

Technical University of Liberec
Faculty of Economics

Proceedings of the 12th International Conference

Liberec Economic Forum 2015



16th – 17th September 2015
Liberec, Czech Republic, EU



TECHNICAL UNIVERSITY OF LIBEREC
Faculty of Economics



Proceedings of the 12th International Conference

Liberec Economic Forum 2015

**16th – 17th September 2015
Liberec, Czech Republic, EU**

The conference has been supported by the main partners
of the Faculty of Economics, Technical University of Liberec:

ŠKODA



Editor & Cover: Ing. Aleš Kocourek, Ph.D.
Publisher: Technical University of Liberec
Studentská 1402/2, Liberec 1, Czech Republic, Europe
Issue: 120 copies

Publication has not been a subject of language check.
Papers are sorted by authors' names in alphabetical order.
All papers passed a double-blind review process.

©Technical University of Liberec, Faculty of Economics
©Authors of papers – 2015

ISBN 978-80-7494-225-9

Programme Committee

- doc. Ing. Miroslav Žižka, Ph.D.
Faculty of Economics, Technical University of Liberec, Czech Republic
- Prof. John Anchor
University of Huddersfield, United Kingdom
- Prof. Arun Aneja
Greenville, North Carolina, United States of America
- doc. Ing. Klára Antlová, Ph.D.
Technical University of Liberec, Czech Republic
- Prof. Rune Todnem By
University of Staffordshire, United Kingdom
- Prof. Horatio Dragomirescu
Bucharest Academy of Economic Studies, Romania
- Prof. Jon Fairbun
University of Staffordshire, United Kingdom
- Prof. Dr. Peter E. Harland
Technische Universität Dresden / International Institute Zittau, Germany
- Prof. Gerhard Chroust
J. Kepler University Linz, Austria
- Prof. Ing. Ivan Jáč, CSc.
Technical University of Liberec, Czech Republic
- Prof. Ing. Jiří Kraft, CSc.
Technical University of Liberec, Czech Republic
- doc. Ing. Šárka Laboutková, Ph.D.
Technical University of Liberec, Czech Republic
- Prof. Earl Molander, PhD
Portland State University, United States of America
- Dr. Rudrajeet Pal
University of Boras, Sweden
- doc. Ing. Petra Rydvalová, Ph.D.
Technical University of Liberec, Czech Republic
- doc. Ing. Jozefína Simová, Ph.D.
Technical University of Liberec, Czech Republic
- Prof. Sigitas Vaitkevicius
Kaunas University of Technology, Lithuania

Organisation Commitee

- doc. Ing. Klára Antlová, Ph.D.
Faculty of Economics, Technical University of Liberec
- Ing. Martina Černíková, Ph.D.
Faculty of Economics, Technical University of Liberec
- Ing. Jaroslav Demel, Ph.D.
Faculty of Economics, Technical University of Liberec
- Ing. Iva Hovorková
Faculty of Economics, Technical University of Liberec
- Ing. Aleš Kocourek, Ph.D.
Faculty of Economics, Technical University of Liberec
- PhDr. Ing. Helena Jáčová, Ph.D.
Faculty of Economics, Technical University of Liberec
- Ing. Kateřina Maršíková, Ph.D.
Faculty of Economics, Technical University of Liberec
- Ing. Jan Mrázek
Faculty of Economics, Technical University of Liberec
- Ing. Iva Nedomlelová, Ph.D.
Faculty of Economics, Technical University of Liberec
- Ing. Athanasios Podaras, Ph.D.
Faculty of Economics, Technical University of Liberec
- Ing. Petr Rozmajzl
Faculty of Economics, Technical University of Liberec
- Ing. Mgr. Marek Skála, Ph.D.
Faculty of Economics, Technical University of Liberec

Table of Contents

Section I	
Quality of Economic Environment and Optimization of Market Structures	
Pavla Bednářová.....	10
Spatial Concept of Market Zones in the Czech Republic	
Josef Botlík, Milena Botlíková, Pavlína Pellešová	20
Change the Quality of Economic Environment of Municipalities – Comparing the Revenue of the Budget Structure of Municipalities to 5000 Inhabitants	
Blanka Brandová, Jiří Rozkovec	29
Nominal Convergence in the European Union	
Radim Dolák, Petr Suchánek.....	36
Lean Company Research in Manufacturing Companies in the Czech Republic	
Zuzana Fraňková, Ivan Jáč	47
Perception and Values of Family Business	
Jiří Kraft, Alexander Zaytsev	56
Developing the Competitive Environment During the Interaction of the State and Market Participants in the Conditions of the Economic Instability	
Irah Kučerová, Iva Nedomlelová.....	65
Applying Integration Theories on Development of Cooperation in Central Europe	
Šárka Laboutková	78
Open Government Data – A Lesson to Be Learned	
Miroslava Lungová.....	89
Difficulties with Measuring Local Economic Resilience	
Miloš Maryška, Petr Doucek, Lea Nedomová	101
ICT ProFessionaLs Wages Development	
Lukáš Melecký, Michaela Staníčková	112
RTS and Efficiency Frontier Estimation for Comparing Competitiveness: Case of EU Regions	
Jozefína Simová.....	122
Factors of Market Environment Affecting Retailing in the Period of Economic Crisis as Perceived by Clothing Retailers	
Jolanta Solnyškinienė, Aistė Kuliavienė.....	132
Evaluation of Large-scale Lithuanian Milk Processors Changes in the Structure of the Export Due to Russian Embargo	
Ivan Soukal, Jan Draessler.....	144
Price Information Asymmetry Impact on Optimal Choice – RCBS Market Case Study	
Michaela Staníčková.....	154
Merging Regions and Effect on Competitiveness: Issue of EU Major Cities and Surrounding Areas	

Lenka Strýčková	165
The Utilization of Industry Standards in the Optimization of Corporate Capital Structure	
Jan Sucháček, Petr Sed'a, Václav Friedrich.....	175
Location Preferences of Largest Enterprises in the Czech Republic and Their Differentiation	
Jarmila Šebestová	184
Regional Business Environment and Business Behaviour of SME's in Moravian-Silesian Region	
Jana Šimanová, Aleš Kocourek.....	192
Nominal vs. Real Regional Income Disparities in Selected Cities of the Czech Republic	
Tomáš Tichý, Miloš Kopa, Sebastiano Vitali.....	201
The Bandwidth Selection in Connection to Option Implied Volatility Extraction	
Jaromír Veber, Tomáš Klíma.....	209
Mapping of ISO 27000 Digital Evidence to Processes of Digital Forensics Lab	
Pavel Zdražil.....	218
The Impact of Public R&D Expenditure on Private R&D Expenditure: The Evidence of Regions of EU Less Developed Countries	

Section II

Strategic Enterprise Performance Management

John R. Anchor, Abdallah Amhalhal, Shabbir Dastgir	230
The Use of Multiple Performance Measures and Organisational Performance in an Emerging Market	
Klára Antlová	236
Agility Approach in Innovation Projects	
Pavol Budaj, Miroslav Hrnčiar	244
The Importance of Risk-Based Thinking for Enterprise Performance Planning	
Iwona Gorzeń-Mitka, Małgorzata Okręglicka.....	253
Review of Complexity Drivers in Enterprise	
Jana Holá, Jan Čapek	261
Evaluation of the Relevance and Effectiveness of Internal Communication Elements	
Ivan Jáč, Josef Sedlář, Andrey Zaytsev, Alexander Zaytsev.....	272
Specificity of Forming the Incremental Value of a High-Technology Enterprise on the Basis of Implementing Innovative Managerial Techniques	
Hendrik Jähn	286
A Methodology for the Integration of Soft Facts in a Performance Analysis	
Varvara Karpova	297
Managing the Competitive Strategy of a High-Technology Enterprise During the Instability of the External Environment	
Anna Lemańska-Majdzik, Małgorzata Okręglicka.....	305
Business Process Management in an Enterprise – Determinants of the Implementation and Expected Advantages	

Kateřina Maršíková, Václav Urbánek.....	315
Firms and Overeducation: Influence on Employee Satisfaction and Firm Productivity	
Oleg Melnikov, Andrey Zaytsev	323
Strategic Management of Innovative Activities of a Company According to the Market Capacity for Innovation	
Žaneta Rylková.....	333
Strategic Drivers of Family Business	
Monika Sipa, Andrzej Skibiński	342
Innovative Strategies of Small Enterprises in Poland	
Alice Reissová, Tomáš Siviček, Josef Jílek	353
Spatial Aspects of Employee Engagement	
Miroslav Žižka, Lukáš Turčok.....	365
Data Envelopment Analysis as a Tool for Evaluating Company Performance	

Section III

Opportunity of Modern Tools in Information and Communication Technologies

Václav Janoščík, Zdeněk Smutný, Radim Čermák.....	376
Integrated Online Marketing Communication of Companies: Survey in Central and Eastern Europe	
Daria E. Jaremen, Elżbieta Nawrocka, Andrzej Rapacz.....	384
ICT and the Travel and Tourism Intermediaries Sector	
David Kubát, Marián Lamr, Jan Skrbek	392
New Approaches to Smart Solutions for Eliminating Car Accidents	
Lukáš Turčok, Athanasios Podaras.....	402
A VBA Application for Dynamic Model with Movement of Stocks Absolutely Determined	
Otakar Ungerman	409
Use of Social Networks in Personnel Marketing	

Section IV

Papers by Doctoral Students

Zuzana Palová.....	424
Measuring of Social Disparities in Selected Regions in the Czech Republic	
Tereza Semerádová, Jan Mrázek.....	431
The Influence of Experience and Education of Project Managers on Project Success	
Kamila Turečková.....	438
Measurement of Income Inequality by Method of Non-Weighted Average Absolute Deviation: Case of South European Countries	
Tomáš Verner, Silvie Chudárková	447
The Economic Freedom Effect on Corporations' Output: The Case of European Union	
Věra Vráblíková.....	456
The Impact of Taxes on Economic Growth in the Long-Run and Short-Run	

Section I

Quality of Economic Environment and Optimization of Market Structures

Pavla Bednářová

Technical University of Liberec, Faculty of Economics, Department of Economics
Studentská 2, 461 17 Liberec 1, Czech Republic
email: pavla.bednarova@tul.cz

Spatial Concept of Market Zones in the Czech Republic

Abstract

Regional economy introduces space into economic theories and to practical procedures – a spatial economic system is introduced which is understood as "a complex of elements in interaction". The aim of the article is to create a spatial concept of market regions (market zones) on the basis of the detection of market spatial interactions with an accent on the actual commutation relations while accepting the current administrative division of the Czech Republic (CR). In connection with the main aim it is necessary to identify market centres (price determining places), determine their gravitational force with regards to their surroundings. As a result of the interconnection of market, administrative and transport principle, 10 market centres of the first degree were detected in the CR and they were all metropolitan cities with high concentration of demand, high centre dominance and strong spatial relations towards its surroundings. These centres also often have the highest prices. The centres of the second degree, in the CR 14 towns in total, are hierarchically below and in connection with regional price disparities these are centres with lower level of regional prices. Having taken into account all three approaches to the hierarchy of market centres, a final map of market regions was created (in Geographic information system GIS) which captures the distribution of market centres of the first and second degree, the boundaries of the market zones belonging to the centres with the accent on actual commutation relations while accepting the current administrative division of the Czech Republic.

Key Words

market centres, market zones, localisation, spatial concept, nodal centre

JEL Classification: R12, R23

Introduction

The article was written as a part of the applied research project TD020047 "Regional Price Index as the Indicator of the Real Social and Economic Disparities" supported by the Technology Agency of the Czech Republic - the Omega Programme, which deals with the issue of spatial comparison of price levels of regions in the Czech Republic. The neoclassical theoretical concept is based on an assumption that the price is determined by the interaction of supply and demand where the supplying party tries to maximize its profit while the demanding party strives to maximize its utility from consumption. Market mechanism of pricing and adaptation of supply and demand is applied. Regional economy introduces space into economic theories and to practical procedures – a spatial economic system is introduced which is understood as "a complex of elements in interaction", including producers, consumers, communities, economic centres, and all these components are interconnected by flows of property, energy, services, persons and information. Spatial organization of production reflecting relations between demand, supply and price is based on economic relations including the influence of distance on costs, demand space potential of the sale/consumption, spatial relations of businesses in

competition in hierarchical relations of economic centres in the space, the influence of transport corridors, the distribution of population with regards to the creation of market zones, consumer mobility, location rent and other factors.

The aim of the article is to create a map prepared in GIS¹ illustrating spatial concept of market regions (market zones) on the basis of the detection of market spatial interaction with an accent on actual commutation relations while accepting the current administrative division of the Czech Republic. In connection with the main aim it is necessary to identify market centres (price determining places), determine their gravitational force with regards to their surroundings and to answer the question whether the administrative division corresponds to the defined market zones. For the delimitation of market centres the regression analysis method was used for the detection of mutual dependences between the regional price level and localisation factors – demand, supply and agglomerative. For the marking of the line interface of market zones (catchment area) to market centres, the method of the comparison of the administrative division of the CR with the borders of so called functional regions delimited by a certified methodology on the basis of the data about direction flows of inbound and outbound commutation between municipalities in the CR was used. The gained information was used to create a map (in the GIS system) which highlights centres of the first and second degree and market regions belonging to them together with characteristics optimal for the construction of a regional index of a price level.

1. Market centres

The starting point for the identification of market (price determining) centres is so called Walter Christaller's Theory of Central Places [7], which deals with the issue of spatial system of settlement, size and distribution of settlements in the settlement structure mainly on the basis of economic characteristics depending on consumers' and business men's behaviour in real time. The basis of this theory is an assumption that small settlements are able to produce only a limited range of goods or services according to their own dispositions and more varied and richer entertainment is provided by larger centres in an accessible distance. The more often the inhabitants use the given goods or services, the closer or further away the centre providing them is and gradually the spheres of power of a particular centre are created, influenced by their time accessibility and transport costs. Regions thus emerge with centres including at least the certain number of inhabitants (threshold population) capable of supporting the specific economic facility, which represents so called economic threshold of effectiveness. The original theory was extended by A. Lösch [10] by the examination and definition of market zones belonging to the market centres, or by W. Isard [8] who focused on theoretical aspects of localisation in the context of regional economy. Spatial modelling and numerical experiments in relation to the Theory of Central Places was also dealt with by S. Openshaw and Y. Veneris [11]. Significant domestic contributions to the issue of spatial interactions were focused on the delimitation of the potential of the sphere of influence of regional centres and

¹ Geographic information system 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. <http://www.geoportalpraha.cz/>

gravitational tendencies, e.g. M. Hampl [4], [5]. Other studies dealt with the assessment of an administrative division of a territory, e.g. V. Hubáčková and T. Krejčí [6], M. Halás and M., Klapka [3] and with the proposal of a potential territorial-administrative structure based on the modelling of modified real-world interactions.

A Market Centre represents a place which provides products, services and administrative facilities for inhabitants of a specific "catchment" area. [7] The basic prerequisites of the market centres construction are:

- Spatial aspects of supply and demand (the existence of a market zone for the given service)
- Localisation of economic subjects (threshold number of inhabitants, factors influencing the localisation (placement) of these subjects).

Market centres gradually develop a service function also for their wider surroundings (background areas) influenced by time accessibility and transport costs. More expensive and less frequently needed services (goods) have a higher limit of accessibility than less expensive or more frequently used services (goods). A centre is connected with its catchment area by centripetal and centrifugal bonds. The centre provides the catchment area with work opportunities, civic amenities, cultural facilities, services. The catchment area, on the other hand, provides the centre with human potential, resources, agricultural products and free-time facilities. The significance of a centre is assessed according to so called centrality, which means that according the extent of services or goods provided so called hierarchy of central places originates. Centres of higher degree provide its catchment area with more services, goods, administrative services, cultural, social and sport facilities, etc., and they thus have wider scope of facilities and thus bigger catchment area, market zone. Centres of lower degree provide less goods and services, less civic facilities and they service only a smaller or just small territory. Spatial delimitation of a market zone can then be done on the basis of so called demographic force which captures social, economic and spatial interactions and which is derived from the principle of the least effort – from the assumption that a man always tries to rationalize their behaviour and thus to minimize the effort leading to the required targets. It is in connection with the spatial behaviour directly related to the impedance effect of distance on which can be applied Reilly model (i.e. the law of gravity retail) setting out the liner interface centres of spheres of influence. [12]

2. Arrangements of central places

In the spatial hierarchy of market centres three possible ways of their creation can be used as a starting point: market, transport and administrative [7].

1. Market principle - structural characteristics of a centre is determined by its size, number of inhabitants, population density, and the number of businesses.
2. Transport principle - nodality principle aims at the integration of the transport system, it observes interaction, commutation and transport relations between centres, e.g. commutation to schools and services, schooling facilities, health care facilities (pharmacies, hospitals, surgeries, emergency services), number of beds, civic facilities).

3. Administrative principle - principle of hierarchy is based on the assumption of an unequivocal affiliation of lower centres to a particular higher centre.

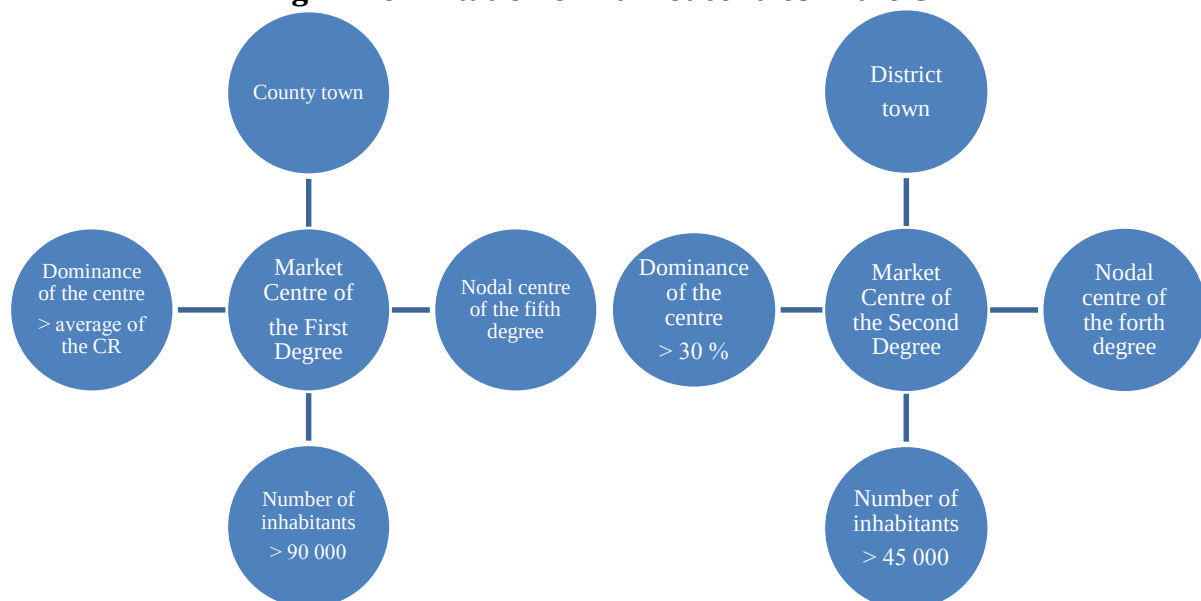
In connection with the spatial delimitation of market regions, and mainly with the definition of market centres, it is necessary to respect recent trends which have a significant influence on differences in price levels in individual regions. Some of the significant trends are:

- A crowding effect when the increase in concentration of companies and inhabitants in centres leads to the increase in prices of factors and goods which are immobile and the offer of which is fixed (housing or land).
- Extension of the offer of new services in centre places of higher degrees as a result of the increasing purchasing power of the population.
- Due to the qualitative development of transport and technologies (commutation to work, growing number of personal cars, suburban transport, long-term storage of food), the demand for services and goods is not performed solely in the place of residence – the centres of lower degree are left out and slowly deteriorate.
- Expanding market centres can be observed around prominent market centres.
- As a result of agglomeration tendencies, production is becoming concentrated with increasing returns to scale and high income-generating potential in central regions of higher degrees.

3. Delimitation and hierarchy of market centres in the CR

All the three principles with respect to their relevance were taken into account when determining market centres (price determining places) of the first degree and market centres of the second degree – see Fig. 1.

