results for 2016 suggest that the situation in the Czech Republic is improving; however, despite the 'significant improvement' in the last two years, it is with strong doubts - at best - that this can be seen as an improvement at all since the actual scores in each category leading to the overall corruption score changed only slightly and therefore suggest that we should not jump to optimistic conclusions too hastily (The Economist, 2010; TI, 2016). Instead, we should take this issue seriously, as it seems that corruption is worsening elsewhere around the world, hence allowing the Czech Republic to move a few places up the rankings. This issue is not only problematic in itself but it is also creating difficulties due to its knock-on effects that cause distortions and fractionalisation in societies.

There are some who argue that despite the extent of this issue in the Czech Republic, Czech society has already got used to the presence of corruption, and that it has become a cultural heritage in a way, but this is a very deceiving conclusion (Lizal and Kocenda, 2001). As already mentioned, corruption has a strong impact on trust which influences all

areas of human activity. In addition to that the World Values Survey (WVS) results suggest that the sensitivity of Czechs to bribe-taking and corruption is high, which is surprising given that it has been suggested that Czechs have developed a tolerance towards corruption (Benesova and Anchor, 2015; WVS, 2017). The Polity IV project provides an interesting insight into the impact of this weakening of social capital in the Czech Republic on the quality of democracy. Their rankings resulted in knocking the Czech Republic down from stable democracy to politically and socially fractionalised. This has been caused by frequent changes in the government and the inability of political parties to achieve common grounds in combination with politicians swapping position, often due to corruption (CSP, 2014). It is therefore not surprising that social capital and trust, especially its generalised forms, have eroded.

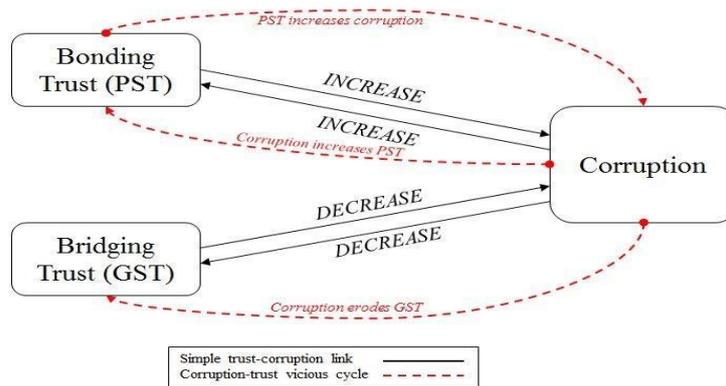
It is unfortunate that the data availability on corruption across different sectors in the Czech Republic is limited, and we have therefore no grounds for comparison between different corruption contexts and trust levels across these contexts; it is due to this data unavailability that we have to limit our discussion to the general context of corruption that tells us about all political, social, and business corruption without further specifying and distributing corruption perceptions across these categories.

## **2. Corruption and Trust: the Case of the Czech Republic**

It is apparent, from our discussion, that trust and corruption are interconnected and that they do shape one another. Since we have already discussed the development of trust and corruption in the Czech Republic, we can now use this information to create a link between what we know about the relationship of trust and corruption in theory and a specific context, the Czech Republic. This will allow us to see how the theory works in practice, as well as describe the Czech experience in theoretical terms.

The relationship between corruption and trust has been studied by a number of researchers; however, in comparison with the attention that each of the phenomena receives in isolation, the number of studies is very small. It is due to this limited knowledge that we have that the relationship between trust and corruption can only be described to certain extent, and there are sometimes more questions than answers arising once we reach a certain point. We discuss and to some extent overcome this issue in our research by including a number of trust types and exploring them across different corruption contexts but unfortunately it is not within the scope of this paper to go into much detail, and we will therefore limit our discussion to the generalised (GST) and particularised trust (PST) types and corruption as something that occurs on various levels and contexts of a society (Benesova and Anchor, 2015). Under these conditions, the relationship between corruption and trust seems rather clear, and provides us with quite a clear picture of the interaction between these two phenomena. Fig. 4 shows how corruption and trust naturally form a 'vicious cycle' through mutual reinforcement of one another.

**Fig. 4: Corruption and Trust Vicious Cycle**



Source: Developed by the authors, based on Uslaner (2013)

The workings and directions within the corruption-trust relationship and its associated vicious cycle is apparent from Fig. 4. When applying this model to the Czech Republic we can see that it is correct in describing the relationship between PST causing corruption to increase, which is what we can observe during and after the end of the Communist regime (EBRD, 2011). We can also see that similarly to corruption being constant, GST seems to be constantly low with a slightly declining trend in the Czech Republic which confirms the suggested, negative link between corruption and GST (Bjornskov, 2007). What we cannot determine with sufficient certainty is the positive effect of GST on corruption because it has not been sufficiently developed, and neither the condition for the GST to be present for long enough in order for corruption to be lower as a result of the GST has been met (Kretschmer, 1998). Other than that, we feel safe in saying that the relationship between GST and PST and corruption in the Czech Republic is aligned with the pattern that we can see elsewhere in the world and that has been suggested on the basis of a large sample of countries across a number of years (Kretschmer, 1998; Uslaner, 2013).

## Conclusion

This paper set out to discuss the issue of trust and corruption in the Czech Republic due to the uniqueness of this context. We have provided a theoretical background upon which we have built our discussion as well as data that provided information about the state of both these phenomena. Once the background has been developed and introduced in a sufficient detail, we have used this information to compare it to the Czech experience.

We have observed the trust and corruption relationship in the Czech Republic to be following the commonly acknowledged pattern (Uslaner, 2013). In addition to this, it seems that the type of corruption - whether it is based on weak or strong ties - also needs to be taken into consideration when determining the influence of corruption on trust.

Since this is a discussion paper, there are undeniably some limitations which need to be mentioned before concluding. This paper is built around the information obtained by means of secondary data which does not allow us to gain access to the 'raw' datasets and

therefore only allows for loose interpretation of these data in the context of the trust-corruption relationship. Ideally, this would be tested empirically; however, given that our argumentation is in line with the rest of the CEE countries that have been previously studied (e.g. Mihaylova, 2004; EBRD, 2011), and fit the available model, they are still persuasive.

Despite the above mentioned limitations, this paper provides us with suggestions for the direction of our future research. It is most desirable that the corruption-trust relationship is studied with greater attention through a large sample that would include information about corruption across various contexts and layers of the society, and that would provide in-depth information through a more structured sample, ideally built around social constructionism. In addition to this, the issue of trust typology and corruption contextualisation should too be taken into consideration.

This paper is important in that it contributes to the discourse on corruption and its influence on trust and provides specific, yet not exhaustive, information about the sources of this issue in the context of the Czech Republic. The discussion is clear in stressing that this issue is to be acknowledged first in its full extent and once this has been done, we can then start developing strategies and policy recommendations leading to the improvement of the quality of social capital in the Czech Republic, and in a more distant future use them also in other contexts.

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## Possibilities to Investigate Transparency and Lobbying in Controlled Environment

### Abstract

Transparency and lobbying, two terms that have direct influences on the behavior of policymakers, politicians, and bureaucrats. Models of both transparency and lobbying exist for decades and are being researched by not only academics but non-profit international organizations and institutions that provide governments with policy recommendations. The recommendations are, however, often based on research that is complicated or almost impossible to perform or relies on self-report surveys by the public officials and policy makers. The real behavior of those actors might, therefore, be hidden. Therefore, there opens an opportunity to model these situations and bring transparency and lobbying into the laboratory or field controlled environment and investigate the behavior of involved actors using methods of experimental economics. As the experimental economics is a field of economic research that has been emerging in the main flow for las few decades, the research on transparency and lobbying is, therefore, emerging as well. There have been published studies that focused on transparency and studies that investigated lobbying, however, the number of publications on experimental research on transparent lobbying is limited. Therefore, the purpose of this article is to provide an overview of experimental research on lobbying and transparency, evaluate the findings and provide suggestions for future research.

### Key Words

*transparency, lobbying, laboratory experiment, field experiment, experimental economics*

**JEL Classification: D72, C90**

## Introduction

Everyday life of any citizen in any country in the world is influenced by laws and decisions made by a politician, legislator or bureaucrats, or in other words, by other human beings. The profession defines the main goal of their work - to serve the public good and make decisions in the interest of others - but do they follow it? Or are they judging their action based on their private regarding preferences? The answer to these questions is not simple to find as the public offices are rigid and the officials may not be willing to cooperate with any researcher.

The decisions made in public sector are always complex and the decision maker requires extensive information base to make a qualified decision. As also the outcomes of the decisions are always uncertain, the decision maker seeks an expert advice. If the advisor,

the expert, is an independent entity, then there should be no constraints to base the decisions on such advice. However, many pieces of advice the decision makers receive come from different interest groups who lobby for their interest.

Lobbying, by the definition, is any form of “communications by intermediaries for companies or organizations aimed at influencing public office holders in relation to public policy or administrative decisions in which their constituents have a particular interest” (Côté, 2006). It opens possibilities for the public administration to base their decision on needs of different parts of the society, but on the other hand, it may negatively influence other parts of the society. However, for a long time perceived the lobbying had been as only a rent-seeking problem, as an exchange of money for the favorable political decision between a politician and an interest group (Krueger, 1974; Snyder, 1991; Tullock, 1967, 1980). The opinion changes in 1990’s when it was proved that the information provided by interest group or lobbyist might be beneficial and it improves the information base for policy makers (Ball, 1991; Grossman & Helpman, 2001; Lohmann, 1995).

On the other hand, lobbying also tends to bring along threat for the society when the information or monetary exchange between policy maker and lobbyist is being kept secret. The non-transparent lobbying may undermine the legitimacy of a political system and democracy (Kretschmer & Schmedes, 2010) or may lead to non-effective allocation of public funds (Campos & Giovannoni, 2007). There is also only a thin line between non-transparent lobbying and corruption (Lambsdorff, 2002). It is, therefore, important to focus on the transparency and its importance for any policy making process.

The empirical research on transparency in the public office usually relies on estimations, constructions of measurements or survey data. It documents effects of the transparency but barely focuses on the behavior of policymakers under different levels of transparency. This drawback might be overcome by use methods of experimental economics as it allows the research to evaluate and observe the behavior of humans in a real time. Therefore, the aim of this article is to map and evaluate possibilities to investigate transparency and lobbying in the laboratory or in the field using an economic experiment. It sums selection of existing studies and gives recommendations for further research.

## **1. Transparency in the experiment**

One of the first studies on transparency in public sector took a look at the process of amendments under opened and closed rules (Frechette, Kagel, & Lehrer, 2003). The opened rule is a situation when the proposal is amended a couple of times before the voting by legislators. On the other hand, the closed rule represents situation when the proposal is brought unamended to the legislators. We can view the two rules of amendment procedures as two different levels of legislature transparency of the process. The authors found that once the process is transparent (opened) then longer delays in distributing benefits appear and the distribution of benefits is more egalitarian. Their data also revealed that the closed rule causes convergence towards minimal winning coalitions, whereas under the opened rule the supermajorities are a norm.

The legislative transparency in a democratic country shall improve the functioning of parliament through voters' responses in the elections. Malesky, Schuler, and Tran (2012) however argue, that this argument does not hold in authoritarian regimes. They addressed this concern via conducting a field experiment in Vietnam, a single-party authoritarian regime. There is being observed a shift towards non-governmental institutions and therefore the governmental liability does not improve there. They find very little evidence of direct positive effects of transparency there and conclude, that to implement transparent institutions like the democratic regime is complicated. The institutions there often play different roles, even though that the institutions hold similar names as in democratic countries.

Anctil et al. (2004) studied the problem of transparency from a different angle. They focused on the effects of transparent economic signals on the economic outcome as the decision makers' uncertainty increases. The more transparent the information base for policy or decision maker is, the more contrary the information might be. The evidence of the experiment shows that once multiple equilibria arise together with increased level of transparency, the agents tend to focus on risk-dominant equilibria. That causes coordination failures and it affects the economic outcome as well. The results and settings of their experiment might be also applied to the problem of transparent lobbying, where lobbyists often extend the information base of a policy maker and lobbying might cause uncertainty in the decision making then.

Peisakhin & Pinto (2010) stepped over the thin line between lobbying and corruption and focused their field study on the second mentioned. They found a strong evidence for a positive anti-corruption effect of transparency even in highly divided, hierarchical and unequal society. The experiment took place in Indian slums where the access to information is usually limited, especially for the poor. The results show that simple transparent access to information improves the public policy and their right to use basic public service. The transparent process there had a direct positive effect on well-being of the poor and disadvantaged part of the society.

The well-being of citizen is important effect of transparency, but not the only one. Another key outcomes is also improvement of the trust in the government, politician or public office in general. Grimmelikhuijsen (2012) conducted a lab in field experiment focusing on the trust in government and knowledge about public processes of the citizens. In the experiment, different information was provided to the visitors of a certain website regarding levels of air pollution of municipalities in Netherlands. The findings of this study show that not only the level of transparency has a minor effect on trust in government, but more importantly, cognitive and emotional processes play a significant role. The general trust in government then also influences the trust in specific governmental institutions. That contrasts with theoretical expectation and with rhetoric and policy recommendations of well know international organizations.

As the trust in the government might also be a question of cultural values. Grimmelikhuijsen et al. (2013) followed the previous study and conducted series of experiment in two developed countries in different parts of the globe - the Netherlands

and South Korea. They found similar effects in both countries. The transparency might under specific condition have a negative effect on the trustworthiness of the government. In South Korea, the transparency significantly contributes to lowering the perception of governmental competence and decreases the trust in it. The magnitude of this effect is significantly differing to the Netherlands where only the negative outcomes have an influence on the perception of the governmental competence. In South Korea, there were always observed more extreme responses. The authors, therefore, conclude, that one of the keys to the citizens' trust in government is the culture.

The idea of transparency in public office is that the politician or policy makers will behave differently when their actions are observed by their customers, the citizens and voters. Carey (2013) modeled the issue as a game of three politicians who vote about budget division and one voter who evaluate their actions via election. Through the experiment different levels of transparency vary. The results of his study show that transparency leads to higher public budget shares and it also foster higher reelection rate. He also found, that the transparency tends to reduce the number of minimum coalitions.

Not only the division of public budget, but preparation of legislature and other actions of policy makers are often an outcome of a bargaining process or communication behind closed doors between political parties. Agranov & Tergiman (2014) took this issue into the lab. They found that public transparent communication is being used to express fair proposals and the private channels lead to lobbying. Once the transparent communication was forced in the experiment, the lobbying activities and quid pro quos bargains nearly stopped.

Kartal & Tremewan (2016) study effects that the transparency has on information transmission and decision-making. In the experiment can an advisor of decision maker accept a side payment from a third party or not. The transparency allows the decisions maker to reflect the behavior of the advisor once he makes the decision. Their theoretical and experimental findings contrary to other studies, the transparency is not harmful and it may help the quality of the decision. However, they show that the positive effects are valid only when the transparency is mandatory; when it is voluntary the results are weaker.

## **2. Lobbying in the experiment**

Even though that on lobbying has been empirically researched for decades, there exists only a limited literature on lobbying in the laboratory.

One of the possibilities how to take a look at the lobbying problem is interpreted as a signaling game. Potters & van Winden (1996) replicated theoretical assumption and empirical findings concerning equilibrium selection and costly signals. Their experiment two players where one is making the decision and the other can transmits a message to him before the action, he signals what the outcome he is looking for. The results of the

experiment show, that these messages have an impact on the decision maker even though that the messages are costly.

Another study by the same authors also used a signaling game to investigate lobbying (Potters & van Winden, 2000). In this study the authors conducted the experiment not only with usual experimental subjects (university students) but performed an experiment with a professional lobbyist as well. They found that part of the professionals behaved more in line with theoretical predictions and earned a significantly larger amount of money, but for most of them was found no difference in behavior compared to students. The paper is important in answering one of the potential methodical issues of a further research on lobbying in the lab. The authors base on their findings a theoretical model of costly lobbying that was later confirmed by an empirical study as well (Helland, 2008). Helland (2008) found that the prediction that the probability of favorable outcome increases with lobbyist investment into the outcome, however, hinge on the structural characteristics of the municipality and distribution of electoral seats per voter there.

Legislature process often faces many direct and indirect lobbying activities. Bergan (2009) focused in the field experiment on the indirect option. He used an email campaign towards legislators in New Hampshire who received differently phrased and framed email based on the districts. The results show that the grassroots email campaigns have a substantial effect on the legislators and their policy decisions.

Another grassroots campaign investigated Richardson & John (2012) who in their field experiment send out letters to local councilors in UK. Contrary to the study by Bergan (2009) they did not find a significant effect on the decision done by the councilors, however, they observed that the politicians forwarded information-rich letters to another expert. The results suggest that the politicians often take clues from the indirect lobbyist.

For many people the perception of politics and lobbying is, that money can buy anything and exchange of favors is often a thing there. Großer, Reuben, & Tymula (2013) address this issue in an experiment. They constructed a game where a firm has an opportunity to influence to politicians and buy then political favor. They observe that substantial part of the subjects than to use tactical quid pro quo agreements and that those agreements are also dependent on time.

Minozzi & Woon (2013) investigated different issues that might be part of lobbying. They focused their experiment on lies in the communication and competition. They found that even though that lying aversion plays a role there, the competition in the political environment crowds it out. This is in line with many critics of politics.

### **3. Discussion and conclusion**

To study the transparency or lobbying in the lab is in general not novel as there exist wide literature on both topics. What is a gap, that needs to be filled, it is an investigation of effects of transparency on the behavior either of the lobbyist or lobbied politicians.

Studies by Agranov & Tergiman (2014) or Kartal & Tremewan (2016) already opens the discussion and contributes to investigating different elements of lobbying and its connection to transparency. Their studies show how the principles of lobbying might, on one hand, be disturbed by existing transparency and that secrecy and limited transparency creates the gray zone of political decisions.

The existing experimental literature often does not include into the relation between the politician and lobbyist a third party that is mostly affected by the policy changes – the voters. As the transparency is a tool provided for the voters at first, also once the effects of transparency on lobbying activities are investigated, the citizen shall not be left out.

For the further experimental research on effects of transparency in lobbying, I suggest that the main concern should be the behavior of the politician and his accountability to citizens. Many international organizations propose and promote different tools of the transparency to fight corruption and to improve the lobbying culture around the globe. Many of the tools have been backed by empirical research done in public offices and surveys among lobbyist or general population, but the advantage of bringing the problem or the policy into the experimental environment is uncontentious.

The experimental economics, especially laboratory experiment, provides a platform where the behavior of policy maker, lobbyist and a voter might be observed at the same time and under the same controlled condition. The outcome of such research might help us to better understand the processes and behavior of those groups and therefore better shape the policy tools we use to keep lobbying for the positive behavior of interest group and not to allowed them to cross the line to corruption. We can also observe there that the lobbying serves its purpose, that it improves the information base of a policy maker and together with transparency it improves the level of democracy and democratic culture in the society.

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## Identifying a Connection between Transparent Lobbying and Quality of Democracy

### Abstract

Considering the core of democratic principles – freedom, equality, and control, one of the relevant dimensions of quality of democracy is participation. Creating opportunities for individuals and groups to talk to policy and decision makers and legislators is a part of the democratic process by which policy is formulated, implemented and tested. But some of these influences might have greater access to policy makers due to their bigger economic power. Some groups or individuals try to act/lobby behind closed doors and in secret. The problem of lack of transparent lobbying – lobbying by the rules – is closely related to decreased equality of access by voices representative of a wide range of interests to public decision-making. Similarly, formal institutions in the form of rules as well as the balance of political forces in society are considered to be endogenous, because they are chosen within the society. When selecting them, conflict of interests between different groups and individuals can be expected. Thus, there is a danger that institutions can develop to the benefit of stronger groups at the expense of others. A transparent environment where groups negotiate and transparency in the promotion of diverse interests – transparent lobbying – can significantly reduce this risk. Therefore, it is necessary to identify the connection between transparent lobbying and quality of democracy, in other words to investigate the influence of transparent lobbying on the process of democratization.

### Key Words

*Lobbying, transparency, quality of democracy, participation, decision-making*

**JEL Classification: P16, D72**

## Introduction

Free and open access to government is necessary for a functioning democracy. But some individuals or organizations have greater access to policy makers due to their bigger economic power. The power of private actors and the balance between individual interests and the public good is a central question of democratic theory. Since Dahl (1971) suggested his minimalist concept of quality of democracy – contestation and participation, there have been identified more of relevant dimensions to measure the quality of democracy, e.g. Collier and Levitesky (1997) expanded the root concept of quality-of-democracy-indices for the link between citizens and their representatives; Diamond and Morlino (2004) pointed out eight categories: rule of law, vertical and horizontal accountability, participation, competition, responsiveness, freedom and equality; Pickel, Stark and Breustedt (2015) added the public sphere, mutual constraints of constitutional

powers, governmental capability, transparency, and representation, which further specify the core dimensions. Bühlmann et al. (2012) and Marshall et al. (2014) have suggested a wider range of procedures and structures that drive elite decision-making between elections like actions of interest and civil society groups. Lauth (2016) pointed out three core dimensions of democracy – freedom, equality and control in which citizens/civil society groups play a crucial role, although the conceptualization of the citizen component of democratic quality is severely underdeveloped in existing research (Mayne and Geissel, 2016: 635). The dimension of freedom means both to demonstrate individual preferences in free and fair elections and the opportunity for continuing political participation (Lauth, 2016), which is based on free competition of different interests. From the political equality point of view Lauth (2016: 608) stresses, that “...it enables all citizens to participate in a fair and effective way in all formal institutions needed for the democratic process”. According to him fairness means “the equal and effective exercise of civil and political rights – regardless of social status, gender, or ethnicity”; it is necessary to add regardless of economic power. And he asks: “Do all citizens have the same opportunity to exercise their rights?” To be able to answer the question, it is important to fulfil the third core dimension of democracy – control, which integrates both vertical and horizontal accountability. Transparency is an important prerequisite for implementing political accountability (e.g., Halachmi and Greiling, 2013). Similarly, it is possible to reach the same conclusion about the necessity of transparency for strengthening quality of democracy through acting of citizens/civil society groups/interest groups in the political process. One of the legitimate activities to promote interests is lobbying. The problem of lack of transparent lobbying is closely related to increased inequality of access by voices representative of a wide range of interests to public decision-making. Equality of access as one of the dimensions of quality of democracy is important in enabling decision makers to act and take decisions impartially, fairly and without discrimination. Inclusive participation, representation, and transparency are required to reach political equality (Bühlmann et al., 2012: 521). However, transparency is a rarely mentioned category in the research literature on measuring the quality of democracy. The aim of this article is to identify the connection between transparent lobbying and quality of democracy, find the common elements and stress the importance of influence of transparency in lobbying on already existing measures of quality of democracy.

## 1. Material and Methods

First, after the defining of basic terms, I will identify the relations between transparent lobbying and dimensions of quality of democracy. The explanatory method – deduction – will be used for this purpose. Then I will briefly introduce the most common measures of quality of democracy and analyze its indicators in terms of transparency requirements. I will conclude with implications and suggestions of the research results for the study of the importance transparent lobbying for the democratization process.

Generally, the transparency in the public sector is defined as a mechanism that reduces information asymmetry and therefore adverse selection. The term of transparency reflects the level of disclosure and clarity of information (e.g., Madhavan, Porter and

Weaver, 2005) on one side, and accuracy, quality and political relevance on the other side (e.g., Granados, Gupta, and Kauffman, 2006).

Lobbying means any direct or indirect communication with a public official that is made, managed or directed with the purpose of influencing public decision-making and is understood as a legitimate way of interest representation in a pluralistic conception of liberal democracies. The Transparency International (TI, 2015) focuses on three critical and inter-related elements of lobbying performance: transparency – whether interactions between lobbyists and public officials are made transparent and open to public scrutiny; integrity – whether there are clear and enforceable rules on ethical conduct for both lobbyists and public officials; and equality of access – how open is public decision-making to a plurality of voices representative of a wide range of interests. Lobbying is often understood as a two-way exchange of information: while lobbyists present the opinions and arguments of their clients – recipients of lobbying – public officials present the opinions of their offices or their superiors, which also express the status of their knowledge about the problem and induce a willingness to accept the possibility of a solution. This two-way exchange of information should be carried out in a transparent manner. According to Stiglitz (1999) information gathered by public officials at public expense is owned by the public. He adds that there are two traditional arguments for transparency: opacity provides first some insulation against being accused of making a mistake and/or of acting in an interest other than public interest, and second the opportunity for special interests to act in their own favour with greater influence (in return for any remuneration like the funding of political parties etc.). *“But if these actions in support of special interest groups are subject to public scrutiny, the scope for favouritism is greatly circumscribed.”* and he concludes that *“Secrecy is the bedrock of this persistent form of corruption, which undermines confidence in democratic governments in so much of the world.”* (Stiglitz, 1999: 11). Thus lobbying transparency is needed in order to level the playing field for the framework design of fair lobbying, and moreover also in respect of a broader scope of a level playing field of the decision-making process and equal access. A high level of transparency in the political process is required (Lauth, 2016: 610).

Based on these assumptions, it is possible to deduce that transparency of lobbying, i.e. transparency of interactions between decision-makers (public body) and interests (lobbyists) is linked to the core dimensions of quality of democracy, particularly equality and control. Freedom is connected rather with the activities carried out within the framework of constitutional guarantees. From this perspective, it is necessary to distinguish the lobbying activities from other legitimate activities in liberal democracies as expression of opinion, the right of petition, the right to campaign for political change, a change in legislation, policies or practices within legitimate political activities, whether it is done individually or collectively.

Measuring the quality of consolidated democracies is a young yet very dynamic field of research, with the number of indices growing considerably (Geissel, Kneuer and Lauth, 2016: 571). The most used measures and their dimensions are listed and described in Table 1.

**Tab. 1: Measures of quality of democracy**

| <b>Name of the Indicator</b>            | <b>Author</b>                   | <b>Dimensions/Principles</b>  | <b>Transparency of decision making process-related sub indicators</b>  |
|---|---------------------------------|---|--|
| Freedom in the World (FH)               | (FH, 2017)                      | Political Rights<br>Civil Liberties   | Functioning of Government<br>Associational and Organizational Rights<br>Rule of Law  |
| Democracy Index (EIU)                   | (EIU, 2017)                     | Electoral Process and Pluralism<br>Civil Liberties<br>The Functioning of Government<br>Political Participation<br>Political Culture | Transparency in the process of financing political parties<br>Exercise of significant political power of special economic, religious or other powerful domestic groups<br>Sufficient mechanism and institutions in place for ensuring government accountability<br>Open and transparent functioning of government with sufficient public access to information<br>Citizens' engagement with politics                               |
| Democracy Barometer (DB)                | (Bühlmann et al., 2012)         | Freedom<br>Control<br>Equality  | Willingness for transparent communication<br>Government decisions are effectively implemented.<br>Existence of provision for disclosure of income by political parties.<br>Existence of provision for public disclosure of expenditure by political parties.<br>Restriction of freedom of information / barriers for access to official information.<br>Effectiveness of Freedom of Information laws.<br>Equality of participation |
| Varieties of Democracy Project (V-Dem)  | (Coppedge et al., 2016)         | Electoral<br>Liberal<br>Participatory<br>Majoritarian<br>Consensual<br>Deliberative<br>Egalitarian                                  | Civil society participation index<br>Equal protection index<br>Political equality comments   |
| WJP Open Government Index (WJP)         | (WJP, 2015)                     | Publicized Laws and Government Data<br>Right to Information<br>Civic Participation<br>Complaint Mechanism                           | Publicized laws and government data<br>Information requests – quality; timeliness; affordability and trust; general accessibility of information<br>Right to petition and civic engagement<br>Complaint mechanisms   |
| Sustainable Governance Indicators (SGI) | (Schraad-Tischler et al., 2016) | Policy Performance<br>Quality of Democracy<br>Executive Capacity<br>Executive Accountability  | Party financing<br>Popular decision-making<br>Access to government information<br>Legal Certainty<br>Judicial Review<br>Corruption prevention<br>Scholarly advice<br>Quality of RIA Process<br>Negotiating Public Support<br>Policy knowledge<br>Associations competence   |

Source: (Bühlmann et al., 2012), (EIU, 2017), (FH, 2017), (Coppedge et al., 2016), (WJP, 2015), (Schraad-Tischler et al., 2016)

## 2. Results of the Research

As can be seen, the sub indicators are set varyingly widely. Those that are set more generally are usually concretized in determining queries. For example, the indicator Freedom in the World specifies its sub indicator *Functioning of Government* by the main question: 'Is the government accountable to the electorate between elections, and does it operate with openness and transparency?'. This main question is complemented by six queries targeted to a specific phenomenon: 'Are civil society groups, interest groups, journalists, and other citizens able to comment on and influence pending policies or legislation?' 'Do citizens have the legal right and practical ability to obtain information about government operations and the means to petition government agencies for it?' 'Is the budget-making process subject to meaningful legislative review and public scrutiny?' 'Does the government publish detailed accounting expenditures in a timely fashion?' 'Does the state ensure transparency and effective competition in the awarding of government contracts?' 'Are the asset declarations of government officials open to public and media scrutiny and verification?' Sub indicator *Associational and Organizational Rights* is determined using these following questions: 'Is there freedom for non-governmental organizations (civic organizations, interest groups, foundations, etc.)?' 'Are there free trade unions and peasant organizations or equivalents, and is there effective collective bargaining?' 'Are there free professional and other private organizations?' (FH, 2017). While the first mentioned sub indicator is pointing towards a requirement of transparency and is linked with the core dimension of quality of democracy – control, the second one deals mainly with free acting of nongovernmental organizations (the core dimension of quality of democracy – freedom), it does not focus on e.g. fair and equal access to public bodies or equality of participation.

With all of the listed indicators, the sub indicators and its questions pointing towards acting of interest groups (citizen – related indicators) focus on the existence or non-existence of the phenomena like capability of society/interest groups to comment on and influence pending policies/legislation in the case of Freedom in the World or routine consultations of policy makers with civil organizations in the case of V-Dem, but they are not concerned with the form. However, there are exceptions emphasizing the degree of equality rights and freedoms within the framework of groups, such as e.g. *Equal Protection Index* measured by V-Dem: "*Equal protection means that the state grants and protects rights and freedoms evenly across social groups. To achieve equal protection of rights and freedoms, the state itself must not interfere in the ability of groups to participate and it must also take action to ensure that rights and freedoms of one social group are not threatened by the actions of another group or individual.*" (Coppedge, 2016) The authors of this index use the term social groups or just groups. In their presented methodology, the definition of a broader view of the meaning of the term group occurs in connection with the *Civil Society Participation index* or *Core Civil Society Index*. The broader meaning comes from definition of the sphere of civil society which lies in the public space between the private sphere and the state. Here, citizens are organized in groups to pursue their collective interests and ideals and the authors call these groups civil society organizations (CSOs). CSOs include interest groups, labour unions, spiritual organizations (if they are engaged in civic or political activities), social movements, professional associations, charities, and

other non-governmental organizations. Then it is possible to assume that the Equal Protection Index could cover all types of the above mentioned groups, not only social groups.

Only two indicators directly focus on transparent communication:

1. **Willingness for transparent communication** (DB) assesses the transparency of government policy measured on a scale ranging from 'The government does not often communicate its intentions successfully' to 'The government is transparent towards citizens'.
2. **Scholarly advice** (SGI) indicates effective and legitimate consultation with non-governmental academic experts which should take place during the early stages of a decision-making process, that is, when outcomes can still be altered and this consultation should be transparent to the public. It is ranging from 'The government does not consult with non-governmental academic experts, or existing consultations lack transparency entirely and/or are exclusively pro forma' to 'In almost all cases, the government transparently consults with a panel of non-governmental academic experts at an early stage of government decision-making'.