Fig. 1: Delimitation of market centres in the CR



Source: authors' own data

Market centres of the first and second degree reflect the three defined principles:

1. Administrative principle - principle of hierarchy (Tab. 1) is based on the assumption of an unequivocal affiliation of lower centres to a particular higher centre. The system of the classification of the territorial structures in the CR is, in compliance with the system of Eurostat, divided into two parts: classification of CZ-NUTS and the system LAU (Local Administrative Units). The affiliation of districts (LAU 1) to counties (NUTS 3) according to the classification CZ-NUTS has been in force since 01/ 08/ 2011. [2]
2. Market principle - structural characteristics of a centre (Tab. 1). A part of the project TD020047 is a detection of mutual relations of regional price disparities with the agglomeration structure in the Czech Republic in the regional division. [1] When trying to explain the spatial distribution of social and economic activities, localisation effects play a role. Localisation effects were specified in their entire width – hard localisation factors, soft business localisation factors and soft individual localisation factors. [1] With regard to the final determination of localisation factors as a source of price differences on a regional level, mainly hard (measurable) localisation factors can be used. 24 significant localisation causes were studied from the viewpoint of the causes of regional price difference. They were subsequently divided into demand factors, supply (cost) factors and agglomeration factors. For the detection of the dependence on the level of counties in the CR, a regression model was used on the basis of which factors with the positive effect on price differences were determined and these are population density in counties (counties with the highest density in the CR are Moravian-Silesian Region, Ústí nad Labem Region, Liberec Region and Zlín Region), and then the share of the number of inhabitants living in towns with the number of inhabitants exceeding 50000. The negative influence on the price level has been proved in an independent variable of the number of inhabitants in cities, which means that growing cities along with the growing demand also enable increasing competition on the supply side, decrease in costs of business and this creates a pressure on the decrease in the price level. An analysis of the relation between regional price levels and capital parameters and competition environment in the region was performed by means of a correlation and regression analysis of the relations between the regional price level and capital strength parameters at the county level. The conclusions of the analysis show, that in the regions no relation between the regional price level and the specific nature of market structures or capital parameters in the region was proved. [9]

For the delimitation of market centres on the level of districts, identical relations between the variables can be expected, and therefore the number of inhabitants in cities and the dominance of a centre (which represents a share of the number of inhabitants of a district town in the total number of inhabitants in a district) were selected as structural parameters. In the CR in 2013, 42.7 % of inhabitants lived in a set of 76 district towns and this ration has been slightly decreasing in time in connection with suburbanization¹. Apart from town districts in which 100 % of inhabitants live in the specific towns (districts Prague, Plzeň-city, Brno-city a Ostrava-city) and country/rural districts of the largest cities where on the other hand 0 %

¹ In the year 2003, 43.9 % of the population of the CR lived in district towns, in the year 2005 it was 43.6 % – see Shrnutí věcných poznatků z procesu výběru a využití ukazatelů regionální statistiky pro kartografickou vizualizaci charakteristik socioekonomického vývoje ČR, <http://www.regionálnírozvoj.cz/catalogue2006/chaps/54/5405.htm>.

inhabitants live (districts Prague-east, Prague-west, Plzeň-south, Plzeň-north and Brno-country), districts with high dominance of a district city include the ones where the district city either reaches a significant size in terms of population or it is a relatively isolated town in a rural area (districts in Ústí nad Labem Region, districts Liberec, Jablonec nad Nisou, Pardubice, Hradec Králové, Kladno, Písek, České Budějovice, Jihlava, Zlín, Prostějov, Olomouc,..).

3. Transport principle - nodality principle was reflected by the inclusion of the results of a project solved by M. Žižka [14], in which on the basis of the data on direction flows of inbound and outbound commutation between municipalities in the CR and the use of certified methodology 411 functional subregions in the CR were delimited and their hierarchy was performed¹. The centres were divided into local (1), of sub regional importance (2), of micro regional importance (3), of regional importance (4) and of very high regional importance (5).

For the identification of market centres (Tab. 1) only centres with the classification 4 (regional importance) were selected, which means the centres with the characteristics of a:

- Catchment centre – significant commutation
- Conditions of a sub regional unit according to the Rural Development Programme of the CR
- Important employer (in the category 100 to 199 employees)
- A high school with a registered office in the given municipality (existence)
- and with the classification 5 (of very high regional importance):
- A university with the registered office in the given municipality and the population over 90 thousand.

Tab. 1: Market centres of the first degree (yellow markings) and market centres of the second degree (blue markings) in the Czech Republic (2013)

		Administrative centres		Number of inhabitants	Dominance of the centre	Nodal centre
CZ010	Prague, the capital	CZ0100	Praha	1 243 201	100	5
CZ020	Central Bohemian Region	CZ0201	Benešov	16 520	17,1	4
		CZ0202	Beroun	18 958	21,55	4
		CZ0203	Kladno	68 519	42,6	4
		CZ0204	Kolín	31 026	31,7	4
		CZ0205	Kutná Hora	20 349	27,4	4
		CZ0206	Mělník	19 139	18,3	4
		CZ0207	Mladá Boleslav	44 272	35,4	4
		CZ0208	Nymburk	14 881	15,5	4
		CZ020B	Příbram	33 450	29,3	4
		CZ020C	Rakovník	16 289	29,4	4
CZ031	South Bohemian Region	CZ0311	České Budějovice	93 253	49,3	5
		CZ0312	Český Krumlov	13 253	21,6	4
		CZ0313	Jindřichův Hradec	21 698	23,5	4
		CZ0314	Písek	29 720	42,1	4
		CZ0315	Prachatice	11 189	21,9	4
		CZ0316	Strakonice	22 922	32,5	4
		CZ0317	Tábor	34 858	33,9	4

¹ The classification of centres is based on the principle where on the higher level all the requirements of the lower level need to meet.

CZ032	Plzeň Region	CZ0321	Domažlice	11 110	18,2	4
		CZ0322	Klatovy	22 367	25,6	4
		CZ0323	Plzeň-město	168 034	100	5
		CZ0326	Rokycany	14 002	29,3	4
CZ041	Karlovy Vary Region	CZ0327	Tachov	12 570	23,7	4
		CZ0411	Cheb	32 617	35,3	4
		CZ0412	Karlovy Vary	49 864	42,5	4
		CZ0413	Sokolov	23 879	31,8	4
CZ042	Ústí nad Labem Region	CZ0421	Děčín	50 104	37,9	4
		CZ0422	Chomutov	49 185	39,3	4
		CZ0423	Litoměřice	24 136	20,2	4
		CZ0424	Louny	18 476	21,3	4
		CZ0425	Most	67 332	58,8	4
		CZ0426	Teplice	50 024	38,8	4
		CZ0427	Ústí nad Labem	93 523	78,2	5
		CZ0511	Česká Lípa	36 805	35,7	4
CZ051	Liberec Region	CZ0512	Jablonec nad Nisou	45 453	50,4	4
		CZ0513	Liberec	102 301	59,6	5
		CZ0514	Semily	8 576	11,5	4
		CZ0521	Hradec Králové	92 904	57,1	5
CZ052	Hradec Králové Region	CZ0522	Jičín	16 282	20,5	4
		CZ0523	Náchod	20 417	18,2	4
		CZ0524	Rychnov nad Kněžnou	11 215	14,2	4
		CZ0525	Trutnov	30 808	25,7	4
		CZ0531	Chrudim	22 996	22,1	4
		CZ0532	Pardubice	89 432	53,0	5
CZ053	Pardubice Region	CZ0533	Svitavy	17 040	16,2	4
		CZ0534	Ústí nad Orlicí	14 364	10,3	4
CZ063	Vysočina Region	CZ0631	Havlíčkův Brod	23 345	24,6	4
		CZ0632	Jihlava	50 510	45,0	4
		CZ0633	Pelhřimov	16 203	22,4	4
		CZ0634	Třebíč	37 095	33,0	4
		CZ0635	Žďár nad Sázavou	21 669	18,2	4
CZ064	South Moravian Region	CZ0641	Blansko	20 845	19,3	4
		CZ0642	Brno-město	377 508	100	5
		CZ0644	Břeclav	24 956	21,7	4
		CZ0645	Hodonín	25 049	16,1	4
		CZ0646	Vyškov	21 341	23,7	4
		CZ0647	Znojmo	33 805	29,8	4
CZ071	Olomouc Region	CZ0711	Jeseník	11 579	29,0	4
		CZ0712	Olomouc	99 489	42,7	5
		CZ0713	Prostějov	44 234	40,4	4
		CZ0714	Přerov	44 538	33,7	4
CZ072	Zlín Region	CZ0715	Šumperk	26 806	21,8	4
		CZ0721	Kroměříž	28 921	27,1	4
		CZ0722	Uherské Hradiště	25 266	17,6	4
		CZ0723	Vsetín	26 668	18,4	4
		CZ0724	Zlín	75 278	39,1	5
CZ080	Moravian-Silesian Region	CZ0801	Bruntál	16 913	17,7	4
		CZ0802	Frýdek-Místek	57 135	26,8	4
		CZ0803	Karviná	56 848	22,0	4
		CZ6225	Havířov (okr. Karviná)	76 348	29,5	4
		CZ0804	Nový Jičín	23 676	15,5	4
		CZ0805	Opava	57 931	32,7	4
		CZ0806	Ostrava-město	295 653	100	5

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

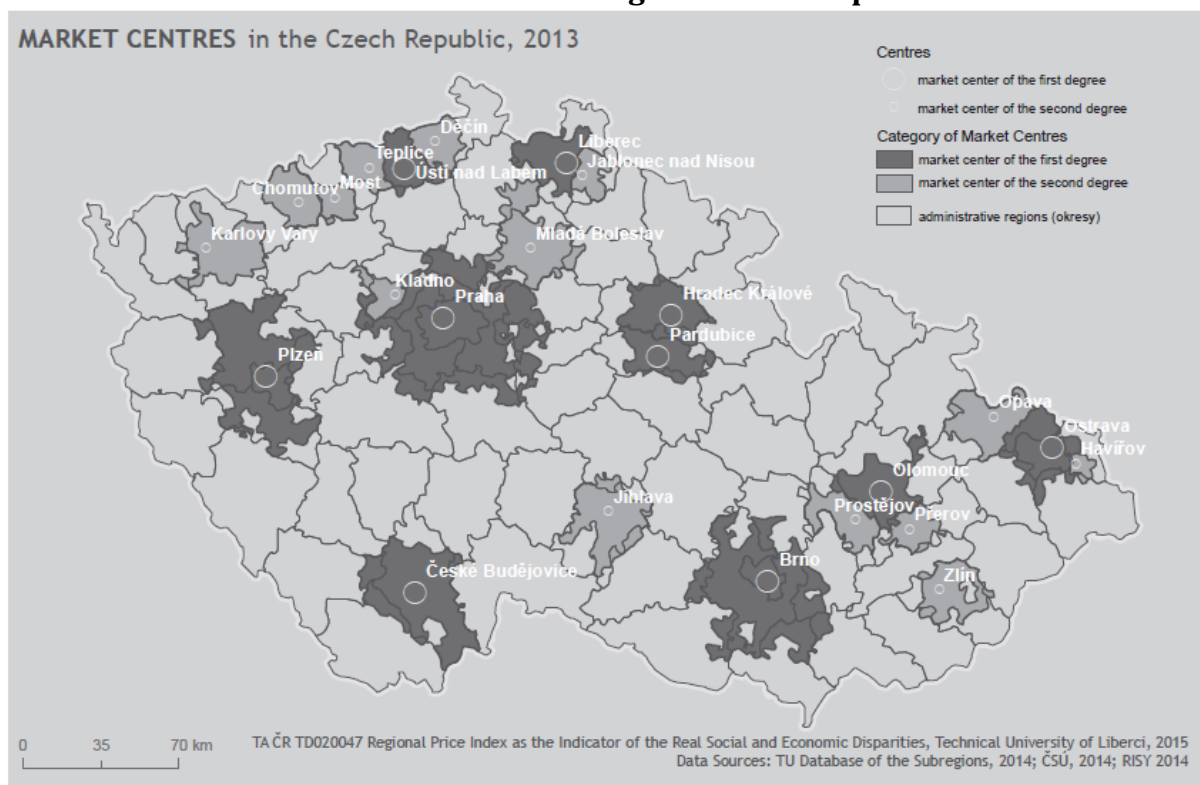
As a result of the interconnection of market, administrative and transport principle, 10 market centres of the first degree were detected in the CR and they were all metropolitan

cities with high concentration of demand, high centre dominance and strong spatial relations towards its surroundings. These centres also often have the highest prices. [1] Besides completely dominant Prague, the centres with accented price-determining regional importance include České Budějovice, Liberec, Hradec Králové, Pardubice and Ústí nad Labem which acts as a strong regional centre in Northern Bohemia. In Moravia the centres with accented price-determining regional importance highest in the hierarchy are: Brno, Ostrava and Olomouc. The centres of the second degree, in the CR 14 towns in total, are hierarchically lower and in connection with regional price disparities these are centres with lower level of regional prices. [1] Apart from county and district cities also Havířov belongs among the market centres of the second degree based on the number of inhabitants (76,348 inhabitants) with the dominance just under 30 % and with the regional importance 4.

4. Spatial concept of market regions

Having taken into account all three approaches (market, administrative and transport) to the hierarchisation of market centres, a final map of market regions was created (Fig. 2).

Fig. 2: Market regions in the CR with the characteristics optimal for the construction of the regional index of price level



Source: CZSO 2014, RISY 2014, Žižka 2013

The map captures the distribution of market centres of the first and second degree, the boundaries of the market zones belonging to the centres with the accent on actual commutation relations while accepting the current administrative division of the Czech Republic.

Conclusion

A spatial economic system which is understood as "a complex of elements in interaction", including producers, consumers, communities, economic centres, and all these components are interconnected by flows of property, energy, services, persons and information. Spatial organization of production reflecting relations between demand, supply and price is based on economic relations including the influence of distance on costs, demand space potential of the sale/consumption, spatial relations of businesses in competition in hierarchical relations of economic centres in the space, the influence of transport corridors, the distribution of population with regards to the creation of market zones, consumer mobility, location rent and other factors. These invoices were used for detection of market centres in the Czech Republic through the procedures of the Walter Christaller's Theory of Central Places. As a result of the interconnection of market principle (the number of inhabitants in cities and the dominance of a centre), administrative principle (the affiliation of districts - LAU 1 to counties - NUTS 3) and transport principle (nodal centre defined on the basis of the data on direction flows of inbound and outbound commutation between municipalities). 10 market centres of the first degree were detected in the CR. These centres are all metropolitan cities with high concentration of demand, high centre dominance and strong spatial relations towards its surroundings. These centres also often have the highest prices. The centres of the second degree, in the CR 14 towns in total, are hierarchically below and in connection with regional price disparities these are centres with lower level of regional prices. Having taken into account all three approaches to the hierarchy of market centres, a final map (see Fig. 2) of market regions with the characteristics optimal for the construction of the regional index of price level was created (in Geographic information system GIS) which captures the distribution of market centres of the first and second degree, the boundaries of the market zones belonging to the centres with the accent on actual commutation relations while accepting the current administrative division of the Czech Republic. The next task in research is to determine if regional price levels correspond to defined market zones and, if so, than identify the direction and strength of these interconnections.

Acknowledgment

This article is a part of the applied research project TD020047 "Regional Price Index as the Indicator of the Real Social and Economic Disparities" supported by the Technology Agency of the Czech Republic, the Omega Programme.

References

- [1] BEDNÁŘOVÁ, P. and Š. LABOUTKOVÁ. The Effect of Agglomeration on the Regional Price Levels in the Czech Republic. In *Proceedings of the articles from the 6th annual international scientific conference "Region in the development of society 2014"*. Brno: Mendel University, 2014. pp. 41–47. ISBN 978-80-7509-139-0.
- [2] CZSO. *Czech Statistical Office* [online]. 2014. [cit. 2015-02-12]. Available at: https://www.czso.cz/csu/czso/klasifikace_uzemnich_statistickych_jednotek_cz_nuts_2011

- [3] HALÁS, M. and P. KLAPKA. Regional division of Czechia on the basis of spatial interaction modelling. *Geografie*, 2010, **115**(2): 144–160. ISSN 1210-3004.
- [4] HAMPL, M. Současný vývoj geografické organizace a změny v dojížděce za prací a do škol v Česku. *Geografie*, 2004, **109**(3): 205–222. ISSN 1210-3004.
- [5] HAMPL, M. *Geografická organizace společnosti v České republice: transformační procesy a jejich obecný kontext*. Praha: Univerzita Karlova v Praze, 2005. ISBN 80-86746-02-X.
- [6] HUBÁČKOVÁ, V. and T. KREJČÍ. Regionální vliv Slováků pohledem Reillyho modelu, na příkladu České republiky. In KLÍMOVÁ, V. ed. *Conference Proceedings from the 10th International Colloquium on Regional Sciences*. Brno: Masaryk University, 2007. pp. 220–227. ISBN 978-80-210-4325-1.
- [7] CHRISTALLER, W. *Die zentralen Orte in Süddeutschland*. Jena: Gustav Fischer, 1933. ISBN 3534197364.
- [8] ISARD, W. *Location and space-economy; a general theory relating to industrial location, market areas, land use, trade, and urban structure*. Cambridge, MA, USA: Massachusetts Institute of Technology Press, 1972. ISBN 0262590050.
- [9] KRAFT, J. The Relationship between Regional Price Index, Market Structures and Capital Parameters of Region. *The research report of the project TD020047 "Regional Price Index as the Indicator of the Real Social and Economic Disparities"*. Liberec: Technical University of Liberec, 2014.
- [10] LÖSCH, A. *The Economics of Location*. New Haven: Yale University Press, 1954. ISBN 0300007272.
- [11] OPENSHAW, S. and Y. VENERIS. Numerical experiments with central place theory and spatial interaction modelling. *Environment and Planning*, 2003, **35**(8): 1389–1403. ISSN 0308-518X.
- [12] REILLY, W. J. Methods for the study of retail relationships. *University of Texas Bulletin*, 1929. University of Texas: Austin, 2944.
- [13] RISY. *Regional Information Service* [online]. 2014. [cit. 2015-02-09]. Available at: <http://www.risy.cz/cs/vyhledavace/statisticka-data/detail?Kapitola=2>
- [14] ŽIŽKA, M. et al. *Results of the project „Definition of subregions for distinguishing between them and the solution of social and economic disparities“*, 2013. Available at: <http://vyzkum.ef.tul.cz/td/upload/files/presentation-en.pdf>

Josef Botlík, Milena Botlíková, Pavlína Pellešová

Silesian University in Opava, School of Business Administration in Karvina,
Department of Informatics and Mathematics, Doctoral Department, Department of Tourism
Univerzitní náměstí 1934/3, 733 40 Karviná, Czech Republic
email: botlik@opf.slu.cz, botlikova@opf.slu.cz,
pellesova@opf.slu.cz.cz

Change the Quality of Economic Environment of Municipalities – Comparing the Revenue of the Budget Structure of Municipalities to 5000 Inhabitants

Abstract

Governance and the prosperity of the regions is related to spending the funds that have been obtained from citizens in the form of taxation. To ensure that these resources are used effectively, it is necessary to establish effective rules for redistribution. Efforts in democratic societies is to bring the public resources and their effective use of the as close as possible to the citizens. One of the principles of regional redistribution are the municipal budgets. The budgets of municipalities are determined by the tax revenue, non-tax revenue, capital revenue and subsidies. In the Czech Republic (CR) municipalities have a relatively small space for influencing income. The vast majority comes from the three shared taxes and grants.

Published results are part of a comprehensive research on the regional business environment. The economic environment for businesses within the segment of small and medium business is dependent on the capabilities of management at the municipal level. The contribution analyses changes in income items of municipal budgets in 2001-2012 focusing on the changes induced by modifying the law. Whereas that in 2013 to further editing and the amendment to the law, the analysis changes induced by the 2008, serve to comparison and prediction of the further development. With regard to the adjustment of the boundaries (population) of the segments (segment municipalities), a significant amount of data and the permissible extent of the contribution, municipalities are analysed to 5,000 inhabitants (the border is the same in both, old and new, municipalities classification systems). In this context, it was hypothesized that modification in budgetary tax led to the increase in share of tax revenues for the segment of municipalities with up to 5,000 inhabitants. Furthermore, it was hypothesized that the municipal budgets in this segment have been stabilized and have not created regional disparities.

Key Words

municipality, municipal budget, revenue of municipalities, expenditure of municipalities, Czech Republic

JEL Classification: O18, C65

Introduction

Deciding the parameters of shared taxes, including the determination of the individual municipalities on their revenue and deciding on subsidies is in the competence of the Government. Applies the principle of a central decision-making about taxes, uniform tax

policy is applied throughout the territory. Each entity in the same conditions is burdened by the same taxes. Due to the limited financial options of municipalities there are tendencies, changing the rules for the allocation of State resources to municipalities. These changes are implemented through the budget to determine the taxes (see example [1], [2]. The current budget determination of taxes, basic principles and bases are defined by law No. 243/2000 Coll., on the budgetary revenue determination certain taxes to the territorial entities and some State funds, as amended. The law specifies the rules for the redistribution of the collection of the taxes levied between the respective nationwide consumers. Its last amendment took effect 1. 1.2013. From the 1. January 2008 entry into force of the amendment to Act No. 243/2000 Coll., the Government's amendment to this Act address the increase in tax revenue of municipalities and a new way of splitting the State levied taxes. The new system of budgetary determinative taxes, eliminate the problems associated with the deployment and registration of business entities and the segmentation of municipalities. Delete problematic areas consisted, in particular, to reduce the weight and the number of coefficients of the size categories for redistribution of tax revenues from 14 to 4. This was achieved by reducing the disparities in rates of atypical between the biggest and smallest municipalities .

The amendment of the budget of destination taxes primarily sought to municipalities have received more money, and that the ratio of revenues shared taxes (both income tax and value added tax) between large and small municipalities has changed so that the differences between them is reduced. Whereas that for the municipality are crucial the overall incomes (primarily income shared taxes), the legislation could cause substantial economic regional disproportion . Reallocation algorithm shared tax revenue according to the number of inhabitants of the modified size coefficients of municipalities (the weight of 94%) was modified so that it is laid down by the "coefficient of successive transitions" multiplied only that part of the population of the municipality which falls within the interval (category) of the population.