### 3. Discussion

The measures of quality of democracy, however, contain other indicators that determine the circumstances of the transparency of the decision-making process. Most of them refer to the so-called sunlight principles as one of the four categories of *The lobbying transparency catalogue* created by Laboutková and Vymětal (2017) like participation/equality of participation; access to government information – open government data; financing disclosure of political parties, obligation of public bodies to consult with citizens and other stakeholders before a decision is made; online platform for civic participation; systematic monitoring of access to information; data sources relevant for policy analysis; proactive publication of information; equal access to information and documents for all.

Liaison points in examining the quality of democracy and transparent lobbying are citizen-related indicators and information related indicators. Basic models of modern democracies – Liberal-Pluralism and Participatory-Deliberative – share a common broad account of citizens, who act, engage, share and contribute. They can do this individually, in groups or by proxy. The right to information is one of the most important elements of the relationship between citizens and public authorities. For the purposes of assessing the quality of democracy, the information is examined especially in terms of its availability – free access to information, while the level of disclosure, clarity and accuracy of information is mainly monitored in terms of transparency. If lobbying is perceived as a communication tool based on the exchange of information, this requirement of transparency also applies to lobbying. The manner of interaction between citizens, civil/interest groups and professional lobbyists shapes the democratic political culture and hence the quality of democracy.

## Conclusion

Quality of democracy and transparent lobbying have common elements. A high level of transparency in the political process is required, as well as a willingness on the part of the citizens to obtain information. To measure transparent lobbying is a current challenge and it is the next step of this particular research on lobbying. So far, the process of explicit direct measuring of the transparency of lobbying remains unresolvable until lobbying is regulated. Variables that were already identified in the mentioned catalogue of transparent lobbying above need to be operationalized/operationally defined to be measurable, detectable and observable. Already existing indicators measuring the quality of democracy, which share some similar characteristics with lobbying transparency requirements, might be an important aid in finding measurable or categorical variables of proposed transparent lobbying measures.

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## The Economic Impacts of Applying the Act on Public Procurement as Seen from the Contracting Authority Point of View

### Abstract

More than 12% of the GDP (almost 600 billion CZK) from public resources is allocated through public procurement in the Czech Republic. The new act on public procurement came into effect on 1 October 2016. There are some changes concerning the obligations of contracting authority as well as contractors, especially the effort to decrease administrative demandingness is obvious. This paper focuses on the possibility of savings in the costs for the implementation of public procurement as opposed to the anticipated price. A sample of 321 public contracts dealing with building works has been chosen for the analysis. The analysis concerning the number of the received tenders, the analysis of the anticipated value of the contract, as well as the analysis of the final value of public contracts is presented. As assumed, a direct dependency of the final value on the anticipated value is proved. Moreover, we proved that within a public contract the achieved savings grow with the number of the submitted tenders.

### Key Words

*public procurement, contract value, savings in public procurement, Czech Republic*

**JEL Classification: L51, H42**

## Introduction

Almost 600 billion Czech crowns are spent annually by contracting authorities on purchases or investment into services, supplies or building works within public procurement. The market of public procurement accounts for more than 12% of the Czech Republic Gross Domestic Product. It is a case of a significant and frequently discussed issue in the Czech economy. The majority of the existing legislative amendments have been dealing predominantly with the effort of increasing transparency, decreasing corruption and increasing profits of contracting authorities from the tender procedure for the purposes of decreasing the public budget spending. The new act on public procurement which came into effect on 1 October 2016 deals with the other side of the issue of the public procurement, namely contractors, who have been ignored up to now. Especially the effort to decrease administrative demandingness is obvious as it accounts for a significant part of the costs for the participation in the tender procedure from the contractor point of view. A research study was implemented in the workplace of the

author of this article dealing with the economic impacts of applying the act on public procurement both from the contracting authority and the contractor points of view.

In this article some findings concerning possible economic impacts of applying the above act from the contracting authority point of view will be presented. We are going to focus on the possibility of savings in the costs for the implementation of public procurement as opposed to the anticipated price. We will then try to prove the dependency of the size of such savings on the total number of tenders for the implementation of public contracts. 321 public contracts dealing with building works have been chosen for the analysis, particularly in a simplified subthreshold mode.

## **1. Literature survey**

The issues of the economic impacts on the overall costs of the contract implementation by means of applying the provisions related to acts on public procurement are not very frequent in professional literature. Nevertheless, it is possible to find some interesting and inspiring studies, namely on the example of the countries in which the implementation of the public procurement the way we understand it now does not have a long tradition. Balaeva & Yakovlev (2017) deal with estimations related to the implementation of public procurement on an example of a large contracting authority. Nunes & Velame (2016) analyzed indicators of cost-effectiveness and time efficiency in public procurement processes in Federal Institutes in Brazil. The different aspects of the development of contractual procurement system as well as some impacts of different regulatory modes on the effectiveness of public procurement were studied by Kirpikov & Goshunova (2016) and Yakovlev et al. (2015) in the Russian federation. There are also articles dealing with some selected specific economic aspects related to inviting tenders for public contracts. For example, Minchuk & Mizrahi (2017) studied procurement auctions in the public sector using game theoretical tools. Keulemans & Van de Walle (2017) tried to explore and explain public preferences for different public procurement practices. Their paper looks into public support for cost-effectiveness, discriminatory procurement in favour of domestic suppliers and sustainable procurement. Patrucco, Luzzini & Ronchi (2016) investigated the architecture of public procurement performance measurement systems in local governments. In the Czech Republic various authors have dealt namely with the examination of the transaction costs of public procurement (Pavel, 2006), Holubářová (2012). A larger study on that topic was published by Dufek (2013). We have not succeeded in finding a recent study which would prove the existence of the dependency of the achieved savings in a public tender on the total number of tenders for the implementation of a given public contract. And this is just the topic we are going to deal with further in the contribution.

## 2. Definitions of basic terms and methodology

In the year 2016 a new act No. 134/2016 Coll. on public procurement was passed which came into effect on October 1<sup>st</sup>, 2016. The purpose of the new act is not only the regulation of the entire investment process but also setting some basic rules for the procurement process itself. (Herman, 2016) The new act originated on the basis of accepting new European directives. The new amendment should bring significantly more flexible and less formal rules for public procurement and namely more economical treatment of public funds. At the same time it should enable faster implementation of funds with a smaller administrative burden.

*Contracting authorities* of public procurement are as follows: the state, organizational components of the state, Czech National Bank, state funded organizations, territorial self-governing units and other legal entities which satisfy public interest and are not of business and industrial nature. *Contractor* is a person or more persons working together who offer to provide supplies, services or building works. The act sets three *types of public procurement*: public supply contract, public service contract and public works contract. The act further distinguishes three basic *modes of public contracts*: excess contracts, subthreshold contracts and public contracts of small extent. Excess public contract is a contract whose anticipated value is equal to or higher than the financial limits stipulated by the rules of the European Union. These limits change regularly in a two year cycle. A subthreshold public contract is a contract whose anticipated value does not reach the limit of the EU (for public works it is Czk 142,688.00) and at the same it exceeds the limits in case of public contract for supplies and services in the amount of Czk 2,000,000 and in case of a public works contract in the amount of Czk 6,000,000. Smaller contracts are labelled as public contracts of small extent (Herman, 2016).

Altogether 12,461 public contracts were commissioned in the Czech Republic in total value of 283 billion Czech crowns in the year 2016. (VVZ, 2017). All three types of contracts (public supply contract, public service contract and public works contract) accounted for almost the same proportion both as far as the number and the sum of funds are concerned. Especially in case of small and medium sized businesses the costs of participation in the tender procedure play a much more significant role than in case of big multinational companies. Therefore a sample of public contracts dealing with building works which were commissioned in a simplified subthreshold mode was chosen for the analysis. The proportion of small and medium sized businesses in this mode was very high in the year 2016, namely 74%. (ISVZ, 2017)

## 3. The sample of the examined public contracts

The following key was set for the choice of public contracts:

- Mode: subthreshold public contract
- Type of tender procedure: simplified subthreshold procedure

- Type of contract: public contract for building works
- Anticipated value: higher than Czk 1,000,000, maximum Czk 50,000,000.
- Date of beginning: October 1<sup>st</sup> 2016

Within the new act on public procurement which came into effect on October 1<sup>st</sup>, 2016 the contracting authorities made use of a simplified subthreshold procedure with 43% of subthreshold public contracts. The limit of the minimum anticipated value in the amount of Czk 1,000,000 was set because of a significant distortion of the analysis results because of the occurrence of a few public contracts in the simplified subthreshold mode with the anticipated value amounting only to a few thousands Czech crowns. In this case there is no point in placing them in the subthreshold public contracts. As far as the time is concerned the choice of the sample was limited because all the contracts were supposed to comply with the new act on public procurement which came to effect on October 1<sup>st</sup> 2016.

The data for the statistics file were taken over from Bulletin of public contracts where, according to law, the contracting authority is obliged to publish all the subthreshold and excess public contracts. The final data collection took place on 14 March 2017. In the statistics file there are public contracts which were published in the bulletin from 1 October 2016 to 14 March 2017. Altogether 321 public contracts were found that met the above mentioned criteria, for more detail see Pivoňka (2017). It was, however, necessary to rid the data of those public contracts that were incomplete; their anticipated value was smaller than Czk 1,000,000 and of those which were cancelled. Further it was necessary to remove those contracts that had been divided into more parts and therefore it was not possible to work with such data credibly enough. (see the following Tab. 1).

**Tab. 1: Ridding the statistics file of public contracts**

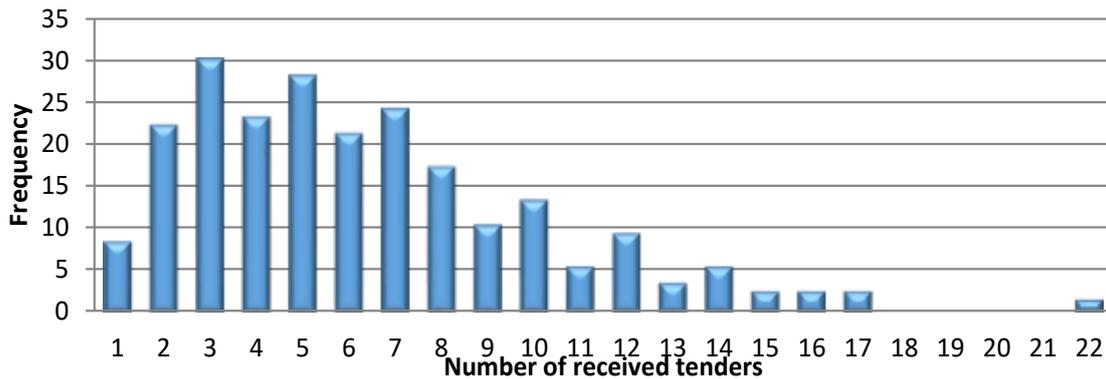
|  |     |
|--|-----|
| Initial number of public contracts in statistics file          | 321 |
| Public contracts with incomplete information                   | 16  |
| Public contracts with anticipated value less than CZK 1million | 12  |
| Cancelled public contracts                                     | 64  |
| Public contracts divided into parts                            | 4   |
| Final number of public contracts in statistics file            | 225 |

*Source: own processing*

## 4. The analysis of the gained data and discussion

All 321 forms were downloaded in PDF format and then transferred into Excel. As each public contract contained approximately seventy-five attributes, it was first necessary to filter out the required attributes. **The number of the received tenders** was one of the monitored attributes. The cumulative frequency characterizing this statistical variable is shown in Fig. 1.

**Fig. 1: Histogram of the number of the received tenders**

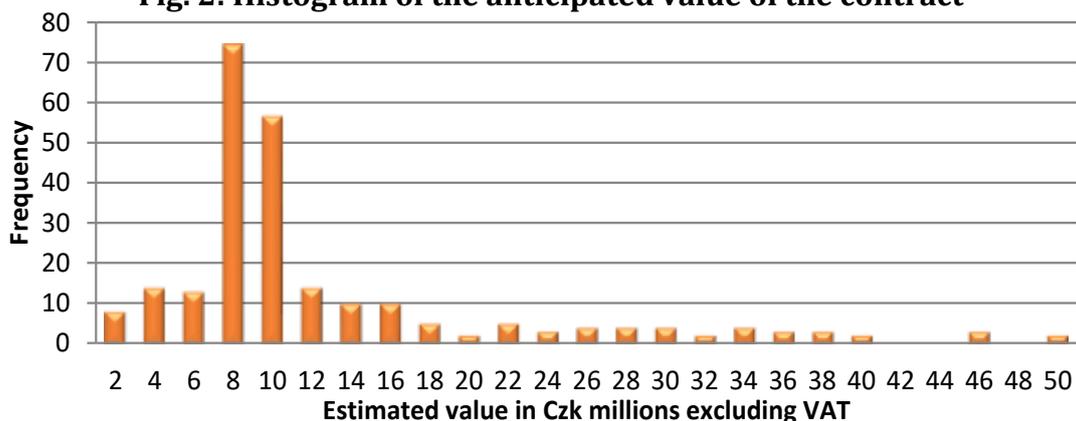


Source: own processing

The minimum number of tenders was 1, the maximum was 22. The most frequent ones were three received tenders that occurred thirty times in total and they accounted for 13.3% of the total number. The second most frequent occurrence was 5 received tenders in the number of 28. The median of the file is in the value of six received tenders. 6,284 is the average number of the received tenders in the category of the monitored subthreshold public contracts for building works. The academic probability that an applicant for public contract will finally gain the contract is 15.9%.

**The anticipated value of the contract** was another examined quantity. According to the above we assume it to be in the range between Czk 1,000,000 and Czk 50,000,000. Cumulative frequencies characterizing this statistical variable are shown in Fig.2. The histogram in Fig. 2 illustrates the frequencies of the anticipated values of public contracts in millions of Czech crowns excluding VAT. To illustrate the parameters better we divided the size of the anticipated values into intervals of two million crowns each. The most frequently anticipated value is in the interval of six up to eight million crowns; this value occurred in as many as one third of the public contracts. The median has a value of Czk 8,264,462 and the average is 11,000,763.

**Fig. 2: Histogram of the anticipated value of the contract**

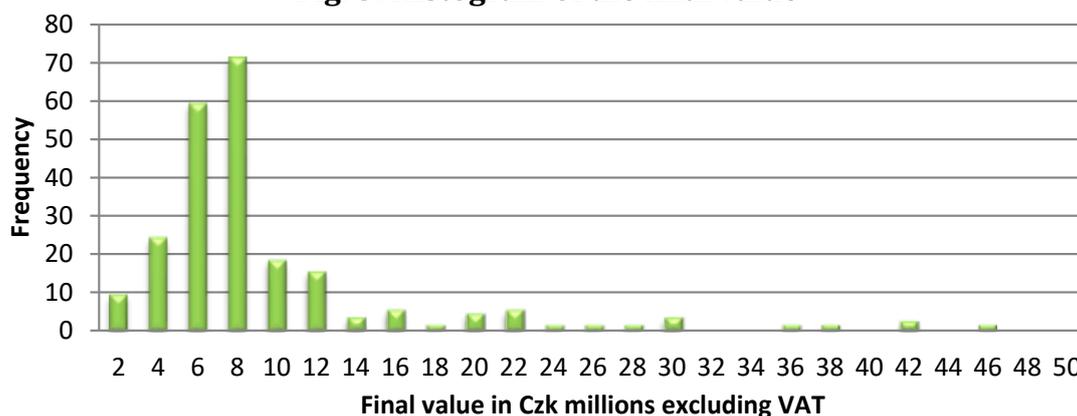


Source: own processing

From a similar division of sets of the anticipated value and the number of the received tenders and because of the fact that smaller contracts with a lower anticipated value can also be managed by small businesses, it could be deduced that these two quantities are dependent on each other. Therefore a correlation analysis was carried out by means of Pearson index of correlation. By comparing the result of 0.05254 with the critical values for Pearson correlation coefficient (Anděl, 2007) it is necessary to reject the hypothesis about the dependency at the level of  $\alpha = 5\%$ . The same result was achieved by using the t-test. It is therefore not possible to claim that the number of the received tenders is dependent on the anticipated value.

Another quantity which was dealt with by the analysis of the sample of public contracts was **the final value of public contracts**. If the lowest price of the tender is the evaluation criterion of a public contract then the lowest price of the tender made from within the applicants for a public contract is the final value. Other evaluation criteria, which, apart from the price also consider, for example, the quality or the speed of delivery, are less frequent. In these cases the final value of a public contract is the one which was made by the contractor chosen by the contracting authority to perform the public contract.

**Fig. 3: Histogram of the final value**



Source: own processing

The histogram in Figure 3 illustrates the frequencies of the final value of a public contract. The values were, as in the previous case, divided into intervals of two million crowns each. Already at the first sight it is possible to see the difference between the histograms for the anticipated value and for the final value. With the final values of public contracts it is possible to see the shift of the columns of histogram to the left, which means that the final values are lower than the anticipated values. This statement is confirmed by the statistical indicators from the below Table 2.

**Tab. 2: Comparison of the anticipated and final values of public contracts [CZK]**

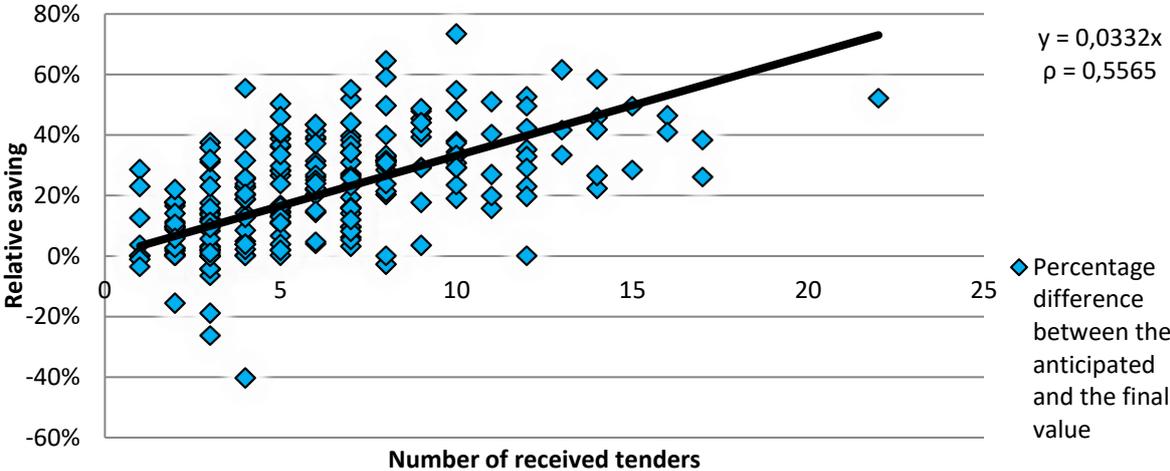
| Statistical indicator | Anticipated value | Final value | Difference |
|-----------------------|-------------------|-------------|------------|
| Minimum               | 1,016,711         | 866,430     | -15 %      |
| Maximum               | 48,533,804        | 45,719,884  | -6 %       |
| Average               | 11,000,763        | 8,432,725   | -23 %      |
| Median                | 8,264,462         | 6,546,215   | -21 %      |

Source: own processing

According to Table 2 the biggest difference in percentage can be seen in comparing averages and medians where the difference reaches 23%, or, as the case may be, 21%. It is obvious that the set of the final values is lower than the set of the anticipated values. According to the comparison of Pearson index of correlation in the amount of 0.814 with the critical values for Pearson correlation coefficient it is possible to confirm the hypothesis that the final value of a public contract is directly dependent on the anticipated value. The linear regression function between the anticipated and final values is given by the formula  $y=0.7357x$ .

Another step was examining the hypothesis whether the percentage difference between the anticipated and the final value is dependent on the number of the received tenders. By definition it could be supposed that the more received tenders there are, the bigger the difference between the anticipated and the final value of a public contract should be. By comparing the result of Pearson correlation coefficient  $-0.17705$  with the critical values for Pearson correlation coefficient (Anděl, 2007), it is possible to confirm the hypothesis about the linear dependence at the level of significance  $\alpha= 5\%$ . With the growing number of tenders the difference between the anticipated and the final values (i.e. achieved savings) is also growing (see Fig. 2). The same result was reached by comparing the result of the t-test with the quantiles of a Student’s distribution. It is therefore possible to claim that at the level of significance of 5% the relative decrease of the final value is linearly dependent on the number of the received tenders pertaining to a public contract. Because of the fact that in the testing process of the significance of the correlation coefficient the testing criterion was very close to critical values, a linear regression model was created to finally confirm this hypothesis.

**Fig. 4: Dependency of achieved saving and number of received tenders**



Source: own processing

Fig. 4 illustrates the individual percentage differences between the anticipated and the final values of a public contract together with a linear trend  $y = 0.0332x$ , where  $y$  is the relative savings and  $x$  is the number of the received tenders. Next, a diagnostics of a model was carried out which will test whether this linear regression model is statistically significant and can be used for the given data. (Popelka, 2012) To carry out an f-test

concerning a regression model a zero hypothesis was chosen in the wording: the chosen model is statistically significant, and an alternative hypothesis in the wording: the chosen model is not statistically significant. The P-value equalling 0.007768 is smaller than the level of significance  $\alpha = 0.05$ . The zero hypothesis that the regression model is statistically significant is therefore confirmed. Next, the t-tests for the individual coefficients were carried out with the result that the coefficient  $\beta_1 = 0.0332$  is statistically significant, which confirms the fact that the final price decreases with the increasing number of the submitted tenders. As expected, the coefficient  $\beta_0 = 0$ . When the number of the submitted tenders is zero, the difference between the anticipated and the final values of a public contract must also be zero because if no tender is made then no savings can be achieved either.

## Conclusion

In this contribution we tried, on the basis of an analysis of a selected sample of public contracts, to determine possible economic impacts of applying the act on public procurement in the Czech Republic from the contracting authority point of view. A sample of 321 public contracts dealing with building works has been chosen for the analysis, namely in a simplified subthreshold mode. On the basis of a quantitative analysis we proved that on the example of the examined sample of public contracts there is a direct dependency of the final value on the anticipated value (which could have been assumed). The average value of savings as opposed to the anticipated value of a public contract accounted for 23% in case of the examined sample. Another interesting finding which we managed to prove is the fact that within a public contract the achieved savings grow with the number of the submitted tenders.

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## Regulating Lobbying in Europe: No Model Fits All?

### Abstract

The paper addresses the question whether there are common transposable standards on which lobbying laws in individual European countries may be based. First, lobbying and other anti-corruption regulations currently in force in European countries are shortly described. Lobbying regulations in the US and at the EU level and their development are subsequently discussed in more detail. Second, the paper asks whether a common definition of lobbying may be found and what is its value for academic research. Third, anti-corruption legislation in European countries is subjected to comparative analysis with the aim to find links between legal regulations and transparent lobbying. The core of the paper features a juxtaposition of corruption levels and adopted legal regulations. The cases of France, Estonia, Poland, and Latvia are highlighted as different approaches that are supposed to achieve the same goal. Finally, the results of the analysis indicate that there indeed may be a common core of lobbying regulations which improves the quality of the anti-corruption legal framework at the national level; however, the significance of details of such regulations and their complementarity cannot be overstated. To develop these standards further and offer them to real-world practitioners should be the next step in this research agenda.

### Key Words

*Lobbying; Corruption; Regulations; European Union; Comparative Analysis*

**JEL Classification: D27**

## Introduction

In the last two decades, lobbying has become a universally acknowledged political activity in Europe both at the EU level and national levels (see, e.g., Coen and Richardson, 2009; Laboutková and Žák, 2010; Kluver, 2013). Even though the profession itself continues to carry a mark of 'shadiness', lobbyists are now an accepted part of the liberal democratic political systems.

The acknowledgment of lobbying as a legitimate professional field comes mainly from its real-world usefulness. Lobbyists have their value both for people outside of the governing bodies, as they voice the people's concerns to the government, as well as for elected representatives, for whom they supply expert information and knowledge. However, if lobbyists are to be perceived as truly legitimate part of the governmental process, they also need to be regulated, as other parts of the democratic government are. Lobbying needs to be transparent in order not to enlarge the space for corruption of public officials

(Warren and Cordis, 2011), not to erode public confidence in the system, and to keep the playing field level and fair for all.

The question then arises how the transparency of lobbying may be achieved. This is a task full of challenges. First, the term 'lobbying' may denote sets of activities of varying spectra, from scheduled appointments in the office to chance meetings on the golf course or in a hotel lobby. Second, lobbying often involves the handling of privileged information related to the private market, competitive advantage, or security issues that cannot simply be shared with everyone. Third, regulation of lobbying does not exist in a vacuum but it is only one part of an already built (supra-)national legal system into which it must fit.

In short, it is difficult to imagine that there may exist a one-model-fits-all formula for lobbying laws. Despite that, it is still worth asking whether there are transposable standards on which such laws may be based. In the following paragraphs, this question is addressed by looking at lobbying and other anti-corruption regulations currently in force in European countries. Anti-corruption legislation in European countries is subjected to comparative analysis with the aim to find links between legal regulations and transparent lobbying. The core of the paper features a juxtaposition of corruption levels and adopted legal regulations.

## **1. The Development of Lobbying Regulations in the US and in Europe**

In the 2010s, lobbying regulations have effectively arrived at the forefront of the anti-corruption efforts in many European countries, supported by efforts of the international community. At the global level, OECD published its '10 Principles for Transparency and Integrity in Lobbying' in 2013, drawing on the experiences of the USA, Australia, or Canada, but also France, Germany, Hungary, Poland or Slovenia (OECD, 2013).

The European Commission started the debate on lobbying regulation at the EU level already in November 2005, when Siim Kallas, the Commissioner for Administrative Affairs, Audit and Anti-Fraud launched the European Transparency Initiative (ETI). The first system of voluntary registration of lobbyists at the European Commission was adopted in June 2008; the European Parliament, previously regulating lobbyists on its premises only by through a 'code of conduct' and disclosure of lobbyists' identity, acceded to the register in 2011, when the Joint Transparency Register was established. Even though the Parliament at that time pushed for a mandatory nature of the register, at the Commission's insistence, it remained purely voluntary (Crepaz and Chair, 2014: 78).

Lobbying regulations have been discussed also at the level of the Council of Europe: in 2014, the European Committee on Legal Co-operation (CDCJ) carried out a feasibility study concerning the legal regulation of lobbying activities and drafted a recommendation to the CoE's member states on common standards of lobbying regulations (CDCJ, 2016).

This recommendation was sent out for comments to interested parties and stakeholders in the spring of 2016, with the goal to complete the drafting before the end of the year.

## 2. What is Transparent Lobbying?

One of the major reasons why lobbying has been so far only minimally regulated at any level, national or supranational, is the problem with its definition. For instance, according to the draft recommendation written by the CDCJ (2016: 4), “[l]obbying” means promoting specific interests by communication with a public official as part of a structured and organized action aimed at influencing public decision-making.

However, this definition is lacking in several aspects: first, ‘communication’ encompasses a virtually infinite spectrum of means how information may be transmitted: orally, in writing, by some means of electronic communication, officially, unofficially, with a clear purpose or just in passing, etc. Moreover, communication may be done indirectly, via a third person or even a chain of persons. Similarly, the expression “structured and organized action” does not help in determining what lobbying is and is not. Does it have to “organized” on paper, or just informally? Does “structured” means long-term, or can a one-off action be structured as well?

The Green Paper on European Transparency Initiative, published by the European Commission on 3 May 2006, defined lobbying for the EU purposes as (EC, 2006: 5) all activities carried out with the objective of influencing the policy formulation and decision-making processes of the European institutions.

Again, this is a very wide definition of the concept, stepping even beyond the boundaries of the term “communication” and choosing the expression “all activities” instead. It means that lobbying at the EU level is not formally restricted only to communication with a public official; it also includes activities which indirectly influence policy formulation and decision-making. The Green Paper specifically mentions one of such activities, “mass campaigns for or against a given cause” (EC, 2006: 6), which, presumably, is turned towards the public as well as towards officials. In other words, in this wide conceptualisation, the term ‘lobbying’ covers not only interactions where the lobbyist serves as a transmitter of wishes from a certain interest group to a decision-maker but also where the lobbyist uses other people, including the public at large, as transmitter of her or his wishes.

The question then arises why the two bodies, the European Committee on Legal Cooperation and the European Commission, chose different ways how to define lobbying. The answer to that most probably lies in the difference between the composition, the working format and the goals of the two bodies. The European Commission is a (formally) independent, supra-national body that sets up standards to serve its own interests. The CDCJ, on the other hand, is an intergovernmental body, whose main role is to draw up standards commonly accepted by the 47 member states of the Council of Europe. While the Commission is thus, at least in theory, working in an environment free of pressure of the EU

member states, the CDCJ is actually composed of representatives of the CoE member states. Unlike the Commission, it therefore always works with regard to the wishes of all stakeholders involved and always needs to derive at a politically accepted consensus.

In the domain of lobbying regulation, but not only there, it means arriving at the lowest common denominator allowing to set at least some shared standards for transparency in lobbying. This is indeed an incredibly difficult thing to achieve: European countries have at the moment very different approaches to the regulation of lobbying. Table 1 shows what the existing framework of laws related to transparent lobbying looks like in the countries of the European Economic Area (EEA) and Norway.