Tab. 1 calculation of multiple sequential transitions

Municipalities with a population of residents from – to	Coefficients of successive transitions	Multiple sequential transitions
0 – 300	1,0000	1,0000 x the population of the municipality
301 – 5 000	1,0640	300 + 1,0640 x number of inhabitants of the municipality population in excess of 300
5001 – 30 000	1,3872	5 300,8+1,3872 x number of inhabitants of the municipality population in excess of 5 000
30 001 – and more	1,7629	39 980,8 +1,7629 x the number of inhabitants of the municipality population exceeding 30 000

Source: Act No. 243/2000, annex of the Act, comment [7]

1. Data

Data for the research are taken primarily from the Czech Statistical Office and are also based on official data published by the Ministry of Finance (data available in ARIS¹ and ÚFIS²).

Due to the fact that municipalities have in addition to the current account also other accounts and funds (reserve fund, development fund for cultural and social needs, etc.), budget can be distinguished, depending on when taking into account movements in these accounts (non-consolidated budget) or not (consolidated budget). Data from consolidated budgets, especially partially pre-processed data about the management of municipalities from database placed on <http://www.rozpocetobce.cz/zdroje-dat> have been used as fundamental data for the analysis. Unfortunately, there are minor inaccuracies in data, notably incomplete database of municipal budgets. Deviation in the number of municipalities between 2000 and 2002 is in the range of 13 to 20 municipalities (partly compensated by newly created municipalities)³, after 2003 it is 12-15 municipalities. Up to the date of January 1, 2013 it means 0.25% deviation. Deviations may be statistically significant only in a narrow band of municipalities (such as missing data about the budget of Hlučín, in selected municipalities segment data may be partially distorted - 10000-20000 segment of the population, about 70 municipalities).

Therefore, it can be concluded that the errors caused by incomplete data are statistically insignificant for the selected segment of 1-5000 municipalities. Data disproportions may further arise by transfer of municipalities between different segments (municipality transition from one zone of the population to another one). Even in this case, the changes are statistically insignificant. They occur rather in the segment of municipalities with more than 100,000 inhabitants (transfers of Olomouc and Liberec over/under this limit).

Tab. 2 segmentation of municipalities

municipality size	CR	1-100	101-200	201-300	1-300	301-500	5000	301-000	1-5001
number of analyzed munic.	6241	469	983	859	2355	2965	636	3602	5957
population	10483099	33606	146806	211762	399598	1995822	1626894	3624216	4023814
percentage of municipalities	100	7,51	15,75	13,76	37,73	47,51	10,19	57,72	95,45
percentage of population	100	0,32	1,4	2,02	3,81	19,04	15,52	34,57	38,38

Source: SGS 20/2014 analysis

For the purpose of analysis, municipalities were segmented according to structure effective until 2008 (Table 2) and for the purpose of further comparison according to the

¹ Presentation data base system IDB ARIS, <http://www.mfcr.cz/cs/o-ministerstvu/zakladni-informace/informacni-systemy/arisweb> [online 10.4.2015]

² Presentation system of state accounting and financial information, <http://www.mfcr.cz/cs/o-ministerstvu/zakladni-informace/informacni-systemy/ufis>, [on line 10.4.2015]

³ being refined and compared with data: <https://www.czso.cz/csu/czso/pocet-obyvatele-v-obcich-k-112012-izjb59u5xn>, [on line 10.4.2015]

Annex of the Act (Table 1). For comparison were used common limits 300 and 5000 inhabitants.

2. Comparative analysis

All graphs are summarized and displayed in the Annex. Individual charts display the trend of income and expenditure (overall and per person). Analysed were the minimum and maximum values, average, median, variance, and standard deviation. Charts of the values are displayed relating to the analysis. Due to the project (the analysis around the year 2008), the charts are only illustrative and comparative, which corresponds to the size. Furthermore, the statistics displayed are the same for each revenue budget items (tax, non-tax, capital income, and subsidies). Graphs are, if necessary, further differentiated. An alternative data analysis methods are described example in [3], [4].

2.1 CR municipalities

Data are shown in Figs 1 and 2 in the Annex. The revenue and expenditure of the charts, it is clear that the minimum income component in absolute terms increased sharply in 2008 and even after this year's upward trend. In contrast, the maximum revenue started after the 2008 more or less stagnate. Of graphs is also obvious that increases in minimum amounts, was caused by modifying the coefficients, in absolute terms, however, is offset by the loss of population (negatively), which is evident from the chart, the "minimum/person" and "maximum/person", where the minimum amount of the per person incomes have stagnated, in contrast, the maximum amounts per person between the years 2007 and 2009 grow strongly. However, this is not about the all-over the phenomenon, which is evident from the variance and standard deviation per person. If you take a closer look at the following chart, where the group is the basic income folder, then in absolute amounts the stabilisation is apparent in the maximum amounts of tax revenue (for the year 2008 was a permanently upward character), with the decline between the years 2008 and 2009. The maximum values in the intervening period 2008 to 2010 were rather thanks to subsidies. On a per person you can see that the minimum and maximum tax revenue has increased sharply. Due to the increase in the average values and the median can be said that the increase was more or less uniform, but in the years 2008 and 2009 shows in relation to persons of considerable variance. Overall, it is therefore represented the growing nature of changes after the year 2008 with subsequent stabilisation, manifesting more per inhabitant, rather than in absolute terms. At the same time one can say that the changes have sparked an increase in provisioning, especially items per inhabitant.

1-100 municipalities segment of the population

Data are shown in Figs 3 and 4 in the Annex. Because the municipality of up to 100 of the population is only 7.5 percent (tab 2), less than half of the municipalities and the percentage of the population, it is clear that the development of the minimum amount of income rather than copies of items. As is clear from the charts, in the years 2008 and 2009 there was an increase in the maximum amounts. From the graph of the minimum amounts

per person, it is then clear that the minimum amounts are increased due to the slight increase in the population. Of graphs is also obvious, that small municipalities are financially less valued because the average income (total and per person) in the years 2008 and 2009 grew and stagnated (or decline slightly), the median rose in 2008, however, is nearly stagnant. For this group of municipalities is evident increase in tax revenue (as the minimum, maximum, and average) after 2008 with fixing after 2010. Of the average values is further evident that the decline in tax revenues after 2009 was partially compensated by subsidies, however, the declining ones have character.

101-200 municipalities segment of the population

Data are shown in Figs 5 and 6 in the Annex. The financing of municipalities to 200 people has not recorded significant changes after the year 2008. The maximum and minimum amounts are more or less stable, there is a slight increase in the differences between the minimum and maximum income. The median and the average increased slightly after 2008, and is stable. About the "yawning shears" between the minimum and maximum values is increasing the variance of (especially in 2010). In the average values and the median is to see a similar character (a slight increase in 2008, further stagnation) in tax revenue, in the maximum amounts is (especially on a per person), a distinct increase in subsidies from the standard deviation and variance, it is obvious that this method does not use most of the municipalities (which confirms the chart of the maximum income, where after 2009 is the item most).

201-300 municipalities segment of the population

Data are shown in Figs 7 and 8 in the Annex. In the segment of municipalities between 201 and 300 inhabitants is off the charts to see that the minimum amounts, the maximum amounts of the medians and averages (absolute and converted to a person) have an almost constant, slightly increasing the character. At the same time it grows and the variance and standard deviation. After 2010, the peak and decline occurs. This decrease is due primarily to the decline in subsidies after the year 2010, as can be seen from the other charts, especially from the average values and dispersion.

2.2 Summary 1-300 municipalities segment of the population

Data are shown in Figs 9 and 10 in the Annex. Summing up the segment 1-300 inhabitants (according to the table 1) that this whole set of municipalities increased from 2008 average income, and it's faster than was the increase in all municipalities. At the same time you can see that in this segment have been between the years 2007 and 2010 a significant disproportion, as evidenced by the relatively high standard deviation. On the disproportions participates in the highest rate of increase in the maximum tax revenue in the years 2008 and 2009, relatively high are in 2009 and capital income (maximum values) and an increase in the average values of subsidies after 2008. Of the average values and the median is visible surge in tax revenue in 2008 folder.

This segment of the municipalities covers almost 38 percent of municipalities, in these municipalities are, however, less than 4 percent of the population (tab 2).

301-1500 municipalities segment of the population

Data are shown in Figs 11 and 12 in the Annex. A segment of the municipalities with a population of between 300 and 1500 form the largest representation, nearly 48 percent of the municipalities, and less than 20 percent of the population. This segment after the receipt page after 2008 almost managed to stabilize. All indicators, the minimum value, maximum value, average and median recognised in the income area to stable, almost constant character with a slightly increasing variance and standard deviation in the year 2010, the changes in the variance is caused by a moderate increase in subsidies.

1501-5000 municipalities segment of the population

Data are shown in Figs 13 and 14 in the Annex. This segment has had in the past (between the years 2003 and 2004) tend to finance municipal budgets primarily from grants. If we look at the maximum value, then there are still municipalities where subsidies make up the largest share (chart peak of appropriations). A relatively high proportion of subsidies is still evident from the average values, even if the increase in variance and standard deviation after 2008 shows the disparity to the formation of budgets. After 2008 the share of subsidies on the overall budget grew again after the year 2010 began to decline. The largest share of here currently make up tax revenue. Despite the fact that the average and median budget for this segment shows a constant balanced tend to increase after 2009, the differences, in particular for the maximum values. For this reason, it can be observed around the year 2010 a higher variance.

2.3 Summary 301-5000 municipalities segment of the population

Data are shown in Figs 15 and 16 in the Annex. If we compare the table again according to tab1 the whole segment of municipalities with a population of 300-5000, we can see the similarity of the particular segment of the 1500-5000. On the charts we see revenue and expenditure, almost identical to the progress of the median, deviation and variance. Also here is an obvious increasing trend of financing using subsidies between the years 2008 and 2010 and a relatively high proportion of subsidies within the maximum amounts (in some municipalities make up the subsidies larger item than the highest share of income from subsidies). In General, the trend for this segment is more evenly split revenue the budget entries with the gradual transition (since 2005) on financing mainly from taxes. A high proportion of subsidies is also noticeable on the graph of deviation and variance, where you see that the share of funding from taxes and subsidies are a significant disproportion.

Conclusion

In conclusion it can be concluded that the adjustment of the budget rules and the related creation of municipal budgets in the segment of municipalities to 5000 inhabitants mean more instability of the system and given rise to extreme fluctuations and negative phenomena. On the contrary, it can be said, that led to stability. The question is whether the increase in the share of subsidies was invoked necessity "to finance" budgets, or

whether the proportion of the tax items dropped thanks to subsidy programs. In particular, around the year 2010 is a distinct higher variance, which in general can cause regional disproportion in the financing of municipalities.

According to the journal of public administration¹, namely in 2007 occurred in the management of municipalities to reduce municipal debt, and after modifications in 2008, this trend is not repeated, yet the budgets of municipalities have ended for the year 2008 a surplus of 16 mld. CZK, which is almost double that of 2007. A substantial part of the surplus of the budget of the municipalities in 2008, however, was the result of the management of Prague and didn't relate of the segment. As a result of the new budget to determine the taxes increased substantially the tax revenue of small municipalities. In particular, the significant growth recorded the smallest municipality with a population of 100, whose tax revenues have increased by almost 150%. Amendment to the Act to mitigate the distance coefficients of small and large municipalities and has led to increased revenue for small municipalities. The municipality of 100 inhabitants have risen almost 2.5 times the income of the year 2007, the municipalities of the segment from 101 to 200 inhabitants recorded growth of tax revenue by one-third. The total tax revenue of municipalities have reached the amount of 154,4 mld. CZK. Non-tax revenue contributed to a total revenue of about one-tenth (26.3 mld. CZK). Capital revenue in 2008 increased by more than one-quarter has reached almost 16 mld. CZK. Transfers (grants) accounted for 28% of total revenue.

It can be stated that hypothesis that modification in budgetary tax revenues increased share of tax revenues for the segment of municipalities with up to 5,000 inhabitants has not been confirmed. On the contrary, especially in the segment of the smallest municipalities (100 inhabitants), although there was an abrupt increase in income tax component between 2008 and 2009, it then decline and in 2010 subsidies and tax components of revenue in the budget were almost balanced in absolute values and also per capita.

The increase in the subsidy component is visible even in the segment of the population 101-200. In the segment of the population 201-300 there is no longer such a fall in the tax component (Fig. 6 – average, Fig. 8 - average). Significant is an increase in the variance and standard deviation in the segment of municipalities with up to 300 inhabitants, which may indicate redistribution of subsidies to compensate for municipal budgets, according to the relatively constant uniform trend of revenue items of the budget as a whole (Fig. 9, Fig. 10 – variance, Fig. 10 – standard deviation).

Furthermore, it was hypothesized that the municipal budgets in this segment was stabilized and did not create regional disparities. For municipalities with up to 100 inhabitants can be on the Fig. 3 (average, average/person) seen that although the average value of the sum of income items recorded in 2008 and 2009 had abruptly increased with subsequent decline, the median values (Fig. 3 – median, median/person) were constant after 2008, without major fluctuations. This testifies to the fluctuation in maximum

¹ More information, see [12]

revenues (Fig. 3 – maximum, maximum/person) and a relatively stable development of the minimum income (Fig. 3 – minimum, minimum/person). Municipalities with 101-300 inhabitants had the average income after 2008 relatively stable and constant, as well as medians. (Fig. 5 – average, Fig. 7 – average, Fig. 5 – median, Fig. 7 - median).

Significant stabilization in budget revenue items is visible at the segment with 301-1500 inhabitants, where the average values and medians are relatively constant. This trend is, however, evident in this segment since 2006 and so it cannot be said for sure whether it is the result of amendments to the Act. A similar and relatively more stable is development of the average values and medians in the segment of municipalities with 1501 – 5000 inhabitants.

The second hypothesis was partially confirmed in the segment of municipalities with 101-5000 inhabitants.

Furthermore, from the above statistics can be concluded that although the amendment of the Act abruptly increased income items after 2008, around 2010, unfortunately, the share of the tax component and thus also some income items in budget of certain municipalities began to decline. It is obvious that in the above-mentioned years, these disproportions were compensated with income subsidy component.

Acknowledgment

The article was written as part of the analysis in the framework of SGS 20/2014, "Analysis of the business environment in Karvina region", Faculty OPF Karviná, Silesian University in Opava.

References

- [1] KOŤÁTKOVÁ STRÁNSKÁ, P. Analysis of financing the municipalities in the Czech Republic. *International Journal of Mathematical Models and Methods in Applied Sciences*, 2012, **6**(8), 917–925. ISSN 1998-0140.
- [2] ŠPAČEK, D. and P. DVOŘÁKOVÁ. Impact of economic crisis on municipal budgets in the Czech Republic. *European Research Studies Journal*, 2011, **14**(1), 29–44. ISSN 1108-2976.
- [3] JANÁKOVÁ, M. Active initiatives to ict innovations for support of competitive advantage. In DOUCEK, P., G. CHROUST, and V. OŠKRDAL. eds. *Proceedings from the 20th Interdisciplinary Information Management Talks 2012*. Linz, Austria: Gerhard Chroust, 2012. pp. 171–178.
- [4] BOTLÍK, J. and M. BOTLÍKOVÁ. Determination of precedence in the network model for the region's analysis. In *Proceedings of the 22nd International Business Information Management Association Conference*. Rome, Italy: IBIMA, 2013. pp. 777–786. ISBN 978-0-9860419-1-4.
- [5] CÍSAŘOVÁ, E. and J. PAVEL. *Průvodce komunálními rozpočty aneb jak může informovaný občan střežit obecní pokladnu* [online]. Praha: Transparency

- International CR, 2008. [cit. 2015-04-10]. Available at: http://www.transparency.cz/wp-content/uploads/kr_pruvodce2008.pdf
- [6] ŘEZÁČ, K. Jak číst rozpočet obce [online]. *Rozpočet obce*, 2015. [cit. 2015-04-10]. Available at: <http://www.rozpocetobce.cz/jak-cist-rozpocet-obce>
- [7] KOMÁREK, E. V novém roce nové rozdělení daní pro obce [online]. *Veřejná správa*, 2008. [cit. 2015-04-10]. Available at: <http://www.mvcr.cz/clanek/v-novem-roce-nove-rozdeleni-dani-pro-obce.aspx>
- [8] ELIÁŠ, A. Rozpočtové určení daní – novelizace zákona se stává předmětem polemiky [online]. *Deník veřejné správy*, 2011. [cit. 2015-04-10]. Available at: <http://denik.obce.cz/clanek.asp?id=6516121>
- [9] RUCKÁ, K. Rozpočtové určení daní: Základní východiska a principy [online]. *Moderní obec*, 2014. [cit. 2015-04-10]. Available at: <http://moderniobec.cz/rozpocetove-urceni-dani-zakladni-vychodiska-a-principy/>
- [10] MARTÍNEK, R. Rozpočtové určení daní pro obce [online]. In *Den malých obcí*, 2008. [cit. 2015-04-10]. Available at: http://www.denmalychobci.cz/file/dmo/prezentace/29/cssd_martinek.pdf
- [11] KAMENÍČKOVÁ, V. Rozpočtové určení daní – vývoj financování, naděje a očekávání [online]. *Deník veřejné správy*, 2012. [cit. 2015-04-10]. Available at: <http://www.dvs.cz/clanek.asp?id=6566995>
- [12] KAMENÍČKOVÁ, V. Hospodaření obcí a krajů v roce 2008 [online]. *Deník veřejné správy*, 2009. [cit. 2015-04-10]. Available at: <http://www.dvs.cz/clanek.asp?id=6388940>

Blanka Brandová, Jiří Rozkovec

Technical University of Liberec, Faculty of Economics,
Department of Economics, Department of Economic Statistics
Studentská 2, 461 17 Liberec 1, Czech Republic
email: blanka.brandova@tul.cz, jiri.rozkovec@tul.cz

Nominal Convergence in the European Union

Abstract

The paper deals with the process of economic convergence in the European Union. Depending on researched indicators, convergence is divided into nominal and real convergence. The aim of this paper is to analyze the nominal convergence in the European Union through the most used indicator that is comparative price level. An alternative concept to the nominal convergence is the Maastricht criteria, fulfillment of which is a condition for joining the European Monetary Union. While researching the Maastricht criteria is a broader form of nominal convergence, price levels in this paper present a narrower form of analysis in this paper through the comparative price level. Values of this indicator of EU Member States are compared to the average of the European Union (EU-28). Nominal convergence is connected with real convergence and both processes, changes in economic level and price level, occur simultaneously. By using simple regression analysis (linear model), the relationship between real and nominal convergence, was tested. Results showed that the correlation between researched indicators, i.e. gross domestic product per capita in PPS and comparative price level, is very tight. Countries with low economic level have low price level and on the contrary, countries with high economic level have high price level. The price level of the Czech Republic is, in comparison to the price level of the European Union, lower than would be appropriate for its economic level.

Key Words

nominal convergence, comparative price level (CPL), real convergence

JEL Classification: O11

Introduction

The stages of European integration were defined by Bela Balassa in 1961. They are free trade area, customs union, common market, economic and monetary union, and political union. The European Union has now reached the third stage, the economic and monetary union (EMU). This stage is characterized by common monetary policy, single currency, full liberalization of the capital flow and an effective institutional system for monetary policy coordination and control. The member states give their sovereignty over the national monetary policy up to the Community. [6]

An entrance into the European Monetary Union (eurozone) and using the euro as official currency are connected with the fulfillment of Maastricht criteria which are an alternative concept of the nominal convergence. These criteria are set out in Article 121 of the Treaty establishing the European Community. The aim of them is an economic convergence of participating states. The article 121 contains a requirement to prove high degree of

sustainable convergence. Each member state has to fulfill following criteria (three monetary and two fiscal).

The first monetary criterion of fulfillment of Maastricht criteria is price stability. An indicator is an average annual inflation rate. The value should be less than 1,5 percentage points above the average inflation rate in the three Member States with the best price stability, i.e. in the three Member States with the lowest average inflation rate. The second monetary criterion concerning to long-term interest rates stability requires the value of an indicator, returns on ten-year government bonds, to be less than 2 percentage points above the average returns in the three Member States with the best price stability. The third monetary criterion concerning to exchange rate stability requires stable exchange rate development without severe tension and joining the Exchange Rate Mechanism (ERM II). The fiscal criteria requires share of the government deficit to gross domestic product less than 3 % and share of the government debt to GDP less than 60 %. These indicators show fiscal discipline of governments.

The aim of this paper is to analyze the nominal convergence in the European Union through the most used indicator that is comparative price level. Within this aim, the relationship between nominal and real convergence will be described. While nominal convergence will be measured by comparative price level, real convergence will be measured by economic level expressed by gross domestic product per capita in Purchasing power parities.

1. Nominal convergence

Nominal convergence can be viewed by two forms. In a broader form in the context of Maastricht criteria, i.e. nominal variables as inflation, interest rates, nominal wages, government deficit, government debt and exchange rate. More narrowly, in the form of the convergence of price levels. [10] When analyzing the second form (i.e. price convergence), it is important to combine the macroeconomic view, i.e. researching the convergence of total price levels and their determinants, with the microeconomic view, i.e. structural aspects of price convergence. The price convergence can occur due to the so-called aggregation effect (for details see [9]).

It is possible to measure nominal convergence by more indicators. For example Alho measured nominal convergence through the ratio of current exchange rate to the PPP exchange rate (i.e. ERDI – exchange rate deviation), Herrmann through inflation rates. [1], [4] Very often, nominal convergence is analyzed from a macroeconomic perspective through comparative price level (CPL). Comparative price levels are defined as the ration between Purchasing power parities (PPPs) and exchange rate of compared countries.

$$CPL = PPP/ER \tag{1}$$

It expresses how much the same amount of goods and services in different countries costs. If the value of CPL is below 100, the price level in observed country is lower than in reference country. [8]

Nominal convergence is realized by two canals – the exchange rate canal and the price canal. In case the country enters the eurozone, the first canal cannot be used anymore. Decomposition of nominal convergence and researching these two canals can demonstrate which canal dominates. The process of nominal convergence can be expressed by equation [7]:

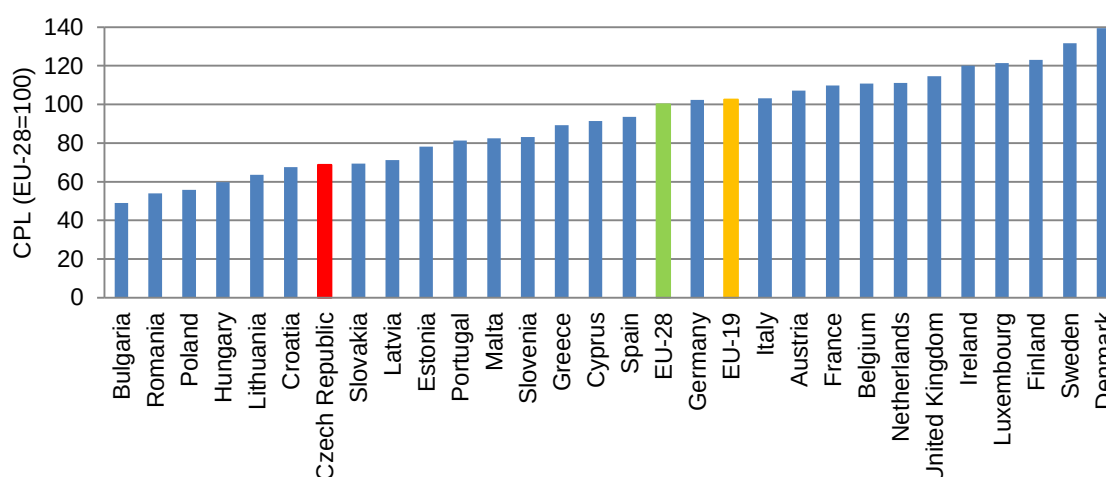
$$CPL_t = \chi_t + \pi_t \quad (2)$$

where χ_t is a change of nominal exchange rate and π_t is an inflation rate, both in period t .

It depends on the monetary and exchange rate policy of the economy, which canal outweighs. In the Czech Republic, nominal convergence was realized mainly through the price canal due to the given inflation target. [9]

The fig. 1 compares CPL values of member states of the European Union in comparison to the EU-28 in the year 2013. Most of the states with CPL under the level of EU-28 are so called new member states. From old member states, only Portugal, Greece and Spain have CPL lower than the level of EU-28.

Fig. 1: CPL in the European Union in 2013 (EU-28=100)



Source: Eurostat

The tab. 1 shows the evaluation of CPL in European Union from the year 2003. During the observed period, only Denmark, Finland, France, Germany, Ireland, Italy and Portugal displayed a decrease in CPL. Except for Portugal all of them are countries with the price level above EU-28. Slovakia recorded the highest growth by 18,6 p.p. The Czech Republic recorded growth by 14,1 p.p. By dividing the whole period into two stages (2003-2008 and 2009-2013), we can observe that in most of the countries, the growth in price level was replaced by decrease. This change in the development of comparative price levels of

Member States was caused by global financial and economic crisis. Nominal convergence was therefore influenced by this phenomenon.

Tab. 1 CPL in European Union 2003 – 2013 (EU-28=100)

	2003	2008	2013	change 2003 - 2013	change 2003 - 2008	change 2009 - 2013
Ireland	126,6	129,8	120	-6,6	3,2	-5,6
Portugal	86,2	87,9	81,3	-4,9	1,7	-7,9
Germany	106,3	103,6	102,3	-4,0	-2,7	-4,7
Finland	126,8	120,8	123,1	-3,7	-6,0	-1,0
Denmark	141,4	139,8	139,4	-2,0	-1,6	-3,7
Italy	103,8	102,5	103,2	-0,6	-1,3	-1,7
France	110,2	110,8	109,8	-0,4	0,6	-2,5
Euro area (19 countries)	102,7	102,9	102,5	-0,2	0,2	-3,0
EU (28 countries)	100	100	100	0,0	0,0	0,0
Cyprus	91,1	87,8	91,4	0,3	-3,3	1,6
Poland	54,5	69,3	55,8	1,3	14,8	-2,4
Hungary	58,4	69,5	59,7	1,3	11,1	-3,5
Croatia	64,9	74,2	67,5	2,6	9,3	-8,9
Netherlands	108	104,2	111,1	3,1	-3,8	3,2
Greece	86	91,8	89,2	3,2	5,8	-5,8
Austria	103,5	105,2	107,2	3,7	1,7	-0,7
Belgium	106,7	110,5	110,8	4,1	3,8	-1,5
Spain	88,5	95,2	93,5	5,0	6,7	-4,2
United Kingdom	108	103,1	114,6	6,6	-4,9	17,8
Slovenia	76,4	82,9	83,1	6,7	6,5	-4,9
Sweden	123,7	113	131,6	7,9	-10,7	24,0
Bulgaria	40,8	49,4	49	8,2	8,6	-2,3
Malta	72,1	77,4	82,5	10,4	5,3	4,4
Romania	43,5	63,1	54	10,5	19,6	-3,6
Lithuania	52,4	66	63,5	11,1	13,6	-3,5
Czech Republic	54,6	77,3	68,7	14,1	22,7	-4,4
Estonia	62,2	76,7	78,1	15,9	14,5	0,8
Latvia	54,5	75,1	71,2	16,7	20,6	-4,9
Luxembourg	103,4	117,3	121,4	18,0	13,9	-0,2
Slovakia	50,8	69,9	69,4	18,6	19,1	-3,8

Source: Eurostat, own calculations

2. Nominal versus real convergence

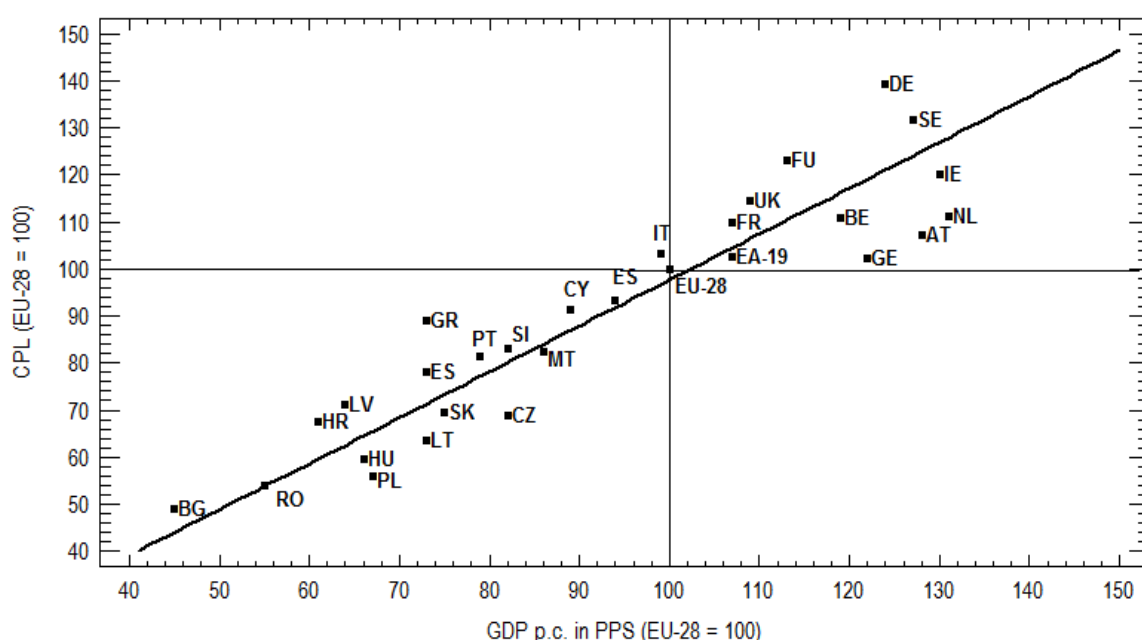
As nominal convergence is being connected with Maastricht criteria, real convergence is being connected with Copenhagen economic criteria. [5] Real convergence expresses the catching-up process when economic levels of different countries converge to the same level. The most used indicator to analyze it is GDP per capita.

Real and nominal convergences are connected processes. The relationship between the GDP per capita and the price level is bilateral. They are mutually influencing and determining. For countries with lower economic level, lower price and wage levels are typical. As countries are increasing their economic levels, it is important (and due to inflation differential and rising exchange rate, there is the tendency) to increase

productivity level, wages and therefore price level. Otherwise, increasing price level without increasing wages would lead into decreasing of real wages and living standard.

The relationship between economic level and price level expressed via the fig. 2. The economic level is measured by the GDP per capita in PPS. The price level is measured by the CPL. For both indicators, the EU-28 average = 100. Through this tested model, we can examine the simultaneous nominal and real convergence. The positive relationship between GDP per capita in PPS (the axis x) and the CPL (the axis y) is visible. Countries with the lowest economic level (Bulgaria, Romania) have the lowest price level. On the contrary, countries with the highest economic level (Netherlands, Ireland, Austria, Sweden and Denmark) have the highest price level. Luxembourg was extracted from this analysis due to its specific position. This economy is highly above other countries and disfigures results.

Fig. 2 Relationship between economic and price level (EU-28 = 100, 2013)



Source: Eurostat, own calculations

Based on the simple regression, the correlation between the economic level and the price level was evaluated as very tight. The equation of the fitted model is $CPL = 0,976782 * GDP \text{ p. c. in PPS}$ and the correlation coefficient equals 0,99.

The price level of the Czech Republic is, in comparison to the price level of the European Union (EU-28), lower than it should be appropriate for the economic level. In comparison to the year 2005, the Czech Republic increased the economic level and the price level relative to the EU. [11]

Differences of price levels are caused by several factors, including non-economic ones. The main reason for lower level of the CPL in less developed countries is the lower labor productivity. [2] The relationship between labor productivity and the price level was described by Balassa and Samuelson. Involving the Balassa-Samuelson model, nominal convergence can be researched in detail. This model divides the economy into two sectors.

The open sector, where goods and services are tradable and the closed sector, where goods and services are non-tradable. [1] The Balassa-Samuelson model showed that different levels of labor productivity between tradable and non-tradable sectors in individual countries are reflected in their price levels.

Conclusion

In general, convergence is a process defined as decreasing differences between two values over time or approaching certain level. Depending on the type of convergence, several indicators can be used for its measurement. Real convergence means decreasing differences of economic levels, while nominal convergence means decreasing differences of price level (in the narrower form). In this paper, the nominal convergence was researched using comparative price level. The relationship between real and nominal convergence was tested by simple regression analysis. Results showed tight correlation between researched indicators. Countries with low economic level have also low price level and conversely. Focusing on the Czech Republic, we realized that the price level is lower than it should be for the economic level. The processes of real and nominal convergence are connected and for economic growth of the Czech economy (and other countries in catching-up process), it is important to increase not only price level, but also productivity.

References

- [1] ALHO, K., V. KAITILA and M. WIDGRÉN. *Speed of Convergence and Relocation New EU Member Countries Catching up with the Old* [online]. Brussels: European Network of Economy Policy Research Institutes, 2005. [cit. 2015-03-28] Available at: http://aei.pitt.edu/6740/1/1215_34.pdf
- [2] DRASTICHOVÁ, M. The relations of real and nominal convergence in the EU with impacts on the euro area participation. *Central European Review of Economic Issues*, 2012, **15**(2): 107–122. ISSN 1212-3951.
- [3] EUROSTAT. *National accounts* [online]. Luxembourg: The statistical office of the European Union. [cit. 2015-03-28]. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/national_accounts/introduction
- [4] HERRMANN, S. and A. JOCHEM. Real and Nominal Convergence in the Central and East European Accession Countries [online]. *Intereconomics*, 2003. Available at: <http://intereconomics.eu/downloads/getfile.php?id=315>
- [5] HOMMĚROVÁ, D. Reálná a nominální konvergence. *E+M Ekonomie a Management*, 2004, **7**(3): 34–41. ISSN 1212-3609.
- [6] IANCU, A. *Nominal Convergence* [online]. Available at: http://www.ipe.ro/RePEc/ror/ror_pdf/wpince090602.pdf
- [7] LEWIS, J. *Hitting and Hoping? Meeting the Exchange Rate and Inflation Criteria During a Period of Nominal Convergence* [online]. [cit. 2015-03-29]. Available at: http://www.cesifo-group.de/portal/page/portal/DocBase_Content/WP/WP-CESifo_Working_Papers/wp-cesifo-2007/wp-cesifo-2007-01/cesifo1_wp1902.pdf
- [8] KADERÁBKOVÁ, A. *Úvod do ekonomické analýzy*. Vysoká škola ekonomická v Praze: Praha, 2002. 158 pgs. ISBN 8024502801.

- [9] VINTROVÁ, R. and V. ŽDÁREK. *Vztah reálné a nominální konvergence v ČR a nových členských zemích EU* [online]. Praha: VŠEM, 2007. [cit. 2015-01-05]. Available at: http://www.vsem.cz/data/data/ces-soubory/working-paper/gf_WP0807.pdf
- [10] ŽDÁREK, V. *Konvergence nových členských zemí EU a aktuální problémy* [online]. 2006. [cit. 2015-02-20]. Available at: http://www.vsem.cz/data/data/cessoubory/konference-seminare/gf_Brno0906_VZ.pdf
- [11] ŽDÁREK, V. and J. ŠINDEL. *Selected Issues Relating to Real and Nominal Convergence on New EU Member States* [online] 2011. [cit. 2015-03-25]. Available at: http://www.vsem.cz/data/data/ces-soubory/gf_INFER_VZ.pdf

Radim Dolák, Petr Suchánek

Silesian University in Opava, School of Business Administration in Karviná,
Department of Informatics and Mathematics
Univerzitní náměstí 1934/3, 733 40 Karviná, Czech Republic
email: dolak@opf.slu.cz, suchanek@opf.slu.cz

Lean Company Research in Manufacturing Companies in the Czech Republic

Abstract

Current global world can be characterized as a very competitive environment with a huge pressure on efficiency in manufacturing and logistic processes. This article is focused on situation of using Lean Company concept in manufacturing and logistics in Czech manufacturing companies. There are many Czech manufacturing companies with a huge rate of wasting in manufacturing and logistic processes. Some of them are trying to take advantage of principles of Lean Company for reduce waste in manufacturing and logistic processes. If we want to transfer some company to the Lean Company status, we need to analyse types of wasting in some processes such as manufacturing and logistics and then manage and control process of transformation. The main research goal of this article is analysis of using lean manufacturing and lean logistics concepts in manufacturing companies in the Czech Republic. There will be also mention in which areas of manufacturing and logistics it is the biggest rate of wasting and which methods and tools of industrial engineering are usually used for elimination of wasting in manufacturing and logistics processes. Our data was obtained using a questionnaire survey. The survey took place during summer 2014 in manufacturing companies in the Czech Republic. A total 20 742 online questionnaires were distributed to randomly select Czech manufacturing companies via e-mails. We obtained data from 322 different companies which are analysed in next section of this article. We have analysed data from questionnaires using MS Excel for basic statistics and also IBM SPSS for finding dependencies among data. We have found that the implementation of lean manufacturing and lean logistics is dependent on the size of the company and also on the branch of industry.

Key Words

lean company, lean manufacturing, lean logistics, questionnaire survey

JEL Classification: L6

Introduction

Lean Company concept is a very useful method to gain a competitive advantage and achieve profitability in the global environment. Nowadays, for companies it is necessary to achieve so called world class status which can be characterized by: total quality, zero errors, lowest possible production cost, minimum delivery time, supply reliability and effective management of human resources in manufacturing and logistics processes. According to research of the Association of small and medium-sized enterprises [2] in May 2011, Lean Company concept is the most used modern methods of business management with count about 29%.

Lean Company concept consists of the following four elements: lean manufacturing, lean logistics, lean administration and lean development. This paper deals with lean manufacturing and lean logistics. The goal of managers should be to reduce waste in all processes. Effective tool to reduce this waste is concept of lean manufacturing and lean logistics. Concept of lean manufacturing and lean logistics has been applied in many companies during the last decades. There are many international authors deal with lean manufacturing concept such as for example Womack [16, 17], Black [4], Carreira [5], Davis [6], Wang [14] and Wilson [15]. We can find information about lean logistics concept in publications off the following authors: Baudin [3], Goldsby and Martichenko [11], Myerson [13] or Zylstra [18]. Czech and Slovak literature is not too extensive. One of the few comprehensive publication that deals with lean manufacturing and lean logistics is a book called "Lean and innovative company" [12]. Lean manufacturing and lean logistics is also engaged in a professional journal called "Success" [9]. There are many methods and tools of industrial engineering for implementing Lean Company concept in manufacturing and logistics such as analysis and measurement of work, OEE (overall equipment effectiveness), Kanban, MOST (Maynard Operation Sequence Technique), OPF (One Piece Flow), Poka-Yoke, 5S, Six Sigma, DMAIC, SMED (Single Minute Exchange of Dies), TOC (Theory of Constraints), TPM (Total Productive Maintenance) and VSM (Value Stream Mapping) [9].

This article is based on research about situation in Czech manufacturing companies in issue of using concepts of lean manufacturing and lean logistics. This research is also connected with PhD thesis [7] that is focused on creating of knowledge bases of an expert system for the evaluation and introduction of the Lean Company concept in manufacturing and logistics.

1. Methodology of research

The questionnaire survey was aimed for finding out the current state of the implementation of lean manufacturing and lean logistics in the Czech manufacturing companies. The questionnaire was designed in a structured way due to simplicity, speed and ease of data acquisition processing so the respondent could answer only on the basis of the available options.

1.1 Objectives of empirical research

The main aim of the survey was to determine the current state of the introduction of Lean Company with a focus on lean manufacturing and lean logistics in the Czech manufacturing companies. The objectives of the questionnaire survey can be defined in several interrelated areas that relate to the concepts of lean manufacturing and lean logistics. The main objectives of questionnaire survey are follows:

- find out the state in training of lean manufacturing and lean logistics;
- ascertain the rate of introduction of lean manufacturing and lean logistics;

- find out types of wasting in manufacturing and logistics processes;
- identify methods and tools of industrial engineering used by companies;
- find out dependencies among data.

1.2 Main hypotheses of empirical research:

- H1: Part of the Czech manufacturing companies is interested in the concept of lean manufacturing and lean logistics.
- H2: There is a potential for using of ICT (Information and Communication Technology) to support lean manufacturing and lean logistics in Czech manufacturing companies.
- H3: There is a lack of experts for lean manufacturing and lean logistics in Czech manufacturing companies.
- H4: Knowledge of lean manufacturing and lean logistics depends on the size of the enterprise.
- H5: Knowledge of lean manufacturing and lean logistics depends on the branch of industry.
- H6: Knowledge of lean manufacturing and lean logistics depends on the region in which the company operates.

1.3 Structure of the questionnaire

The questionnaire contained 17 questions. The first three related to the basic characteristics of the company such as enterprise size (number of employees), branch of industry and region in which a company base is located. Size of enterprises by number of employees was divided according to the rules of the European Union [10] to microenterprises (1-9 employees), small enterprises (10-99 employees), medium sized enterprises (100-499 employees) and large enterprises (500 and more employees). There were following branches of industry: iron and steel, machinery, electro-technical, chemical, energy, consumer, food, weapons, glass, mining, wood and paper manufacturing and construction. The region is a place, where the company has its official seat.

Another questions focused on detailed information about lean manufacturing and lean logistics such as knowledge of lean manufacturing and lean logistics, training / consulting issues of lean manufacturing and lean logistics, the rate of implementation lean manufacturing and lean logistics, the areas of greatest wasting in manufacturing and logistics, the most used methods and tools of industrial engineering, the usage of specific ICT application to support Lean Company, experts for lean manufacturing and lean logistics.

1.4 Data Acquisition

Research was conducted through a questionnaire survey in selected manufacturing companies from all regions in the Czech Republic. There were sent questionnaires to respondents by email with link to website for entering data. Selection of manufacturing

companies was carried out on the basis of information from the Internet portal "European Databank" (<http://www.edb.cz/>), which is used to search for Czech companies by sectors or regions and companies and institutions "Firmy.cz" (<http://www.firmy.cz/>). Overall, it was sent out 20 742 questionnaires and obtained 322 completed, it is a total return only about 1.6%.