**Tab. 1: Anti-Corruption Legal Regulations in EEA Member States**

|    | Lobbying | Lobbyists Codes of Conduct | Register of Lobbyists | Year of Introduction | Codes of Conduct for MPs | Conflict of Interests | Declaration of Assets | Political Party Financing |
|----|----------|----------------------------|-----------------------|----------------------|--------------------------|-----------------------|-----------------------|---------------------------|
| AT | 1        | 1                          | 1                     | 2012                 | 0                        | 0                     | 0                     | 1                         |
| BE | 0        | 0                          | 0                     |                      | 0                        | 1                     | 1                     | 1                         |
| BG | 0        | 0                          | 0                     |                      | 0                        | 1                     | 1                     | 1                         |
| CT | 0        | 0                          | 0.5                   |                      | 0                        | 1                     | 1                     | 1                         |
| CY | 0        | 0                          | 0                     |                      | 0                        | 0                     | 0                     | 1                         |
| CZ | 0        | 0.5                        | 0                     |                      | 0                        | 0                     | 0                     | 1                         |
| DN | 0        | 0                          | 0                     |                      | 0                        | 0                     | 0                     | 1                         |
| ES | 0        | 0                          | 0                     |                      | 0                        | 1                     | 1                     | 1                         |
| FN | 0        | 0.5                        | 0                     |                      | 0                        | 0                     | 0                     | 1                         |
| FR | 1        | 1                          | 0.5                   | 2009                 | 1                        | 1                     | 0                     | 1                         |
| GE | 1        | 0                          | 0.5                   | 1951                 | 1                        | 0                     | 1                     | 1                         |
| GC | 0        | 0                          | 0                     |                      | 1                        | 1                     | 1                     | 1                         |
| HN | 0        | 0                          | 0                     | (2005-10)            | 0                        | 1                     | 1                     | 1                         |
| IC | 0        | 0                          | 0                     |                      | 0                        | 0                     | 0                     | 0                         |
| IR | 1        | 1                          | 1                     | 2015                 | 1                        | 1                     | 1                     | 1                         |
| IT | 0        | 0                          | 0                     | 2012                 | 0                        | 0                     | 0                     | 1                         |
| LA | 0        | 0.5                        | 0                     |                      | 1                        | 1                     | 1                     | 1                         |
| LC | 0        | 0                          | 0                     |                      |                          |                       |                       | 1                         |
| LT | 1        | 1                          | 1                     | 2001                 | 1                        | 1                     | 1                     | 1                         |
| LX | 0        | 0                          | 0                     |                      | 0                        | 1                     | 1                     | 1                         |
| ML | 0        | 0                          | 0                     |                      | 0                        | 1                     | 1                     | 1                         |
| ND | 1        | 0                          | 1                     | 2012                 | 0                        | 0                     | 1                     | 1                         |
| NW | 0        | 0                          | 0                     |                      | 0                        | 0                     | 0                     | 0                         |
| PL | 1        | 0                          | 1                     | 2005                 | 1                        | 0                     | 1                     | 1                         |
| PR | 0        | 0                          | 0                     |                      | 0                        | 0                     | 0                     | 1                         |
| RM | 0        | 0.5                        | 0                     |                      | 0                        | 0                     | 0                     | 1                         |
| SK | 0        | 0                          | 0                     |                      | 0                        | 1                     | 1                     | 1                         |
| SL | 1        | 0.5                        | 1                     | 2010                 | 0                        | 1                     | 1                     | 1                         |
| SP | 0        | 0.5                        | 0                     |                      | 0                        | 0                     | 1                     | 1                         |
| SE | 0        | 0.5                        | 0                     |                      | 0                        | 0                     | 1                     | 1                         |
| SW | 0        | 0                          | 0                     |                      | 0                        | 0                     | 0                     | 0                         |
| UK | 1        | 0                          | 1                     | 2014                 | 1                        | 1                     | 1                     | 1                         |
|    | <b>9</b> | <b>4</b>                   | <b>7</b>              |                      | <b>8</b>                 | <b>15</b>             | <b>19</b>             | <b>29</b>                 |

*Source: compiled by author from IDEA, (COE, 2017), national sources (see references).*

As of December 2016, 9 out of 32 countries regulate specifically lobbying, either in the form of a mandatory register of lobbyists (Germany, Netherlands, Poland, Slovenia, United Kingdom), or a lobbyists' code of conduct (France), or both (Austria, Ireland, Lithuania). That the remaining 23 countries do not have stand-alone laws on lobbying does not,

however, mean that they do not regulate it at all. Lobbying regulations are usually comprised of a set of laws that together form a legal framework covering activities found under the umbrella term ‘lobbying’. As Table 1 also shows, eight countries have adopted codes of conduct for Members of Parliament, 15 laws on public officials’ conflict of interests, 19 laws related to declaration of assets and 29 countries have laws regulating the financing of political parties.

The French and the Estonian case are telling in what actually constitutes a transparent lobbying mechanism. While France adopted in 2009 voluntary registers of lobbyists for the National Assemblée and the Senate, together with a non-binding code of lobbyists’ conduct, the level of transparency on the French lobbying scene is not significantly, if at all, higher than in Estonia. Estonia does not have a specific lobbying law or regulation similar to the French system but in the recent years, it introduced several anti-corruption measures that indirectly lead also to a more transparent lobbying scene. The regulatory framework is comprised of laws and sub-law legislation such as the Anti-Corruption Act, the Civil Service Act, the Political Parties Act, the Public Information Act, or the Good Practice for Preparing Legislation and Technical Rules. All these regulations put together form a rather robust system of transparency, which helps to explain, why Estonia scored on par with France in Transparency International’s last ranking of transparent lobbying in Europe (TI, 2015: 27).

**Tab. 2: TI 2015 Analysis**

|           | Lobbying | Lobbyists Codes of Conduct | Register of Lobbyists | Year of Introduction | Access to information | Registration and disclosure by lobbyists | Oversight of register and transparency rules | Pro-active public sector transparency mechanisms including legislative footprint | Overall score |
|-----------|----------|----------------------------|-----------------------|----------------------|-----------------------|--|--|--|---------------|
| <b>IR</b> | 1        | 1                          | 1                     | 2015                 | 67                    | 64                                       | 56   | 50   | <b>58</b>     |
| <b>SL</b> | 1        | 0.5                        | 1                     | 2010                 | 67                    | 60                                       | 56   | 50   | <b>58</b>     |
| <b>LT</b> | 1        | 1                          | 1                     | 2001                 | 50                    | 50                                       | 56   | 38   | <b>48</b>     |
| <b>AT</b> | 1        | 1                          | 1                     | 2012                 | 50                    | 57                                       | 19   | 13   | <b>34</b>     |
| <b>UK</b> | 1        | 0                          | 1                     | 2014                 | 67                    | 33                                       | 25   | 13   | <b>34</b>     |
| <b>PL</b> | 1        | 0                          | 1                     | 2005                 | 50                    | 27                                       | 13   | 25   | <b>29</b>     |
| <b>LA</b> | 0        | 0.5                        | 0                     |                      | 50                    | 13                                       | 0  | 50   | <b>28</b>     |
| <b>ND</b> | 1        | 0                          | 1                     | 2012                 | 67                    | 10                                       | 0  | 25   | <b>25</b>     |
| <b>FR</b> | 1        | 1                          | 0.5                   | 2009                 | 33                    | 30                                       | 10   | 21   | <b>24</b>     |
| <b>SK</b> | 0        | 0                          | 0                     |                      | 83                    | 0  | 0  | 0  | <b>21</b>     |
| <b>CZ</b> | 0        | 0.5                        | 0                     |                      | 75                    | 0  | 0  | 0  | <b>19</b>     |
| <b>BG</b> | 0        | 0                          | 0                     |                      | 50                    | 0  | 0  | 0  | <b>13</b>     |
| <b>GE</b> | 1        | 0                          | 0.5                   | 1951                 | 50                    | 0  | 0  | 0  | <b>13</b>     |
| <b>PR</b> | 0        | 0                          | 0                     |                      | 33                    | 0  | 0  | 17   | <b>13</b>     |
| <b>IT</b> | 0        | 0                          | 0                     | 2012                 | 33                    | 10                                       | 0  | 0  | <b>11</b>     |
| <b>ES</b> | 0        | 0                          | 0                     |                      | 33                    | 7  | 0  | 0  | <b>10</b>     |
| <b>SP</b> | 0        | 0.5                        | 0                     |                      | 33                    | 7  | 0  | 0  | <b>10</b>     |
| <b>HN</b> | 0        | 0                          | 0                     | (2005-10)            | 33                    | 0  | 0  | 0  | <b>8</b>      |
| <b>CY</b> | 0        | 0                          | 0                     |                      | 17                    | 0  | 0  | 13   | <b>7</b>      |
|           | <b>9</b> | <b>6</b>                   | <b>8</b>              |                      | <b>50</b>             | <b>19</b>                                | <b>12</b>                                    | <b>17</b>  | <b>24</b>     |

*Source: compiled by author, (TI, 2015)*

Table 2 shows the results of Transparency International’s analysis from 2015 (variables “Access to information” to “Overall score”). It does not cover all countries in the previous Table, but in the selected cases that were analyzed, there is a high correlation between having specific lobbying laws and achieving high scores in the ranking (Table 3). Since more lobbying laws are based on a register of lobbyists, the correlation is slightly higher for lobbyists’ registration than for lobbyists’ codes of conduct. Moreover, the majority of lobbying laws are adopted together with a code of conduct also for public officials, members of parliament in particular, which leads to a high correlation between these two variables also in the non-shortened dataset of all 32 EEA countries (.597 at the .01 level). Similar levels of correlation, that would be quite probably revealed also by factor analysis, can be found for laws on declaration of assets and conflict of interests (correlation .637 at the 0.01 level).

**Tab. 3: Correlations Laws x TI Analysis (Pearson, two-tailed)**

|  | Lobbying | Lobbyists Codes of Conduct | Register of Lobbyists | Access to information | Registration and disclosure by lobbyists | Oversight of register and transparency rules | Pro-active public sector transparency... | Overall score |
|--|----------|----------------------------|-----------------------|-----------------------|--|--|--|---------------|
| Lobbying                                     | 1        | .432                       | .952**                | .337                  | .739**                                   | .645**                                       | .500*                                    | .700**        |
| Lobbyists Codes of Conduct                   | .432     | 1                          | .411                  | .115                  | .726**                                   | .611**                                       | .522*                                    | .628**        |
| Register of Lobbyists                        | .952**   | .411                       | 1                     | .413                  | .813**                                   | .732**                                       | .574*                                    | .792**        |
| Access to information                        | .337     | .115                       | .413                  | 1                     | .285                                     | .342   | .239                                     | .553*         |
| Registration and disclosure by lobbyists     | .739**   | .726**                     | .813*                 | .285                  | 1  | .903**                                       | .700**                                   | .912*         |
| Oversight of register and transparency rules | .645**   | .611**                     | .732**                | .342                  | .903**                                   | 1  | .712**                                   | .929**        |
| Pro-active public sector transparency        | .500*    | .522*                      | .574*                 | 0.239                 | .700**                                   | .712**                                       | 1  | .820**        |
| Overall score                                | .700*    | .628**                     | .792**                | .553*                 | .912**                                   | .929**                                       | .820**                                   | 1             |

\*\* significant at the 0.01 level, \* significant at the 0.05 level

Source: author

Two things coming from this correlational analysis are worth noting: first, having any lobbying regulations clearly favors lobbying transparency. With no regulation, countries score very low in the ranking. On the other hand, having such a regulation does not automatically lead to high scores. In terms of qualitative comparative analysis, hard legal regulations for lobbying indeed seem to be a necessary but insufficient condition for achieving transparency of the lobbying mechanism.

Second, the correlational analysis points to a possible over-reliance of European countries’ legislation on registration of lobbyists, without the necessary oversight over compliance with the rules. Overall score is correlated, from the most to the least, with “Oversight of register and transparency rules” (.929\*\*), “Registration and disclosure by lobbyists” (.912\*\*), “Pro-active public sector transparency mechanisms including legislative footprint” (.820\*\*), and, finally, with “Access to information” (.553\*). The differences in correlations are from a major part caused by differences in average scores

of the individual variables (see again Table 2). “Oversight of register and transparency rules” has the lowest average of 12; in other words, legislators very often rely on self-regulating capacities of lobbyists and leave gaps in laws in terms of low enforcement of these rules. Therefore, the actual transparency of lobbying even in countries with high scores may be significantly worse than the TI’s analysis might suggest.

For instance, Poland has been discussing formal regulations of lobbying already since the 1990s, when Polish officials were several times implicated in lobbying scandals (see, e.g., Sutch et al., 1999: 7). By 2005, working groups in the Polish government as well as independent experts from NGOs developed four different drafts of formal lobbying regulations. In the end, a rather unambitious variant was chosen and passed as Act on the Lobbying Activity in the Legislative Process (KSRP, 2005).

The final form of the act was to the NGO sector quite a disappointment and has been since its adoption the target of much criticism (see, e.g., Makowski and Zbieranek, 2007). Besides the obligation to register, the act does not set any other requirements or obligations for lobbyists, its definitions are seen as vague, blurred and impractical, and it covers too many issues, many of them not directly connected to lobbying (e.g., public hearings); these unrelated issues were even expanded by four subsequent amendments of the act, which, however, did not improve on the overall quality of the legal regulation (Kwiatkowski et al., 2016: 11–14).

In Poland, lobbying is “any legal action designed to influence the legislative or regulatory actions of a Public Authority” (Lobbying Act 2005, Art 2, Sentence 1). This very broad definition, resembling more the EU approach than the restricted definition preferred by the Council of Europe, allows for the regulation of basically any activity with a direct or indirect impact on the legislative process. However, already in the second and third sentences of the same article, it transpires that the act is aimed purely at the regulation of professional lobbying, which is “paid activity carried out for or on behalf of a third party with a view to ensuring that their interests are fully reflected in legislation or regulation proposed or pending” (Lobbying Act 2005, Art 2, Sentence 1). The broad definition used for lobbying loses its potential advantage when the act establishes that professional lobbyists are “a firm (hereinafter referred to as the Professional Lobbying Firm) or by an individual not registered as such (hereinafter referred to as the Professional Lobbyist) pursuant to a civil contract” (Lobbying Act 2005, Art 2, Sentence 3).

It is therefore quite unsurprising that the practice of transparent lobbying in Poland severely lacks behind what the law-makers may have envisioned. The level of transparency is theoretically higher than in other countries ranked lower by Transparency International, including the Czech Republic and Slovakia. However, as, e.g., Kwiatkowski et al. (2016) demonstrate, the realities of the three countries are largely similar, with no effective progress towards real transparency of lobbying in none of these countries.

### 3. What Next for Transparent Lobbying?

The Polish example suggests that not even adopting a specific law on lobbying will immediately lead to an improvement in the level of transparency of lobbying. Before drafting such a law, important questions need to be answered: first, how broad is the scope of regulated activities and who is actually regulated by the law? Second, how is the law enforced and what are the incentives for compliance? Third, what role does the law fulfil in the entire structure of anti-corruption legal regulation of the country?

The third question is highlighted when the current situation in Poland is compared to Latvia. Latvia, one of the countries with no obligatory rules for lobbying, is in TI's 2015 analysis ranked virtually at the same level as Poland. The country's relatively high scores are caused by other anti-corruption laws, not specifically aimed at lobbying. Latvia features strong provisions to open public access to information, there are some, even if far from ideal, rules for legislative footprint of draft bills, and the country also established a well-regarded anti-corruption body, the Corruption Prevention and Combating Bureau of Latvia (KNAB). KNAB has been since 2008 involved in the national discussion on transparency of lobbying, which is closely related to the bureau's activities as stipulated in the existing anti-corruption legislation (e.g., Law on Prevention of Conflict of Interest in Activities of Public Officials, Law on Financing of Political Organisations, Law on Prevention of Squandering of the Financial Resources and Property of the State and Local Governments, Law on Freedom of Information, etc). Thus, the activity of KNAB, which enforces and supervises the compliance with the country's system of anti-corruption laws, indirectly increases also the transparency of the lobbying scene in Latvia.

On the other hand, having a body specialising in anti-corruption in itself does not translate to low levels of corruption throughout the political system. In this sense, this weak correlation is very similar to the weak correlation between a transparent lobbying mechanism and an adopted law on lobbying. A simple correlational analysis of these rankings with scores from the rankings of transparent lobbying dimensions (Table 2) does not point to any strong relationship between these two areas (Table 4).

The lack of statistical correlation does not mean that formal lobbying regulation may be entirely ineffective in curbing corrupt practices in a political system. Most of the recent adoptions of lobbying laws have taken place in post-communist countries, i.e., in a region with lower scores on the CPI and other corruption rankings than in longer existing Western European democracies. If only post-communist cases are selected, countries with adopted formal lobbying laws indeed fare better also on the CPI scale than those with no lobbying laws: Slovenia 60, Lithuania 61, Poland 62 versus Latvia 55, Slovakia 51, Czech Republic 56, Bulgaria 41, Hungary 51, Croatia 50, Romania 46. These scores are quite probably significantly influenced by endogeneity due to a loop of causality between the willingness to adopt formal lobbying legislation and the level of corruption in the system but it is still a fact worth noting. A similar relationship, on the other hand, is not found in Western Europe, where none of the Scandinavian countries, traditionally regarded as the least region of Europe with lowest levels of corruption in politics, have so far adopted any formal legal regulation on lobbying. Scandinavia is a very specific case in

other sub-fields of global anti-corruption efforts, resisting to formally regulate public officials' conflicts of interests, assets control and others (see Table 2).

**Tab. 4: Correlations Lobbying VS Corruption indexes (Pearson, two-tailed)**

|                                   | Lobbying | Lobbyists Codes of Conduct | Register of Lobbyists | Overall score | Corruption Perceptions Index 2015 | Control of Corruption 2010 | Open Budget Index 2010 | Global Competitiveness Index 2013 | Judicial Independence Index 2012 | Rule of Law 2010 | Voice & Accountability 2010 | Press Freedom Index 2012 |
|-----------------------------------|----------|----------------------------|-----------------------|---------------|-----------------------------------|----------------------------|------------------------|-----------------------------------|----------------------------------|------------------|-----------------------------|--------------------------|
| Lobbying                          | 1        | .470**                     | .941**                | .700**        | .227                              | .198                       | .484                   | .270                              | .182                             | .180             | .137                        | -.182                    |
| Lobbyists Codes of Conduct        | .470**   | 1                          | .429*                 | .628**        | .033                              | .033                       | .370                   | .069                              | -.052                            | .101             | -.021                       | -.071                    |
| Register of Lobbyists             | .941**   | .429*                      | 1                     | .792**        | .161                              | .110                       | .345                   | .163                              | .100                             | .091             | .034                        | -.129                    |
| Overall score                     | .700**   | .628**                     | .792**                | 1             | .303                              | .213                       | .451                   | .148                              | .135                             | .235             | .147                        | -.157                    |
| Corruption Perceptions Index 2015 | .227     | .033                       | .161                  | .303          | 1                                 | .953**                     | .840**                 | .921**                            | .927**                           | .908**           | .921**                      | -.821**                  |
| Control of Corruption 2010        | .198     | .033                       | .110                  | .213          | .953**                            | 1                          | .819**                 | .877**                            | .926**                           | .967**           | .962**                      | -.786**                  |
| Open Budget Index 2010            | .484     | .370                       | .345                  | .451          | .840**                            | .819**                     | 1                      | .844**                            | .825**                           | .814**           | .771**                      | -.506                    |
| Global Competitiveness Index 2013 | .270     | .069                       | .163                  | .148          | .921**                            | .877**                     | .844**                 | 1                                 | .884**                           | .836**           | .880**                      | -.694**                  |
| Judicial Independence Index 2012  | .182     | -.052                      | .100                  | .135          | .927**                            | .926**                     | .825**                 | .884**                            | 1                                | .903**           | .919**                      | -.732**                  |
| Rule of Law 2010                  | .180     | .101                       | .091                  | .235          | .908**                            | .967**                     | .814**                 | .836**                            | .903**                           | 1                | .955**                      | -.753**                  |
| Voice & Accountability 2010       | .137     | -.021                      | .034                  | .147          | .921**                            | .962**                     | .771**                 | .880**                            | .919**                           | .955**           | 1                           | -.778**                  |
| Press Freedom Index 2012          | -.182    | -.071                      | -.129                 | -.157         | -.821**                           | -.786**                    | -.506                  | -.694**                           | -.732**                          | -.753**          | -.778**                     | 1                        |

\*\* significant at the 0.01 level, \* significant at the 0.05 level

Source: author

However, to follow the Scandinavian way would be most probably very detrimental to other countries, especially in the post-communist region; there are cultural and historical factors to consider. New democracies in Central and Eastern Europe lack the deep-rooted feeling of community and care for the public good that are to be found in Western and Northern Europe; formal regulations of high quality should speed up the process of making the politico-economic system fairer for all citizens. The contrasting Latvian and Polish cases indicate that countries which take the same approach towards the problem of transparent lobbying may still arrive at very similar outcomes. The question then arises whether this outcome is desired; whether it cannot be improved upon by taking further, more ambitious measures. This question cannot be fully answered before further data are analysed, particularly those originating at the recent reform cases such as in Slovenia. While this short excursus into the current lobbying regulation scene in Europe shows that there is no one model of formal regulation that would perfectly fit all, common principles and standards on which transparent lobbying may be built already emerge, tested by recent experiences. How to develop these standards further and where to go from here is the next task in this research agenda.

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## Perception of Transparency of Lobbying: First Empirical Approach

### Abstract

The benefits of transparent lobbying are often discussed. The theoretical grounds result in a statement that they may contribute to the democratic environment and the efficient allocation of public funds. But the real perception of lobbying has not been investigated. Therefore, this study focuses on the perception of transparency of lobbying in sample organisations in the Czech Republic. The aim of this paper is to evaluate the perception of the premise that adequate lobbying and transparency of lobbying has the potential to be viewed positively by stakeholders. Data for the study was gathered from a sample of businesses, non-profit organisations, and other institutions in the Czech Republic. Totally, 73 organisation/institution members took part in the survey. One respondent per organisation/institution was questioned. The results show that 80% of respondents perceive transparency of lobbying positively. Remaining 20% of respondents partly disagree with the positive impacts of transparent lobbying. Moreover, statistically significant differences were found between three observed groups (business, non-profit and other institutions). Non-profit organisations perceive transparency of lobbying statistically significantly better than respondents from business and other institutions. This article may be considered as a case study of perception of transparency of lobbying in the Czech Republic. Other studies may conduct further research on the found direction in terms of information flows.

### Key Words

*lobbying, transparency, stakeholders, regulation, perception*

**JEL Classification: D72, D82**

## Introduction

In this paper, the perception of the interest groups of relationship transparency between different governmental actors is presented. The models of relationships between state, policymaking environment, business, and lobbyists however differs (Jordan and Meirowitz, 2011). There are number of technical similarities between models and recent work (i.e. Konrad and Kovenock, 2009; Konrad, 2009; Jordan and Meirowitz, 2011). All the mentioned models describe actors as competing in a series of contests. The structure and sequencing of these contests are highly structured. As a result, the current outcome alters the terms of contests in future dates. Therefore, an equilibrium of all parties is derived from expectations about their behaviour in future. Konrad and Kovenock (2009) and Jordan and Meirowitz (2011) state that each of government actors have an inherent bias to favour certain policy (or interest group). If the biases are non-zero by any of the

governmental actors, the results need additional attention and further modelling. Leading contributions include Baye et al. (1996) and Skaperdas (1996) in this area. As an essential building block of any model, there is the analysis of roles in which the parties have asymmetric valuations. Furthermore, Bennedsen and Feldmann (2002) analysed informational lobbying in the context of a multimember legislature that decides on the allocation of a public good. Authors observed that a majoritarian legislature provides widely different incentives for interest groups to lobby than a single decision maker does.

In the next section, we present a new model of interest group competition and policymaking over a binary agenda. The analysis of the model ends with a characterization of policies with description and justification of those that are stable.

Laboutková and Žák (2016) defined the relationship model which is based on a simple scheme of three parties: interests - the decision maker - the outcomes. The state (the decision-making body) is a bureaucratic institution and determines the rules. It makes decisions based on information drawn from its own sources (knowledge of officials and state institutions which supply information) or obtain it from a public non-government sector and from the private sector – business. Information arising from an interaction between lobbying and the state presents a situation where companies hire professional lobbyists or establish professional lobbying and civil companies establish interest groups who attempt to influence the decision making of the state and therefore format rules through their activities – lobbying.

Based on the model described above authors formulated three hypothetical situations which are further divided into variants which summarises the described hypothetical situations and their possible consequences.

**Tab. 1: Variants of lobbying and its consequences**

| Options               | Source of information   | Rules formal/informal | Costs   | Uncertainty of actors as a consequence of IA | Failure of the state                      |
|-----------------------|---|-----------------------|---|--|---|
| No lobby              | Own   | X                     | None  | high*  | ineffective (uninformed) decision         |
|                       | own + obtained at random from the public and businesses (outsiders)                                       | no/yes                | high for obtaining info (bureaucracy),                | Medium                                       | time delays, excessive bureaucracy        |
| Non-transparent lobby | own + lobbying - selectively (insiders)   | no/yes                | for obtaining info, rent seeking                      | High   | social inefficiency, space for corruption |
|                       | own + lobbying selectively (insiders) + random tracing of info from the public and businesses (outsiders) | no/yes                | high for obtaining info (bureaucracy),                | Medium                                       | time delays, excessive bureaucracy        |
| Transparent lobby     | own + lobbying (equal access for all stakeholders) everyone can become an insider                         | yes/yes               | costs of implementing and enforcing rules, incentives | Low  | risk of exaggerated regulation            |

*Source: Laboutková and Žák (2016)*

The model by Laboutková and Žák (2016) describe state as a bureaucratic institution which determines the rules and obtains information, partially from its own sources and partially from other stakeholders. Stakeholders influence the government's decision making and bureaucratic apparatus. The entire process can be carried out with or without transparency and with or without rules. Without rules, companies use lobbying to seek rent from the state as a consequence of a high information asymmetry. When decision-makers behave responsibly, it could increase the quality of a decision. However, in the transparent environment the risk of information asymmetry is reduced. By additional rent from the state, a benefit for companies could be made by building a "good name", i.e. accepting the principles of transparency (openness, accuracy or truthfulness, and comprehensibility), ethics, and concept of corporate social responsibility. Acting responsibly by transparent lobby however brings a risk in form of overregulated society and therefore lowering of natural competitiveness and citizen's initiative (Laboutková and Žák, 2016).

The aim of this paper is to evaluate the perception of the premise that adequate lobbying and transparency of lobbying has the potential to be viewed positively by stakeholders.

The method used in the article is the application of the main links used for potential lobbying interaction in the case study conducted in business sector in the Czech Republic.

The paper is organized as follows: the Introduction part provides the theoretical background and summary of the current state of knowledge of the research issue. Methodical part introduces the conducted study. The chapter "Results" presents main outcomes and relationships. Finally, the discussion and conclusion of the paper is carried out with summary and implication of the presented paper.

## **1. Methods of Research**

Analysis and the comparative method have been used to analyse the theoretical basis and terms. The analytical section of the paper has been based on deductions and the synthesis of the acquired knowledge. The recommendations are based on quantitative research realized using questionnaire data collection techniques. The data for the evaluation of the current level of perception of lobbying transparency in Czech organizations has been collected in a primary quantitative survey by means of a questionnaire. Only one respondent per business was contacted. The questionnaire was completed on behalf of the organization by one chosen respondent. The data collection respected the ethical aspects of the research (Personal Data Protection Act no. 101/2000 Coll.).

Selected companies' representatives were contacted by e-mail, the electronic questionnaire was automatically recorded and the respondents' answers were pre-categorized (the CAWI method). The questionnaire consisted of two main parts (the first one focused on lobbyists and the second one on those who are being lobbied). Both parts included 10 questions on lobbying and one identification question on their current job position. A semantic differential permitted the identification of nuances in the

respondents' attitudes throughout the questionnaire. The respondents' reactions to target statements and their attitudes to the given matter were restricted by offering a set of several statements. The body of the questionnaire consisted of block questions with partial sub-questions with a 4-point scale from totally agree to totally disagree. Total of 73 respondents had participated in the questionnaire survey. Overall return of the questionnaire was low (8%), because of the specific theme; respondents did not always have a knowledge and experiences with lobbying and thus could not answer. Therefore, we may consider the sample size as sufficient. The 56.2% of respondents worked in business, 11% in non-profit organisations, and 32.8% run their own business or work in public or other institutions.

The questionnaire focused on the areas of lobbying in general, transparency of lobbying, transparency of lobbyists, transparency of environment, legislation regarding lobbying, relations to stakeholders, data availability, financing, and regulations.

The first stage of processing the questionnaire results focused on the preparation of a data matrix. The data was described and then it was coded and sorted according to the type of variables (qualitative, quantitative). The research analysis of the data realized in this stage focused on investigating the important properties and the typical features of the statistical file. The statistical evaluation of the data was undertaken on the basis of a one-dimensional analysis based on the frequency distribution, the calculation of descriptors, and the testing of hypotheses about the frequency of the categories of individual variable values.

## **2. Results of the Research**

The objective of this chapter is to evaluate the results obtained from the primary survey. The results of the quantitative research are shortly presented below.

As it is possible to see in the Tab. 2, respondents mostly positively perceive transparency of lobbying. On average, 80% of respondents perceive lobbying transparency. Transparent lobbying according to respondents mostly increase decision legitimacy and responsibility, increases reliability of politicians and officials, improve and cultivate quality of government decisions, increase democratic principles, and restrict corruption. Also, average values are very positive. On a four-point scale where 1 is totally agree and 4 is totally disagree, all statements are equal to 2 or below.

Surveyed statements regarding the impact of transparent lobbying on quality information, decision and relationships is perceived even better. Almost 90% of respondents totally or partly agree with this statement. In the case of creation of pressure on increasing responsibility of decisions and increased equality of stakeholders towards decision process the level of agreement reached the maximum agreement.

On the other hand, a quarter of respondents disagree to some extent that transparency of lobbying pushes on higher responsibility of accepted bureaucratic decisions and 27.91%

of respondents do not see the impact on quality of accepted decisions. There is still scepticism among respondents towards bureaucratic decisions and its quality regardless of transparent lobbying.

**Tab. 2: Perceived transparency of lobbying (% of the sample)**

|  | Totally agree | Partly agree | Partly disagree | Totally disagree | AVG  | MOD | MED |
|--|---------------|--------------|-----------------|------------------|------|-----|-----|
| Interaction with lobbyists increase accepted decision legitimacy                   | 23.26         | 58.14        | 16.28           | 2.33             | 1.98 | 2   | 2   |
| Increases reliability of politicians/officials                                     | 23.26         | 53.49        | 18.60           | 4.65             | 2.05 | 2   | 2   |
| Impact on quality of accepted decisions (competency, efficiency)                   | 20.93         | 51.16        | 25.58           | 2.33             | 2.09 | 2   | 2   |
| Increases democratic principles and lower gap between citizens and decision-makers | 23.26         | 58.14        | 13.95           | 4.65             | 2.00 | 2   | 2   |
| Cultivate decision process   | 37.21         | 46.51        | 13.95           | 2.33             | 1.81 | 2   | 2   |
| Push on higher responsibility of accepted bureaucratic decisions                   | 25.58         | 48.84        | 23.26           | 2.33             | 2.02 | 2   | 2   |
| Restrict corruption practices  | 27.91         | 48.84        | 20.93           | 2.33             | 1.98 | 2   | 2   |
| Impact relationship quality between lobbyists and lobbying                         | 15.15         | 63.64        | 21.21           | 0.00             | 2.06 | 2   | 2   |
| Impact quality of information provided by both parties                             | 18.18         | 63.64        | 18.18           | 0.00             | 2.00 | 2   | 2   |
| Creates pressure on increasing responsibility of accepted decisions                | 45.45         | 45.45        | 6.06            | 3.03             | 1.67 | 2   | 2   |
| Support equality of stakeholders towards decision process                          | 30.30         | 57.58        | 9.09            | 3.03             | 1.85 | 2   | 2   |

Source: authors' calculations in Excel

A Pearson Chi-Square analysis was used to further review the survey output based on the stated results (see the Tab. 3). The following three hypotheses were postulated in order to review the results. The tested work hypotheses related to perception of transparency of lobbying are stated below:

- **H1:** There is no difference between perception of transparency of lobbying in business and non-profit organisations.
- **H2:** There is no difference between perception of transparency of lobbying in business and other institutions.
- **H3:** There is no difference between perception of transparency of lobbying in non-profit organisations and other institutions.

**Tab. 3: Hypotheses - transparency of lobbying by stakeholders**

| Hypothesis ( $\chi^2$ test)   | p-value | H <sub>0</sub> |
|---|---------|----------------|
| Perception of transparency of lobbying in business vs. non-profit           | 0.029   | Rejected       |
| Perception of transparency of lobbying in business vs. other institutions   | 0.001   | Rejected       |
| Perception of transparency of lobbying in non-profit vs. other institutions | 0.000   | Rejected       |

Source: authors' calculations in Excel

As it is possible to see in the Tab. 3, statistically significant differences were found between all three observed groups (business, non-profit and other institutions). Non-profit organisations perceive transparency of lobbying statistically significantly better than respondents from business and other institutions. Also, business perceive transparency of lobbying better than other institutions.

### **3. Discussion**

As it has been already mentioned among the theoretical starting points of the paper, benefits of transparent lobbying are often discussed. It is possible to view current economy as a collective term for the current distinctly positive supply shock, at the core of which lies the rapid development of information and communication technology (Kruss et al., 2015; Urbancová et al., 2016). Its wide use brings ever increasing requirements with it when searching for and processing information and an emphasis on knowledge and its application in practice (Kloudová, 2012).