1.5 Structure of questions

For many categories such as the knowledge of lean manufacturing and the knowledge of lean logistics, the training of lean manufacturing and lean logistics only positive or negative answers "yes" or "no" were possible. Level of implementation of lean manufacturing and lean logistics concept could be one of the following: fully implemented, partially implemented, will be implemented, will not be implemented.

The data could be separated into many categories according to:

- the company size (number of employees);
- the branch of industry;
- the distribution by region;
- the knowledge of lean manufacturing and the knowledge of lean logistics;
- the training of lean manufacturing and the training of lean logistics;
- the level of implementation of lean manufacturing concept and lean logistics concept;
- using ICT to support Lean Company concept;
- using experts for lean manufacturing and the using experts for lean logistics.

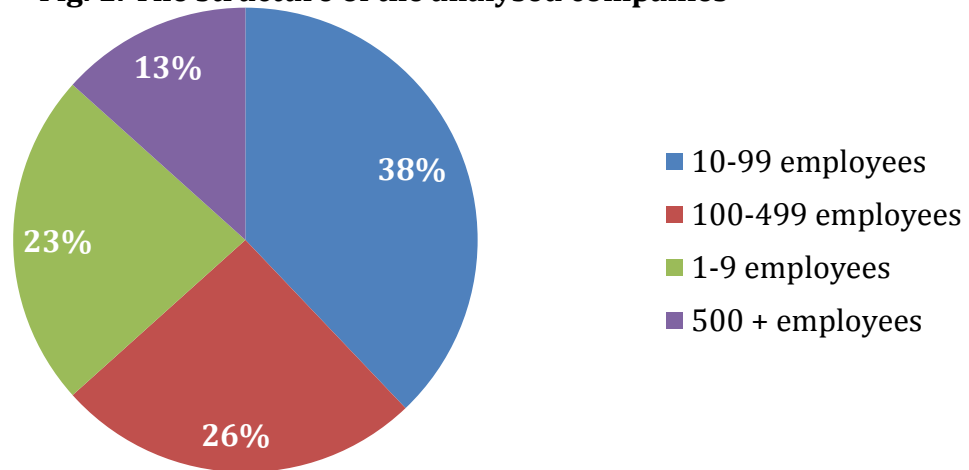
1.6 Structure of respondents (companies)

As mentioned above, companies can be divided according to number of employees, industrial branches and regions in the Czech Republic.

1.6.1 Number of employees

Companies could be divided according their size as: microenterprise, small enterprise, medium sized enterprise and large enterprise. Fig. 1 presents the structure of the analysed companies. 38 % of them were small enterprises (10-99 employees), 26 % amounted to medium sized enterprises (100-499 employees) and microenterprises (up to 9 employees) were represented by 23 %. The rest of them were large enterprises (more than 500 employees) with the share of 13 %.

Fig. 1: The structure of the analysed companies



Source: Own primary research results, N=322

1.6.2 Industrial branches

There were 322 respondents (companies) with the following structure: engineering industry (167 companies, 51.9%), electrical engineering (37 respondents, 11.5%), consumer industry (29 respondents, 9%), chemical (27 respondents, 8.4%) and food (24 respondents, 7.5%). Other industries such as metallurgy, energy, mining, arms, glass, mining, wood and paper industry are represented with the percentage of respondents under 5%.

1.6.3 Regions in the Czech Republic

We have had respondents from all regions in the Czech Republic so in next section of paper we can find some differences in using lean manufacturing and lean logistics concepts between regions in the Czech Republic.

2. Survey results

There are results from own primary research - basic statistics about questionnaire survey and categorical data analysis in SPSS (Statistical Package for the Social Sciences) with dependencies among data.

2.1 Basic statistics

The basic statistics includes overview about the rate of knowledge of lean manufacturing and lean logistics concepts in Czech manufacturing companies, the training in lean manufacturing and lean logistics concepts, the rate of implementation of lean manufacturing and lean logistics concepts, areas of greatest waste in manufacturing and logistic processes, the most used methods and tools of industrial engineering, application of ICT to support Lean Company concept, experts for lean manufacturing and for lean logistics.

2.1.1 Knowledge of lean manufacturing concept and lean logistics concept

Based on the research, it was found that 149 companies from total 322 (46.3%) have a basic knowledge about lean manufacturing concept and 173 companies (53.7 %) do not have a basic knowledge about lean manufacturing concept. If we compare this results with the research of the Association of small and medium-sized enterprises and crafts of the Czech Republic (AMSP ČR) called "Opinions of entrepreneurs in modern methods of management" from May 2011 [2], then we can see that the level of the knowledge of lean manufacturing within the Czech enterprises has been rising in the past three years. The results from survey provided by the AMSP ČR in May 2011 were following: the knowledge of the concept of Lean Company is typical for only 11%. In Tab. 1 we can see situation about knowledge of Lean Company concept in 2014 according to a size of company.

Tab. 1: Knowledge of lean manufacturing concept according to a size of company

		Knowledge of lean manufacturing		Total
		YES	NO	
Employees	1-9	10	65	75
	10-99	41	81	122
	100-499	59	23	82
	500+	39	4	43
Total		149	173	322

Source: Output from SPSS, data based on own questionnaire survey, N=322

The table shows that bigger companies have better knowledge of lean manufacturing concept than smaller. If we analyse small enterprises with 1-99 employees so we will see that there is only 25.9% of companies which know lean manufacturing concept and 74.1% of companies do not know this concept. For enterprises with 100 and more employees is the situation different because a full 78.4% of companies know lean manufacturing concept and only 21.6% of companies do not know this concept. If we compare knowledge of lean manufacturing and lean logistics concepts for all companies so we will see that more known is lean manufacturing concept (46.6%) than lean logistics concept (38.8%). Below is a table of knowledge of the lean logistics concept according to a company size.

Tab. 2: Knowledge of lean logistics concept according to a size of company

		Knowledge of lean manufacturing		Total
		YES	NO	
Employees	1-9	8	67	75
	10-99	34	88	122
	100-499	49	33	82
	500+	34	9	43
Total		125	197	322

Source: Output from SPSS, data based on own questionnaire survey, N=322

The table shows that there is better knowledge of lean logistics concept for bigger companies. We can see that there is knowledge of this concept only 21.3% for group of small companies with 1-99 employees. The situation is absolutely different for enterprises with 100 and more employees when 66.4% know concept of lean logistics.

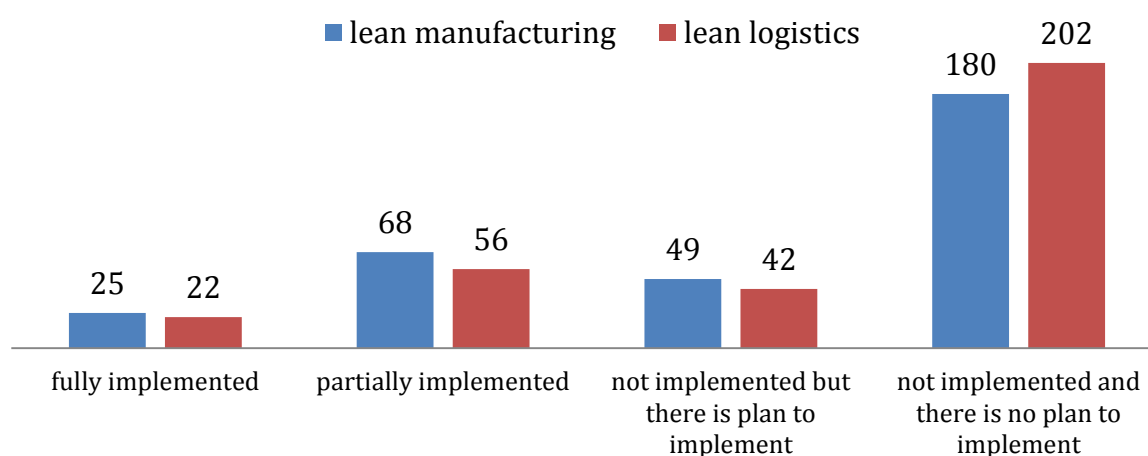
2.1.2 Training of lean manufacturing and lean logistics concepts

Training of lean manufacturing concept was realized in only 33.2% of the companies. There is significant difference according to company size. Training of lean manufacturing concept was realized more in bigger companies. Training of lean logistics concept was realized in only 24.5% of the companies. There is again significant difference according to company size. Training of lean logistics concept was again realized more in bigger companies.

2.1.3 The implementation of lean manufacturing and lean logistics concepts

One of the main questions was focused on rate of implementation of concepts for lean manufacturing and lean logistics. The concept of lean manufacturing is fully implemented in only 7.8% companies, partly is implemented in 21.1% implementation is planned in case of 15.2% of enterprises. We can summarise that in 44.1% of companies was lean manufacturing concept implemented or will be implemented in the future. The concept of lean logistics is fully implemented in only 6.8% companies, partially is introduced in 17.4% and implementation is planned for further 13% of companies. We can summarise that in 37.2% of companies was lean logistics concept implemented or will be implemented in the future. Hypothesis H1 is approved: Part of the Czech manufacturing companies is interested in the concept of lean manufacturing and lean logistics. The rate of introduction of both concepts is displayed in the following figure.

Fig. 2: Concepts of lean manufacturing and lean logistics in the Czech Republic

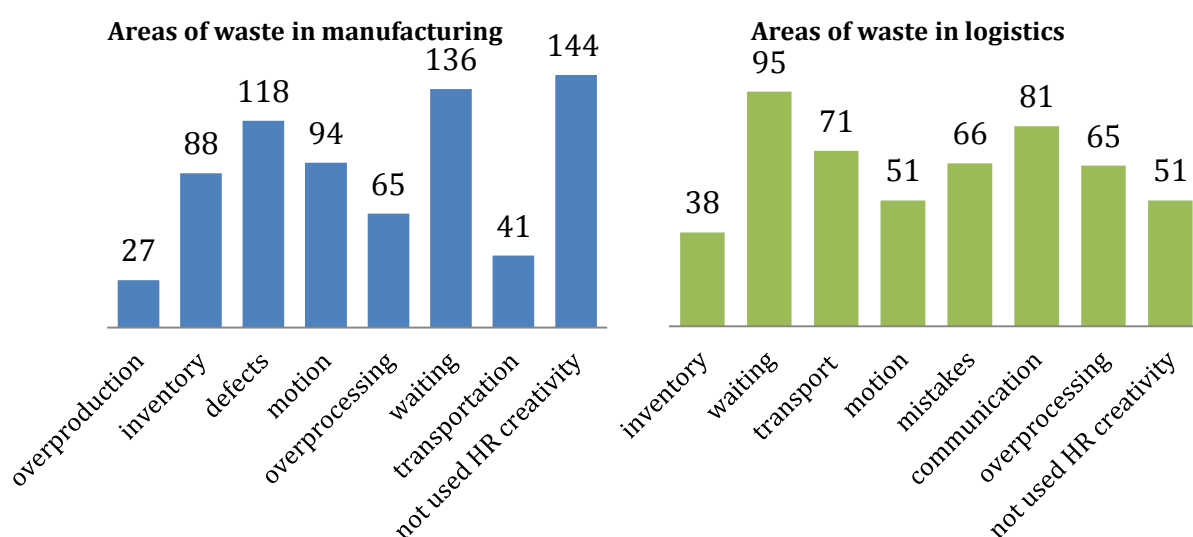


Source: Own primary research results, N=322

2.1.4 Areas of wasting in manufacturing and logistics processes

There were found following areas of greatest waste in manufacturing processes: not used human resource creativity, waiting and defects. The minimal wasting was found in the following processes: overprocessing, transportation and overproduction. There were found following areas of greatest waste in logistics processes: waiting, communication and transport. The minimal wasting was found in the following processes: motion, not used human resource creativity and inventory. The frequency of different types of waste in manufacturing and logistics processes based on data from 322 manufacturing companies is shown in the following figure.

Fig. 3: Wasting in manufacturing and logistics

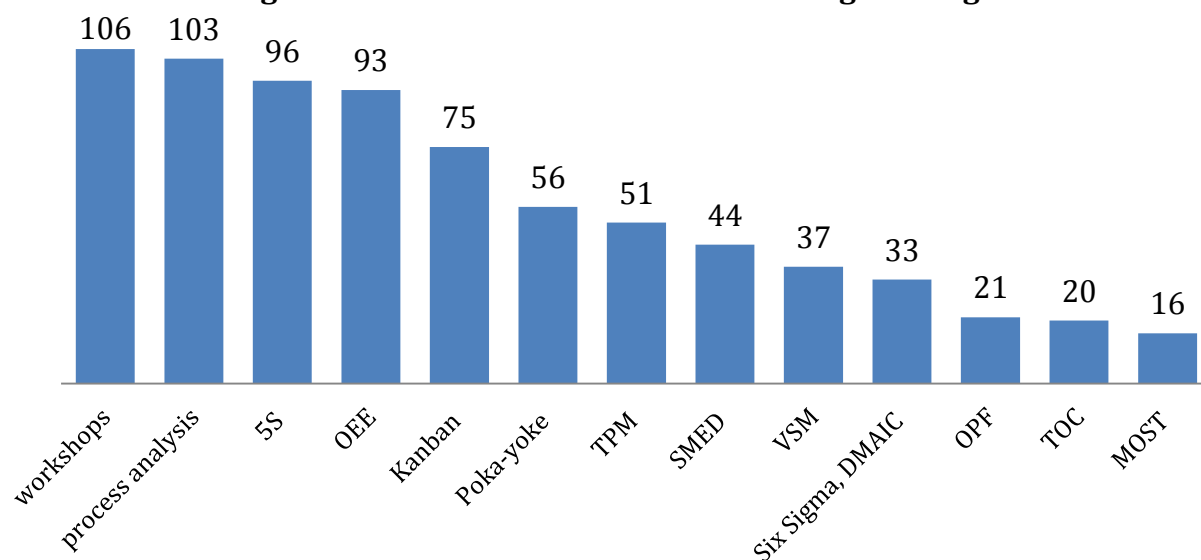


Source: Own primary research results, N=322

2.1.5 Methods and Tools of Industrial Engineering

Based on research are the most used methods and tools of industrial engineering following: workshops, process analysis, 5S method and OEE. The frequency of different methods and tools of industrial engineering is shown in the following figure.

Fig. 4: Methods and Tools of Industrial Engineering



Source: Own primary research results, N=322

2.1.6 Application of ICT to support Lean Company

Specific ICT application to support Lean Company is used by only 6.2% of companies. Hypothesis H2 is confirmed: There is a potential for the use of ICT to support lean manufacturing and lean logistics in the Czech manufacturing companies.

2.1.7 Experts for lean manufacturing and for lean logistics

There is an expert in the field of lean manufacturing only in 22.7% of companies. We can conclude that there is a lack of experts for lean manufacturing in Czech companies because there is 44.1% of companies when was lean manufacturing concept implemented or will be implemented in the future.

There is an expert in the field of lean logistics only in 15.5% of companies. We can conclude that there is a lack of experts for lean logistics in Czech companies because there is 37.2% of companies when was lean logistics concept implemented or will be implemented in the future. Hypothesis H3 is confirmed: There is a lack of experts for lean manufacturing and lean logistics in the Czech manufacturing companies.

2.2 Categorical data analysis in SPSS

We have analysed data from questionnaires using excel for basic statistics and also IBM SPSS for finding dependencies among data. We have used for categorical data analysis results of Chi-Square tests in SPSS software. We consider according to Agresti [1] the null hypothesis H0 that cell probabilities equal certain fixed values (π_{ij}). For a sample of size n with cells counts (n_{ij}), the values ($\mu_{ij} = n\pi_{ij}$) are expected frequencies. They represent the values of the expectations ($E(n_{ij})$) when H0 is true. Pearsons chi-squared statistic for testing H0 is defined as the following equation:

$$\chi^2 = \sum \frac{(n_{ij} - \mu_{ij})^2}{\mu_{ij}} \quad (1)$$

This statistics takes its minimum value of zero when all $n_{ij} = \mu_{ij}$. For a fixed sample size, greater differences ($n_{ij} - \mu_{ij}$) produce larger χ^2 values and stronger evidence against H0 [1]. This issue is more described on smaller sample size from Lean Company research with only 101 respondents (manufacturing companies) in [8].

Hypotheses H4-H6 were confirmed. We have found that the implementation of lean manufacturing and lean logistics is dependent on the size of the company and also on the branch of industry. The data were divided into four categories by the size of company: a micro company, a small company, a medium company and a large enterprise. There were following industrial branches: engineering, electro-technical, chemical, food processing and consumer industry. There is no dependency between the implementation of lean manufacturing/lean logistics and regions in the Czech Republic.

Conclusion

Presented paper introduces new findings about implementation of lean manufacturing and lean logistics concepts in the Czech manufacturing companies. The research confirms that the biggest problem is a lack of experts for both concepts. Results of survey also confirm very low using of ICT tools for supporting Lean Company concepts (just 6.2 %

company use ICT tools for supporting lean concept). There were also confirmed hypotheses about dependency between knowledge of lean manufacturing/lean logistics concepts and size of company and also with branch of industry. We can conclude that based on survey there is no dependency between knowledge of lean manufacturing/lean logistics and regions where the companies operate.

Acknowledgement

The work of Radim Dolák was supported by the project SGS/21/2014, the work of Petr Suchánek was supported by the Ministry of Education, Youth and Sports in Czech Republic within the Institutional Support for Long-term Development of a Research Organizations in 2015.

References

- [1] AGRESTI, A. *An Introduction to Categorical Data Analysis*. Hoboken, NJ, USA: John Wiley & Sons, 2007. ISBN 978-0471226185.
- [2] ASMP ČR. *Výsledky průzkumu „Názory podnikatelů na moderní metody řízení společnosti“* [online]. Prague: Asociace malých a středních podniků a živnostníků ČR, 2012. [cit. 2013-02-18]. Available at: <http://www.amp.cz/10-pruzkum-amp-cr-nazory-podnikatelu-na-moderni-metody>
- [3] BAUDIN, M. *Lean Logistics: The Nuts and Bolts of Delivering Materials and Goods*. New York: Productivity Press, 2004. ISBN 9781563272967.
- [4] BLACK, J. R. *Lean Production: Implementing a World-class System*. New York: Industrial Press, 2008. ISBN 978-0831133511.
- [5] CARREIRA, B. *Lean Manufacturing That Works: Powerful Tools for Dramatically Reducing Waste and Maximizing Profits*. New York: AMACOM, 2005. ISBN 0-8144-7237-0.
- [6] DAVIS, J. W. *Lean Manufacturing: Implementation Strategies that Work*. New York: Industrial Press, 2009. ISBN 978-0-8311-3385-6.
- [7] DOLÁK, R. *Creating of knowledge bases of an expert system for the evaluation and introduction of the Lean Company concept in production and logistics* [PhD thesis]. Karvina: School of Business Administration in Karvina, 2015.
- [8] DOLÁK, R., J. GÓRECKI, L. SLECHAN, and M. KUBÁT. Categorical data analysis from Lean Company research. In TALAŠOVÁ, J., J. STOKLASA, and T. TALÁŠEK. eds. *Proceedings of the 32nd International Conference Mathematical Methods in Economics*. Olomouc: University of Palacky, pp. 162–167. ISBN 978-80-244-4209-9.
- [9] DLABAČ, J. Cesta ke štíhlému podniku. *Úspěch*, 2009, 4(1): 11–12. ISSN 1803-5183.
- [10] Evropská společenství. *Nová definice malých a středních podniků – Uživatelská příručka a vzor prohlášení*. Evropské společenství: Úřad pro úřední tisky, 2006. ISBN 92-894-7917-5.
- [11] GOLDSBY, T. J. and R. MARTICHENKO. *Lean Six Sigma Logistics: Strategic Development to Operational Success*. Boca Raton: J. Ross Publishing, 2005. ISBN 9781932159363
- [12] KOŠTURIÁK, J. and Z. FROLÍK. *Štíhlý a inovativní podnik*. Praha: Alfa Publishing, 2006. ISBN 80-86851-38-9.

- [13] MYERSON, P. *Lean Supply Chain and Logistics Management*. New York: McGraw-Hill Companies, 2012. ISBN 978-0071766265.
- [14] WANG, J. X. *Lean Manufacturing: Business Bottom-Line Based*. Boca Raton: CRC Press, 2011. ISBN 978-1-4200-8603-4.
- [15] WILSON, L. *How to Implement Lean Manufacturing*. Columbus: McGraw-Hill Education, 2010. ISBN 978-0-07-162508-1.
- [16] WOMACK, J. P., D. T. JONES, and D. ROO. *The machine that changed the world: The story of lean production*. New York: Rawson Associates, 1990. ISBN 978-0060974176.
- [17] WOMACK, J. P. A D. T. JONES. *Lean thinking: Banish waste and create wealth in your corporation*. New York: Free Press, 2003. ISBN 978-0743249270.
- [18] ZYLSTRA, K., D. *Lean Distribution: Applying Lean Manufacturing to Distribution, Logistics, and Supply Chain*. Hoboken, NJ, USA: John Wiley & Sons, 2006. ISBN 978-0-471-74075-9.

Zuzana Fraňková, Ivan Jáč

Technical University of Liberec, Faculty of Economics, Department of Business
Economics and Management

Studentská 2, 461 17 Liberec 1, Czech Republic

email: zuzana.frankova@tul.cz, ivan.jac@tul.cz

Perception and Values of Family Business

Abstract

The article contains various definitions of family businesses, both at home and in neighbouring countries, although there is no clear or universal definition of a family business. It also includes the strengths and weaknesses of family business. In the second section, the results and findings of the team pilot survey of family business, conducted by the Department of Business Economics and Management, EF, TUL, are presented. The aim of this survey was to identify perceptions, attitudes and evaluation of family business enterprises as such. Despite the low number of respondents it can be stated that family firms benefit from their names, which guarantee the quality of their products and services. Dependence analysis was performed, based on the logarithmic regression and chi-squared test, specifically through the association table. According to these analyses, the survey showed that in small localities family firms are considered as key employers. In terms of the traditional character of the core business weak dependence on the type of business (whether it is family or non-family type) was reflected, where more non-family firms operate in traditional industries in the region. However, the result could have been influenced by the low number of respondents. It is necessary to continue to investigate this type of business, in order to identify relevant data, on the basis of which institutional support for the development of family firms could come forward. It could then help, especially in municipalities with smaller population, to reduce disparities in the regions concerned and create new jobs for these disparities (reduce the often higher unemployment) in connection with the elimination of social benefits payment and encourage consumption in the municipality.

Key Words

family, family business, social responsibility, strengths and weaknesses of a family firm

JEL Classification: M14, M20

Introduction

The aim of this article is to present selected results of a pilot survey of the Department of Business Economics, EF, TUL which was focused on finding perceptions, attitudes and evaluation of family business as such. The issue of family businesses is very topical nowadays. Its role in the business environment in the Czech Republic has, in theory and in particular in legislative terms, not been defined yet, and there is a lack of historical experience which could help to accelerate this form of business in our environment. In a time of global economic crisis, there is no universal guide to help the Czech Republic during the crisis. However, the development of domestic family firms may help stabilize the economy, because in difficult times it is them who are more bankruptcy-resistant [1]. The risks of this type occur mainly in the areas of strategic development of the company. In Italy, this type of business represents 95% of all business entities, similar values can also be found in Portugal, Germany and France. In Germany, family businesses account

for 40% of GDP and contribute to employment with 65%. Although in these countries they represent mainly small and medium-sized enterprises, they bring continuity of the business plan, the responsibility for long-term viability of the company, corporate culture, employee motivation and understanding the needs in the area [2]. For example, in the USA, Canada, Spain, Mexico, but also in the aforementioned Italy, Portugal and France, there are family businesses with a turnover of more than a billion dollars [1]. Among family-type companies belong businesses such as Wal-Mart (with a turnover \$ 421.85 billion in 2011), Ford Motor Co., Cargill, Koch Industries and others [3]. The economic and social benefits of family businesses are an important element of success in business, both small and medium, as well as the large ones.

1. Family Business

There is no generally accepted definition of a family business, therefore we can find different determinations of family business in many countries. The most common criteria which are contained in various definitions are the shares of property rights of the families, the number of generations involved in the enterprise, the number of family members working in the company, but also the intention of the family to hand over the reins to the next generations [4].

The Austrian Institute for Survey of Small and Medium-sized Enterprises in the Overview of the Relevant Issues of Family Businesses stated that in the Czech Republic a family business is defined by being owned by one or several families, while in some types of companies just partial ownership is enough, but there has to be the dominant control over the management. Traders are considered family businesses where the business is the main source of a family employment and their material existence [5].

In accordance with the Swiss definition by Goehler, an enterprise can be regarded as a family one if shareholders' equity is controlled by the family and if the statutory body is formed by members of this family. The important issue here is the influence of family, i.e. the family completely dominates one of these factors, or if a smaller influence of one factor is compensated by a greater influence of the second factor, the condition being family share in the equity. Therefore, for a family business relationship seen in Equation 1 [4] is valid.

$$FB \approx \frac{\text{Equity controlled by the family}}{\text{Company equity}} + \frac{\text{Number of statutory body from the family}}{\text{Number of statutory body company members}} \geq 1 \quad (1)$$

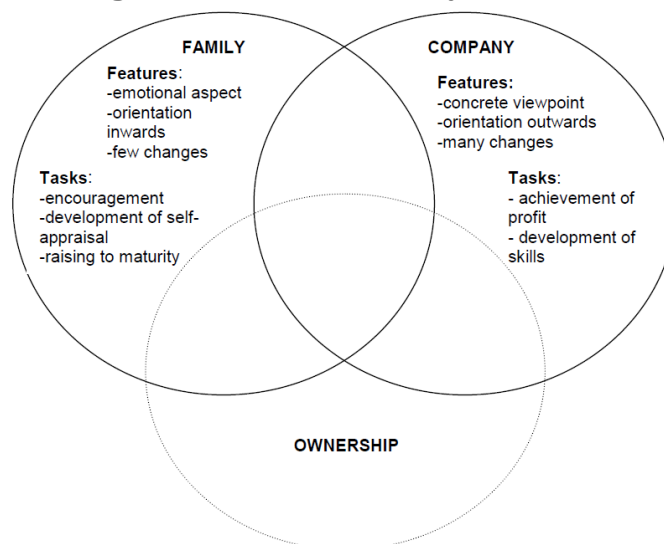
A German definition according to Institut für Forschung Mittelstand states that at least two individuals must be directly involved in the management of a company and together they must possess at least a 50% share of the business. An Austrian definition is based on Vogler, who was limited to commercial companies, and according to whom it is necessary to meet the following three criteria:

- people who are interested in the business must come from the same family;
- the company must be run by individual members or the whole family and have a majority of the voting rights;

- management of the company is made up of family members, who will manage the company in order to ensure the livelihood of their family [4].

Family business is a specific model of business management, and as such it has much strength, but also pitfalls. Among the factors which may represent an advantage but a disadvantage too belong parallel roles, shared identity, life-long common history, emotional involvement and ambivalence, private language, mutual awareness of privacy and opinion on the family business [6]. Linking the family and the businesses itself is considered as one of the biggest challenges but a great joy as well. Each family member has different expectations, different goals and behaviour. Family members must learn to move in two systems and be aware of the fact that relations might vary within them [4]. Businesses and families generally have certain assumptions. These factors overlap in the family business, which is shown in Figure 1. Some authors suggest more than a double-circuit model, which also includes property, since family members working in the family business can play three types of roles: they are relatives, managers or owners [7].

Fig. 1: Model of the Family Business



Source: own, processed according to [7]

These relationships can be the core issue. There can occur emotional pressures, such as reluctance of the father / mother founder to pass on at least some of the powers (resulting from autocratic style of management), as well as rivalry between siblings. Other adverse factors which may occur in the family business is nepotism, which can demotivate competent staff, spoiled child syndrome, which stems from excessive dedication to work matters, and child neglect. Communication is an important factor not only in business, and its absence in the family enterprise can cause an uncomfortable atmosphere. Between work and private life there are fragile narrow boundaries, and therefore both positive and negative factors spill over from one system into another [4].

The strengths are mutual agreement between the persons, involvement of family members, knowledge of technologies and know-how, flexibility in work, time and money, long-term plans, stable corporate culture, decision-making speed, proximity to local markets, pride and credibility, efficiency, productivity, focus on quality [8], [9]. In recent decades, corporate social responsibility goes at the forefront of marketing tools of business companies and is often

associated only with ethical standards, which among other things seek to minimize negative impacts on the environment. Social responsibility, however, includes all activities that are far beyond the maximum statutory or regulatory requirements as well as activities through which organizations strive to understand and satisfy the expectations of all interested parties, stakeholders, in the company. Thus they focus on the area of health care and human resources and relationships with the local community. [10] Among the advantages of family businesses also belongs creation of working places (they mostly show a greater ability to create new jobs) and socially responsible behaviour - investing in the development of the local community, sponsoring local civic activities, they tend towards a greener behaviour, good care of employees etc. [8].

2. Method of Survey

Our pilot survey of family business was based on primary data that had been collected for 20 days. The questionnaire survey was conducted within ORP Liberec ("Obec s Rozšířenou Působností" = municipality with extended competence). For faster obtaining objective data written questioning was used – by mail, e-mail or electronically. A structured questionnaire was compiled and divided into two parts. Respondents chose from offered options (closed questions), or they wrote their own opinion (open questions). Selection of the sample respondents was intentional. The respondents were key employers, who were identified by mayors in the project TAČR (Technology Agency Czech Republic) called Definition of Subregions for Resolution and Solution of Social and Economic Disparities. To determine the family business was a criterion perception of themselves as a family enterprise.

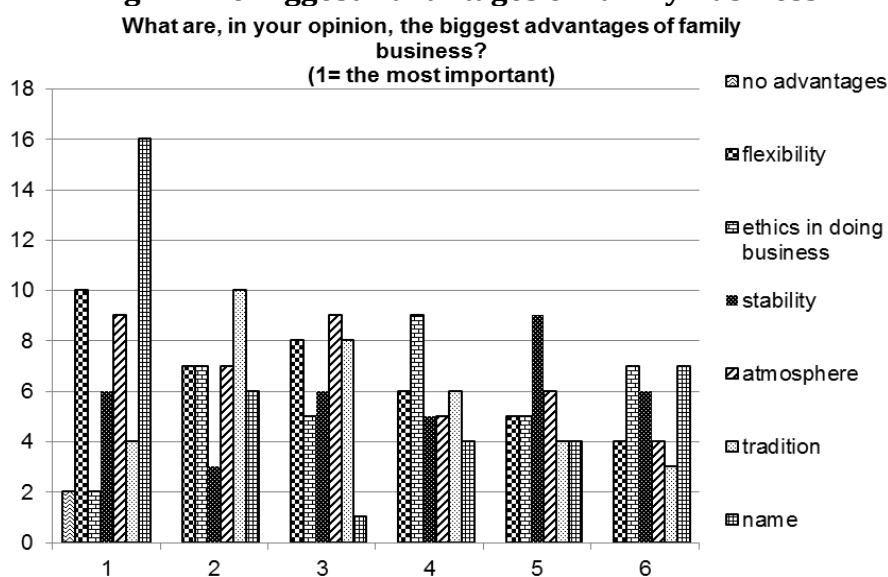
The questionnaire was divided into two parts. The first general part was structured into 8 questions, some of which contained sub-questions. The second part dealt with the importance of family businesses for the development of the town and the region. In the first part there were evaluated parameters such as the idea of a family business, the perception of family run companies by the general public in the Czech Republic, the advantages of family businesses, family businesses' behaviour at the time of prosperity, family businesses' behaviour in times of crisis, family business as a factor in community development and the future of the family business in the country. In the second part there were evaluated criteria focused on the family businesses as they perceive themselves, support of the adoption of legal measures in favour of FB, the origins of foundation, transformation of society, foreign contacts, business activities and family business traditions in a given locality.

In addition to descriptive statistics, an analysis between selected variables was performed by means of Statgraphics (SGP). In case of dependence analysis, where the independent variable was numerical and the dependent variable verbal, more specifically an alternative verbal variable, logarithmic regression method was used. The files were tested on standard normal distribution, but because of the negative outcome it was not possible to use ANOVA method. In analyses where ordinal verbal or numeric variables occurred together with alternative verbal variables, chi-square goodness of fit was used, namely an association table with Pearson's coefficient of dependence.

3. Results of the Pilot Survey

The questionnaire survey was carried out in 47 companies, of which 34 companies identified themselves as family businesses and 13 as non-family ones. Two family businesses had to be excluded from the analysis because of incompetence of their responses. Since there is no precise and universally accepted definition of family business, the respondents answered the question on what they thought the term family firm represented. Among the most common responses was the decisive influence of family members in a company management, a long tradition involving generational family development and workers being mainly family members.

Fig. 2: The Biggest Advantages of Family Business



Source: own

According to 37% of respondents, family firms are positively perceived by the general public in the Czech Republic. 59% of respondents' opinion was that it could not be clearly determined. It is therefore not possible to claim that the status of family enterprise is perceived better than a non-family firm type. Among the greatest benefits of a family way of doing business, see Fig. 2, the respondents most often put in the first place the name, which guarantees the quality of products or services; then flexibility and the atmosphere in the company. The second place ranked with the highest frequency company tradition. The third place went to the atmosphere in the business, as well as flexibility together with tradition.

According to 69% of respondents, family businesses invest in the development of current activities if prospering, further 15% of respondents stated that companies invested in the development of other activities and 12% of them answered that family-owned companies saved funds as a reserve for the future. Only 2% of respondents said that a family run company would pay their family members extraordinary profit shares. In case problems arise in business, according to 63% of respondents a family business would endeavour to maintain family influence at the cost of lowering their standard of living. This confirms the fact that family businesses are focused on the long term and seek to do business to be able to support their families for a long time and over several generations, even at the expense of their families in time of economic problems. Businesses also commented on

the allegations that the family firm wants to keep the company at the cost of termination of family tradition. 26% of respondents agreed with this opinion.

78% of respondents believe that family business is an important factor for the development of the town/ village. Of these respondents, 27% stated as the greatest importance of family companies their support of the development of the municipality, 24% saw it in completion of the image of the municipality and 21% in influencing events in the community. Therefore the assertion that family businesses tend to be socially responsible was confirmed. 83% of surveyed businesses believe that there is a future for family businesses in the Czech Republic. Among the reasons given by those who do not believe in family business future in the Czech Republic, were presented opinions that business here had no basis in the law, as well as that in the current globalized society the young generation had far greater opportunities to make use of their potential than to build a family business, and that everything was going to be controlled by multinational corporations very soon.

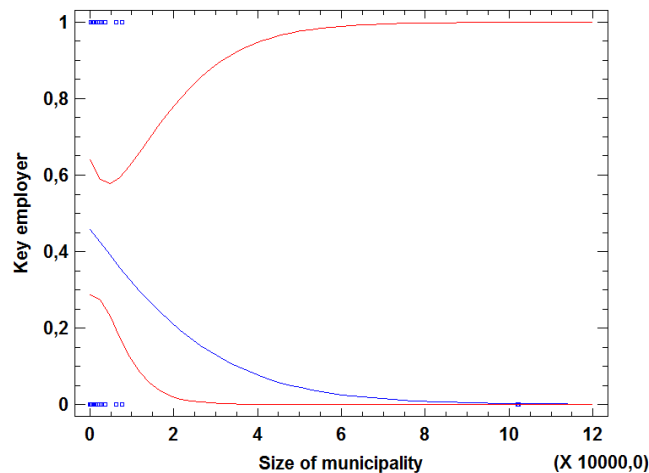
Of all those surveyed there were 72% of family businesses. Of these, 76% would support the adoption supplement legal measures in favour of family businesses. 73% of family firms were established as family businesses. 53% of all those surveyed were founded as family businesses and in 65% of them occurred no transformation during the period of their existence. 35% of respondents have no contact with foreign firms of a family type. At the same time, the same percentage does have a regular contact with foreign companies. 26% of those interviewed claimed only a random contact with foreign companies. Of the surveyed, 63% responded that their business was considered traditional in the locality. The questions were answered by non-family businesses as well, that is why in a part of dependence analysis the link of the type of business (family or non-family type) to the traditional character of this line of business in their area was investigated.

The first part of the questionnaire was also submitted to villages in Liberec region, of which 15 communities participated in the survey. To the question of a notion of family business the villages responded similarly to companies. What is important is the finding that 87% of them consider family business as an important factor for the development of the village. According to them, family businesses influence social events in the community, influence and complete the image of the village and carry out activities that promote community development.

3.1 Dependence of Family Firms as Key Employers on the Size of the Village

The following hypothesis was examined: the smaller the community, the more are family businesses considered a key employer in the village. Dependence evaluation was done using a logarithmic regression.

Fig. 3: Key Employer vs. Village Size



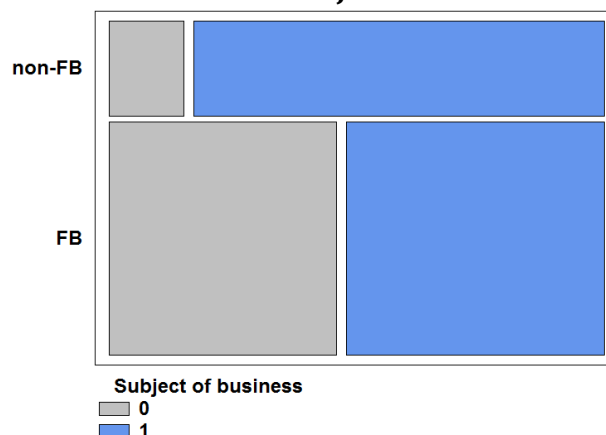
Source: own, processed in programme SGP

Only 12.53% of the variations are explained by the model, see the chart above. There was, however, a weak relationship between the above parameters demonstrated. Whether a family business is considered a key employer in the village, is weakly dependent on the size of the municipality. Family businesses are usually key employers in municipalities with fewer inhabitants.

3.2 Dependence of the Traditional Character of the Subject of Business on the Kind of Business Enterprise

The following hypothesis was examined: family firms do business following the tradition of their region. Dependence evaluation was done using contingency - association table. Fig. 4 shows a mosaic graph depicting the ratio distribution of individual responses. The first narrow line indicates non-family businesses answers. The bottom line indicates responses of family businesses. The blue colour labelled 0 (right part of the graph) identifies companies that do business traditional in their area. Grey colour labelled number 1 (left part of the graph), on the other hand, indicates that the company operates in a non-traditional sector.

Fig. 4: Traditional Character of the Subject of Business vs. Type of Business



Source: own, processed in programme SGP

There was weak evidence of a direct correlation between the above mentioned parameters. Pearson's coefficient has a value of -0.2944. The results show that more non-family type businesses operate in fields traditional for the region. However, the result may be affected by the low number of respondents. Therefore, it would be appropriate to carry out a more extensive investigation.

3.3 Dependence of the Kind of Business on the Size of Company

Among the respondents were 69 % of small family businesses, 15.5 % medium-sized and 15.5 % big family type enterprises. The following hypothesis was examined: small and medium-sized companies are family businesses. Dependence evaluation was done using a logarithmic regression. Only 1.02 % of the variations are explained by the model. It is not demonstrated dependence between the mentioned parameters. The results show that family businesses are mainly small and medium enterprises (SMEs), but it can not be argued that SMEs are the only family businesses, ie, that kind of a company depends on its size.

4. Discussion

For the results of dependence, the small number of respondents must be taken into account. Especially with the hypotheses that focus on family and non-family businesses comparison it is important to realize that there were only 14 answers from non-family type businesses. Hence the low number of counts in the association table, which can interfere with the result. It is necessary to continue to investigate this type of business in order to identify relevant data, on the basis of which institutional support for the development of family firms could be developed. It could then help, especially in municipalities with smaller population, to reduce disparities of individual regions.

Conclusion

Family based businesses are fundamentally destined to be prosperous. The company management desires to make a living for their relatives, and it follows the pursuit of sustainability and long-term development. Such a stable environment is beneficial for the State as well. Like every business, the family one has both benefits and risks. It is not only up to the State to promote the benefits and lower the risks because it is not only good for the state to make this type of business develop and expand.

This initial study suggests and outlines possible directions for further research on the subject, particularly in the secondary research, because of the unwillingness to answer the survey questions including "higher" level of subjectivity. Municipalities themselves identify family businesses as key employers and it can be said that the smaller the community, the more accurate this statement. With regard to the limited number of survey respondents the results should be taken with reserve. In world economies this type of business has been well mapped and such companies constitute a considerable part of their gross domestic product. Czech Republic should learn from economies where these

processes have been set and verified for years, and thus directing its activities to the identification of family firms and setting legislation that will serve to promote efficient use and spread of this type of business.

Acknowledgement

The article was written thanks to the financial support of Technical University of Liberec within the Students Grant Competition.

References

- [1] KACHANER, N. et al. What You Can Learn from Family Business [online]. *Harvard Business Review*, 2012. [cit. 2015-03-25]. Available from: <https://hbr.org/2012/11/what-you-can-learn-from-family-business>
- [2] TESAŘÍK, J. Ne rodina, ale rodinná firma je základ státu. *Ekonom*. Praha: Economia, 2011, 16. – 23. 11. 2011, **55**(46): 28. ISSN 1210-0714.
- [3] WEINMANN, K. and A. GROTH. The 10 Largest Family Businesses In The U.S. [online]. *Business Insider*, 2011. [cit. 2015-03-25]. Available at: <http://www.businessinsider.com/the-10-largest-family-businesses-in-america-2011-11>
- [4] KORÁB, V., A. HANZELKOVÁ and M. MIHALISKO. *Rodinné podnikání*. Brno: Computer Press, 2008. ISBN 978-80-251-1843-6.
- [5] MANDL, I. *Overview of Family Business Relevant Issues – Final Report*. Vienna: Austrian Institute for SME Research, 2008. ISBN n/a.
- [6] TAGIURI, R. and J. A. DAVIS. Bivalent attributes of the family firm. *Family business review*, 1996, **9**(2): 199–208. ISSN 0894-4865.
- [7] ODEHNALOVÁ, P. *Přednosti a meze rodinného podnikání* [PhD Thesis]. Brno: Masarykova univerzita, Ekonomicko-správní fakulta, 2009. 160 pgs.
- [8] KORÁB, V. et al. *Jak pracují malé rodinné firmy*. Brno: PC-DIR, 1998. ISBN 80-214-1121-X.
- [9] AMSP ČR. Situace rodinných firem [online]. Prague: Asociace malých a středních podniků a živnostníků ČR, 2014. [cit. 2015-03-25]. Available at: http://www.amspace.cz/uploads/Prizkumy/Vysledky_26._prizkumu_AMSP_CR.pdf
- [10] PETŘÍČKOVÁ, R. et al. *Společenská odpovědnost organizací*. Ostrava: DTO CZ, 2008. ISBN 978-80-02-02099-8.