Transparency of lobbying reflects the level of disclosure, accuracy and comprehensibility of information (Laboutková and Vymětal, 2017). However, it creates high costs for the implementation of rules as well as costs associated with the implementation of incentives for agents, which lead them to the maximisation of the principal's interest rather than their own (Moe, 1984). Another benefit of reducing space for seeking additional rent from the state may be an attempt by organisations and institutions to pursue market dominance by responsible and ethical behaviour, and accepting the principles of transparency (Laboutková and Žák, 2016). On the other hand, this situation may bring overregulated society and thus paradoxically the suppression of the natural competitiveness and citizen's initiative.

Currently, stakeholders and lobbyists participate in the political process in many ways (Bennedson and Feldmann, 2002). Those ways may be seen for example in testifying in congressional and administrative hearings, formal and informal communication with policy makers and their staff, presentation of their view and information, drafting of policy proposals and providing legal expertise, and in informing and mobilizing other members and the public on matters that may be concerning them (Schlozman and Tierney 1986). Therefore, it is necessary to pay attention to all stakeholders, interest groups and lobbying itself and its transparency. Transparency of lobbying is perceived by all interest groups and they pay special attention to its impacts as it was also found in the results of this papers. Interest groups shows the direction and justification of all actions.

Helpman and Persson (2001) and Baron (1999) analysed the importance of the legislative structure for interest groups and their lobbying behaviour. Results of both articles show that the means of influence are campaign contributions, or financial incentives. Our analysis presented in this paper extends these two influential factors and show how lobbying behaviour is perceived by interest groups and how. The study made on interest groups present perception of information as a means of resulting policy outcomes.

## Conclusion

The results of the study show that 80% of respondents perceive transparency of lobbying positively. The remaining 20% of respondents partly disagree with the positive impacts of transparent lobbying. Moreover, statistically significant differences were found between the three observed groups (business, non-profit and other institutions). Non-profit organisations perceive transparency of lobbying statistically significantly better than respondents from business and public institutions. It is very important to highlight the trend reflected in the results, namely focus on positive impacts of transparent lobbying, which is a conduit of positive development of democratic society.

Limits of the article can be seen in a relatively small sample of respondents. But as, for the time being, organisations and thus respondents in the Czech Republic are not always familiar with lobbying and its transparency, the sample of 73 respondents from 134 organisations can be described as sufficient and representative. Nevertheless, the results can be applied generally to the sample of respondents – organisations and institutions operating in the Czech Republic. This article may be considered as a case study of perception of transparency of lobbying in the Czech Republic. Other studies may conduct further research on the found direction in terms of information flows.

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## **Transparency in Lobbying – the Key Aspects of Lobbyists’ Activity**

### **Abstract**

To evaluate lobbying, lobbyists and especially the transparency of lobbying activities seem to be difficult. Although there are some tools trying to measure effectiveness of lobbying regulation and/or quality of lobbying, they lack to cover the lobbying issue in its complexity. Moreover, they do not specifically focus on transparency in lobbying. This paper is a first part of broader research on transparency in lobbying and its aim is to develop methodological fundament presented earlier. Following this, for any later evaluation it is necessary to design indicators of transparency in lobbying, or more precisely in this paper, to design indicators dealing with one side of lobbying contact – the lobbyists only. For that reason, analysis of existing rules, documents, recommendations, research papers, experience and also expert critique of lobbying is used; there is a strong empirical background used for deriving all indicators. The author finally identifies 31 relevant indicators that are divided into four groups – Register, Codes, Disclosures, Open diaries – that mostly take the binominal value yes/no. All presented indicators are presented as preliminary and opening the space for next discussion about measuring this phenomenon. Only well discussed and clear indicators (together with those not developed yet) can create a solid base for the evaluation of transparency in lobbying on real countries’ data later on.

### **Key Words**

*lobbying, lobbyists, transparency, register*

**JEL Classification: D72, D73, D82, D85**

## **Introduction**

However more than 180 years have passed from first recognition and description of lobbying in America, until the World War II. the activities of lobbyists were supposed to be suspicious, at the edge of ethical behaviour and/or close to the corruption. The first rules on lobbying activity introduced in 1946 were motivated by the goal to define the border between legitimate lobbying activity conducted according the rules (however imperfect they were), and illegal corruption. From that time, only some countries try to regulate lobbying for at least two reasons – first, to close down the space for corruption dealing, and second to promote transparency, accountability and democracy (good governance principles).

Many countries in the Europe have already discussed the possibility of some regulation of lobbyists and their activity and according the Committee of Ministers of Council of

Europe (COE 2017) recommendation, among other recommendations (OECD (2013); Access Info Europe (2015); Access Info Europe, Open Knowledge, Sunlight Foundation, and Transparency International (2015); TI (2015)), all European countries are supported to introduce any rules that regulate lobbying in the decision-making process. Although Council of Europe provided a basic guideline, it is general and offers only general definitions, the list of specific measures is neither addressed nor limited, and potentially a huge variety of results in countries' practices is expected. No perfect solution exists but transparency principle resonates in all recommendations.

As we have discussed earlier (Laboutková, Vymětal 2017, p. 51-52), there are efforts to "measure" the quality of lobbying regulation, mostly based on existing rules on lobbying (laws, Codes of Behaviour, Codes of Ethics). The broader approach that would evaluate not only the rules on lobbying itself, but broader environment of lobbying activities that is a complex of four different categories, is not covered sufficiently. This proposed paper continues in the authors' effort. The aim of the paper is to find, define and propose a set of relevant measures of transparency that can both identify and evaluate the activities and behaviour of lobbyists – the first piece of the transparency puzzle of our proposed approach of measuring transparency of lobbying.

The paper is structured as follows: first chapter provides the basic conceptual background and research methods used for identifying and designing the indicators. Second chapter presents the four basic groups of indicators that describes and reflects the transparency in lobbying. Third chapter later opens a discussion about the approach chosen and about indicators identified.

## **1. Conceptual Background and Research Method**

The evaluation of lobbying activities is not as popular, compared of the impact of lobbying activities in the real world. Current approach to any lobbying evaluation is rather narrow in the scope – it deals with the regulations, mostly in the form of bills and/or Codes of Behaviour or Codes of Ethics (CPI 2014; Chari, Hogan, Murphy 2010). This understanding is limited and do not access the quality of lobbying practices in reality – the laws mostly deal with the rules for lobbyists, only partly set commitments for targets of lobbying (public office holders, decision makers, politicians). The landscape of environment is much coloured and definitely includes other provisions that influence transparency of decision-making. That is why Laboutková and Vymětal (2017) conceptualized a catalogue of basic categories that should be taken into account when describing transparency of lobbying practices – those categories covers: (1) lobbyists, (2) targets of lobbying, (3) sunlight principles, (4) monitoring and sanctioning system. In the next step both authors promised, each category to be operationalized by specific reasonable variables (measures) that makes evaluation possible. This paper deals with the first set of measures connected with lobbyists only.

We have to make one conceptual note here. The measures – or more precisely rules – we understand in the more general way – it is the all formal and informal rules that constrain

the peoples' behaviour and actions or as North (1990, p. 97) defines “*humanly devised constraints that structure political, economic and social interactions*”. They can take many forms – they can be written and unwritten, they can be bills, orders, recommendations, but various binding (obligatory) and non-binding (voluntary) codes (conduct, behaviour, ethics), and also habits and customs can be included. All this material – laws, Codes, recommendations, habits, but also a critical remarks on low effectiveness and/or negative aspects of lobbying is necessary to take into consideration when deriving indicators. All listed below follows this logic of broad definition of rules.

Inductive approach and the knowledge of grounded theory are used and can be inspiration for this type of research. The core of it is to develop and design basic indicators/variables for later evaluation of transparency of lobbying. For the operationalization of basic variables of transparency in lobbying, the analysis of empirical data is used. First, all available data dealing with any rules for lobbyists are analysed. Then, the main variables are identified and defined and they are classified into logical groups of indicators/variables, which are further ready to be used for evaluation. For now, the binominal values (yes – no) for most indicators were chosen.

## 2. Results of the Research

As presented here above, the paper is developing the former methodological proposal of evaluating the transparency in lobbying (Laboutková, Vymětal 2017), where the category of “lobbyists” was one among four categories and focuses on rules for the active actors of influence. Such instruments shown in Tab. 1 demarcate the basic conceptual empirical framework for next development specific indicators.

**Tab. 1: Main areas and data on lobbyists' transparency**

| Area                     | Data/information  |
|--------------------------|---|
| Register                 | Register of lobbyists/lobbying activities   |
| Codes                    | Codes of Conduct, Codes of Behaviour, Codes of Ethics<br>Annual reports of lobbyists associations |
| Disclosure of activities | Lobbyist's declarations<br>Declarations of politicians and POH                                    |
| Open calendars           | Lobbyists web pages<br>Lobbyist's declarations  |

Source: Laboutková, Vymětal (2017), author's own changes

In each area we can identify at least one source of information that can be used for next determination of indicators of transparency of lobbying. Next tables develop each area and propose specific indicators.

First set of indicators cover the registry schema of lobbyists – if any exist. Not all jurisdictions have any statutory register but still there can be voluntary activities mostly within the associations. The registry supports the transparency principle in two ways: it defines and it identifies who the lobbyists are. Tab. 2 is a basic set of indicators proposed in the case of register.

**Tab. 2: Main indicators of Register of lobbyists/lobbying**

|    | <b>Indicator</b>  | <b>Answer</b>   |
|----|---|---|
| 1  | Is there any statutory Register?  | Yes / No  |
| 2  | The register covers mainly:   | Lobbyists<br>Activities of lobbyist   |
| 3  | Is there any other register of interest and pressure groups and/or lobbyists (if there is no statutory register)? | Yes / No  |
| 4  | Types of lobbyists registered:  | Professional lobbyists/consultants<br>In-house lobbyists corporations<br>In-house lobbyists organizations |
| 5  | Number of registered lobbyists:   | Number  |
| 6  | Estimation of the number of lobbyists in the country, including those non-registered                              | Number  |
| 7  | Register contains a basic data on lobbyists (name, address,...)   | Yes / No  |
| 8  | Is basic data of the Register publicly accessible without any registration?                                       | Yes / No  |
| 9  | Is possible to search and filter data in the Register?  | Yes / No  |
| 10 | Does Register contains data on lobbyist's clients?  | Yes / No  |
| 11 | Is data on clients publically available?  | Yes / No  |
| 12 | Is there any time limit for updating the basic data on lobbyists (name, address, clients etc.)                    | Yes / No (if yes, what is the time limit in days)   |
| 13 | Is lobbyist obliged to report quitting lobbying business?   | Yes / No (if yes, what is the time limit in days)   |
| 14 | Are there any exemptions of who is not supposed to be a lobbyists/lobbying contact?                               | Yes / No (if yes provide a list of exemptions)  |

*Source: author's own construction*

The second type of problems is connected with the lobbyists' activities or more precisely with the problem how the activities are conducted. Whatever or not, there are any legal rules for lobbying, the easiest form of regulation of activities are the Codes imposed by lobbyists themselves. The Codes can have various forms – Codes of Ethics, Codes of Behaviour, Codes of Conduct – and they can have various degree of obligatory force. The following Tab. 3 summarizes the main indicators dealing with the Codes of lobbyists and/or lobbyists' activities.

**Tab. 3: Main indicators of Codes of lobbyists/lobbyists' activities**

|   | <b>Indicator</b>  | <b>Answer</b> |
|---|---|---------------|
| 1 | Is there any obligatory and binding Code for lobbyists?   | Yes / No      |
| 2 | Is there any voluntary Code for lobbyists?  | Yes / No      |
| 3 | Are the any regulations banning and discouraging lobbyists from unethical behaviour?  | Yes / No      |
| 4 | Do lobbyists have any association/federation?   | Yes / No      |
| 5 | Membership in association is obligatory.  | Yes / No      |
| 6 | Does association publish any information about its lobbying activities and/or activities of its members in the annual report? | Yes / No      |
| 7 | Are lobbyists associated in other associations (PR, PA etc.)?   | Yes / No      |
| 8 | Can association investigate and check its members for unethical behaviour and breaching the Codes?                            | Yes / No      |

*Source: author's own construction*

Third group of indicators covers the basic data provided on regular basis on lobbying activities. There is an extensive variety in data collected covering contacts, clients, forms of lobbying, and finance, as well as from the point of detail of information, frequency of

disclosure and time period for disclosure. Tab. 4 summarizes the most important indicators in this area.

**Tab. 4: Main indicators on lobbyists' disclosures**

|   | <b>Indicator</b>  | <b>Answer</b>                                |
|---|---|--|
| 1 | Do lobbyists provide regular disclosure on their activities?  | Yes / No                                     |
| 2 | What is the time period for submission?   | Days after the end of period (year, quarter) |
| 3 | How much time per year are disclosures required?  | Number                                       |
| 4 | Do reports include information on lobbyists' contacts made, place, time, persons and institution influenced and the matter of the contact?                              | Yes / No                                     |
| 5 | Do disclosure include data on income and spending of lobbyists?   | Yes / No                                     |
| 6 | Do disclosure include information on clients represented?   | Yes / No                                     |
| 7 | Do lobbyists disclose data on support and gifts (financial and non-financial) provided to the politicians, public office holders, civil servants and political parties? | Yes / No                                     |

*Source: author's own construction*

Last group of indicators is linked with the third group, but the aim is a little bit different. This set of indicators is more likely to be voluntary, and can have ex ante effect on transparency of lobbying activities – the information is provided before the lobbying contact and/or in a short time after it has been conducted. On the other hand, the information is not to be specific and detailed very much. Next Tab. 5 presents such indicators.

**Tab. 5: Main indicators on lobbyists' open diaries**

|   | <b>Indicator</b>   | <b>Answer</b> |
|---|--|---------------|
| 1 | Do lobbyists have publicly accessible webpages?                        | Yes / No      |
| 2 | Do lobbyists have publicly available open diaries with their meetings? | Yes / No      |

*Source: author's own construction*

### 3. Discussion

There is no single way neither for regulation of lobbying activities or the approaches for evaluation of lobbying activities. The paper, which is a part of broader research, thus tries to design indicators that make possible to evaluate more specifically the transparency of lobbying in general. The methodological approach chosen and is somehow unique – the aim is to evaluate the whole lobbying environment.

This paper is just a starting point in broad and complex effort to evaluate lobbying, and proposes a set of indicators for the most common reference and focus of many studies – the lobbyists' side. In the next step, the authors of the background methodology will develop other aspects and therefore other indicators of lobbying. All the indicators proposed here but also in the future are open for critical comments to avoid uncertainty, definition vagueness, incompleteness and other problems before the authors apply the research design on countries real data. Due to the fact it is the start of operationalization

of transparency of lobbying done within one category and indicators do not fill the other categories yet, moving some indicators between the categories in the future is possible.

The author knows the proposed indicators are limited in some respect. They mostly serves as proxy variables but still the approach is to find evidence in the real world – to find document, rule, Code, Register etc. that exists or not rather than the approach of soft data (indicators of perception). Moreover, some disputes and questions can be raised upon the definitions of indicators themselves, and maybe missing some other indicators – the author is grateful for any recommendations. And finally, it is true that those indicators could not picture the reality in all details and colours...

## Conclusion

However it seems hard to evaluate transparency of lobbying, the research and this paper made a first step in designing any specific indicators. The preliminary list consists of 31 indicators divided into four logical groups and focuses only on the one side of lobbying contacts – the lobbyists. Majority of indicators can take mostly the binominal value, although some ask for specific numbers. Although the design seems to be very narrow, it is the only small part of the complex issue of transparency of lobbying. In the next step, the categories of targets of lobbying, sunlight rules and monitoring and control have to be filled by other indicators, before they can be applied on a real data.

## Acknowledgment

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Section V

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## **Papers by Doctoral Students**





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## **The Dependence of the Perception of Corruption on the Openness of Data in the European Union**

### **Abstract**

Open data is presented as an accelerator of the economy. Their applications serve to streamline various economic processes such as strategic or innovation management. This fact has been accepted in a number of countries that are already trying to effectively open and publicly access data. Transparency is perceived as an important element of institutional, political and corporate culture. A sufficient level of transparency causes the reduction of corruption rates in individual countries. This is not only about government institutions, but about private companies too. Open data and transparency are closely intertwined. The opening of data should effectively increase transparency and reduce the level of corruption in the countries concerned. For this reason, improving transparency and making data available is part of a series of initiatives that are narrowly targeted to this issue. The question is whether the truly open data influences the level of perceived corruption and thus increases transparency. The aim of the paper is to find out whether there is a dependency between the level of perceived corruption and the level of openness of data in the countries of the European Union through statistical regression analysis. The outcome of the contribution is the statistical demonstration or reversal dependence of the level of perception of corruption at the level of openness of data in the countries of the European Union and secondly the evaluation of the effectiveness of the initiatives supporting the reduction of corruption.

### **Key Words**

*corruption, European Union, open data, regression analysis, transparency*

**JEL Classification: D73, F43, L86**

## **Introduction**

Open data is a new tool that is applied in a variety of business management areas. Among other things, they are considered as a significant means of increasing the transparency and credibility of companies and government institutions. The effort to open data is visible worldwide and it is already taken for granted in many countries. Support for data digitization is evident from a number of initiatives, among the most prominent being Industry 4.0. The aim of the initiatives is to make the meetings of individual institutions more credible through transparent information. The question is whether these initiatives have a real effect. So whether opening the data actually increases transparency. (Rajshree and Srivastava, 2012)

The basic feature of the open data is their free availability. Data is open to all businesses, institutions and private individuals. These are data from a wide range of areas of economics, research, statistics, etc. Data is published in electronic form, allowing for free distribution and sharing of as many entities as possible. (OKI, 2017) The most important benefit of open data is the ability to share and analyze them. This resulted in increased efficiency of economic processes. (MV ČR, 2017)

According to Lindstedt and Naurin (2010), transparency represents reliable and publicly available information about negotiations. All the key facts, including economic data, are available. This may not only concern public institutions as it is often presented. A certain proportion of private companies publish their dealings with an emphasis on the transparency of the negotiations. This usually results in building a company goodwill.

Janssen (2012) states that open data is more widely used in the public sector. In the private sector, data is to some extent perceived as a problem in the form of disclosure or know-how. For this reason, some processes are less transparent and may be seduced by corrupt behavior. It suffers from transparency, even in negotiations between a public institution and a private company (eg inadequate prices, problematic contract parameters, etc.)

Both corporate and institutional transparency are linked to the concept of corruption. Unfortunately, this is something that is perfectly part of today's "culture" at the level of the private and public sectors. The question is whether the transparency of individual steps, accounting and other elements in the form of open data can at least partially prevent corruption. (Shim and Eom, 2008)

## **1. Methods of Research**

The main research question of the contribution is: Does the level of perception of corruption in the countries of the European Union depends on the quality of open data in the countries concerned?

The aim of the paper is to statistically prove or to overcome the dependence between the given variables, ie between the state of corruption and the level of openness of data in the given country. The contribution includes literary research, analysis of acquired data and application of statistical regression analysis methods. For the purpose of research, world-recognized quantifiers have been selected to adequately assess the quality of data openness and the level of perception of corruption in a given country. The first indicator is the Open Data Barometer (ODB), which comprehensively evaluates the quality and extent of data openness in individual countries, where 100 points are the maximum value (highest quality) and the lowest is zero (no negative points can be obtained). The second indicator is the Corruption Perceptions Index (CPI), where again countries with the lowest perceived corruption can get up to 100 points, at least zero.

Totally, Open Data Barometer records 92 countries, but there are 19 countries of the European Union only. Specifically, there aren't Bulgaria, Croatia, Cyprus, Lithuania, Latvia, Luxembourg, Malta, Romania and Slovenia. Therefore, these countries are not included in the research. The figures date back to 2015, as data from ODB are not yet available for 2016. The dates of the listed countries are shown in Tab. 1.

**Tab. 1: European Union Countries data of ODB and CPI**

| Country         | ODB   | CPI | Country        | ODB   | CPI |
|-----------------|-------|-----|----------------|-------|-----|
| Great Britain   | 100   | 81  | Belgium        | 52.62 | 77  |
| France          | 81.65 | 70  | Estonia        | 50.63 | 70  |
| Denmark         | 76.62 | 91  | Czech Republic | 49.15 | 56  |
| The Netherlands | 75.13 | 87  | Ireland        | 46.53 | 75  |
| Sweden          | 69.26 | 89  | Portugal       | 41.38 | 63  |
| Finland         | 65.45 | 90  | Poland         | 39.95 | 62  |
| Germany         | 64.79 | 81  | Greece         | 38.48 | 46  |
| Spain           | 64.35 | 58  | Slovakia       | 37.16 | 51  |
| Austria         | 64.18 | 76  | Hungary        | 25.54 | 51  |
| Italy           | 53.78 | 44  |                |       |     |

Source: authors' own calculations, data from (ODB, 2016) and (TI, 2016)

## 2. Results of the Research

The paper focuses on the study of the unilateral dependence of numerical variables, therefore regression analysis was chosen as a method of investigation. In the first step, it was necessary to choose a suitable model.

**Tab. 2: Alternative models for regression analysis by R-Squared**

| Model                       | Correlation | R-Squared | Model                      | Correlation | R-Squared |
|-----------------------------|-------------|-----------|----------------------------|-------------|-----------|
| Squared-Y logarithmic-X     | 0.6933      | 48.06%    | Reciprocal-Y logarithmic-X | -0.6633     | 43.99%    |
| Logarithmic-X               | 0.6928      | 48.00%    | Exponential                | 0.6629      | 43.94%    |
| Squared-Y square root-X     | 0.6892      | 47.50%    | S-curve model              | -0.6626     | 43.91%    |
| Square root-Y logarithmic-X | 0.6891      | 47.49%    | Reciprocal-Y square root-X | -0.6576     | 43.24%    |
| Square root-X               | 0.688       | 47.33%    | Double reciprocal          | 0.645       | 41.60%    |
| Double square root          | 0.684       | 46.78%    | Reciprocal-Y               | -0.6431     | 41.36%    |
| Multiplicative              | 0.6829      | 46.64%    | Double squared             | 0.6231      | 38.82%    |
| Logarithmic-Y square root-X | 0.6776      | 45.91%    | Squared-X                  | 0.6218      | 38.66%    |
| Squared-Y                   | 0.675       | 45.57%    | Square root-Y squared-X    | 0.618       | 38.20%    |
| Linear                      | 0.6734      | 45.35%    | Logarithmic-Y squared-X    | 0.6122      | 37.48%    |
| Reciprocal-X                | -0.6701     | 44.91%    | Reciprocal-Y squared-X     | -0.5942     | 35.31%    |
| Square root-Y               | 0.6693      | 44.79%    | Logistic                   | <no fit>    |           |
| Squared-Y reciprocal-X      | -0.6682     | 44.65%    | Log probit                 | <no fit>    |           |
| Square root-Y reciprocal-X  | -0.6676     | 44.57%    |                            |             |           |

Source: authors' calculations in Statgraphics Centurion XVII

Subsequently, the regression line equation was determined. The third step involved assessing the suitability of parameters (partial t-tests). Consequently, if the whole test is appropriate, it is possible to test and prove the dependence of the variables. The materiality level was set at 5 %. The final step is to measure the dependency force using the Index of determination. As suitable model is selected based on the indexes of determination in Tab. 2. Given very similar values ranging between 40 and 48 percent, it is advisable to choose a simple linear model.

Tab. 3 and Tab. 4 show the specific statistical outputs applied in the next intermediate steps of analyzing the dependence of variables. Tab. 3 shows the individual statistical parameters of the partial parameters. Tab. 4 sums up the data for the overall model of dependency analysis.

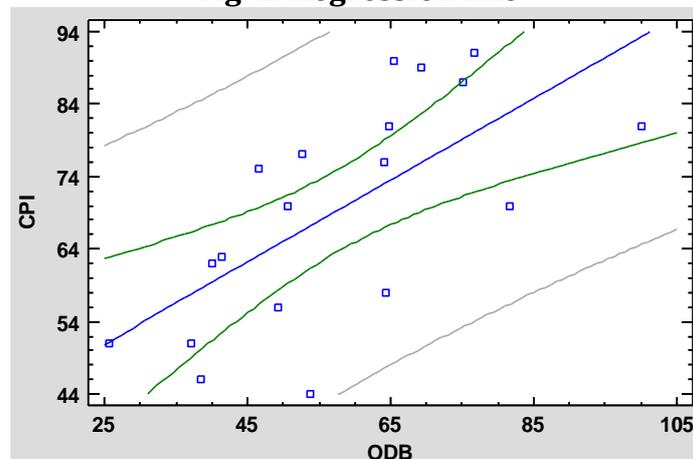
**Tab.3: The individual statistical parameters of the partial parameters**

| Parameter | Least Squares Estimate | Standard Error | T Statistic | P-Value |
|-----------|------------------------|----------------|-------------|---------|
| Intercept | 36.7464                | 9.09161        | 4.04179     | 0.0008  |
| Slope     | 0.565193               | 0.150488       | 3.75574     | 0.0016  |

Source: authors' calculations in Statgraphics Centurion XVII

The equation of the regression line is given by  $CPI = 36.7464 + 0.565193 \times ODB$ , based on the data (Estimate) mentioned above in Tab. 3. This relationship can also be represented graphically (see Fig.1).

**Fig. 1: Regression line**



Source: authors' calculations in Statgraphics Centurion XVII

**Tab.4: The individual statistical parameters for the overall model**

| Source        | Sum of Squares | Df | Mean Square | F-Ratio | P-Value |
|---------------|----------------|----|-------------|---------|---------|
| Model         | 1932.9         | 1  | 1932.9      | 14.11   | 0.0016  |
| Residual      | 2329.52        | 17 | 137.031     |         |         |
| Total (Corr.) | 4262.42        | 18 |             |         |         |

Source: authors' calculations in Statgraphics Centurion XVII

It is also necessary to perform a test of the individual partial parameters. In the first step, it is necessary to correctly define the hypotheses  $H_0$  and  $H_1$  and consequently their rejection or acceptance at a significance level of 5% (compared to P – Values from Tab. 3).

**$\beta_0$  parameter test:**  $H_0: \beta_0 = 0$   $H_1: \beta_0 \neq 0$   
P-Value = 0.0008 <  $\alpha = 0.05$   
 $H_0$  rejected,  $H_1$  accepted => parameter  $\beta_0$  is statistically significant.

**$\beta_1$  parameter test:**  $H_0: \beta_1 = 0$   $H_1: \beta_1 \neq 0$   
P-Value = 0.0016 <  $\alpha = 0.05$   
 $H_0$  rejected,  $H_1$  accepted => parameter  $\beta_0$  is statistically significant.

Finally, the total F-test is performed and the dependence strength is measured using the index of determination. The figures are based on the data from Tab. 2 (index of determination  $I^2$  / R-Squared) and from Tab. 4 (P-Value).

**$H_0$ :** The corruption perception index does not depend on the level of openness of the data.  
 **$H_1$ :** non  $H_0$   
P-Value = 0.0016 <  $\alpha = 0.05$   
 $H_0$  rejected,  $H_1$  accepted => dependence was statistically proven.  
 $I^2 = 45.3475 \%$

Based on the results of partial t-tests, both parameters can be considered as statistically significant, so the model used can be considered relevant. Relationship between variables has been proven. The index of determination is close to 50%, so that represent a moderate dependencies.

### 3. Discussion

Zuiderwijk (2015) mentions that a large proportion of institutions and businesses still consider data opening to be problematic. Excessive disclosure of information may, in their view, jeopardize their strategy. Excessive data coverage may, however, threaten the company or institution in terms of its credibility. In the public sector, there is a need to make the processes more transparent. But also in the private sector, the opening of, at least, selected data is very important. And it is closely related to establishing business contacts and maintaining customer loyalty.

In the European Union, the current situation identifies the efforts of many initiatives. Open data support needs to be targeted and really focused on increasing transparency. These initiatives are few, but their impact is at least controversial. (Lathrop and Ruma, 2010) Based on the analysis of this paper, it can be said that, in the European Union, the initiative of opening data reduces the perception of corruption, so the initiatives really make sense. Limit of research is the fact that there are more indicators of the effectiveness of the data opening (e.g. the Open Data Index) and indicators of the level of corruption (e.g. the Corruption Perception Index). Research is still relevant, but for this reason there

is a certain likelihood that dependence will not be demonstrated for other applied variables.

Nevertheless, it is clear from the available data that most EU countries are only at the beginning of the journey from the point of view of effective transparency of individual bodies. The assessment of a number of countries in terms of data opening is average to below average. This is also related to the relatively high perception of corruption. Therefore, initiatives need to be made more effective and targeted to specific groups. Above all, emphasize the positive effects of opening data and increase transparency for the overall economy as well as for individual market players.

## **Conclusion**

The statistical survey was conducted at the level of the European Union countries. Dependence of the level of perception of corruption at the level of openness was tested.

Clearly, this dependence has been proven. Therefore, the more quantity and better quality of the data opens, the less perceptions of corruption in the country are, and the effect is positive. The model is suitable for partial tests and therefore dependence can be considered as proven. Moreover, in this case, there was determined a moderate level of dependence by the index of determination.

From the point of view of the research results, the positive impact of open data on the level of corruption perception can be estimated. Further research would offer the option of extending research to multiple indicators and comprehensively assessing the impact of open data on the transparency of political and business processes. Another option is to link open data with corporate social responsibility in comparison with the level of corruption (deeper interdependence of individual effects).

The results point to the positive targeting of individual initiatives, ie the opening of the data has a real impact on reducing perceived corruption and then increasing the transparency of economic processes in individual countries. Support for the opening of data should therefore be constant and intense so that the transparency of the economy becomes an integral part of the market culture.

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## **Overestimation of Terrorist Risks and Its Impact on Public Policy in the Czech Republic**

### **Abstract**

Research journals and institutions recently published lots of different research articles and reports related to disproportioned public spending on counterterrorism in the United States and the disability of the American governance to evaluate the likelihood of terrorist attacks rationally. Some of the studies and their conclusions became very popular even in the Czech mainstream media and American counter-terrorist public spending became an example of irrational decision-making. This article provides a brief summary of American counterterrorist measures based on the cost per saved life analysis and using risk perception data of Institute of Sociology at The Czech Academy of Sciences discusses the fear of terrorism which could have a potential for similarly disproportioned public spending in the Czech Republic. Then, based on a review of strategic plans and data of Ministry of Defense of the Czech Republic, Ministry of the Interior of the Czech Republic and Transport Research Centre in the Czech Republic, follows the list of newly introduced counterterrorist measures in the Czech Republic and the cost per saved life analysis evaluating the public spending on domestic counterterrorism in Czech Republic and the total Czech expenditure for the War on Terror. The main purpose of this paper is to analyze the adequacy of Czech counterterrorist measures and confirm that disproportioned public spending on counterterrorism is not just the problem of the United States of America, but also of the Czech Republic.

### **Key Words**

*terrorism, public policy, risk perception, decision-making*

**JEL Classification: D81, J18**

## **Introduction**

Public institutions are responsible for spending funds in a manner that most effectively and efficiently keeps its people safe and for taking actions which have a good chance to divert life-threatening risks its population is facing. The number of potential life-threatening risks is enormous (from diseases, accidents and crimes to wide range of natural disasters) and the funds available for this purpose are limited. Moreover, there are inevitable distortions stemming from public and personal emotion and from political pressures. One of the distortions which evoke disproportionate fear and anxiety is terrorism. (Mueller, Stevart, 2014; Kahneman 2011) No wonder this fear and anxiety of general public is transmitted also on decision-making of public institutions which can therefore spend on counterterrorist measures disproportional amount of money.

Research journals and institutions recently published different research articles and reports related to the inefficient public spending on security in the United States and the disability of the American governance to evaluate the likelihood of terrorist attacks rationally. (Mueller, Stewart, 2014; Brooks, Manza, 2013; Lint, Kassa, 2015) Normally, regulators and administrators in the US begin to become extremely unwilling to spend over \$10 million to save a life, preferring instead to expend funds on alternative measures that save lives at a lower cost. But in case of domestic counterterrorism they spend \$100 billion per year, meaning they should prevent the death of at least 10 000 people annually to justify such a spending. (Mueller, Stevart, 2014) Since 2001 (2996 victims during the attacks from 9/11) the probability of death caused by terrorism in the US is lower than the probability of death caused by lightning, making such a spending on domestic counterterrorism disproportioned. In the fifteen years after 9/11, jihadists have killed 95 people, while the lightning 735 people. (GTD, 2017)

Even in the unusual context of 2001, the risk of dying from terrorism in the US was one in 100 000. That contrasts with higher risks of other causes of deaths like homicide (one in 22 000), traffic accident (one in 8 000) and cancer-related fatalities (one in 540). (Brooks, Manza, 2013) The attacks on the World Trade Centre and Pentagon in 2001 did not lead just to higher spending on domestic counterterrorism (for example \$ 589 billion spent on the Homeland Security Department). The attacks in 2001 also led to the so called “War on Terror” in Afghanistan, causing further costs (\$1.6 trillion spent on war funding and \$867 billion spent on future veterans’ care) and adding the total cost of 2001 attacks up to \$ 3.3 trillion. (Sorkin, 2015)

The method of this article is based on the risk perception data of Institute of Sociology at The Czech Academy of Sciences (SÚ AV ČR, 2015). We try to find out the potential for fear of terrorism, which could lead to similarly disproportioned public spending in the Czech Republic. Furthermore, using the cost per saved life methodology we evaluate the public spending on domestic counterterrorism and total expenditure for the Czech involvement in the War on Terror in Afghanistan. For this evaluation, data of Ministry of Defense of the Czech Republic (MO ČR, 2017), Ministry of the Interior of the Czech Republic (MV ČR, 2017) and Transport Research Centre (CDV, 2015) in the Czech Republic will be used. The main goal of this paper is to analyze the adequacy of Czech counterterrorist measures and find out if Czech counterterrorist expenditures are connected with similar scale of controversy as the counterterrorist measures in the United States mentioned above.

## **1. Methods of Research**

Terrorism is a hazard to human life, and it should be dealt with in a manner similar to other hazards. One of the ways to analyze the cost of an institutional change or a safety measure connected with counterterrorism is the „*cost per saved life*“, which defines how much it will cost under the new proposal to save a single life. This cost per saved life is than compared with the economic value of human life, which is based on the assumption that the loss of a human life due to an accident is a loss not only for the victims themselves

and their closest, but also for the state and the overall society causing lower tax revenues, lower productivity and lower spending leading to decline of GDP. (Mueller, Stevart, 2014)

For example, the U.S. Department of Transportation appraised the life of one American citizen on \$9, 4 million in 2015. (Rogoff, Thomson, 2014) This leads to the fact that in the U. S., where the economic value of human life is stated around \$9, 4 million, regulators and administrators generally begin to become extremely unwilling to spend over \$10 million to save a life, preferring instead to expend funds on alternative measures that save lives at a lower cost. (Mueller, Stevart, 2014) If we compare this economic value of human life of an American citizen with the real domestic counterterrorist spending (about \$100 billion per year), we get the U.S. government should prevent between 10 000 to 11 000 terrorism deaths in the county each year. Using this methodology for the total cost of the “War on Terror” (including the War in Afghanistan) with funds of \$3, 3 trillion we get that, if efficient, all these measures should save the minimum of 351 000 human life’s in the U.S. If we compare these 351 000 potentially saved human lives with the real U.S. statistics (95 victims of terrorist attacks in the last 15 years) we can speak about financial inadequacy of U.S. counterterrorist funding. (Of course, it is possible there would be more victims if fewer measures were implemented; despite this fact there is still a huge cost exaggeration). The goal of this paper is to use the same methodology for evaluating the adequacy of counterterrorist measures in the Czech Republic.

We will firstly carry out thorough research of open government data and strategic security conceptions in the Czech Republic and prepare a list of recent counterterrorist measures, which has been already implemented or can be implemented in the Czech Republic in near future. Subsequently follows the cost per saved life analysis for each counterterrorist measure. The Czech counterpart of U.S. Department of Transportation (Transport Research Centre in the Czech Republic) has calculated the economic value of human life in the Czech Republic for the year 2015 at 20 881 000 CZK, about \$ 829 692 if we recount this figure from 2015 in the Czech Republic by exchange rate from April 2017. This economic value of human life in the Czech Republic will be used for cost per saved life analysis of domestic counter-terrorism measures and also for the overall involvement of the Czech Republic in the War on Terror in Afghanistan. (CDV, 2015)

## **2. Importance of counter-terrorist steps in the Czech Republic**

Between 2001 and 2015, 571 people died (on average 38 victims a year) in all Western Europe in connection with terrorism. In the Czech Republic, there was no terrorist attack at all. (GTD, 2016) Despite this low probability of death from terrorist threats, the majority of the Czech population felt more threatened by terrorism than by illness or losing a family member, child or partner in 2015. (SÚ AV ČR, 2015)

**Tab. 1: The survey of concerns among the Czech public (from a variety of concerns respondents have always chosen two biggest concerns; for the purposes of this article, the table was reduced to the most frequent concerns).**

| What Czech citizens worry about the most?                             | Expressed in percentage |
|---|-------------------------|
| terrorism   | 22 %                    |
| illness   | 20 %                    |
| unemployment  | 13 %                    |
| crime, security   | 8 %                     |
| concerns about family, children, partner, friends, about their health | 7 %                     |
| natural disasters   | 2 %                     |

*Source: (SÚ AV ČR, 2015)*

According to the survey results of Institute of Sociology, 81% (2015) and 71% (2016) of the population regarded terrorism as a major threat. Fear of terrorist groups or individuals was during the survey in 2015 and 2016 the most widely widespread concern among the Czech population. (SÚ AV ČR, 2015, 2016)

This irrational fear of terrorism has a big potential to be used for political purposes and it can be an important influence on policies and measures, which are and will be taken by public authorities. Especially the populists are feeding on the fear that current governments cannot or will not keep their citizens safe and call for a complete shutdown of Czech borders for Muslims and further measures. (The Economist, 2015) Since the fear of terrorism is so widespread, the reaction of the government in power is needed.

There is neither a coherent political strategy nor an unmistakable political consensus on European level regarding counterterrorism. On the contrary, previous studies revealed a methodological nationalism, jumble of ethically inconsistent and practically contradictory measures taken by ruling governments in Europe. Because of this incoherent and fragmented counterterrorism agenda in Europe, it is the reaction of Czech national government, which is by fear of terrorism threatened population strongly expected. (O'Brien, 2017)

### **3. Results of Research – Czech domestic counterterrorism measures**

Because of the widely spread fear among Czech population, the reaction on terrorist attacks in Western Europe was needed. An important step for the Czech counterterrorist agenda was the establishment of the National Focal Point for Terrorism (NKBT), launched on 30<sup>th</sup> of March 2009 at the Unit for Combating Organized Crime of the Criminal Police and Investigation of the Police of the Czech Republic. NKBT department is engaged in collecting, evaluating, analyzing and processing information that are related to the issues of terrorism and radicalism. The cost of setting up NKBT amounted to 21 million and the estimate of its regular operation at 15 - 20 million CZK a year. (MV ČR, 2013) Using the cost per saved life analysis, this NKBT center is efficient if it saves approximately one human life annually.

In January 2016, the Czech government has introduced a four-stage warning system focusing on the threat of terrorism. The introduction of this warning system was a response to the terrorist attacks in Paris in 2015. The main shortcoming of the introduced warning system is the absence of concrete measures connected with particular security stages. This warning system presents rather a symbolic designation of terrorist threats by colors, which works as a tool for communication with public rather than a real tool for state's safety and rescue system. This measure is not connected with costs, which are worth mentioning (MV ČR, 2017a)

Also, the Centre against Terrorism and Hybrid Threats started operating on 1<sup>st</sup> January 2017. The center was formed within an existing department using the budget of the Ministry of the Interior with up to 20 employees. The main purpose of this center is not just counterterrorism and therefore these costs cannot be estimated. (MV ČR, 2017b)

The Ministry of the Interior has proposed amendments to the Constitutional Law on Security of the Czech Republic, which states: "*Citizens of the Czech Republic have the right to acquire, keep and bear arms and ammunition in order to protect the lives, health and property and thus to contribute to securing internal order and security and protection of the territorial integrity, sovereignty and the democratic foundations of the Czech Republic. The conditions and details are provided by law.*" The main reason for this amendment is according to the head of the Ministry of the Interior to provide citizens with a constitutional right to shoot terrorists. (ČT, 2017) This amendment has not yet been approved.

All these institutional measures were financed by standard budgetary resources and National Focal Point for Terrorism and Centre against Terrorism and Hybrid Threats were established within already existing institutions meaning lower financial demands. More expensive than institutional changes was an immediate deployment of security forces immediately after the attacks in Western Europe. For example, after the terrorist attacks in Brussels (March 2016) the Czech government deployed for two months several hundred soldiers who were patrolling together with the police in three biggest cities – Prague (350 soldiers), Brno (100 soldiers) and Ostrava (100 soldiers). Further security measures followed after the terrorist attack in Berlin (December 2016) when enhanced police patrols (about 500 policemen) were sent to streets of Czech cities to protect busy locations (such as Christmas markets in larger cities) or make barriers in important locations (for example the Prague Wenceslas Square). All these immediate actions ranged in the tens of millions of CZK. For example, the immediate police patrol deployed after the terrorist attack in Berlin was estimated at 30 million CZK (\$ 1 191 422). Using the cost per saved life analysis these funds should serve for saving 1, 4 human lives.

Since 2001, the number of cameras and security scanners at the entrance to the state institutions has also increased considerably. Counterterrorism is usually just one reason for their implementation. Also, it is not possible to quantify their total number and the staff costs for those, who take care of them, as the relevant data are not available. At this level of the fight against terrorism we deal with an asymmetry of information and only

pieces of data can be found. For example, for the protection of Prague Castle, the Security Committee approved 100 million CZK (over \$ 4 million) a year.

In conclusion, the financial value of measures connected with domestic counterterrorism does not exceed the Czech economic value of human life as much as in the United States, although it is difficult to obtain exact data. On the other hand, the introduced measures are definitely not in balance with the cost per saved life analysis, either.

#### **4. Results of Research – Czech involvement in Afghanistan**

The most expensive item of American counterterrorist measures was the funding of the war in Afghanistan (\$1.6 trillion), which followed as a War on Terror shortly after 9/11 attacks. If we also include this financial item as part of the Czech counterterrorist policy (Czech Republic also supported the War on Terror in Afghanistan), we come across much bigger overestimation than in the case of Czech domestic counterterrorism. Only in the year 2015 the cost of Czech participation in mission International Security Assistance Force (ISAF) in Afghanistan was 907.39 million CZK (\$ 36.66 million). And the year 2015 was quite sparing compared to the year 2009 for example, when Czech authorities had spent on mission ISAF in Afghanistan 2.17 billion CZK or \$ 87.68 million (should serve as a prevention of 104 deaths). The total Czech expenditure for the War on Terror in Afghanistan between 2002 and 2016 amounted to 14.307 billion CZK (\$ 578 million) and using the cost per saved life analysis (with the economic value of human life at 20 881 000 CZK for 2015 and neglecting inflation) we get that such a spending is appropriate when preventing the death of the minimum of 685 people. (MO ČR, 2017)

#### **5. Discussion**

Including the Czech participation in the war in Afghanistan as a counterterrorist measure can be questionable. Although there was an official declaration of Czech officials describing the War on Terror as a main objective of Czech involvement in Afghanistan, fighting terrorism could be only secondary objective. From the political perspective, Czech Republic, a middle-sized state in the midst of Europe with the experience of occupation, needs a strong ally and therefore fulfilling commitments to its foreign partners from the organization NATO can be important for its security. The motivation of the Czech Republic to participate in the War on Terror in Afghanistan can be therefore very different from the motivation of the U.S. It would be a mistake to look at the Czech mission in Afghanistan from purely economic and cost per saved life perspective. The aim of this paper, however, is to point out the overall controversy of the war in Afghanistan as a suitable Czech anti-terrorist instrument.

Also, it is important to note a significant difference between the economic value of human life in the United States and in the Czech Republic, which makes the cost per saved life analysis for the Czech policy-makers much stricter. This difference in economic value of

human life does not depend only on disparity of welfare and prosperity (the GDP per capita for the year 2015 was \$ 56 115.7 in the United States and \$ 33 770.5 in the Czech Republic, meaning that the economic value of Czech life should be at worst half of the American one), but also in the methodology of Transport Research Centre in the Czech Republic and its American counterpart. Czech authorities operate with “human capital” approach based on models of economic productivity, thus producing relatively low economic values of human life. On the other hand, the US federal agencies operate with a “willingness to pay” approach reflecting consumer choice and producing much higher values. (Rogoff, Thomson, 2014)

## **Conclusion**

Although there has been no single terrorist attack in the Czech Republic, and even in Western Europe, such deaths are rare (about 38 deaths per year), Czech population suffers from a disproportionate fear of terrorism and therefore there is a huge potential for taking irrational counterterrorist actions of similar scale as in the United States. It is not easy for a rational policy-maker to act. The fear of terrorism is so widespread that if no counterterrorist actions are taken, the policy-makers automatically give space to populists. And on the other hand, the valuable funds devoted to irrational counterterrorist measures can be missed elsewhere causing real casualties.

Although Czech costs of domestic counterterrorist actions do not meet the expectations of cost per saved life analysis, they are far from being as exaggerated as in the United States. Some of the implemented measures like “change of the constitution” or “four-stage warning system” are not financially demanding at all, and the institutional changes like establishing Centre against Terrorism and Hybrid Threats and National Focal Point for Terrorism were financed by standard budgetary resources established within already existing institutions meaning lower financial demands.

Much more controversial is the security forces deployment and especially the Czech involvement in the War in Afghanistan, which has cost more than 14 billion CZK (\$600 million) since 2002. Such financial means would normally save life of 685 people at least, according to cost per saved life analysis. If this huge investment was motivated only by counterterrorism, it would be clearly inadequate public spending. In conclusion, inadequate public spending on counterterrorism is not just the problem of the United States of America, but also of the Czech Republic. But it is also important to note that the impact of the overestimation of terrorist risks in the Czech Republic is far from being as extreme as in the U.S., nevertheless represents a real challenge for Czech policy-makers.

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## **Succession and Other Goals of Family Businesses: A Study of Selected Czech SMEs**

### **Abstract**

This article presents selected results of a pilot survey and concerns an ownership aspect, concretely a family ownership in relation with goals of the company. One of the mentioned goals is also “to hand over the company”. This goal is often neglected. The article shows differences in goals between small and medium-sized family companies. Next, it describes correlations among goals, and if the type of manager influences these goals. Surprisingly, results did not confirm that goals are influenced by the type of manager. However, the link among the goals was found. Finally, the article shows if the goal of succession is dependent on years of the company on the market, or on a number of generations managing the company. Respondents were especially companies with the first or second family generation in the management. Nowadays, family companies are at the stage where it is necessary to mention about the succession. Nevertheless, results show that in most cases companies do not attach importance to the goal “to transfer the company to the next generation”.

### **Key Words**

*family business, goals, succession, Czech Republic, SMEs*

**JEL Classification: G32, L20, M12**

## **Introduction**

Business goals are different from country to country. They are dependent on the culture, social and political traditions of the country. There are no globally universal business goals (Hofstede et al., 2002). Therefore it is important to distinguish firm objectives between countries and looking for specifics of business goals in the Czech Republic. Family businesses are companies where is a different ownership or management structure than in case of non-family firms. What is the most important is a family control, i.e., a level of family involvement in a firm. At the same time, in family firms there is the wish to pass the business to future family generations (Zellweger, 2017).

Sharma and Dave (2014, p. 151) have stated: “*Due to family involvement, the goals and objectives of a family business are likely to be quite different from the firm-value maximization goal assumed for publicly held and professionally managed non-family firms.*” Further, according to them family businesses have rather multiple, complex and changing goals than a singular, simple and constant goals. A manager influences goals of the

company and Odehnalová (2011) have stated that management is different in the development phases of the firm. Hence, these phases influence goals of the enterprise.

Results from the primary survey of Rydvalová et al. (2015) showed that family businesses invest into the development of current activities in “good times“. But when there is a problem in the business, families try to keep the family's influence even at the cost of the lower living standards. Family businesses focus on the future rather than on short-term profit (Rydvalová et al., 2015; PWC, 2014).

## 1. Methods of Research

This article describes results of a pilot survey which was based on primary data collected in NUTS II Northeast (Czech Republic) in 2016. Respondents were small, medium-sized and large companies (listed in the Bisnode MagnusWeb database) which were on the market at least 5 years and their e-mail address was available. Respondents received an e-mail with the attached MS Word document and also with the link to the web interface (the link was created extra for each respondent). Return of these questionnaires was 3.25%.

The pilot survey then included 117 companies, of which 56 companies identified themselves as family businesses and 47 as non-family ones. 14 companies did not express their status of the ownership structure. 54.70% of respondents were small enterprises, 42.74% of them were medium-sized companies and only 2.56% were large companies. Most of these small companies were family businesses (53.12%). In case of medium-sized companies, 44.00% of them were family firms. No family firm was a large company. As family firms were considered companies which identified themselves as family businesses. Binek et al. (2011) presented an expert estimation where small and medium-sized enterprises (SMEs) were over 99% of all Czech companies, and family businesses represented 50-60% of small and medium-sized companies in the Czech Republic. Therefore, for a family-business research in the Czech Republic, there are important responses especially of SMEs.

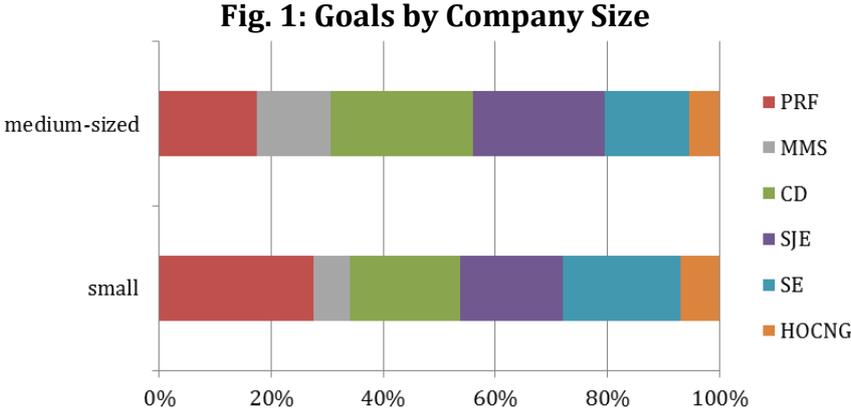
In the questionnaire there were following goals: “to provide resources to the family” (PRF), “maximization of the market share” (MMS), “company development” (CD), “to secure jobs for employees” (SJE), “sustainability of the enterprise” (SE), “to hand over the company to the next generation” (HOCNG). Firms divided ten points among these goals by importance. Following research questions were addressed:

- **RQ1:** Does exist correlation between goals and the type of manager (family or non-family)?
- **RQ2:** Is there any correlation among goals?
- **RQ3:** Is the goal “to hand over the company” (HOCNG) dependent on a number of family generations?
- **RQ4:** Is the goal of succession (HOCNG) dependent on years of the company on the market?

Two types of programs were used for evaluating data. In case of descriptive statistics, it was used MS Excel and Statgraphics Centurion (SGP). Besides descriptive statistics there were used analysis methods. This evaluation was processed in SGP. Where missing data appeared, pairwise method was applied. For addressing research questions were used dependence analyses. Alternative variables were transferred into the binary form. Data was tested on normal distribution. Because of the negative outcome it was not possible to apply the ANOVA method. Therefore the non-parametric Kruskal-Wallis test was used in case of RQ3 and RQ4. For finding correlations in RQ1 and RQ2 there was used multiple-variable analysis.

## 2. Results of the Research

This part presents results of descriptive statistics and results of dependence analysis. Concretely, if there exists correlation between goals above and the type of manager. Then, if there is any correlation among goals. Finally, if number of years on the market and a number of family generations managing the company influence the goal “to hand over the company”. Four family companies did not answer the question of goals. Next firm had to be excluded because it did not fill out the questionnaire correctly. Results in this article consist of answers from 51 family businesses.



*Source: authors' own calculations*

Figure 1 above shows how much important are goals for small and medium-sized enterprises (sum of points for each goal). To provide resources to the family is more important for small companies. On the other hand, medium-sized companies focus more on company development and to secure jobs for employees.

### 2.1 Correlation between Goals and the Type of Manager

This part presents correlation between the goals mentioned above and the type of manager (family or non-family). Table 1 bellow shows the results. P-Value is greater than 0.05 that means there are not statistically significant correlations at the 95% confidence level.

**Tab. 1: Correlation between Goals and the Type of Manager**

| RQ1         | PRF     | MMS    | CD     | SJE    | SE      | HOCNG   |
|-------------|---------|--------|--------|--------|---------|---------|
| Correlation | -0.1477 | 0.0749 | 0.1849 | 0.1624 | -0.2133 | -0.1631 |
| P-Value     | 0.3011  | 0.6016 | 0.1939 | 0.2549 | 0.1329  | 0.2529  |

Source: authors' own calculations (processed in SGP)

Miller et al. (2013) have stated that on the one hand, there is a stewardship advantage. Family managers are especially attached to their firm and loyal to it. They are working assiduously to manage for the long-run by investing generously in capabilities, employees, and stakeholdery partnerships. On the other hand, there may exists a costly stewardship. Family managers are stewards not of the business but of their immediate family. They may behave with unrequited altruism toward family members, who may not deserve their positions or their rewards, and such unrewarded beneficence can harm a business.

On the basis mentioned above, it was assumed that goals are influenced by the type of manager manager. Concretely, that “to provide resources to the family” (PRF), “to secure jobs for employees” (SJE), “sustainability of the entreprise” (SE) and “to hand over the company to the next generation” (HOCNG) are goals typical for family managers. These assumptions were not filled.

## 2.2 Correlation among Goals

This part presents correlation among individual goals. Table 2 shows the results. In most cases P-Value is greater than 0.05: there are not statistically significant correlations at the 95% confidence level. Correlation was found in case of PRF (to provide resources to the family) with SJE (to secure jobs for employees) and with SE (sustainability of the enterprise). Pearson's coefficients indicate indirect correlations and have values of -0.5525 (a middle-strong correlation) in case of SJE and -0.3113 (a weak correlation) in case of SE.

**Tab. 2: Correlation among goals**

| RQ2   | PRF     | MMS     | CD      | SJE     | SE      | HOCNG   | O       |
|-------|---------|---------|---------|---------|---------|---------|---------|
| PRF   |         | -0.1921 | -0.2469 | -0.5525 | -0.3113 | 0.0300  | 0.2367  |
|       |         | 0.1744  | 0.0808  | 0.0001  | 0.0277  | 0.8322  | 0.0941  |
| MMS   | -0.1921 |         | -0.2077 | -0.1833 | -0.1665 | 0.1606  | -0.1095 |
|       | 0.1744  |         | 0.1420  | 0.1948  | 0.2389  | 0.2560  | 0.4387  |
| CD    | -0.2469 | -0.2077 |         | -0.0007 | -0.0488 | -0.0530 | -0.2122 |
|       | 0.0808  | 0.1420  |         | 0.9961  | 0.7302  | 0.7076  | 0.1335  |
| SJE   | -0.5525 | -0.1833 | -0.0007 |         | 0.0653  | -0.1627 | -0.2081 |
|       | 0.0001  | 0.1948  | 0.9961  |         | 0.6443  | 0.2498  | 0.1411  |
| SE    | -0.3113 | -0.1665 | -0.0488 | 0.0653  |         | -0.1845 | -0.2070 |
|       | 0.0277  | 0.2389  | 0.7302  | 0.6443  |         | 0.1920  | 0.1433  |
| HOCNG | 0.0300  | 0.1606  | -0.0530 | -0.1627 | -0.1845 |         | -0.1187 |
|       | 0.8322  | 0.2560  | 0.7076  | 0.2498  | 0.1920  |         | 0.4014  |

Source: authors' own calculations (processed in SGP)

Results show the more (less) important “to provide resources to the family” is for the company, the less (more) important are goals “to secure jobs for employees” and “sustainability of the enterprise”. These results were expected on the basis of a stewardship advantage and a costly stewardship (Miller et al., 2013). Nevertheless, it was also assumed that the goal HOCNG is among these goals which indirectly correlate with PRF.

### 2.3 Dependence analysis: Hand Over the Company

The hypotheses in Table 3 (below) were pronounced. H0 of RQ3 and RQ4 cannot be rejected on the basis on Kruskal-Wallis tests. P-Values are greater than 0.05: there is not a statistically significant difference amongst the medians at the 95.0% confidence level. This survey did not prove that the goal of succession is dependent on the years of the company on the market, or on a number of (family) generations managing the company.

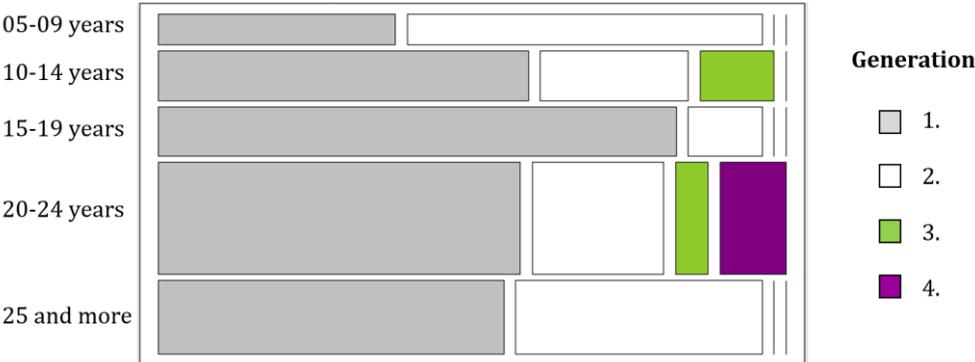
**Tab. 3: Hand Over the Company**

|            | Hypothesis H0   | Test           | P-Value | Dependence       |
|------------|---|----------------|---------|------------------|
| <b>RQ3</b> | The goal “to hand over the company” (HOCNG) is dependent on a number of generenations managing the company. | Kruskal-Wallis | 0.9991  | Do not reject H0 |
| <b>RQ4</b> | The goal of succession (HOCNG) is dependent on years of the company on the market.                          | Kruskal-Wallis | 0.9834  | Do not reject H0 |

*Source: authors’ own calculations (processed in SGP)*

It was assumed that for companies which are on the market for a long time (especially in case of the first generation managing the company), is the goal to transfer the company to the next generation more important than for these that operate on the market for a shorter time. These assumptions were not confirmed. As you can see in Figure 2, most firms were established more than 15 years ago and they are still managed by the first family generation (founders).

**Fig. 2: Mosaic Graph – Generation vs. Years on the Market**



*Source: authors’ own calculations (processed in SGP)*

### **3. Discussion**

According to the teoreical backround, goals of family firms are influenced by many factors like a country, a type of manager (a family manger or a professional non-family manager), economics, development phases of the enterprise, etc. and they change during the time. Results of this research did not confirm the assumption in case of the type of manager. However, there were found links among some goals.

A family business has not long tradition in recent history of the Czech Republic. The tradition was interrupted after the World War II. A business began to develop again after 1989 (Rydvalová et al., 2015). Therefore, there is many companies with the first or second family generation in management. Family companies are at the stage where it is necessary to mention about the succession. Nevertheless, results show that in most cases companies do not attach importance to the goal “to hand over the company to the next generation”.

This study has some limitations. First of all, it is necessary to mention that these results came out of the pilot survey, where is not a big number of respondents. Then, the survey did not distinguish between family businesses founded and family businesses bought. It is not taken into account in the analyses if a family bought the company (did not establish it).

### **Conclusion**

This article have contained selected results of a pilot survey. It has focused on relation between family ownership and goals in selected Czech small and medium-sized companies. The first analysis concerning RQ1 has shown that there is not any correlation between goals and the type of manager. It was assumed that “to provide resources to the family” (PRF), “to secure jobs for employees” (SJE), “sustainability of the entreprise” (SE) and “to hand over the company to the next generation” (HOCNG) are goals influenced by family managers.

The assumed correlations were found in case of RQ2. Results have shown that goal “to provide resources to the family” is indirectly correlated with goals “to secure jobs for employees” and “sustainability of the enterprise”.

The last analyses concern the dependence of succession on years of the company on the market (RQ3) or on a number of family generation managing the company (RQ4). Hypotheses were not approved. Mosaic graph has shown that the most companies are manging by the first generation and lots of them operate on the market for a long time. This tends to the problem with a succession process.

## Acknowledgment

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## **Innovative Marketing: The New Role of Social Influencers**

### **Abstract**

The work addresses the changes social media have brought to business today and deals with the impact these changes have on small businesses. The main part of the work focuses on the trend of social influencers, whose role is gradually evolving. Social influencers are no longer merely a tool for marketing communication and an intermediary of brand marketing of well-known brands; they now are directly involved in brokering sales and thus function as distributors to a certain degree. The work deals with the question of how small businesses can use this trend to increase their ability to compete on the market and presents a sales model that takes into account the new role of social influencers. The proposed model was created on the basis of the theory of autopoiesis, i.e. a system capable of maintaining itself without external help, and also builds on one of the basic principles of general systems theory.

In the second part of the work, a study was conducted between social influencers in the Czech and Slovak republics with the aim of determining the current state of partnerships between social influencers and the commercial sphere and to identify the attitude of the survey participants toward the commission remuneration system on which the proposed innovative model is built. Given the focus of the work on small businesses, the survey addressed social influencers with a small number of fans, i.e. those whose services are not as expensive as in the case of the leading social influencers.

### **Key Words**

*autopoiesis, living systems theory, innovative marketing, online marketing, social influencers*

**JEL Classification: M31**

## **Introduction**

The original theory of autopoiesis is based on the study by Chilean biologist Humberto Maturana, who described the nature of cells as an individual system (Varela, Haturana et al., 1974). The principles of this study have also been applied to other areas of research. The German sociologist Niklas Luhmann applied the idea of autopoiesis in the social sciences and tested whether it is possible to use the general assumptions of the study of living organisms with non-living systems and mechanisms such as the functioning of the economy (Luhmann, 1986). The application of the theory in the economic sciences was further studied and developed. A leading Czech economist living in the USA, Milan Zelený (1981), also embraced the use of the theory.

This work builds on the theory of Professor Zelený, who in his lecture for a Czech audience spoke of the end of the trend of globalising all production and the gradual return to local production and services (Zelený, 2016). The aim of the work is to present a method utilising selected possibilities of innovative marketing to increase the competitiveness of small businesses and thus enable them to take advantage of the trend of returning to local production and services.

## **1. Methods of research**

The work is divided into two parts. The first deals with the creation of a model of current sales possibilities based on the principles of autopoiesis. The second part then involves a survey of the 'fertile soil' for the application of this model for small businesses.