Jiří Kraft, Alexander Zaytsev

Technical University of Liberec,
Faculty of Economics
Studentská 2, 461 17 Liberec 1
Czech Republic
email: jiri.kraft@tul.cz

Moscow State University of Design and
Technology, Textile Institute "A.N. Kosygin"
Malaya Kaluzhskaya 1, 119 071 Moscow
Russian Federation
email: az-inform@mail.ru

Developing the Competitive Environment During the Interaction of the State and Market Participants in the Conditions of the Economic Instability

Abstract

The paper analyzes problems of improving the competitive environment during rapid global changes and multifactor influence of multidirectional disturbances on development of the world economic system. The topicality and need for further research in the nature of development of the competitive environment in the conditions of political and economic instability are substantiated. In this connexion, both features of the global economy and traditional disturbances of the unstable external environment, affecting high-technology enterprises, are revealed. Therefore, a framework of tasks, required for facilitating efficient development of a national economy, is examined.

The significance of the public-private partnership for innovative development of market structures and its role in improving the competitive environment are demonstrated. The authors have scrutinized the possibility and conditions for forming a partnership between a state, active monopolies, and other market players in order to support innovative processes, depending on changes in external influences.

Key Words

competitive environment, economic instability, high-technology enterprise, innovative development, market structure, monopoly, oligopoly, public-private partnership, state

JEL Classification: D42, D43, F19, O31, O33

Introduction

Nowadays, the European countries and the whole international community experience colossal multifactor multidirectional influence on development of the world economic system. This is not only a period of transition from the industrial production way to the knowledge-based economy, but also the age when new social-economic paradigms emerge. The current period is unlike any other in the world history; new challenges to national economies in the conditions of high uncertainty and increasing instability of the external environment.

Globalization processes had led to the fact that the 2008 financial crisis affected economies of almost all countries, including the USA, Japan, the EU and BRICS countries. However, the political crises of 2014 and 2015 in the Ukraine and the Middle East

countries (Iraq, Syria, Yemen, etc.) has made a significant impact on the European economic system. Introduction of sectoral sanctions against Russia and the Russian retaliatory measures against the EU countries, the USA, and Australia have exerted a negative effect on the macroeconomic system development dynamics. In 2014-2015 the world commodity and capital markets were warped, the access to new technology became complicated, etc. Such changes in the external environment have led to the necessity of cardinally amending national strategies of economic development and high-technology industries. The abovementioned factors substantiate the topicality and need for further research into the nature of development of a competitive environment in the conditions of political and economic instability [1-3, 5, 7-10, 12, 14].

1. Competitive environment and influence of the instability of the economy on formation of high-technology industries.

Nowadays, as negative factors and economic globalization affect the competitive environment of market entities, it is undergoing drastic changes in the conditions of economic instability. Therefore, in conditions of the global market enterprises from high-technology industries function under the influence of increasing numbers of the external environment disturbing factors. Operations of enterprises from science-intensive and strategic industries are the most vulnerable to these effects. These industries cannot function without state financial and other support for innovative activities, a high intellectual potential and a developed cooperation system. For this reason, creating an efficient innovation support system, accounting for the current market conditions, requires from national economies (especially, the former socialist ones) much effort.

Such approach is strategically feasible, because development prospects are linked exactly to the transition to high-technology production based on application of science-intensive technology (process innovations) and creating products with high degree of intellectual work (product innovations). Therefore, integration of national high-technology enterprises into the world economic space is not only the matter of their survival, but also the matter of their further development on the basis of activating innovative factors.

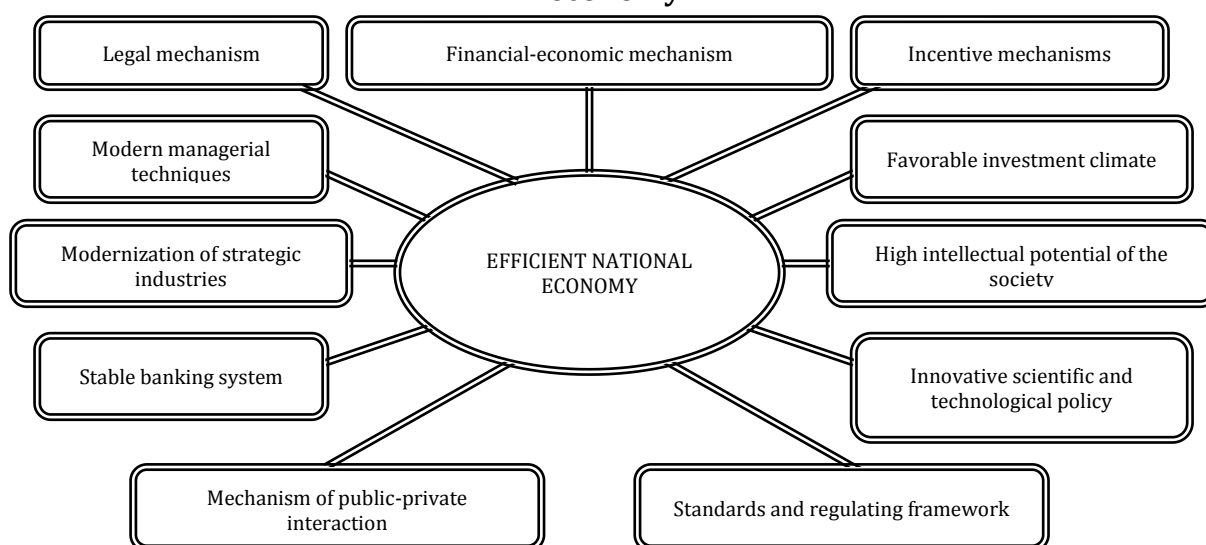
As for disturbing influences on the functioning process of high-technology enterprises, it is necessary to highlight the severe competitive pressure from foreign companies of the highly developed countries, possessing often wider financial and production capabilities to satisfy the public demand for modern high-quality goods and services. As of lately, the competition between domestic manufactures, focusing on the same markets, has been strengthening as well.

In addition to the features of the global economy, the traditional disturbances of the unstable external environment, including fluctuations and the demand for consumed resources (material, financial and intellectual) and produced goods, changes in the legislation in force, etc., are present as well. In the market environment these factors take place on a regular basis, regardless of the world financial crisis. However, in the conditions of the global crisis their negative impact is multiplied. Taking into account the fact that many national economies experience at the moment a high level of instability, associated with the external environment turbulence, it is necessary to ascertain that

tools of achieving strategic goals must be adequate to ongoing changes. The unstable status of the external environment may signify a recession phase that can transform into a stagnation phase under certain circumstances.

Therefore, it leads to the fact that the state support of innovative activities of enterprises should be initiated by creating a macroeconomic equilibrium and a competitive market environment. In this case, a government faces the problem of forming a framework of legal and economic tasks that are to be solved in order to facilitate efficient development of a national economy and national security, as well as to achieve competitive advantages on the world market. Figure 1 demonstrates the task framework.

Fig. 1: The framework of tasks of facilitating efficient development of a national economy



Source: own

Forming a competitive environment and conditions for efficient development of a national economy requires creating a favorable investment climate in the country. These conditions facilitate activation of innovative development factors of enterprises, industries, and regions. Thus, in the global economy macroeconomic conditions for efficient development are linked in the first place to forming such state scientific and technologic policy that can ensure support of the priority industries, science-intensive enterprises and technology. For this purpose it is necessary to encourage application of tools that can enhance efficiency of the country's economy in the best way, e.g. by developing markets of leasing and trust transactions, mortgage lending, using accelerated depreciation and amortization methods. Organizational tools of improving efficiency of a national economy stipulate creating structures that are highly receptive to innovative activities (technoparks, techno-innovation special economic zones, technopolises, etc.), developing mechanisms for public-private partnerships [2, 12, 14, 15].

Encouraging attraction of domestic and foreign investments to the real sector of the national economy can be secured via activation of such mechanisms as providing state guarantees, customs facilities and fiscal incentives, developing risk insurance systems, etc. Furthermore, it is necessary to provide support and incentives to facilitate the process of creating competitive products with prolonged lifetime – first of all in those industries that have a high innovative and intellectual potential and form the national security. In

the crisis time it is impossible to realize such measures without the state support for the banking system, developing a system of crediting science-intensive industries of the economy on the basis of tools of the project and venture financing, etc.

2. Innovative development of market structures and the role of the state in improving the competitive environment.

Accelerated development of the technical-economic level of enterprises and expansion of influence spheres of economic entities forms real conditions for running business within the market structure. However, this does not lead to the perfect competition. Such development of the competitive environment can lead to creating a monopoly or an oligopoly – cooperative or with a dominant firm. The imperfect competition in the form of a monopoly is not such an environment. Therefore, in order to secure economic efficiency of innovative activities of organizations with different ownership forms it is necessary to exert influence upon monopolization processes, containing their negative impact on the market. It is possible to transform a monopoly into a form of imperfect competition close to an imperfect competitive environment by influencing the market structure.

In the real market conditions such form can be represented by an oligopoly. A dominant firm oligopoly is a type most contributing to development of the competition. At the moment this environment is supported to a significant extent by the state support for small and medium-sized businesses that function in reality in close cooperation with the dominant firm, which is quite often a former monopoly. Real conditions for the efficient use of this market structure are arising within the world economic system.

Small and medium-sized enterprises, remaining on the competitive outskirts of such market structure, actively interact with the dominant firm. While forming a price policy, enterprises must take into consideration the fact that, as a rule, prices for products of the dominant firm on the oligopoly market are lower than prices of small and medium-sized enterprises. However, firms on the competitive outskirts can change this if they transform the market into the imperfect competition environment via innovative activities and state support.

In this case a strategy of improving the competitive environment, aimed at the transition of the national economy to the innovative development model, must be amended. Such amendments are made taking into consideration the increasing influence of negative factors of the external environment on the macroeconomic system. Within the national economy management system the factors represent disturbing influences that decrease the stability margin of the system in total. Therefore, it is necessary to react accordingly to these changes, introducing control signal into the management system. Such controllers may lead to cost optimization, restructuring of industries and individual production systems, transition to the resource-saving technology, etc. Combined, this will have a positive effect on forming and developing the competitive environment.

Nevertheless, in order to shift the economy to the innovative model it is necessary to fortify the business development foundation. The dynamic growth of the financial

economic state of market structures can serve as such foundation. While evaluating the external environment, analyzing the spectrum of disturbing influences and innovative processes, as well as suggesting methods for managing innovations, those in charge of developing strategies and programs seldom look into innovative changes in market structures. Therefore, in the current conditions it is necessary scrutinize the state of innovative development of market structures. It is to a large extent stipulated by the fact that the government must formulate an adequate response to the impact of negative factors of the external environment in the specific (at the moment) macroeconomic system. For this reason, forming the nationwide competitive environment becomes an important factor, ensuring efficiency of innovative activities of the national economy in general. It is stipulated by the fact that it is possible to achieve the sustainable development of enterprises, securing their competitiveness, only if the government endeavors to improve the competitive environment.

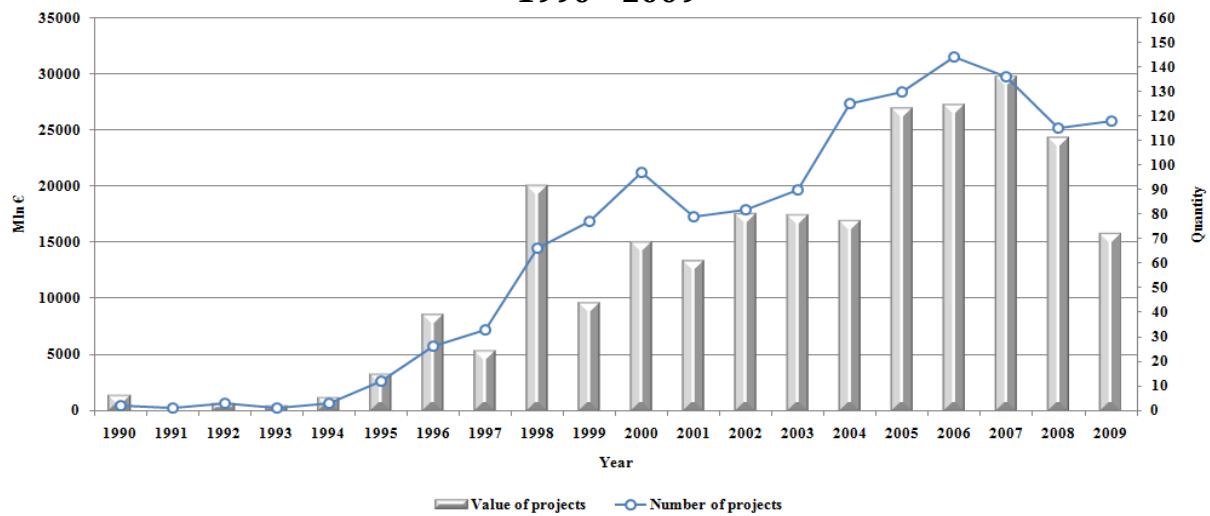
Concentrating investment resources on priority courses of scientific, technical and technological development of the country becomes an important tool of the macroeconomic system for responding to disturbing influences of the external environment within solving tasks of forming and improving the competitive environment. In this case, organizational forms that can enable to accumulate the resources and use them in the best way are required.

One of such forms is a public-private partnership. Originating from Great Britain, mechanisms of the partnership have been firstly implemented in the European countries, the USA, Japan, and later propagated to other countries. The government plays the key role in this model of accumulating resources; it serves, firstly, as an initiator of forming innovative courses of development of various industries of the economy. Secondly, the government acts as the guarantor of accomplishing the set tasks. Figure 2 demonstrates graphs of realizing investment projects, based on different forms of the public-private partnership in the EU countries during 1990 – 2009.

Development of the public-private partnership on Figure 2, encompassing the first decade of the 21st century, may have a serious impact on the current state of market structures, their functioning and, as a result, on the competitive environment.

Traditionally, a particular emphasis is placed on the connection between the business and the government in terms of the latter protecting the market environment from monopolies which are eager to take advantage of their opportune position on the market. A monopoly realizes such situation at the expense of its clients. However, such connection can change depending on states of external influences. The government, being a partner of the business, can become a certain constituent of the monopoly even though it loses the function of the existing market defender. At the same time the government keeps its function of suppressing threats, induced by the monopoly, which can influence the market in terms of obtaining ineligible benefits, e.g., linked to the 1 – 3 degree price discrimination against consumers [6, 10, 14].

Fig. 2: Development of the public-private partnerships in the EU countries during 1990 – 2009



Source: authors' plotting on the basis of Kappeler A., Nemoz M.¹

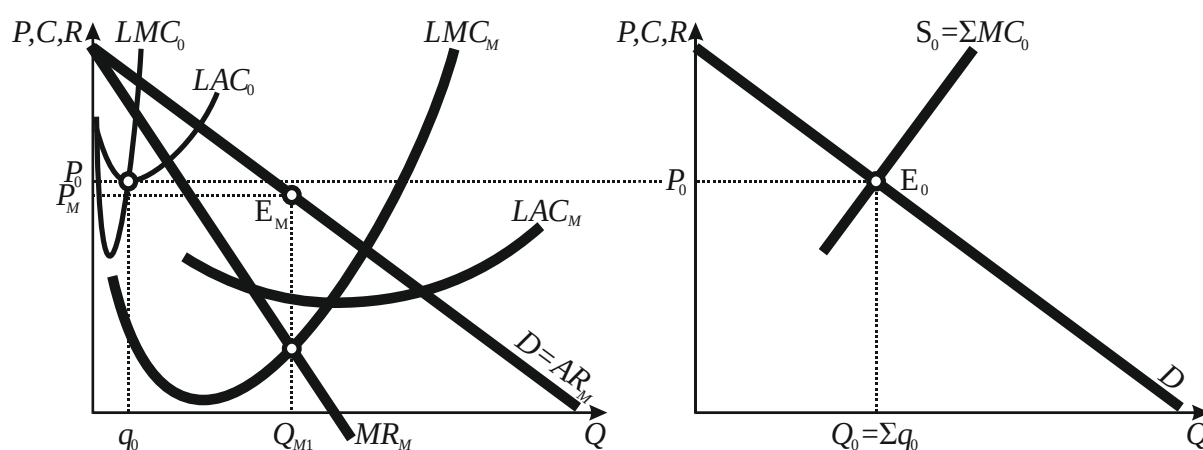
If the government by using the partnership was able to control this negative factor, associated with the monopoly, favorable conditions, typical and certainly significant for the monopoly, would dominate the market. If we assume that a natural monopoly can exist, most likely, it will have reached its beneficial position by reducing costs during the competition with a number of other economic subjects. Consequently, the existence of such monopoly would be the result of the competition, because it had managed to maintain the lowest possible costs and won over its rivals.

It is the achieved cost level where the advantage of monopolies lies. It is an issue of relatively low costs for a unit of a product as compared to outsiders. Such low costs on a unit of a product are beneficial not only for the said monopoly, but also for consumers, and the economy in toto in terms of its competitiveness. The graph on Figure 3 serves as a proof. It compares high costs of the outsider – a small manufacturer, applying obsolete small-scale production – with costs of the monopoly – a large-scale manufacturer, using high technology. It is all compared for equal volumes of goods produced.

The analysis of Figure 3 reveals that, obviously, the price set by the monopoly is the monopoly price. However, for a client or consumer it is not necessarily higher than the price that could have been designated by the market in the conditions of the perfect competition. This assumption is made taking into consideration existence of different cost levels of the reviewed subjects. At the same time we do not assume, as had been previously shown, that the government would lower the monopoly price, ensuing from the equality of marginal costs and marginal revenue. The government would only prohibit using 1 – 3 degree price discrimination against clients.

¹ Kappeler A., Nemoz M. Public-Private Partnerships in Europe – Before and During the Recent Financial Crisis. Economic and Financial Report 2010 [online]. European Investment Bank database, 2010. [cit. 05.02.2015]. Available at: http://www.bei.europa.eu/attachments/efs/efr_2010_v04_en.pdf

Fig. 3: Comparison of costs of the market players (market participants).



Legend: P – price; C – costs; R – revenue; MC – marginal costs; MR – marginal revenue; AR – average revenue; S – supply; D – demand; LAC – long-term average costs; LMC – long-term marginal costs; E – Equilibrium Q, q – quantity produced. Indices denote: ₀ – a parameter belongs to the outsider firm; _M – a parameter belongs to the monopoly.

Source: own

In light of the above-stated, let us divert from the demonopolization – in the present conditions it would be similar to tilting at windmills. At the same time we can assume that development of monopolies of large production enterprises is economically expedient. Clearly, it concerns only some productions, and it is exactly for them the discussed partnership is realized in order to maintain innovative processes [2, 10, 14]

Conclusion

The conducted analysis of the important role of large production enterprises in improving the competitive environment does not in any way diminish the significance of small and medium-sized innovative enterprises in development of the economy. Their significance is proved in a number of research works, mentioned in the references. The public-private partnership simply represents an alternative path to positively influence the functioning of the market environment. It is justified even in the conditions when the government has to take measures against monopolies or oligopolies that make excessive use of their domineering position on the market.

The efficiency of forming public-private interaction models depends to a great extent on the elements that partners contribute to the partnership system. In the conditions of high instability of the external environment the role of state guarantees, public contract and benefits, granted by the government to the innovative business (including tax, credit, renting and leasing benefits), rises. It is those elements that become defining tools for limiting operating risks of structures created within the public-private partnership. Moreover, elements contributed by the business to the partnership become important tools for limiting risks. These elements encompass intellectual assets, consisting of intangible assets, knowledge and abilities, skills and experience in professional and managerial spheres, information resources that enhance responsiveness of the decision making, etc. It is joining all these elements into an integrated system that creates a synergistic effect within public-private interaction. The integration of elements, becoming

an important tool for managing such partnerships, ensures efficient counteractions to disturbing factors of the external environment.

In this case it is necessary to strengthen teleological and control functions of the government, being a vehicle of socially important interests. In the conditions of instability of the external environment and scarcity of investment resources the state concernment, as a member of the partnership, increases. Firstly, it is shown in achieving national economic efficiency of the undergoing public-private projects. Secondly, in achieving the budgetary effect. The private sector partner, as an efficient owner, holds an interest in maximizing the value and reaching a high level of the business capitalization. In this case, the private sector, playing a role in the partnership, is more responsible on selecting projects, distributing risks, as its aim is to make the undergoing projects as much profitable as possible.