### **1.1 Model proposal**

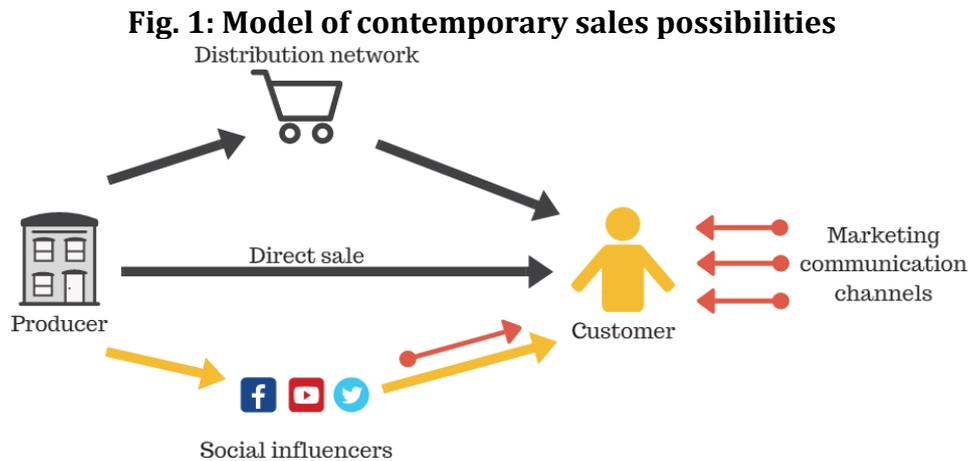
The principles of autopoiesis were used in the creation of the model to ensure that it fulfilled the premise of self-sustainability, i.e. that it was able to exist without expensive external regulation mechanisms that are untenable in the long-term (Zelený, 2016).

The model is proposed on the basis of new marketing trends. The ascent of social media, especially Facebook, has brought great changes in marketing (Hennig-Thurau et al., 2013). Prior to social media, marketing was much more direct and it was essentially impossible to move far off the beaten tracks. Marketing is now far more complex, especially because customers can be in direct interaction with the firm (Deighton, Kornfeld, 2009). Hennig-Thurau et al.(2010) describe this situation very well by comparing contemporary marketing with the game of pinball: nothing is certain and it is essentially impossible to plan anything in advance.

A look at the general sales model shows that the producer has two possibilities for selling: through a broker, i.e. a distribution network, or directly to the customer (B2C) (Huang et al., 2009). However, the possibilities of distribution have expanded with the emergence of new technologies and it is therefore necessary to modify the original model. In the same way that earlier marketing used celebrities and opinion makers for their communication with customers (Choi, Reid, 2015), the online environment has also witnessed the emergence of popular individuals – social influencers – who are being followed on the internet by an increasing number of people and who have in this way obtained great influence on their surroundings (Forbes, 2016).

Large companies use social influencers most often for brand communication and in this manner increase general brand awareness (Uzunoğlu, Kip, 2014). And yet, the use of social influencers is far broader. Customer decision-making on purchases and the search for products has shifted for the most part to the online environment (Chen, Barnes, 2007). Although social influencers are valuable intermediaries for reviews (Lu et al., 2014), with the emergence of internet commission systems, so-called 'affiliate programs' (Duffy, 2005), they

are becoming not only a marketing communication channel (as they have been thus far), but also a link in the distribution network. In the newly created model, social influencers are therefore placed away from channels of marketing communication (indicated with red arrows in the illustration) and stand alone in a separate position (see Fig. 1).



The connection of the proposed model with the principles of autopoiesis is not apparent at first glance and is hidden behind the mutual ties between individual links in the sales chain. According to the basic principles of general systems theory (from which the idea of autopoiesis comes), the stability and reliability of the systems (in this case the *Model of contemporary sales possibilities*) sharply increases with the growing number of elements in the system which, in the case of a failure of one link in the chain, can replace the faulty part (Bureš, 2011). In other words, it is possible to say that thanks to the inclusion of another distribution channel, risk is diversified and the system is capable of maintaining itself without external regulation.

## 1.2 Methodology

The research part of this work focusses on a study of market opportunities, specifically on the offer of social influencers, without whom the proposed model could not be realised. The research was conducted by means of a survey on social media with which the influencers are affiliated. Given that the proposed model is built on the premise that social influencers partially assume the position of distribution by creating a source for direct sales, the questions were composed to primarily determine:

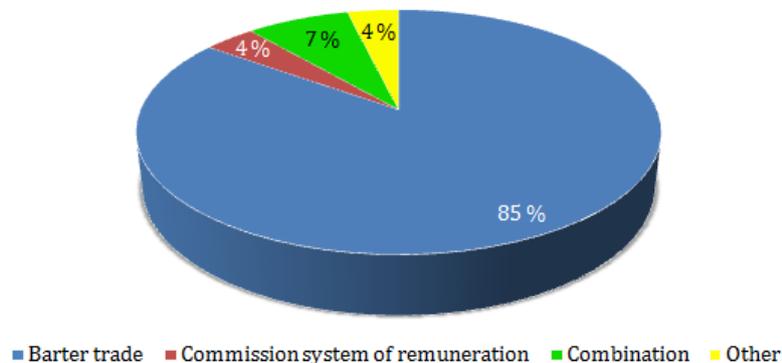
- the current state of established cooperation with social influencers and its nature (specific method of remuneration);
- the attitude of social influencers to the commission system of remuneration;
- the thematic categories of contributions from social influencers.

Due to the focus of the work on increasing the competitive ability of small businesses, who would not be able to afford the services of the greatest influencers, the survey addressed only social influencers with a smaller following.

## 2. Results of the research

A total of 81 respondents participated in the survey, and the results indicated that Czech and Slovak influencers are very active with respect to establishing cooperation with trading partners. Precisely two-thirds of respondents (54) have some sort of established business partnership at present. Nevertheless, the responses also showed that only a small percentage of respondents use the commission system for remuneration (4%) on which the proposed model is based. The most widely-used remuneration method is 'barter trade', i.e. the possibility of keeping the reviewed goods for a shared product post (see Fig. 2).

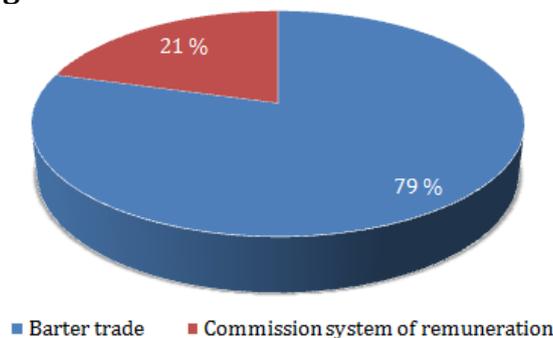
**Fig. 2: Percentage distribution of applied remuneration methods**



*Source: author*

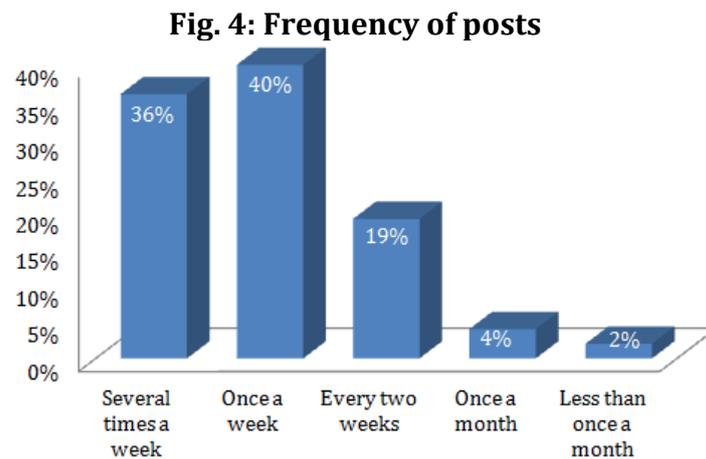
With regard to the actual attitude of social influencers toward the commission system of remuneration, this does not change considerably even in the case that the respondents could choose on their own which remuneration method to pick independent of the trading partner. The preference for barter trade heavily predominates over the possibility of the commission system of remuneration (see Fig. 3). Responses can be influenced by the fact that social influencers fear change (more in Chapter 3).

**Fig. 3: Preferred method of remuneration**



*Source: author*

The final part of the survey addressed the subjects that social influencers focus on and on how often they post. The results showed that the genre focus of the social channels of surveyed influencers is composed of 10 various categories: lifestyle, fashion, beauty, fitness, food, books, travel, hobby, culture and personal. Professionally focused social channels are missing among the categories (instructions, PC, technology...). With respect to the frequency of posting, the survey showed that social influencers are highly active in this regard: 40% post current news at least once a week, 36% even multiple times per week (see Fig. 4).



*Source: author*

### 3. Discussion

The results of the survey are not entirely satisfying from the view of the proposed model. Although the responses showed that Czech and Slovak social influencers are active, for some unknown reason they have a negative view of the commission system of remuneration. This attitude could be the result of inadequate experience with this type of remuneration or, for example, a lack of trust in the commission level. Moreover, for social influencers barter trade represents a particular level of certainty, which can be another reason why respondents fear a change to the commission system, which depends more on their active cooperation with the given partner. The verification of these assertions and ideas for eliminating the practical deficiencies in the proposed model will be the subject of future research.

The result of the thematic focus of channels of social influencers is also good for thought. The survey showed that the proposed model needn't be appropriate for all types of businesses, as the marketing is lacking a higher percentage of social influencers with a professional subject. This raises the question of whether it might be appropriate for small businesses in this segment to focus on creating content that customers search for on their own on the internet.

## Conclusion

The work offers an innovative method for increasing the ability of small businesses to compete. The main idea behind the proposed model is based on the standing of social influencers not only on the side of marketing communication tools, but also on the same level as the distribution network. The model was built on foundations that some businesses already use and explains the functioning of this mechanism in connection with the theory of autopoiesis.

The research part of the work was focused on determining whether the proposed model is applied in business practice. Based on a survey of 80 social influencers, it was found that there are a sufficient number of influencers on Czech and Slovak social media with experience in establishing trade partnerships, while for now only a small percentage of these have experience with playing the role of 'distributor'. The question of changing this situation and whether the proposed model can be functional on a greater scale will be the subject of additional research.

## Acknowledgment

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## **Business Acquisition in the People's Republic of China: Developments and Conditions**

### **Abstract**

During the past years, a decline in M&A activity has been observed in China. The motives for investment activity are subject to changes just as much as the economic basic conditions of the country are under constant change. This is based on the obvious trend of shifting the production based economy to the service based economy. The correlation between the rising production costs and M&A activity in China is examined by a linear regression. Steady modifications of the local legal basis which pursue incentive-supporting goals and which cannot be standardized. Investment risks specific to China find not much room within the sphere of the appropriate literature. The paper demonstrates possibilities to inbound investments into the People's Republic of China before a risk-averse background. Additionally, potentially appearing risks which can find room ex ante in the assessment consideration for future investment decisions are named. Even if within the scope of the present paper not quantifiable, the excursion does point to a higher risk for share deals. In spite of the comparatively higher risks, the People's Republic of China is for foreign investors of a not to be underestimated value. To this result comes the linear regression if merely the last four years of the investigated period flows into the analysis. This is to be judged as a clue for a change in M&A activities in the People's Republic of China with western investor's participation which is based on the changing conditions and can also be classified as approval of politics.

### **Key Words**

*share deal, asset deal, M&A China, Investment China*

**JEL Classification: G11, G24, G44**

## **Introduction**

The People's Republic of China underlies growth-related considerable changes, which influence everyday business in the most different areas. Foreign western investors face special challenges, if they want to extend their business activities within the Middle Kingdom. Although, it can be increasingly observed that China takes an approach to standardize its legal and financial procedures comparable to the western investment sphere, the introduction of new laws and standards occurs by no means uniformly. According to the present state of literature, indicators exist pointing towards a disadvantageous position for foreign investors within the scope of M&A business activities. This can be largely based on interpretation gaps of the regulating bodies and

political actors. It remains indisputably true, that it is not possible for outstanding business people to gain access to low risk measurements without having gained access to existing network structures. Based on this consideration, the development of the Chinese M&A market shall be the central theme within the scope of the following elaboration considering the essential factors of influence. Building onto this knowledge, ways to implement M&A in the People's Republic of China are indicated. This happens under the allocation and acknowledgment of current risk, which can influence the value of an enterprise as an investment object substantially. The paper closes with a discussion on those factors which have an impact on the activities of foreign investors. Connections are indicated by the application of a linear regression with correlation according to Pearson and the strength of the influence is determined. The abbreviation M&A covers acquisitions on the one hand and mergers of at least two companies on the other hand. The most common method to buy a company in the PR China is an acquisition. For a more detailed definition of M&A please check the scientific literature.

## **1. Acquisitions in the People's Republic of China**

For acquisitions in China, two different definitions - assets and shares deals - are to be distinguished (Meyer, 2017, p. 199) When foreign investors are involved with a Chinese company, it is called according to local Chinese law, Foreign Invested Enterprises – FIE. Generally a foreign investor constellation leads to a variety of actors leading to time consuming processes in the area of acquisitions. One of the most important authorities, is the Ministry Responsible for Foreign Trade and Commerce – MOFCOM as an approving active institution. (Zimmerman, 2010, p 137f) Next to the Chinese M&A-regulations, other regulations exist which have to be considered on the buyer's side. The Catalogue for the Guidance of Foreign investment Industries (National Development and Reform Commission, 2015), which limits a foreign participation in certain industrial branches, provided that the national security is affected. A quick approval, is often deemed useful if it concerns a state sponsored industrial branch. (Büttner/Meckl, 2016, 326ff)

The government sponsored support is driven by a pursuit of a service based economy in the following areas: Energy and environment protection, IT, biological technologies, new materials and energy as well as energy-efficient transportation. (Lampe/Mahler, 2011, p. 28 f) With the good development of the Gross Domestic Product within the last decades, the wage demands and salary expectations of the employees have also risen and substantially increased the cost of production. It cannot be disputed that these costs are settled within the market, leading to pressure for business models with low know how provided that no protection by a unique selling proposition exists. In general it is doubtful how long this can be maintained if the causalities are not determined in the case of legal offenses according to western understanding. As a consequence, a negative position can be perceived, before the context of long-term capital projects which can influence strategical adjustments of the business with lasting effect, while not calculable business risks are transferred. The Chinese cartel law is a regulation body for M&A-business plans. It formulates six test criteria which are to be taken from the 27<sup>th</sup> article of the law and which systematize M&A control. Nevertheless, the cartel law is applied unilaterally on

foreign investors, (Masseli, 2009, p. 343) because Chinese companies are not targeted by Chinese officials. By removing this process, a clearly quicker winding up process between local business is to be anticipated. It is of high importance for the performance of the purchasing process whether it concerns a listed or not listed business in private or state possession. In correlation, other legal hurdles are to be considered. This results in other juridical and administrative specifications which call for different measures. The payment of the purchasing price forms an essential landmark of the transaction. Buyers and sellers are limited by the prevailing set of rules in China considerably in the contract creation concerning the performance measure of creating incentives. The legislator demands the settlement of the purchasing price within three months of issuing the commercial license. For foreign investors, this term is extendable up to a year, if 60 percent were paid after six months. (Tetz, 2006, p. 396) Earn out clauses which compensate for insecure developments in the future as a variable component of the purchasing price in favor of both parties, are applicable therefore only restrictively. Should such a regulation still be a contract component, it is worth, to follow restrictions in particular relating to the continuation of the target as an independent commercial unity. Seldom, the inquiry of successful dimensions is based on an accounting division led separately which prescribes a suitable organizational structure and can hinder the usage of synergies in favor of transparency. (Ziegler, 2016, p. 226 f)

In literature, other problems relevant for the assessment of the target business are named. Predominantly, these can be found concerning issues of long-term assets and land rights or without permit constructed structures. Chinese target businesses, usually attract attention with insufficient wage and social security contributions (Glück, 2016, p. 364 f) and not yet paid costs of goods sold. Business assessments on the basis of historical values or future cash flows would lead unadjusted to errors and to overestimation. Economic evaluations therefore assume a clearly higher value in order to cope with potentially wrong assessments. Up to now, it remained unanswered which differences exist between asset and share deal in the People's Republic of China.

## **1.1 Asset Deal**

With the Asset deal, assets are transfer between the target and a newly founded business. Available hidden reserves must be disclosed within this process which can lead for the seller, depending on the magnitude of the tax load, to a considerable disadvantage. Besides, the possibility of non-existing deductions should be added to the calculation, which can result in considerable loses especially concerning businesses with a need for restructuring. The inquiry of the purchasing price seems easier with this acquisition variation, because the forced assets can be evaluated in a cumulative manner. Should the purchasing price exceed the sum of all acquired assets, the difference is to be activated as a goodwill. The profit is to be taxed after settlement of the costs. Sales of movable assets underlie in China generally a sales tax of 17%, provided that a continuation does not seem to be in the interest of business.

The asset deal of non-movable economic goods, such as land rights, is clearly more complicated. Next to the usual 5% business tax on the profit, an appreciation tax at a progressive tax rate between 30 and 60% is raised from the seller. The buyer pays a deed tax for the acquisition of the non-movable assets. Independent of the type of asset, a stamp fee is raised on the part of the government, on account of its size in the second post-comma area (Lampe/Mahler, 2011, p. 32 f) aus Sicht des Autors vernachlässigbar ist.it seems to be negligible from the point of view of the author.

The probably biggest advantage of asset deals lies for risk adverse investors in the selective choice of those assets which best fit the M&A-strategy. Knowing that every transaction has to be evaluated individually, the thought is obvious that the risk can be controlled. Asset deals in China are confirmed by concealed ownership structures or obligations. (Pfeiffer et al., 2009, p. 138) With the creation of business purchase, a reduction of tax risks is often associated within the discourse of literature. Nevertheless, for the activities in the People's Republic of China this consideration is of limited validity.

The local tax authorities represent the view that their tax demands are bound to the business operation and therefore survive a M&A process. (Schramm et al., 2011, p. 497) In the international comparison, considerable differences arise therefore concerning the assumption of old tax loads to the disadvantage of the business.

The transaction arrangement as an asset deal is bound in the People's Republic of China, to the local legislation. According to this, it is to be implemented that investment vehicles are used to create a legally binding relationship. Wholly Foreign Owned Enterprises, also known as WFOE, are entities entirely owned by foreign investors (Germany Trade & Invest, 2015, p. 16) Limited Liability Company. They are for the direct acquisition of assets according to the local legislation a basic condition. These are regulated and based on the Law of People's Republic of China on Wholly Foreign-Owned Enterprise as well as Rules of Implementation of the Law of the People's Republic of China on Wholly Foreign-Owned Enterprises. Special regulations take precedence over general statements.

WFOE are to be distinguished according to the business purpose in production, consultation and trading companies which, depending on the performed activities, fall politically into the categories "desirable" up to "forbidden". (Lorenz & Partners, 2014, p. 3ff) The Chinese legislation distinguishes itself with the considerable freedom of interpretation. Chinese M&A-regulations follow two variations. On the one hand, acquired assets can be introduced as cash investments into the founded corporation or be acquired directly by subsidiaries. (Tetz, 2006, p. 392 f) In the nature of the asset deal lies a selective character which shows under risk aspects, in an insecure sphere, undoubtedly advantages for the process of business purchases. On the others side, problems of existing licenses which, depending on the contribution to the service, can be of substantial help. (Germany Trade & Invest, 2015, p. 51) The result of the local practice results in a loss of the in general perceived advantages of the asset deal within the Chinese legal sphere if this acquisition form should be used before the background of risk minimization.

## 1.2 Share Deal

The share deal describes the direct acquisition of company shares at the target business. It is of importance, that with this transaction hidden reserves are not declared which is under the tax point of view advantageous for the seller. For the buyer a renunciation of the option arises traditionally associated with M&A → to charge off assets, in order to lower the tax burden. (Burger et al., 2010, p. 42 f)

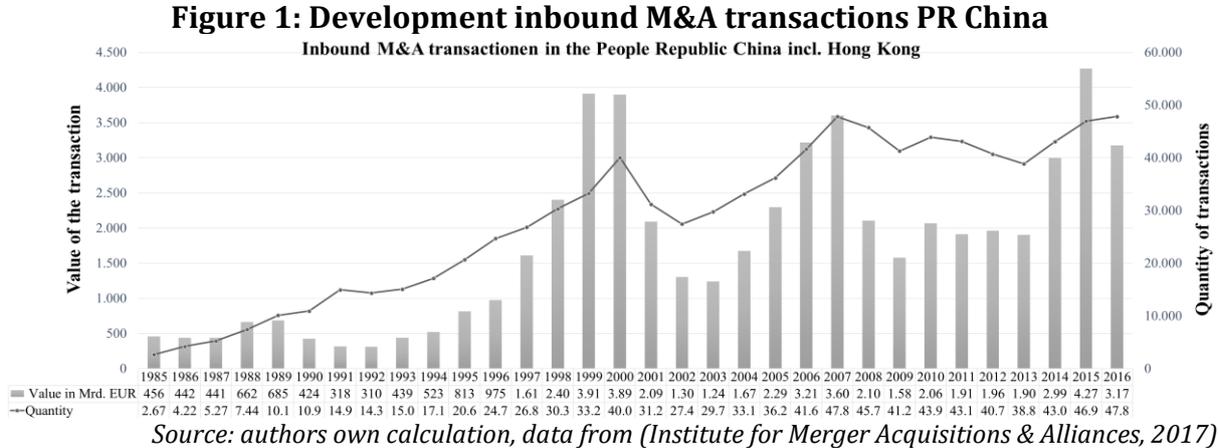
Legally allowed variations of the share deals are on the one hand the direct share purchase, on the other hand, an increase of capital after approval of the old owners at the target enterprise. If the company continues as a legal entity after the acquisition, losses carried forward can be still attached up to five years after the acquisition period. (Lampe/Mahler, 2011, p. 34) In 2006, the option on an international share-swap were first regulated by the new M&A-regulations. Therefore, a foreign investor has to submit to due diligence, before the Ministry of Commerce starts to check the plan. The buyer assumes, according to his shares, all chances and risks of the business. Therefore highly risk afflicted, according to the appropriate literature on the topic, is the acquisition of company shares not publicly listed. (Tetz, 2006, p. 394 f)

Consequently it is obvious, that in particular Chinese KMU can be marked by comparatively higher risks. The last innovation of M&A-regulations brought, concerning the shares acquisition, an approach to the local rights of chinese corporations with it. Now the possibility exists for foreign investors to deposit the joint stock successively during a duration of three years, after 15 percent were paid down within three months. (Tetz, 2006, p. 396) It is noteworthy, that an offshore disposal can result in 10% taxation since 2008. This is given if the actual taxation of the profit of Chinese business shares is less than 12.5% or the local authorities assume abusive behaviour. Nevertheless, in the literature doubts about the legality of this practise are discussed, especially regarding the existence of double taxation agreements. (Lampe/Mahler, 2011, p. 34)

Regardless of the tax perspective, the shares acquisition on indirect way can serve the purpose of avoiding local hurdles, while prevailing M&A-regulations are avoided. With the share deal in particular, the surviving organisational structures are to be classified as especially advantageous which can affect existing employment and strengthen consequently the competitive position of the company at hand (Germany Trade & Invest, 2015, p. 51). Following these considerations it has to be pointed out that with the share deal a higher risk is assumed by the investor, due in particular to liability risks by preceding business activities which are of substantial meaning in the business evaluation. A lack of enough documentation which does not violate legal regulations, is often encountered in the People's Republic of China. This is especially critical in cases with unclear possession relating to assets, which are often without legal basis declared as a balance. Additionally, taxes on social security contributions not paid are to be encountered as well. A reclaim often occurs only with the assumption of the shares by the new proprietor. The disadvantages linked with it are often hardly identifiable as there are often two to three accounting systems following different purposes, thus limiting the foundation for decision making.

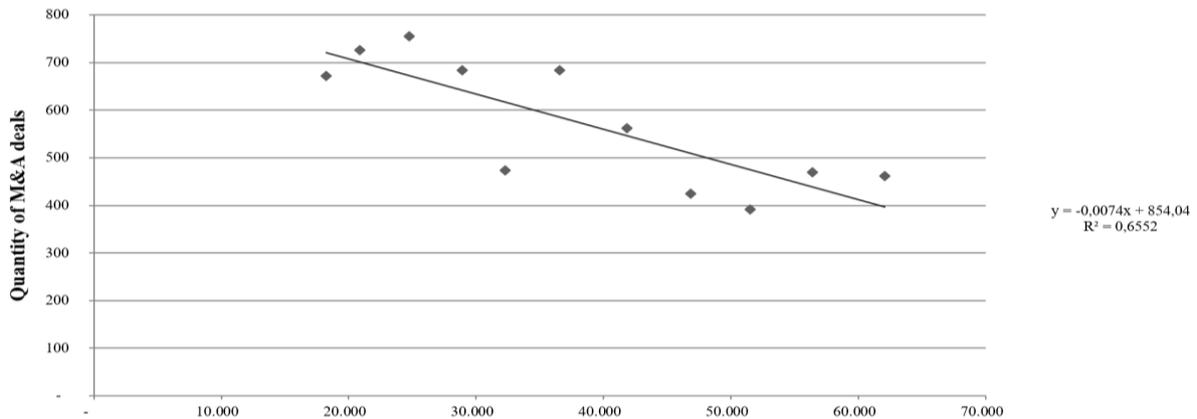
## 2. M&A development status quo

The direct shares acquisition in the People's Republic of China puts foreign investors before special challenges while exposing them to risks. At macrolevel the question of the added value of M&A compared to new establishment of a company has to be raised. The expenditure and benefit linked with a transaction is out of balance. This fact is reflected by the following picture with focus on the historical development of M&A transactions with foreign investor's participation. This consideration stretching over 20 years shows China in a different state of business development. Next to local risks and influencing variables, rising cost pressure, the changing legal system finds consideration. The fastest changing variables with damping character are the wage and salary costs always in proportion to the attainable output. This influence should be moved by the following implementation closer to the centre of the elaboration to reach a classification of the described topic.



As can be clearly recognised, the attraction of the People's Republic of China as an investment ground for foreign investors measured in number and volume decreases successively. It is doubtful to what extent this development can be based on adapting to the western wage level, as it is increasingly argued. Should cost/benefit considerations take place, this points to a consideration of input and output. In case of an inbalance, these are to be corrected by a higher level. This supposed correlation between the average income and M&A activity should be examined by means of linear regression of correlation according to Pearson. The yearly average income of an employee is hereby considered (Statista, 2015) as well as the transaction activity between 2005 and 2015 (Institute for Merger/Acquisitions & Alliances, 2017) as shown in the lower part of this statistical representation.

**Figure 2: Linear regression M&A activity and average income in PR China**



**Average income in PR China**

| Year                  | 2005   | 2006   | 2007   | 2008   | 2009   | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Average income in RMB | 18.200 | 20.856 | 24.721 | 28.898 | 32.244 | 36.539 | 41.799 | 46.799 | 51.483 | 56.360 | 62.029 |
| Quantity of M&A deals | 672    | 726    | 755    | 684    | 473    | 684    | 562    | 424    | 391    | 470    | 462    |

*Source: authors own calculation, data from (Institute for Merger Acquisitions & Alliances, 2017)*

The correlation coefficient describes with a value of -0.809 a very negative connection between the variable salary development and M&A transactions with foreign participation. The coefficient of determination 0.655 reveals that the decline of M&A activity is explained to 65.52 percent by the salary development within the People's Republic of China. Therefore, other factors to 34.48 percent are responsible for the decline. On this occasion, a high significance by a t value at the rate of 4.14 with a probability of error of 0.01 could be proved.

Surely the data contains special influences like the effects of the economic crisis in the time from 2008 to 2010 which can have a distorting influence. If one isolates these values, the correlation coefficient rises to -0.891. An analogous development is recognizable also for the coefficient of determination and the t value after adjusting the special influence, because these rise to 0.793 or 4.79 respectively. The legal basic conditions are changing in the PR China by a gradual adaptation to western standards offering higher securities in the investment sphere. This can be statistically proven on the basis of a linear regression if merely the last 4 years find consideration. This fact can be interpreted at the moment merely as an indicator for successfully created incentive.

As a result of this segment, the following hypothesis is to be made: the salary increase in China VR reduces M&A activity. It has to be added, that according to the results of a recently carried out study which comes to the result that China is still interesting for foreign investors in certain areas. As a positive driver can be seen above all the striving for capacity increases from the Chinese perspective. Besides, on the Chinese side the readiness for selling enterprises within the reorganisation sphere has increased. Also is to be assumed from the fact that the changing growth will lead to influence on the selling prices of the Chinese targets which could lead to an adjustment towards the international. (Gätzner, 2016, p. 41ff) Should the sales readiness be based on the pursuit of risk distribution, this would reveal itself to be an indicator for elevated risks at the market level.

## Conclusion

By the preceding discussion, it was made clear that M&A's in the People's Republic of China are marked by a higher degree of uncertainties and risks. This is to be led back on the one hand on the legal basic conditions and on the other hand, the current practise works as a driver for danger. The complete range of potential risks can be based on the share deal. The counterpart asset deal can due to the local legal understanding which implies that with the assumption of assets by a new company, also certain old debts and commitments are to be assumed, can therefore not bring the neutralizing solution as this would be the case in other countries. The income development could be established as a main driver of decreasing M&A activities on the basis of a linear regression which requires at the same time political measures to partly counteract against this development. The innovations in the area of M&A legislation are to be mentioned in a positive manner. The approach on international regulations will raise gradually the trust of insecure investors, provided that no difficulties originate with the conversion of new regulations. Because the implementation of new laws is left to the province, it remains whether a uniform interpretation is carried out in favour of the trust.

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## Using Text Comparison to Detect Risk Financial Transactions

### Abstract

This paper shows how can corporations quite easily deal with risks. COSO framework recognizes three categories of risks which came from financial transactions between our organization and embargoed countries and partners. – strategic, operational and compliance. It is based on collecting information from various sources all around the word and string comparison to detect these transactions in internal enterprise resource planning system. At the first part, the paper describes three basic data formats (CSV, XML, and PDF) and methods which we used to extract, prepare and transformation the data sets. Data extraction was complicated in PDF files. We used R snippets connected to R server and advanced XML interpretation. In the second part, it describes data processing using open source analytical tool KNIME. It is based on text comparison of these transformed sources to our sap tables which describe vendors and purchases. Finally, we made an evaluation of the amount of transaction and money which we have with these partners. In the end, we evaluate the measure and set targets for further development.

### Key Words

*risk management, process weaknesses, data mining*

**JEL Classification: G32, D81**

## Introduction

In this paper, we will have a look on one identification factor of risk financial transaction – Financial transactions between our organization and embargoed business partners. Because of law, every organization has to monitor, evaluate and build measures to prevent potential risks (Soomro and Fong-Woon, 2017). This kind of control is called Enterprise Risk Management. The strategy of our company consists of three risk managements layers (lines of defense). The first line of defense consists of Management controls and Internal Control Measures. Each business unit is responsible for building this line. The second line of defense contains assurance units (Security, Quality, Compliance etc.) and divides risks into groups regarding their properties. Internal audit forms the third line of defense and it should be independent on the previous two lines. It gives results directly to the management board. (Brustbauer, 2014)

Risk management in our organization is based on COSO framework developed by The Committee of Sponsoring Organizations of the Treadway Commission. In this paper, we

will have a look on two main parts of this framework – the first is how to identify and evaluate risks and the second is how to adapt reaction on these risks into internal risk management system of the company. COSO framework divides risks into three groups – compliance, strategic, operational and reporting (Janvrin et al., 2012).

According to COSO framework risk classification, we identified these 4 risks (Janvrin et al., 2012):

1. Strategic risk - political: Adverse actions by foreign governments – violation of The European Union and The United States foreign policy
2. Compliance risk – Changing laws, liabilities, and commercial disputes: violation of the United Nations resolution
3. Compliance risk – ethics and integrity: Fraudulent, illegal or unethical acts.
4. Operational risk – Major natural/manmade disaster, terrorism: Financing of terrorism.

In general, we recognize two categories of these financial transactions. The first of them consists of payments to embargoed countries. It is based on the list of embargoed countries which is continuously updated by the Federal Office for Economic Affairs and Export Control of Germany. The second category is based on embargoed partners check. But for multinational companies here arise a problem. It does not exist one consolidated list of these partners.

For example article of European Commission number 215 (Treaty on the Functioning of the European Union) provides some legal reasons to interrupt or reduce of financial relations between states of the European Union and countries which the European Union marks as a embargoed or risky (EEAS, 2016).

To prevent these risk such as economic loss or to waste good name the board of management agreed that it is necessary to have some automated checking mechanism. We will try to implement text mining methods because we need to process patterns which are extracted from natural language text. This is based on various data comparison methods which calculate with mistakes given into system by a person or various character changes between languages. (Hearst, 2003).

Our target is to build a systematic tool which will ensure our organization that we have not more financial transactions with embargoed partners that are absolutely necessary. Today I will show you the first part of our development which contains only 1:1 check. In the next phase, we are going to implement some string mining techniques which will hopefully detect more dangerous financial transaction.

## **1. Various data format usage**

Our measure will have two levels. First of all, we identified all data sources. In the first case – embargoed countries – we have quite a simple task. The consolidated list of

embargoed countries exists. On the other side, we identified four relevant data sources of embargoed partners. They are:

1. List of United States (US list)
2. List of European Union (EU list)
3. List of United Nations (UN list)
4. List of Switzerland. (CH list)

Each of these lists has his own format – in general, we can find two types of format there. Open document standard file XML (Extensible Markup Language) is the first one (for the UN, EU, and CH) which is used for markup documents and is multiplatform and registered under open source license. The big advantage also is that this format was strictly developed for computer processing of data sets. (Amano et al., 2014) The second way is to use Comma-separated Values (CSV files) on the other side which are used for US list which is quite easy to use but there can be a problem to process data because of data separator (Dramski, 2016).

Our target for this step was to develop a procedure which will give us the opportunity to have consolidated data with no duplicities and always up to date. This is the second challenge we had – each list is updated in different periods. US list is available every day at 5:00 completely new and the others are updated only when some changes were made. It means that we can't set some automated trigger to download these lists. On the other side, of course, we can but it ineffective for data storage, database machine etc. to maintain such a big number of lists. For example, the UN list was not changed for 3 quarters. Nowadays the RSS are ready on EU and UN lists so it seems that we will be able to solve that issue in few weeks. The only problem is with the Switzerland's list – they are currently working on their RSS channel.

The embargo countries list (the one of European Commission) is distributed as a Portable Data Format (PDF) as multiple tables with a various combination of reasons for which are they on embargo list. It can be a problem because there is a chance that the reasons can be changed (added, removed and edited). So, there we have to develop a method which will check every new version of this list if it is compatible with the previous version and alert mechanism which will inform us that the change came and it would be great to check the structure of this new version of the list.

On the other side, the data in our company are stored in SAP ERP system's databases. So, we can export them using SAP COMMIT exporter. The other way is to developed Microsoft SQL server with SQL database where we can store data which would be ready for data preprocessing by using advanced data queries. Another advantage of SQL server is opinion to extend the current solution which contains data processing on local machines by server processing of data. It means that we will be after development able to set up a trigger to start the job automatically and only wait for the result.

In this part, we will have a look on a quite easy data extractor on the side of data which are available on the internet for free. We spoke about 5 lists which have to be somehow

checked and loaded in the correct form. We developed an ETL (Extract, Transformation, and Loading) tool to ensure that we can make this comparison which has the main role in the first step of this risk elimination.

## 2. Data preparation

We started with workflow development by downloading all these lists to see in which structure data are. We started with the US list because it was easy to open – we can simply open CSV file in Microsoft Excel. We were nicely surprised that the structure of all these lists is mainly the same, that there are only small differences in column headers. So, for the embargoed partners' part, we had to develop only two exact methods – one for the CSV and another for the XML files. We can transform the XML files into CSV and then make one exaction (Gibbs, 2008) but in my opinion is a better way to have tool for XML extraction.

PDF extraction seemed to be more complicated. As mentioned above we had to extract structure and finally if the check is successfully finished load the complete data set. That check was not so complicated in the end so the biggest challenge was how to access the data from the PDF file.

For data preparation and processing we used KNIME Analytics Platform. It is an open source tool for advanced data analytics including data mining, text mining, and predictive tools. KNIME is quite to similar to SPSS Modeler which is licensed by IBM. Its biggest advantage is that it has quite a big community which is ready to give you a hand. It has various options of prepared nodes and you can create your own workspace by combining them. (KNIME, 2017)

## 3. Data transformation

From the previous step, we had six different data sources but only with three different data types and the first two types (CSV and XML) have almost identical structures.

**PDF file:** We use an R snippet to extract data from PDF file (R, 2017). We worked with the tabulizer package in R scripting language which is implemented directly as a snippet into KNIME Analytics Platform. At first, we loaded 2 necessary packages designed for R and distributed under open source license. They are tabulizer, dplyr.

```
R code:
  library(tabulizer)
  library(dplyr)
```

In the second step, we used function of the tabulizer called `extract_tables()` which gets one metrix of table for every PDF list.

```
R code:
location  <-  http://www.ausfuhrkontrolle.info/ausfuhrkontro
lle/de/arbeitshilfen/merkblaetter/merkblatt_ebt.pdf'
output <- extract_tables(location)
```

In the output, there are all **PDF** pages as a single matrix. In this phase, we have to combine all these n matrices into one matrix. We used a combination of functions `do.call()` which is a loopink function in other programming languages and `rbind` parameter which has an information about each matrix which should be combined.

```
R code:
  final_table <- do.call(rbind)
```

Finally we exported the final table into a CSV file and will continue with cross file set.

```
R code:
  write.csv(final, file='Embargoed_Countries.csv')
```

**CSV:** We will use this dataset as a pattern so we will not implement any changes there. After analysis of our data from SAP, we recognized that we can implement quite quick win solution – match names or alternative names of these partners with our metadata. Key columns: Name, Alternative Name. We would have a small problem with alternative names because they are in one column separated by commas. It means that we have various numbers of entities here.

**XML:** The XML file is in the mainly same structure, the only problem is that the data come in batches which have to be sorted. We use one of KNIME's nodes called XPath which can take one element of an XML file and make a line from it. To have a complete dataset as in the previous case, we repeated this procedure 11 times.

## 4. Data processing

We used all these prepared data into three groups which are checked separately with our corporate data.

### 1. Embargoed countries check

We collected all reasons why the country can be embargoed and for the quick setup of this measure, we said OK, we do not care from which reason does embargo come. Every embargoed country is wrong so we aggregated all columns to one column. Embargoed – binary.

Tables from SAP system used:

- LFA1 – Vendor master.
- EKKO – Purchasing Document Headers
- EKPO – Purchasing Document Items

Principle: We checked if exists some vendor (partner) from embargoed countries and after that, we check if there is any purchase (nevermind if on header or detail). In the third step, we evaluated the amount of money we speak about. After that, we spoke with our account department to identify financial transactions which we have to make (e.g. marks and copyrights)

Periodicity: Quarter

## 2. Embargoed partners check:

We took our prepared data and check our company's data against these lists. We split alternative names into several columns and developed loop which tested all these columns vs Name1, Name2, and Name3 from the LFA1 table.

Tables from SAP system used:

LFA1 – Vendor master.

EKKO – Purchasing Document Headers

EKPO – Purchasing Document Items

We checked if exists some partner which is listed on at least one list and after that, we check if there is any purchase (nevermind if on header or detail). In the third step, we evaluated the amount of money we speak about. After that, we spoke with our account department to identify financial transactions which we have to make (e.g. marks and copyrights)

Periodicity: Quarter

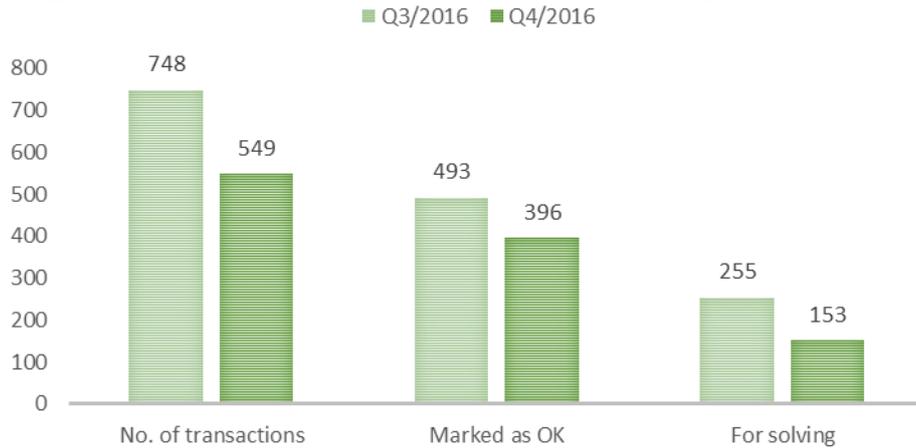
## 5. Results

As you can see on Fig.1 and Fig2, we found about one thousand of the transaction by both checking methods. We were quite surprised how many critical events the algorithm found but most of them were marked by our account department as OK. There are 2 main reasons as mentioned above. The biggest amount of events were from countries where we have production plants. Rest ones we gave to our colleagues who will check if they are relevant. All information about cases marked by our text mining algorithm as critical were implemented into the searching method. The biggest part of embargoed partners (mainly from embargoed countries where we have production plants) was added into whitelists. We also initiated negotiations that these payments will have some prefix.

We set up some measures to eliminate a number of critical events including special prefix for embargoed partners which are suppliers for our production plants. Fig. 1 and Fig. 2 show that our measures with the improvement of our searching algorithms reduced a number of results. The target is to have until Q3/2017 (time frame of one year) about 10 results. After that, our tool will serve only to provide insurance about this topic. In Q4/2016 this algorithm blocked transaction in an amount about 14,5 million CZK (in comparison to Q3/2016).

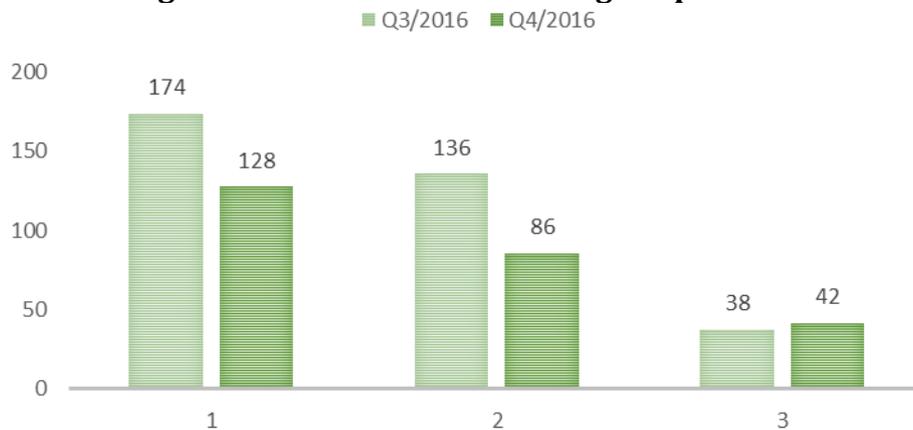
There will be a maybe significant increase of critical events after implementation of mistake sensitive algorithms (for example Levenstein or Jaro-Winkler methods) but we will continue with reduction of these events.

**Fig. 1: Transactions with partners from embargoed countries**



*Source: authors' own calculations*

**Fig. 2: Transactions with embargoed partners**



*Source: authors' own calculations*

## Conclusion

When we process the first check we were surprised how many transactions with embargoed objects do we have. After the first feedback of our account department we were ensured that we have mainly two groups of these transactions:

1. Payment for some legal reasons (taxes, patents, trademarks, copyrights etc.)
2. Payment to countries where we have production.

All these countries and partners were added to whitelists and next turns were better. In general, we have to say that we implemented the first level of elimination these risks. The next steps can be in error protected comparison – use some none 1:1 checks and set up updating triggers.

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## Potentials of Regional Marketing for a Sustainable Land Use in the Zittau and Lusatian Mountains

### Abstract

This Paper will give a short overview on the author's dissertation topic and its first results. The subject deals with the question to what extent regional marketing is able to support a sustainable land use according to the guiding principle of "Protect by Use". We all depend on the variety of nature, the biodiversity. That is the basis for the provision of manifold ecosystem services (ES). We not only benefit from food production and fresh water supply but also from flood control and recreation through intact and aesthetic landscapes. However the biodiversity is threatened even on our doorstep by different factors. The ES-concept provides an appropriate conceptual framework for assessing sustainability in land use. In the scientific community there is currently a high demand in measuring and evaluating ES and in regional case studies. As research area the Zittau Mountains Nature Park (Naturpark Zittauer Gebirge) and the Protected Landscape Area (PLA) Lusatian Mountains (Chráněná krajinná oblast Lužické hory) were chosen, because they form a unique and connected cross-border landscape. Due to its landscape diversity it is a representative area for Central Europe. Despite its rich natural and cultural heritage there are significant ecologic deficits and challenges. With that in mind the project aims to work out potentials of regional marketing for maintaining ES in this area in order to generate transferable recommendations and well-founded arguments for local decision makers. The dissertation is still at the very beginning, but some researches and methodical considerations have been already done.

### Key Words

*Regional marketing, ecosystem services, protected areas, biodiversity, regional development*

**JEL Classification: Q57, R11**

## Introduction

In the face of global environmental changes, the financial challenges of practical nature conservation, and the growing awareness of the people towards environmental protection, quality and regional links, the maxim "Protect by Use" is more relevant than ever. Against this background, the "Agenda 2030" of the United Nations, which entered into force in 2016, considers environmental protection and sustainability as the basis for socioeconomic development. Thus in its 17 "Sustainable Development Goals", Goal 15 aims to "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably

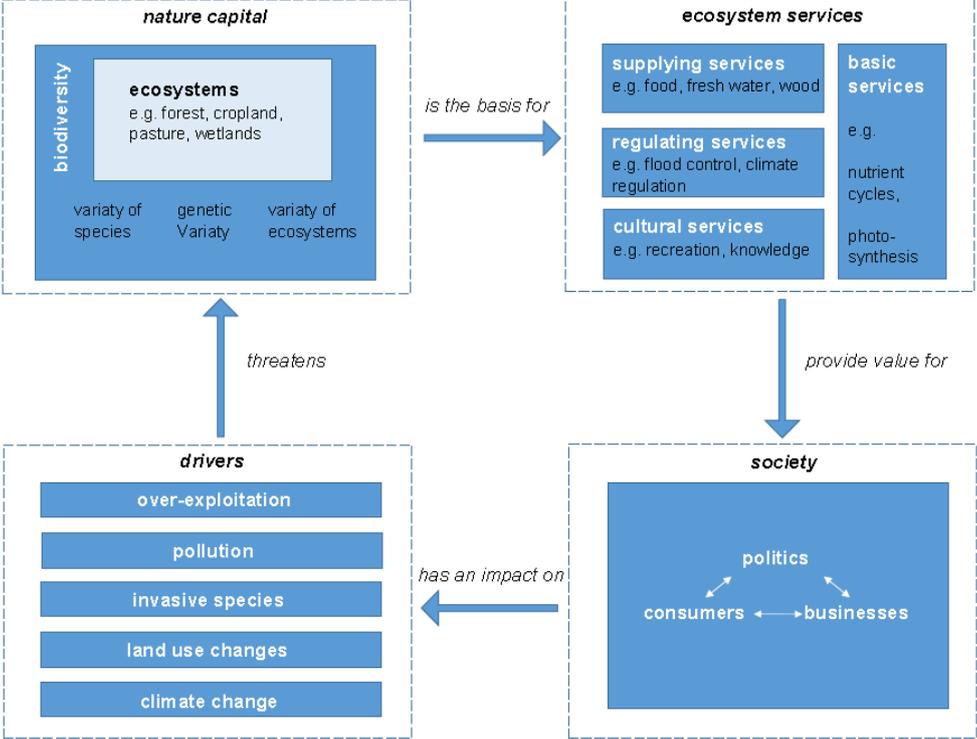
*manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss*" (UN, 2017b). An expedient approach for analysing and assessing the aspect of sustainability in land use is the ecosystem services (ES) concept. During the 1990s, the term "ecosystem services" has been defined by (Groot, 1992); (Daily, 1997); (Costanza et al., 1997) and entered into the international environmental debate (cf. Grunewald & Bastian, 2015). Since the "Millennium Ecosystem Assessment" report in 2005 (MEA, 2005), the term has been obtained in public discourse (ibid.). Numerous initiatives from business and research, such as "Biodiversity in Good Company" or the European Business & Biodiversity Campaign, have been established in recent years with the aim of promoting application-oriented decision-making and management approaches. Particularly noteworthy is the international study "The Economics of Ecosystems and Biodiversity" (TEEB), which published its main reports in 2009 and 2010 and is currently working on diverse spin-off projects. The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) initiated the national offshoot "Naturkapital Deutschland TEEB DE" under the direction of the Helmholtz Centre for Environmental Research (UFZ) and on behalf of the Federal Agency for Nature Conservation (BfN). The aim is to „[...] assess the economic value of nature's services, to determine the economic impacts of ecosystem degradation and to demonstrate the cost of policy inaction" (TEEB DE, 2017). The connections between biodiversity, ES and society are illustrated in Figure 1. The basis for human's wellbeing is the biodiversity and its resulting services. Biodiversity „ [...] means the variability among living organisms and the ecological complexes of which they are part. It comprises the following levels: 1) the diversity of ecosystems or biotic communities, habitats and landscapes, 2) the diversity of species, and 3) genetic diversity within the different species" (TEEB DE, 2017). From an anthropocentric perspective the biodiversity provides nature capital. This is an "economic metaphor for the limited stocks of physical and biological resources found on Earth, and of the limited capacity of ecosystems to provide goods and services" (ibid.). Nature capital is the source for multifaceted ecosystem services which are defined as „Direct and indirect contributions by ecosystems to human wellbeing, i.e. goods and services which offer direct or indirect financial, material, health or psychological benefits for humans. " (ibid.). They are grouped by four major categories. First of all provisioning services are „material goods and services, such as food, fresh water, and wood for building and fuel. They are often traded in the market place." (ibid.). Secondly, regulating services are indirect benefits for example soil filtering for groundwater quality, and hedges as protection against soil erosion (ibid.) Although they are the basis for human life on earth, „they are often overlooked and not sufficiently considered until they are damaged or lost (Groot, 1992; Grunewald & Bastian, 2015). Third, cultural ecosystem services represent the psychological-social component. They are important to recreation, aesthetic perception, spiritual experiences, ethical requirements, cultural identity, a sense of place, knowledge and discovery (TEEB DE, 2017). The fourth category, the basic or supporting services, plays a special role, because it is the "the mother of all other services" (ibid.). It represents elementary processes such as photosynthesis or nutrient circles which are necessary for the first three services. Referring to the CICES<sup>1</sup> Classification these three

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<sup>1</sup> CICES means Common International Classification of Ecosystem Services, see <https://cices.eu/>

mentioned main categories (sections) are broken down to eight divisions, 20 groups and 48 classes. The society, in particular the economy that is driven by the consumers' needs and habits, business decisions and political and legal framework, has significant impacts on our nature capital and its services. Globally, the planetary boundaries for biodiversity are far exceeded, which leads to unpredictable risks to humanity (Rockström & Klum, 2016). The main anthropogenic drivers for biodiversity loss are over exploitation (e.g. industrial agriculture), pollution, the spread of invasive species, land use changes and climate change (TEEB DE, 2013). These developments are even observable in Central Europe, where land pressure on agricultural land is increasing, and the growing demand for farmland leads to a change of important grassland sites (BfN, 2014; Grunewald & Bastian, 2015). Another problem is the abandonment of extensive used farmland (ibid.). In Germany intensive food production often under mines soil and biodiversity conservation (TEEB DE, 2017). And in recent times, biofuel crop cultivation has exacerbated this process and "Global warming is causing changes in precipitation patterns, is having a negative impact on parts of agricultural and forestry production and is placing increased pressure on flood control and other infrastructure systems." (ibid.)

**Fig. 1: connection between biodiversity and society**



Source: author's own illustration, adapted from ( TEEB DE, 2013)

With regard to the tremendous influence of man on the earth's ecosystem, the thesis of the "Anthropocene" formulated by Paul Crutzen in 2000 has been subject of heated discussions in science and society since the turn of the century (Crutzen & Stoermer, 2000; Schwägerl, 2016). According to this, the current epoch of Holocene, in which mankind was able to develop as a result of stable climatic conditions for some twelve thousand years, is replaced by a new earth-historical age in which human beings, similar

to the ice ages, are attributed the role of an earth-historical actor becomes (Rockström & Klum, 2016) . This epoch can also be interpreted positively as an "era of responsibility", in which the individual man is aware of his enormous creative potential and integrates this knowledge into everyday decisions in face of planetary boundaries (Schwägerl, 2016). At present about 7.5 billion people live on the earth. In the year 2050 one expects with two billion more and in the year 2100 with 11.2 billion earth citizens (UN, 2017). In order to ensure the ecological resilience of the planet, it is one of the major challenges of the future, with a limited arable land, to feed considerably more people. A sustained intensification plays a decisive role, as does the change of consciousness in society in consumer questions (Rockström & Klum, 2016). Indeed various market studies show that consumer awareness in Germany and Europe is rising. Local settings on the product level is becoming increasingly important (Otto, 2013). Commerzbank's consumption barometer from 2015 showed that two-thirds of Europeans compared to 2010 pay more attention to the composition and origin of the products (Commerzbank, 2015). These developments in consumer behaviour underline the relevance of a regional marketing of sustainable products. This fact is gaining in importance for nature park administrations and land care associations which are heavily dependent on public funds. Meanwhile there are many good examples from Germany where these players have launched regional marketing actions and thus successfully offer nature conservation products on the market. Many of them are recorded at "RegioPortal"<sup>1</sup>, which pools all those initiatives.

In view of the above the subject will focus on the area of the Zittau Mountains Nature Park on the German side and the Protected Landscape Area (PLA) Lusatian Mountains on the territory of the Czech Republic. Both areas form a connected future-oriented recreational landscape. The cross-border German-Czech cooperation of local authorities is a special characteristic of the nature park, with the aim of a coordinated and sustainable spatial development (cf. Müldener, 2015). Due to the mixed land use structure with large proportions of forestry, agriculture and pastures it is a representative area for Central European cultural landscapes. In addition to the proximity to the research location at the IHI Zittau, the special potentials of this region were also decisive. Despite demographic changes, it is an area with high development opportunities with regard to unique natural diversity, its rich cultural heritage and the transnational identification of its citizens with the region of traditional Lusatian architecture (in German "Umgebndeland") for instance. Nevertheless there are significant ecological deficits and challenges that will be pointed out in chapter three.

In this light the central research question is: *How can regional marketing contributes to a sustainable land use?* Following sub questions are linked to that: *What local ecosystem services are important or even endangered? How can regional supply chains protect them?*

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<sup>1</sup> See <http://regioportal.regionalbewegung.de>

## 1. Methods of Research

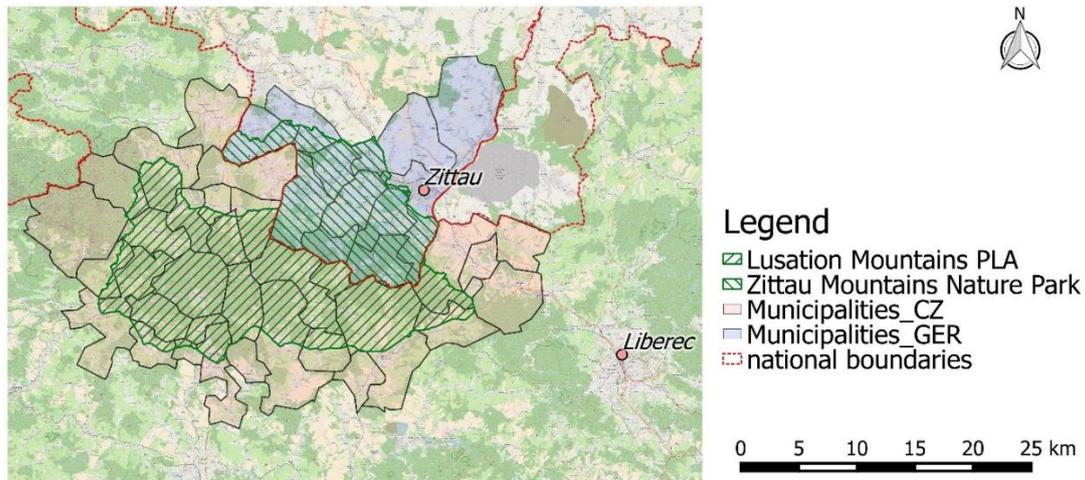
To answer the research questions, quantitative and qualitative investigations will be undertaken. According to Grunewald & Bastian, 2015 the procedure of evaluating ES starts with the *definition of the task*. That means to define a clear question and objective of the research and to carry out a suitable investigation area. This includes the research for relevant GIS-data in order to confine the boundaries exactly. When the area is defined, *characteristics of the area* have to be figured out notably by official statistical data (e.g. size, population, demographic trends, tourism, emissions etc.). Given the fact that not every 48 ES-classes can be considered, a *balanced selection of the ES* is rather revealing. For this purpose, relevant local ecologic issues will be pointed out by literature research (e.g. management reports, statistical data or cartographical material) and categorized according to the CICES-classification. As an interim result, there will be statements about what ES are endangered or on what ES the local society depends on. Having described the selected ES in a qualitative way, the next step implies the quantification of the ES by meaningful *indicators* and the selection and processing of ecological/biophysical *assessment approaches*. These steps are needed to *evaluate* dangers, risks, limit values and trade-offs. To deepen these issues a realisation of case studies is planned. Therefore stakeholders and institutions will be identified. What common ES-assessment approaches are suitable (e.g. cost-benefit analyses, willingness-to-pay) must be decided in the individual case. Beyond that a material flow analysis on business level combined with a SWOT-analysis based on partly standardized interviews could help to discover interdependences between ES and to reveal potentials and risks for regional marketing. Within this framework recommendations for need for action and ES management will be derived.

## 2. Results of the Research

As already mentioned, the work is at the very beginning. But according to the described proceeding the area was clearly confined and relevant statistical data and cartographical material was analysed. So this chapter sketches the results of the first two steps in a very concisely way.

After researching relevant GIS-data a suitable study area was defined. For statistical data analysis it is necessary to distinguish between protection-related and administrative boundaries. Figure 2 shows both protected areas with respective municipalities. The German localities represents the “LEADER-region Zittau Mountains Nature Park”. On the Czech side those municipalities were selected that are completely or partly located within the PLA Lusatian Mountains or neighbouring the nature park (such as Varnsdorf and Rumburk).

**Fig. 1: Boundaries of the research area**



Source: author's own illustration, data from (EEA, 2017; Eurostat, 2017 and OpenStreetMap)

After defining the area, characteristics of the territory were examined by means of available statistical data. Demographic data showed that the population in the German part is constantly decreasing since the 1980s, while the number of inhabitants in the Czech area remain on a comparatively stable level within the given period from 2000 to 2016 (cf. CZSO, 2017; STALA, 2017). In view of touristic statistics it is interesting that the accommodation rate is rising in both subareas. In 2016 nearly half a million overnight stays were registered in Zittau Mountain localities and more than a half of that number in the Lusatian Mountains (ibid.). By analysing geographical land cover data it became clear that more than a half of the whole territory is covered by forests and more than a third (37%) is used for agriculture. Comparing both subareas it is visible that the amount of forest is quite higher in the Lusatian Mountain landscape (two third) in contrast to the Zittau Mountain Nature Park (one third). Although agricultural areas have similar absolute levels in both subareas, there are big differences in land use. While farmland in the Lusatian Mountains is mostly used for pastures, the amount of arable land in the foreland of the Zittau Mountains is much higher (27% compared to 2% on the Czech side). These areas are predominantly used intensively, in particular for rapeseed and maize cultivation. By literature research three major environmental challenges were worked out on which further investigations will concentrate on (cf. Müldener, 2015):

- Forest conversion (in terms of establishing mixed and ecologically stable forests);
- Erosion and flood control;
- Maintenance and management of extensive species-rich open grassland sites.

### 3. Discussion

As we see, there is plenty of work to be done to deal with the research question. Otherwise a solid statistical and geospatial data basis was already carried out. In the further steps the mentioned environmental issues have to be classified to the ES-concept, quantified

with indicators and evaluated. Selected case studies based on qualitative methods will deepen these issues and examine potentials of cross-border regional market based approaches to protect ES (e.g. by interviewing relevant stakeholder of regional supply chains). Nevertheless the success of these efforts will obviously depend on the willingness of public and private partners to cooperate. Finally, transferable recommended actions ought to be derived from those findings.

## Conclusion

This paper gave a short outline to the author's dissertation project and its first results. Using the example of the Zittau and Lusatian Mountains the ES-concept provides a constructive approach to answer the research question how regional marketing can contribute to a sustainable land use. In this context sustainability is to be understood as a balanced use of local ES that supports a wide range of direct provisioning services (e.g. food, wood and fresh water production) as well as indirect regulating and cultural services (e.g. erosion and flood control, aesthetic landscapes and recreation). All in all this project offers the chance to promote the research on ES and hopefully to encourage regional development. Last but not least it would be very welcome, if cooperations between IHI Zittau and TU Liberec will be launched in context of this topic.

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## Problem Areas in the Accreditation Process under Information-economic Aspects

### Abstract

The process of quality assurance within the European university system has found its entry with the introduction of the Bologna reform, however the criticism of the system remains in place as the most current discussions show. The present elaboration questions the quality assurance accreditation procedure and describes its methods based on the German accreditation system which is the general aim for the continuous improvement process. At the beginning of this elaboration stands a thematic imbedding of the accreditation procedure within the EU university system. In the following, accreditation procedures are looked upon from the context of the university education policy context with the aim to protect the quality of research and education, thus the origins are to be seen starting with education and the quality itself. The abstraction of accreditation is extended by the PDCA circuit. With the help of the PDCA control circuit, a detailed sequence is made possible, from this result the four most important phases which are further discussed. For the process oriented consideration, the German accreditation system which implements so called life cycle management was introduced. A variety of actors are involved in this accreditation process and from it result information-economic perspectives, which are examined in detail and highlighted where necessary. The critical acknowledgment of the introduced accreditation process flows into the principal agent theory. A summary and an outlook with future research questions complement this elaboration.

### Key Words

*higher education accreditation, bologna process, process life cycle, quality management, principles-agent-theory*

**JEL Classification: I21, I28**

## Introduction

The most important substance of economic nations is the living society within and their know-how (Bellmann/Liver, 2012, p. 5), this conclusion can be drawn if one pays a closer look at the educational economy of a country and its coherent innovative strength. That's why the educational system is an essential catalyst for the economic and political aspirations of a country and has gained consequently with regard to the inevitable process of globalization in the past decades successive relevance. "University education, research and innovation have a determining influence on the cohesion of a society, its economic growth and global competitiveness". (HRK, 2015, p. 9) Therefore, university

based education performs an essential service towards socioeconomic and cultural development. The present elaboration attempts to explain the quality-securing drivers within the scope of the accreditation process in the university based education system and thus reflect the status quo of the European accreditation process. In particular, the life cycle process will be investigated, which has assumed an elementary and recurring value since the introduction of the Bologna reform.

The 21<sup>st</sup> century will be determined by fast paced, shortened procurement processes and an elevated service character, consequently many-sided changes were carried out in the shortest time and in the most different branches. The educational sector did not remain untouched by this development, the reason for this lies in the fact that education poses as a determining innovation driver. With the Bologna reform, it was intended for Europe to grow together as one in the area of education. A central part of this reform is to guarantee the mobility and comparability of studies which leads to the process of quality assurance of education and further requires to be carried out accreditation. In this manner a common European construct was created ensuring the external quality assurance in the university space. Nevertheless, this persistent change in the past decades within the university sphere was looked upon by some not as an advanced maxim, so that the criticism of the Bologna reform grew. As soon as the respective ministers of the participating countries gathered within the scope of a meeting in 2010, they recognized the insufficient realization within the European terrain. (HRK, 2010) The reformation and establishment of these new control instruments, which stand in connection with Bologna, are considerably more difficult to implement than anticipated by the developers in 1999. Exorbitant organizational and administrative expenditures and elevated costs are connected with accreditations from the point of view of the involved European universities. (Ternes, 2010, p. 11) After 17 years of the Bologna reform, no uniform standard regarding the accreditation procedures could be implemented, this becomes evident when four European nations are picked out exemplarily and directly compared with each other: in Slovakia and the Netherlands a state accreditation system exists, in the Federal Republic of Germany a half-privatized accreditation procedure and in Great Britain a fully privatized accreditation procedure can be found.

Due to the current market standards, caused by growing customer demands and challenges by competitors as well as technical and ecological regulations put in place by globalization, enterprises complicate the long-term continued existence in the market without a steady paced advancement. Based on the Bologna reform, quality management has assumed an elementary value in the educational sector. Presently, no uniform accreditation system could be set up, so that this elaboration serves the purpose of functioning as a starting point for a transnational European accreditation standard.

The aim of this work is to create a key building block for the development of a single European standard in the EU and to better understand the framework conditions surrounding the accreditation process. Of course, the present work cannot fully fulfill the desired goal, nor does this claim be raised. The elaboration is the cornerstone for further research. The methodological approach is primarily based on the literature research, which is followed by a process-oriented review of the accreditation process based on the

PDCA cycle. This is transformed into a life cycle management consideration. The methodological approach of this work is based on the grounded theory. The logic of grounded theory is based on its principles and unseen connections. It is all about the nature of the accreditation process, the actors involved, the process of how such a procedure works, and why. In addition, issues of the strategies and consequences that are associated with the accreditation process are discussed. At the same time, this elaboration will make a major contribution to consolidating the research project towards a uniform accreditation standard.

## **1. Accreditation as a quality assuring instrument within the educational sector**

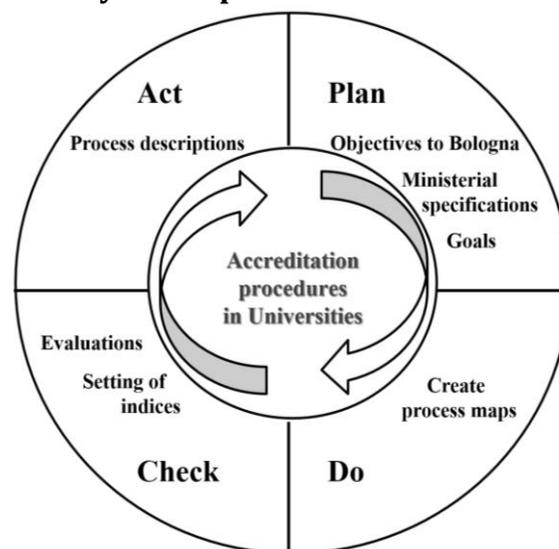
Education functions as a sovereign area and can be integrated into the same field as Science, Politics and Practice. (Tippelt/Schmidt, 2010, p. 234.) The education system is assigned to the sovereign area. (ACQUIN, 2014, p. 17) The Bologna process implemented such an instrument at the beginning. For many years, the concept of quality belonged to everyday vocabulary, also in the previous segments this concept had been mentioned over and over again. Because the separation of quality proves itself to be a difficult manner. (HRK, 2015, p. 9) Quality consists according to Kultusministerkonferenz (KMK, 2016) of the result of an interaction between lecturer and student as well as their learning surroundings, of which the latter is based on quality assurance, of the following subject areas: Contents of study, possibilities of learning as well as the equipment of the respective educational facility. Safeguarding quality, which means all activities which belong to the continuous improvement, can be characterized into two functions; on the one hand into improvements by which the recommendations and optimizations are directed towards a specific goal, and on the other hand on putting into account the towards quality aiming activities of the university itself. This can be the basis for deriving a culture of quality by which all internal partners stand in relation to each other. (HRK, 2015, p. 10)

At this point, dedication shall be given to the accreditation process. The product life cycle often cited by the literature offers in the case of the accreditation process little scope of action to look in detail at the accreditation process, which is why the process oriented quality management system should move to the centre in order to fully understand which effects and actors play an essential role. This method describes the quality management as an eternal circle by which it comes to the continuous improvement in all areas of the company. A company depends essentially on customer demands and market standards, or in easy terms from the concept of input shown in the picture, which has to be determined at an early stage. In order to stimulate these expectations, the following seven stages must be implemented. In the first step these needs and changes of the market must be recognized by the management in which recognizing, leading and understanding goes along. This step can lead in particular by analyses and measures to the desired decisions. It was judged as of a necessary character to pay attention to the pursuit of aims, so that to the executives know what goal is to be pursued and can intensively work on serving this

purpose. Nevertheless, this can only happen with the support of the employees, that is why they must be also kept up to date. Also, the abilities and the know-how of the employees or the staff are to be considered, because this knowledge is of incalculable value and consequently an elementary driver of success. For a more efficient sequence of working steps and successively constant quality of the products to be provided, it is further inevitably to formulate a description process which flows in the process-oriented approach. By steady corrections and more efficient working instructions, the continuous improvement process is initiated, which complements the PDCA control circuit and is explained in the next segment. In spite of these considerations, the suppliers should not be disregarded, because they also contribute to the added value. (Bülow-Schramm, 2006, p. 23)

In order to fully comprehend the system of quality assurance, the PDCA tool will be fully explained and laid out within the following segment. Deming achieved in 1986 with the PDCA-circle as an instrument for the continuous improvement, which is still valid and often used nowadays. Based on his understanding, four areas contribute towards the goal of continuous improvement - plan, do, check and act, whose first letters make up the name of the concept itself. (Färber, 2010, p. 79f.) P (Plan) for the planning of goals and necessary steps, D (Do) for the implementation, C (Check) for the check of the continuous progress A (Act) for the initiation of measures aimed towards continuous improvement itself. In the following, the PDCA circle is being adapted to the system of accreditation.

**Figure 1: PDCA cycle adapted into the accreditation process**



*Source: own figure*

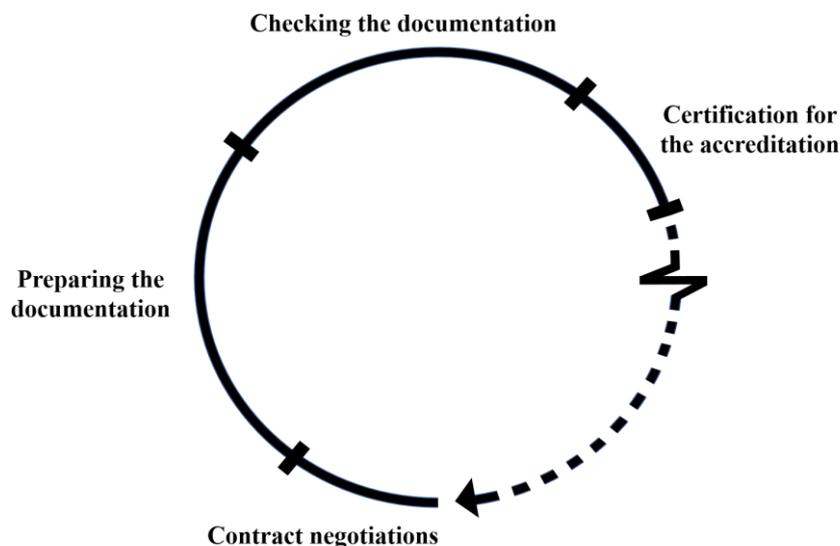
Before a university can accredit a course, certain conditions have to be fulfilled. It is to be assumed that a new course of study shall be implemented. The first step is the creation of a concept by the university. At this point, university related processes have to be implemented into the course in order to guarantee the existence of the university. Further, planning regarding the duration of study, the degree and the different modules in validation with Bologna has to be made. Additionally, requirements by the political

stage have to be fulfilled. This planning is supported by additional appointments and a well formulated concept. At this point, we already commenced towards the first stage (Plan) of the PDCA circle. The second stage (Do) concerns itself with the direct implementation of this plan, all steps will be taken to guarantee accordance with the plan. This leads to a template, safeguarding the whole process, based on pre-determined standards. With the help of controlling instruments, the third stage can be (Check) put into action. This is followed by a supportive system of evaluations, statistical data and reports. In the last stage (Act) measures will be taken which contribute to the further improvement of quality. Process descriptions, standards and figures contribute towards this goal. Otherwise the information cannot be reliable and is prevented from being implemented by the university's internal staff.

## 2. Accreditation procedure within the product life circle

At this point, the process life cycle shall be the subject of discourse, an essential component for companies stressing the importance of sustainability and the life cycle orientation. A detailed approach of the German accreditation procedure from the university's standpoint seems to be appropriate. The German education system is federal in its nature and the administrative apparatus is based with the 16 federal states, essential regulations can be found within the basic law of the Federal Republic of Germany. Consequently, this provides for a close cooperation between the federal level and the states. (KMK, 2016) At this point, the four stages of the accreditation process within the Federal Republic of Germany should be explained from the point of view of the universities.

**Figure 2: Accreditation process from Universities in higher education**



*Source: own figure*

The first stage consists of the contract, which is the selection of the respective accreditation agencies which will, as requested by the ministry, carry out the procedure in a timely manner. Essentially this process is based on cost-efficiency rather than quality. Then the contract is closed between university and the accreditation agency by agreeing on a future date for the delivery of the document. Afterwards, access to the second stage is given with the production of the self-documentation of the course of study to be accredited. This documentation can be divided into five segments. (BVG, 2016)

In the first segment, the university should stand to the aims of the institution and the course of study and is urged to give explanation about future university-related advancement possibilities. After investigating the macroeconomic perspective of a university, the course of study-related signs are discussed in the second segment. At this point, it seems to make sense to outline the study concept, the modules, admissions conditions and advancement opportunities for each individual course. (ACQUIN, 2014, p. 2) The third segment is devoted to the implementation, in which the issues are to be addressed related to full-time and non-full-time teaching staff, decision-making processes and cooperation, exam systems, documentation and gender aspects. In the fourth segment, all quality assurance measures and advancement process shall be documented and outlined. The last segment deals with attachments such as statistics, study and exam guidelines, module descriptions, graduation documents, teaching staff and capacity calculations.

In the third stage, by the university submitted documents are presented to the consulting group of the accreditation agency and checked based on completeness and plausibility. Within the scope of an on site-visit at the university, the consulting group can put their questions before the course of study representatives within the scope of a bilateral exchange of information. In this case, the university selects the lecturers, students and graduates for these interviews. The university will be informed on the view of the consulting commission and can defend its own opinion if deviating from the report. The consulting commission presents its recommendation of the course of studies to be accredited to the accreditation commission and the accreditation commission decides the accreditation procedure, hereby four scenarios are conceivable: (ACQUIN, 2014, p. 6). 1) Accreditation without conditions: The course of study is well structured and the high-quality standards are fulfilled. Recommendations which can be useful for the advancement of the course of study can be given. The re-accreditation period amounts to five years after the initial accreditation, afterwards every seven years. 2) Accreditation with conditions: The course of study shows content or structural deficiencies which must be addressed within the next nine months. The accreditation term is limited up to the procedure end and is extended after fulfillment of the conditions as provided by the first scenario. 3) Non-accreditation: If the defects listed in the previous scenario are not addressed within nine subsequent months, the refusal of the accreditation follows. The university can put out the procedure for the deficiency removal once up to 18 months. 4) Reinstatement: The suspension of the accreditation procedure occurs on the part of the university, the resumption must occur within the formulated term, otherwise this may lead to the refusal of the accreditation.

Based on the example of the German accreditation procedure, it was shown that a variety of actors are involved. In this manner, a business connection originates between principal and contractor which leads to a dependence. In this context, the principal agent theory has to be mentioned, which exists in imperfect markets of an asymmetrical approach to information with which the actors experience different states of information. (Varian, 2016, p. 811) The signs of an unequal distribution of information are among others: "hidden characteristics", "hidden intention", "hidden information" and "hidden action". (Heyd et. al., 2011, p. 38) All four process phases can be anticipated within the scope of an accreditation procedure if asymmetrically distributed information can be reasonably perceived. It is important to attach the suitable roles to the essential actors: the university is the principal and the accreditation agency is the agent. From the point of view of the author, essential information can already be held back with the contract's initiation, because the ministry, the university and the commission do not keep contact with each other directly. In this stage "hidden characteristics" could occur. In this case of the contract's initiation, different claims of every party are enforced by the university and accreditation agency, so that it can already be referred to as "hidden intention". With the gathering of the papers relating to the self-documentation which is carried out by the universities and the statistical data collected, the principal possesses more detailed information on the quality of the students and the employees than the agent, which can lead to information held back in the process. At the same time, this can occur within the examination stage outgoing from the accreditation agency. At this point, "hidden information" is possibly created. By the on site-visit, the university can make suitable arrangements to make the course of study to be accredited appear to be better off, so that already in this stage "hidden action" begins. Thus it is also possible in the last stage, which is conducted by the accreditation agency, that the subjective opinion of the Agents can have a considerable influence on the course of study to be accredited. The above-mentioned supposition concerning asymmetrical information could already be proven by Suri/J due to observations and they came to the result that in this connection the often cited "moral hazard" and "adverse selection" exist. (Suri and J, 2016) "Moral hazard" can be described as a not observable action or as a hidden action in terms of the opposite market side, whereas "adverse selection" can be described as the intentional hiding of information. (Varian, 2016, p. 811) "Moral hazard" can result out of "hidden information" and "hidden action", whereas "adverse selection" generally results from "hidden characteristics" and "hidden information". This creates varied uncertainties and asymmetries of information by which the actions of the agent and with it the accreditation itself can be influenced.

If we turn to the addressing circle of accreditations, it could be supposed that the students are the only addressees of the accreditation procedure, this would be a fallacy, because much more partners are involved. Because it concerns the educational mission which belongs traditionally to the state and contributes to the business development, more partners must have a stake in it. If the perception is steered towards the macroeconomic considerations, from the stakeholder perspective, the addressee circle is enlarged and external actors are able to influence the results as it is sometimes done by external companies. Further the public can also be perceived as a stakeholder, because by a suitable reputation and image the continued existence of the university can be guaranteed

by new incoming students. In this context, cooperation partners have to be named as well. (HRK, 2015, p. 11) In addition, next to the macroeconomic consideration the microeconomic perspective should also be considered. In this connection, next to the students belong professors, full-time and non-full-time lecturers as well as employees to all of these areas.

## Conclusion

The criticism of the Bologna reform grows in particular on account of the elevated administrative expenses from the point of view of the universities involved. The author notes that sometimes a uniform standard of the accreditation procedure is not existent and is not desired. This is based by the currently different political and sociocultural systems as well as educational tradition. Furthermore, the information-economic analysis of the stakeholders within the accreditation process, which the author has worked out, and may pose even as an economic damage for the countries of Europe. Also the consideration of the stakeholder within the accreditation process, has shown that considerable hidden information aspects exist. Consequently, everyone looks after their own interests and is denied certain information.

Based on these findings, the aim is to maintain a uniform standard of accreditation within the EU. A possible method for the subsequent research is a qualitative survey consisting of specially selected experts on European terrain, in particular university professors, who had, in particular, passed through the accreditation process in the past several times. This approach could be based on a downstream delphi method or semi-structured interviews. The following points should be integrated, the expectations of the private sector as well as the teaching in the digital age of industry 4.0. The scope of the questions is variable. The advantage of the guidance interview is that the respondent is given enough room for his own formulations. This allows the author to better define the topic field for a standardized accreditation procedure.

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## Using Symmetric Cryptography for Evacuation Control during Naturogenic Emergencies

### Abstract

This paper links the field of crisis management and informatics as a – specifically the application of cryptographic methods for evacuation control in case of abiotic naturogenic emergencies. Basic terms are defined here, including the division of emergencies and the definition of crisis communication. The proposed case study is based on a real danger, namely the tsunami. Since 2004, when Thailand's coast was hit by the tsunami wave, the detection systems have significantly improved, but the notification of individuals at risk and subsequent evacuation is still not very effective. The basic idea of the described system (currently at a conceptual level) is to ensure the gradual distribution of warnings and coordinate information to predefined areas with an exclusivity attribute. To achieve this exclusivity, the information must be encrypted. It is the ability to encrypt this information. In this case, the encryption key would be created from characters that correspond to the geographic coordinates of the area where the information would be targeted.

### Key Words

*AES, evacuation, encryption, emergency, tsunami*

**JEL Classification: H12, L86**

## Introduction

There are many inhabited sites all over the world that are potentially at risk of tsunami and have a very weak infrastructure that would cause many problems in any situation requiring a mass evacuation. One of these places is, for example, Padang, located on the island of Sumatra on the Indian Ocean coast. It is the largest city on the west coast of Sumatra, with a population of about 1,000,000. The problem is that the surrounding areas are mountainous and the main roads are mostly near the coast. Eventual mass evacuation of large numbers of inhabitants has thus become problematic mainly because of the impassability of major escape routes.

Systems capable of detecting this type of danger are now relatively sophisticated, and it is possible to determine fairly precisely when, where and by what force the tsunami will strike. Regional Operations Centers will receive this information within minutes, but unfortunately, the final step, namely the notification of the population and the "smooth" course of the evacuation of the endangered area, is not very effective.

The following text of the submitted paper deals with the issue of how to improve the procedures for distributing information to vulnerable groups of people in the event of emergencies caused by natural influences.

## **1. Methods and Tools**

### **1.1 Basic concepts**

According to Veverka (2003), extraordinary events may be divided into two basic groups: naturogenic (induced by natural influences) and anthropogenic (caused by human activities). Naturogenic events are further classified as abiotic, caused by inanimate nature (fires caused by natural influences, floods, ...) and biotic caused by living nature (epidemic, epizootic, ...). Anthropogenic emergencies can be further subdivided into technogenic (eg traffic accidents), sociogenic internal (terrorism), sociogenic external (military crisis), and agrogenic (degradation of water resources).

This paper focuses mainly on abiotic naturogenic emergencies, more specifically on events such as tsunamis or typhoons.

The concept of crisis communication, which can be defined According to Antušák (2009) as "transfer of information between the state authorities, territorial self-governing bodies and between the components of the integrated rescue system using the appropriate means of voice and data transmission of public information", is closely related to the solution of emergency events and the distribution of information during them. The goal of crisis communication is to spread the right (timely, valuable, trustworthy and persuasive) information at the right time and place to ensure timely and professional readiness of the authorities and elements of crisis management to execute the follow up activities. Partial attributes of crisis communication include the reduction of uncertainty, avoiding panic, and contributing to effective organized behavior in a given situation (the public, the employees of the company, the family, etc.).

### **1.2 Indian Ocean Tsunami Warning and Mitigation System**

There are a number of systems around the world that focus on different categories of potential threats and hazards. One such system is the Indian Ocean Tsunami Warning and Mitigation System (IOTWS).

This system has been in operation since 2006 and is primarily focused on Tsunami warnings in the Indian Ocean (IOC Tsunami Programme, 2011). The IOTWS is able to pass the information to the National Tsunami Warning Centers (NTWCs) within five minutes. The monitoring stations of this system consist of an underwater seismograph that is designed to measure groundwater quake and ocean buoys that transfer information to

the operational centers of the individual states. However, there is no effective channel to warn people and manage evacuation.

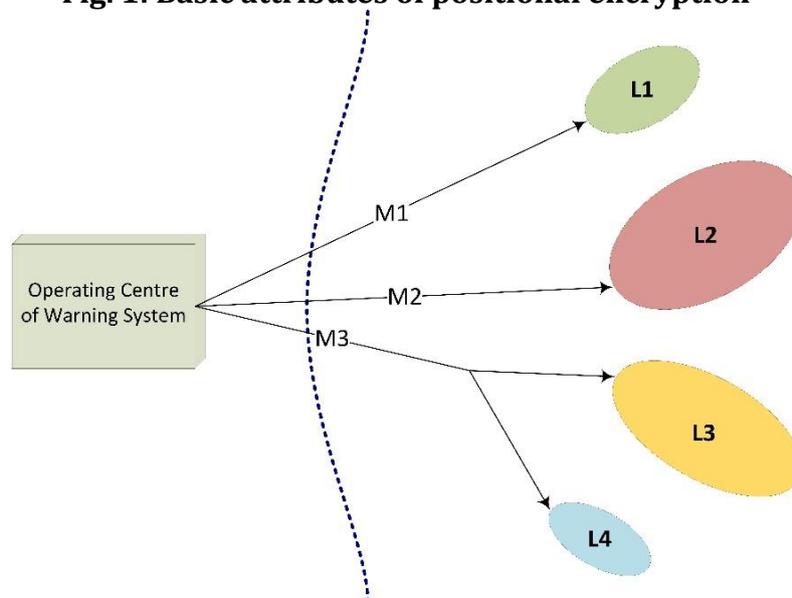
The end-points of this system are represented by not a very intensive loudspeaker systems. In some countries, the role of the „Messenger“ is performed by runners. The advantage of IOTWS is the ability to quickly detect the approaching tsunami. However, taking into account the fact that the whole area is experiencing an imminent danger in the same moment, there are problems especially in the overcrowded areas caused by panic and consequent issues created by mass evacuation.

### 1.3 Positional encryption

The general principle of positional encryption is an algorithm that ensures that encrypted text can only be decrypted at a specific location determined by the sender. If someone attempts to decrypt a message elsewhere (a potential attacker, a person unwilling to receive a message at that time), the decryption process fails and no details of the original information are shown. This principle allows data to be encrypted locally and thus reserved for a particular location or a wider area.

The principle of positional encryption was first published in 2003 under the title Geo-Encryption (Scott & Denning) and was tested for encrypted digital film distribution with purpose to reduce piracy. In addition, in combination with Radio-Help (Skrbek, 2010), it is possible to spread different information to several designated locations at the same time. For each of these locations, the message can be encrypted using an encryption key that is derived from the geographic coordinates of the determined location.

**Fig. 1: Basic attributes of positional encryption**



*Source: authors' own picture*

The basic elements of the positional encryption are shown in Figure 1. Ellipses L1 to L4 show areas / locations where an encrypted warning message needs to be sent in addition to the requirement that the message  $M1 \neq M2 \neq M3$ . In addition, the message exclusivity in the individual areas must be ensured. This means that the M1 message can be successfully decrypted only in the L1 area, the M2 message only in the L2 area, the M3 message in the L3 and L4 regions - the same message can be sent at the same time to the same non-adjacent regions.

## **1.4 AES algorithm**

Suitable algorithms for the propagation of positionally encrypted warning messages include the AES (Advanced Encryption Standard) block cipher. A detailed description of the algorithm is provided in the "Specification for the ADVANCED ENCRYPTION STANDARD (AES)", which was issued in 2001 by the US National Institute of Standards and Technology after the adoption of the cipher by the US State Administration (US NIST, 2011).

Currently, the AES block cipher is one of the most commonly used cryptographic algorithms. The length of one cipher block is  $n = 128$  bits. The algorithm counts with three key length variants: 128, 192, or 256 bits.

## **2. Results and Discussion**

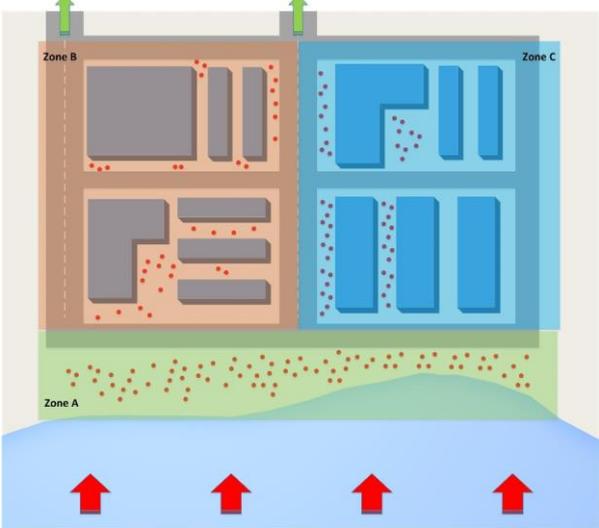
### **2.1 A case study on tsunami threats**

In the case of tsunami and state of danger announcement with the help of the loud-speaker system available, there is a high risk of rapidly spreading panic due to the mass spontaneous evacuation, which often results in the clogging of access roads leading towards the city center (away from the coast). Another consequence of this evacuation is panic even in places that are not immediately threatened, which makes the overall permeability of the roads even worse, and despite the efforts of the rescue and coordination teams, a complete loss of control over the evacuation may occur.

Summarizing the above information and taking into account the fact that disruptions of power networks, mobile networks and the Internet are very common during natural disasters we will realize that the existing communication channels often fail and there is a high risk that the necessary information will not be delivered in the right time to the right place. For this reason, we need to eliminate the dependence on the power infrastructure, mobile networks and the Internet as much as possible and to find such communication channels and information systems that allow us to disseminate important information in a suitable form and to the places where it is needed the most.

The above model situation (see Figure 2) represents the case of a region that is threatened by a tsunami and needs to be evacuated. Even though the model is specifically targeted at the tsunami, it can also be generalized for other cases where it is necessary to evacuate more individuals in danger.

**Fig. 2: Graphic representation of the case study**



*Source: authors' own picture*

The situation is based on the already mentioned systems, which are able to evaluate the phenomenon and determine precisely when and where the tsunami will hit the coast and with what force. Despite the fact that such information is available, there is currently no way to pass this information to the residents (or tourists) using some other sophisticated way than the loudspeaker system. The problem of this way of distributing information is, in particular, the bulk attribute, meaning that information is read by a large number of individuals at once. As a result, a very rapid spread of panic will arise, resulting in clogging of roadways and access roads. Moreover, there is a risk that panic will arise even in places that are not immediately threatened, thus making the progress towards the center of a particular city (i.e. away from the coast) even worse.

If we assume that the time from the detection of the danger to a possible tsunami hit on the coast is in the order of several hours, not minutes, there is some time for more efficient evacuation control. In order to do this, however, it is necessary to ensure that the evacuation takes place gradually by sub-areas, which implies, among other things, a prerequisite of gradual dissemination of warnings and organizational information into these areas. In addition, for each of these areas, it would be desirable to ensure the exclusivity of this information (see Figure 1). This means that a message available at a predetermined time interval in one area (zone B) should at that time be unavailable in other locations (zone A and zone C). After a certain lapse of time, the message will be forwarded to other areas (zone C and finally zone A) in the updated form. One of the possible ways to do this is to use a device that is available today for almost everyone, that is, a mobile phone. The method that can provide this information exclusivity is called positional encryption (see Chapter 3). However, this step should be in synergy with

shutting down or limiting the mobile network and the Internet connection, because if the mobile network was to operate in full mode, it would not prevent the spread of panic to the other areas. Specific evacuation scenarios based on geographic possibilities of the area and other aspects should be developed by cities, grounding units, etc.

## **2.2 Using symmetric cryptography for positional encryption purposes**

Using positioning encryption, it can theoretically be ensured that a warning message for one population group that moves in a predefined area (not necessarily a contiguous area) is not readable elsewhere. As a result, sequential controlled evacuation could occur in certain areas.

The original Geo-Encryption algorithm uses the hybrid cryptography principle. Here, however, it is necessary for the recipient of the information to be known in advance. In the case of the distribution of warning messages, there is a problem that unknown inhabitants / tourists are in the area defined for receiving the message. Thus, if the potential recipient of the report is an anonymous person (or an anonymous device belonging to that person), a question arises regarding what cryptographic algorithm can be used in these cases to ensure the exclusivity of the information transmitted. For the purpose of transmitting warning information, where it is additionally desirable to add a confidentiality factor related to a particular location, symmetric classification cryptographic systems are considered as the best suited. The often-mentioned disadvantage of symmetric algorithms, namely the problems associated with the safe delivery of the key to the sender and the recipient, is to some extent eliminated here, as there is no key forwarding. If an anonymous recipient is authorized to receive the message, which means that he is located in an area defined to receive decrypted information, he will have available on his device the correct decryption key (geographic coordinates).

Formally, the encryption process can be expressed as  $C = E(Z, K_E)$ , where  $E$  is the encryption function that is determined by the  $K_E$  encryption key on the sender side of the message. This function transforms the open message  $Z$  into cryptogram  $C$ , which is then transmitted via the selected communication channel to the potential recipients of the message. The cryptogram  $C$  is decrypted in the form of an open message  $Z$ . This process can be expressed as  $D(C, K_D) = Z$ .  $D$  is the decryption function inverse to function  $E$ . To determine and open the original message  $Z$ , it is necessary to have knowledge of the  $K_D$  decryption key.

The encryption function  $K_E$  must be designed in such a manner so that the attacker is unable to derive a message from the cryptogram without knowing the encryption key before the specified cryptogram resistance time. The cryptogram resistance time depends on the needs of the specific application. In the case of emergency warnings, a minute time span would be sufficient for the cryptogram resistance.

There is a dependence between the  $K_E$  encryption key and the decryption key  $K_D$ , which can be expressed as  $K_D = f(K_E)$ . If it is practically possible during the cryptogram resistance period to detect the  $K_D$  value from the  $K_E$  value, then both keys must be secret. Cryptographic systems where the  $K_E$  and  $K_D$  keys have the same or symmetrical status for confidentiality are referred to as symmetric secret cryptosystems (secret systems with secret key).

If the AES algorithm is used, the encryption key is derived from the geographical coordinates (coordinate) of the point defining the location where the encrypted broadcast is to be directed. In the case of specific coordinates 0°53'36.1"S, 100°20'39.0"E (location on the Padang coast), the cryptographic key could consist of the following 16 characters 053361S10020390E, which implies the use of a 128-bit key (one character equals 8 Bits). This key length corresponds to the precision of the positioning in the order of tenths of seconds, which for the above purposes is sufficient because the smallest areas for receiving encrypted messages should not be less than tens of square meters.

## Conclusion

This article briefly describes the concept of a system for positional cryptographic transmission of warning information, including motivational reasons, which led to the creation of the above described case study. The whole system is currently in the early stages of its development. The aim is to propose a procedure that would eliminate the weaknesses of the existing information distribution and, consequently, improve the evacuation process in the case of abiotic naturopathic emergencies – in this case specifically the tsunami. One of the basic problems in the case of mass evacuation of a larger group of people from a certain area is the rapidly spreading panic, which leads to further negative effects. One way to help manage such evacuation is to gradually spread exclusive information to potentially endangered areas, based on a pre-developed detailed scenarios and positional encryption. This means that confidentiality of the message is guaranteed exclusively for a predetermined area. In another area, the message would be unavailable. In these cases, only symmetric cryptosystems are applicable. Appropriate candidates include the AES algorithm, which is one of the most reliable, fast and transparent cryptographic methods.

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