References

- [1] BUKOWITZ, W. R. and R. L. WILLIAMS. *The Knowledge Management Fieldbook*. Moscow: Infra-M, 2008. ISBN 5-16-001413-6.
- [2] FÁREK, J., J. KRAFT, and A. V. ZAYTSEV. *High tech podniky v globalizovane znalostni ekonomice*. Liberec: Technická univerzita v Liberci, 2013. ISBN 978-80-7494-016-3.
- [3] KEŘKOVSKÝ, M. *Moderní přístupy k řízení výroby*. 2nd ed. Praha: C. H. Beck, 2009. ISBN 978-80-7400-119-2.
- [4] KOŠTURIK, J. and Z. FROLÍK. *Štíhlý a inovativní podnik*. Praha: Alfa Publishing, 2006. ISBN 80-86851-38-9.
- [5] KRAFT, J. *Market Structures and Macroeconomic Reality*. In KOCOUREK, A. ed. *Proceedings of the 10th International Conference Liberec Economic Forum*. Liberec: Technická univerzita v Liberci, 2011. pp. 252–259. ISBN 978-80-7372-755-0.
- [6] KRAFT, J., P. BEDNÁŘOVÁ, and A. KOCOUREK. *Mikroekonomie II*. 2. vyd. Liberec: Technická univerzita v Liberci, 2013. ISBN 978-80-7372-992-9.
- [7] KRAFT, J., P. BEDNÁŘOVÁ, and A. KOCOUREK. *Globalizace na prahu 21. století*. Liberec: Technická univerzita v Liberci, 2012. ISBN 978-80-7372-930-1.
- [8] KRAFT, J., P. BEDNÁŘOVÁ, M. LUNGOVÁ, I. NEDOMLELOVÁ, and L. SOJKOVÁ. *Hospodářská krize. Vybrané makroekonomické a mikroekonomické souvislosti s projekcí na úrovni regionů*. 1. vydání. Liberec: Technická univerzita v Liberci, 2010. ISBN 978-80-7372-678-2.
- [9] KRAFT, J., J. FÁREK, P. BEDNÁŘOVÁ, I. NEDOMLELOVÁ, and M. SKÁLA. *Odras globalizace v současné ekonomické teorii a realitě*. Liberec: Technická univerzita v Liberci, 2011. ISBN 978-80-7372-814-4.
- [10] KRAFT, J., A. V. ZAYTSEV, and V. V. BARANOV. Globalization and innovative factors of the enterprises development. In KOCOUREK, A. ed. *Proceedings of the 9th International Conference Liberec Economic Forum*. Liberec: Technická univerzita v Liberci, 2009. pp. 193 –199. ISBN 978-80-7372-523-5.
- [11] KUCHARČÍKOVÁ, A. et al. *Efektivní výroba*. 1st ed. Brno: Computer Press, 2011. ISBN 978-80-251-2524-3.
- [12] NIKOLAYEV, S. D., A. V. ZAYTSEV, V. V. BARANOV, and J. KRAFT. *The intellect of the modern enterprise*. Moscow: Publishing House Komsomolskaya Pravda, 2010. ISBN 978-5-93434-116-0.

- [13] NOHRIA, N., W. JOYCE, and B. ROBERSON. What really works. *Harvard Business Review*, 2003, **81**(7): 42–52. ISSN 0017-8012.
- [14] IVASHCHENKO, N. S. and A. V. ZAYTSEV. eds. *Peculiarities of developing an enterprise in the innovative economy*. Moscow: Creative economy, 2011. ISBN 9785912920769.
- [15] ZAYTSEV, A.V. *Managing innovative changes and evaluating efficiency of their realization at high-technology enterprises*. Moscow: Moscow State Textile University “A.N. Kosygin”, 2012. ISBN 978-5-8196-0230-0.
- [16] ZUZÁK, R. *Strategické řízení podniku*. 1st ed. Praha: Grada Publishing, 2011. ISBN 978-80-247-4008-9.

Irah Kučerová, Iva Nedomlelová

Charles University of Prague, Faculty
of Social Sciences, Department
of International Relations
U Kříže 8, 158 00 Prague 5, Czech Republic
email: irah.kucerova@fsv.cuni.cz

Technical University of Liberec, Faculty
of Economics, Department of Economics
Studentská 2, 461 17 Liberec 1
Czech Republic
email: iva.nedomlelova@tul.cz

Applying Integration Theories on Development of Cooperation in Central Europe

Abstract

This article presents the output of research being held on Comparison of development of Central European States. The attention is paid to applying integration theories, respectively theory of European Integration, in the countries of Central Europe. The fundamental research question is „what theoretical models could explain the development of Central Europe“, particularly their mutual coincidence“. From the methodological point of view, the authors did not choose an exact theoretical concept but a set of theoretical concepts which are adequate for the research issue. The European integration phenomenon was formed by three basic theoretical directions at the very beginning: federalism, communication theory and functionalism. A different portfolio of paradigms has been chosen for the analysis of central European integration process after the fall of communism. The present situation is different to the situation after the Second World War. Theory of Europeanisation is applied besides traditional theoretical concepts. It seems significant due to central European facts. The contribution clarifies why, regarding the aim of the article, some theoretical directions are not relevant according to the authors. Using examples of real development and cooperation of Central European countries the authors conclude that the best concept to describe the development of Central Europe in the view of functionalism is neo-functionalism and particularly the theory of Europeanisation. Post-functionalism is only to certain extent adequate respectively ad hoc on national levels but not in Central European Cooperation. The theoretical framework explains the position of Central European countries generally and concretely.

Key Words

theory of european integration, central europe, modern federalism, communication theory, functionalism, neo-functionalism, post-functionalism, theory of europeanisation

JEL Classification: F02, F50, N01

Introduction

The aim of the article is to explore the theories of European Integration and their adequacy related to the real development in selected countries of Central Europe. Each theory tries to recognize the nature of the examined phenomenon. The possibility to predict future events based on exactly defined patterns of their changes in some of the criteria to identify the essentials. To learn more about the role of science and theory formation see e.g. [1].

European integration phenomenon was from its very beginning formulated by the three basic theoretical directions - federalism, communication theory and functionalism. A different portfolio of paradigms has been chosen for the analysis of central European integration process after the fall of communism. The present situation is different to the situation after the Second World War. Theory of Europeanisation is applied besides traditional theoretical concepts. Regarding the aim of the article the contribution clarifies why some theoretical directions are not relevant according to the authors.

The contribution is divided into three chapters. The first chapter presents the basic ideals of modern federalism and communication theory. The authors do not find these theoretical approaches relevant for the integration development in the countries of Central Europe from 90s of 20th century. The second chapter deals with functionalism, neo-functionalism, post-functionalism and evaluation of real development process in Central Europe in relation to the nature of this theoretical principle. The theory of Europeanisation and its possible application on real development in Central Europe forms chapter three. The conclusion summarizes the arguments which make the authors think the theoretical approaches can be applied on real development in Central Europe respectively Central European cooperation.

1. Modern federalism and theory of a communication theory

1.1 Basic concept of the theory

Modern federalism is the oldest from the observed integration theories. Its beginning goes back to the development after the First World War. Modern federalism is connected with Paneuropean Movement. Its ideological father became Richard Mikuláš earl Coudenhove-Kalergi in 1923. The aim was to prevent repeating European wars through political and economic union – Paneurope. The importance of federalism increases after the Second World War. The radicals and the moderates polarized Europe with different opinions on when is the right time to federalize Europe. Robert Schuman and Jean Monnet are probably the most important for the development of economic integration. Their plan to connect essential economic sectors among more states led to establishment of European Coal and Steel Community (ECSC). They pushed through the supranational principle of organization management. Jean Monnet's vision was slow federalization of Europe by gradual sectorial integration. He differed from the main federalism stream which preferred enforcement of integration at once.

Communication theory is connected mainly with Karl Deutsch. It bases on the importance of strong communication links. As a result of them the risk of conflict decreases. However, this approach primarily focuses on security cooperation.

1.2 Real process – conformity with concept ideas (evaluation of application)

Federalism is mainly a political and security concept. After the fall of Iron Curtain and disarmament processes, security aspects in Central Europe were not primarily solved,

even there was the war in disintegrating Yugoslavia. The Central European states fully enjoyed real freedom without dictatorship from the East. The idea of federalism or political unification was and still fundamentally is unacceptable.

Communication theory is substantially oriented on security cooperation. This theory is also not relevant for following author's target even it has much in common with functionalism (communication among elites, their cooperation and removing inconsistencies in opinion in professional fields) or possibly with social constructivism (formation of identity, socialization of actors).

2. Functionalism, neo-functionalism, post-functionalism

2.1 Basic ideas of functionalism

Functionalism is being motivated mainly by security in line with historical patterns. This theoretical concept could react on challenges of integration process. Its orientation on economy is also important even it is original. The economy should have been a test polygon of the ability of European states to real cooperation in political field, respectively in other fields.

David Mitrany considers formation of international community to grant sustainable peace already in 1943. He proposed cooperation in technical fields, economic activity and such fields where a broader consensus is displayed and where a gradual widening of such cooperation into other uncontroversial sectors is. The success of partial cooperation leads to its expansion to other fields – i.e. the doctrine of branching - ramification [2]. Mitrany assumed gradual approximation of technical elites and other experts from different countries will lead to a functional interlink of the economies of individual countries to such a great extent that conflict could be contra productive, what is more it could endanger the economies. Mitrany consider infrastructure connections – harmonizing technical standards – up to harmonizing economic policies. As a result of that, the population is aware of the benefits of economic connections (economies of scale) and will require widening the cooperation in other fields. This encourages the establishment of an international network of technocracy. Technocracy prevents war. The national states would surrender part of their sovereignty. Their interconnectivity would increase and the reasons and possibility for potential conflict would diminish.

Jean Monnet's considerations were similar to Mitrany's ones. He proposed solidarity based on actions and events – so called *solidarité de faits*. It results in forming small functional ties or networks which develop further in context of deeper integration. The solidarity principle is one of the foundation stones of European integration even in the most difficult times (the crises in the 70s; crises of Eurozone during 2008 – 2013) still influencing today's situation). Monnet believed the wider the economic integration, the more significant the willingness to non-violent conflict resolution.

2.1.1 Real process – conformity with concept ideas (evaluation of application)

Ramification can be applied from Mitrany's concept for Central European cooperation. It means the development of not only technicist cooperation, which was considered on macroeconomic level – telecommunication and transport infrastructure. The cooperation on microeconomic level started to develop in Central Europe in the 90s. The development was stronger in border regions where Euroregions were established as independent integration items with an own dynamic development. The authors assume that Monnet idea of development based on solidarity of actions and events – so called *solidarité de faits* – is relevant for the analysis of Central Europe. We can state that the relationship between Poland, Slovakia and the Czech Republic is more cooperative than ever before. It is not only economic level but also security or police cooperation. Slovak and Czech contingents cooperate closer on peacekeeping missions than other nations. Their cooperation is based on institutional agreement. The agreement between Slovak Republic and Czech Republic on conference GLOBSEC in April 2013 in Bratislava presents a vivid example. Slovak doctors joined the Czech surgeons in Kabul. *Solidarité de fait* is confirmed for example in energetic help. The gas crisis in 2009 provided a concrete example. Russia stopped gas supply to Ukraine and countries which were fully dependent on Russian import such as Hungary and Slovakia suffered from no gas supply. Due to diversified gas import in the Czech Republic which is not only dependent on Russia, Czech Republic could offer gas supplies using a reverse flow in current gas pipeline. For strategic reason, Ukraine finalizes the Agreement with Slovakia on pipeline connection in 2015.

2.2 Basic idea of neo-functionalism

Neo-functionalism and mainly Ernst Haas influenced the discussions about theoretical perspectives of integration process, particularly economic integration. Integration is the results of subject's expectation. These subjects put it across because they see their future connected with integration activity and advantages. Political or economic elites are the accelerators of integration. This makes it different to functionalist who see the core of integration activities by technical elites.

Compared to functionalism, mutual cooperation is not strictly divided into technical and political field in neo-functionalism. Spill-over effects are on regular basis which is not in confrontation with the theory of ramification. The differences apply to general spill-over effects. Haas distinguished three aspects of this phenomenon [3]:

1. **functional spill-over**, it means integration is widening from one branch or sector onto the other – the analogy to Mitrany's doctrine is the most significant;
2. **political spill-over**, it means psychological line and the line of political decision by which the interest of stakeholders converge. Political elites of member states are bearers of integration activities, further expanding integration of interests and activities;
3. **cultivated spill-over** (created-breeding, basically institutional spill over) as the crowning of political spill-over leading to formation of new institutional structure. The bearers are governing bodies, e.g. European Commission, later European Parliament. Haas's concept dates back to the 50s – 60s of twentieth century.

Nevertheless, it is still a viable approach, which explains the phenomenon of relatively flourishing Central European cooperation.

2.2.1 Real process – conformity with concept ideas (evaluation of application)

Neo-functional principle of cooperation can easily be applied on Central Europe:

1. **functional spill-over** is visible in every branch. Realizing economies of scale, or the use of comparative advantages in regions with lower costs lead to expansion at first to regionally neighbouring markets later on even further. There is an effort to test the neighbouring and highly related markets by Central European EU Member States, i.e. those participants with free movement of commodities and factors of production on internal market. There are certain commodities which are normally a part of the consumption basket on local, respectively regionally defined markets. That is why expanding on new markets is determined regionally to a great extent. There is another reason - at the beginning of the transformation of the vast majority of Czech goods were uncompetitive. As a result of that manufacturers looked for analogous markets as outlet. Functional spill-over effect has been clearly confirmed;
2. **political spill-over** lead quite early due to personal presidents' contacts in a new era into very tight cooperation in Central Europe, even though it was not institutionalized. This cooperation also proves to be a successful one even in the negotiation process on European Union level. The existence of the Visegrad Group is the clearest example. May be it originated as a gesture, as a reminder of the previous cooperation in Central Europe, anyway it has demonstrated great vitality. Even in times of difficult relations between Slovakia and Hungary during the time of the last Orbán's government, the statesmen did not meet each other bilaterally, but as Visegrad. According to Haas's understanding of political spill-over there is a prove to the validity and flexible ad hoc coalition of V-4 in 'Brussels', i.e. when discussing EU issues. The Visegrad Group of competent politicians or senior officials often the meet together and harmonize their attitude on the issues on communitary level. Visegrad is rather an example of forming further core of the integration in the sense of subregionalism. Cooperation on the field of security sphere, respectively in military proves that. E.g. in 2011, the Visegrad countries agreed to establish a joint combat defence units until 2016, in which signatory countries see an opportunity to modernize and deepen military cooperation to strengthen EU defence. [4] But already in 2005, the successor states of Czechoslovakia agreed to create a joint battle group, which has already confirmed its readiness in 2009.

Certainly political spill-over in Central Europe was the strongest immediately after the fall of the Iron Curtain, when the then three Visegrad countries were led by allies and friends from the days of dissent - Václav Havel, Lech Wałęsa and Árpád Göncz as president, József Antall as the prime minister. Indeed, the formation of the Visegrad Group in February 1991, ten days before the expected dissolution of the Warsaw Pact, is a clear example of political cooperation. Although even here, not everything always worked according to the ideas of others, Poland originally supposed to be the leader of Visegrad. When other countries did not respond positively, it finally focused on closer cooperation with Germany and France. Central Europe is not only Visegrad. We need to admit openly that political spillover between the Czech Republic and Austria is a possible future. Austria does not have warm relations with Slovakia, Hungary,

Poland or Germany. On the contrary, a strong interplay between Warsaw and Berlin is obvious from 2010;

3. **cultivated spill-over** created-bred, institutional spillovers can be identified in a modified form in Central Europe primarily in connection with the CEFTA project. After the collapse of the CMEA there was not a strong will of former Member States to further regional integration. The aim of these countries was EU membership. Other European integrations were considered to delay performing the duties of the convergence process or regarded completely unnecessary. An opinion on CEFTA appeared which regarded it a small version of CMEA, non-viable integration of a weaker economy. The political elites of Central European countries began to negotiate after the European Union indicated Central European countries show that the CEFTA project makes sense and that is of mutual interest to implement it.

It is positive that spill-back effect cannot be identified in Central European cooperation [5]. It is an opposite approach to integration, not so reserved, rather disapproving. The reason may be in inadequate pace of previous integration activities, which may lead to worries about losing sovereignty. This approach appeared during the 60s as a supplement neo-functionalism in connection with the reluctance to deepen integration further. It seems that Central Europe is not endangered because it does not support projects of inadequate interests and abilities of the protagonists.

However, it would seem inappropriate to avoid certain indifferent tendencies towards European integration in some Central European countries and in certain periods. Czech Republic under the presidency of Vaclav Klaus began to show strong Eurosceptic attitudes, which are echoed in the government of Petr Nečas in 2010 - 2013. The most striking example of unwillingness to include into the integration process was how Nečas rejected Fiscal Pact in January 2012, although he was commissioned by the Parliaments decision to sign it and join the Czech Republic to the agreement. He openly acted against the parliamentary resolution. Eurosceptic attitudes were also manifested in the Bank Board of Central Bank (CNB), which has been completely reappointed by Klaus. The Board will manage monetary development in the Czech Republic until 2016. The Government of Poland led by President Lech Kaczynski (2005-2010) profiled strongly anti-European for some time. In Hungary, after the political control changed in 2009 and Viktor Orbán reigned, dissenting attitudes to "Brussels" opinions appeared.

After parliamentary elections in 1999 in Austria, the yet non-governmental party appeared on the second place. It was the populist Freedom Party (FPÖ) which focussed against immigration and the abuse of the social system. Until then (for fifty years) the coalition was formed by the same three political entities. The European Union has responded unluckily and rashly declared diplomatic sanctions against Austria. This was the first time in its history to declare sanctions to its own member country. The Austrian public responded with disapproval with their membership and willingness to hold a referendum on leaving the EU. However, all these expressions of disagreement with the integration "order" were limited. Particularly they did not involve cooperation among Central European countries, so spill-back effect as a systemic approach can be excluded.

Spill-around [6] in terms of spillover round in all respects is apparent in the Central European region. It is a phenomenon of increasing the range of functions performed within already existing integration structures and areas of integration, but without

administrative increase. These are mainly signs of expanding integration activities on the bottom-up principle. This is a situation where the dynamics of integration process is very high and more or less unstoppable. The integration continues despite hesitation or open spill-back. We might use the term holistic development of integration activities. These tendencies can be recognized on the development of the Euroregion, which are formed since the early 90s also in Central Europe. The development of European integration in the 80s and again in the late years of the 90th provides further verification neo-functionalism, even no longer as dominant integration theory.

Although examples of functional or non-functional cooperation among Central European states can be documented, we must admit that it "does not fit completely". Neo-functionalism is clearly based on multinational principle when national governments will gradually transfer their competences to the supranational community institutions. They will not only overtake the integration dynamics, but they will act as main actors. This is neither the case of Visegrad, nor realized cooperation between other Central European countries. (Neo) functional paradigm for Central Europe just modified from this perspective.

2.3 Basic ideas of post-functionalism

Quite recently a new theoretical concept called post-functionalism has been postulated. It focuses on the gradual politicization of the European integration process [7] starting Maastricht Treaty [8]. It proclaimed political and security objectives besides traditional economic goals. The core of post-functional approach is the emphasis on building a national or regional identity. The growth of an active role of public in the integration process and formation of multilevel governance structure are connected with it. On the contrary, the current neo-functional concept was based on the role of privileged elites in integration process. To understand the differences between neo-functionalism and post-functionalism see Tab.1.

Tab.1 Comparison of neo-functionalism and post-functionalism

Neo-functionalism	Post-functionalism
Transfers national interest on community level	European policy on national scene, system of multi-level governance
From the perspective of European Integration – bottom-up principle	Top-down principle
Elites as players in European integration	Shift of interest from elites towards mass which want to take part in decisions about integration, increase of competences EP, weakening of elites
Result: democratic deficit	Target: democratic legitimacy
In terms of cooperation - liberalism	More realism: own interests
Focus on economic cooperation	European integration got politicized using elections and referendum, nevertheless Maastricht formulated political targets, building community consciousness, strengthening national or regional identity
Perception of integration with an indulgent consent	Restrictive disagreement

Source: From Permissive Consensus to Constraining Dissensus (Hooghe-Marks, 2008), own analysis

The politicization of the integration process and the shift from elite interests towards mass politics is significant for post-functionalism. It also is the main differentiating feature

compared neo-functionalism. The question is how far post-functional paradigm is relevant for cooperation among Central European countries. We can use above mentioned scheme for assessing it.

2.3.1 Real process – conformity with concept ideas (evaluation of application)

European policy on the domestic scene: politicization of integration process has reached a stage where all political parties in the member states solves European topics. This naturally reflects in views on mutual cooperation of closest neighbours. European issues play an important role in election campaign rhetoric on all sides, and later in the parliamentary debate and cooperation of national governments on the international level.

Top-down principle i.e. transferring competencies to lower-level decision-makers is a symbolic and effective manifestation of the real democratization of any community, not only EU. It is not focus on regional co-decision on sub-regional institutional level of, but national or supranational-regional authorities. It does not apply to e.g. regional cooperation in Central Europe. Therefore, the authors consider this point irrelevant.

Strengthening regional or national identity will certainly increase the real and perceived identity of national bodies which is clearly related to a more realistic concept of EU-membership comprehension - primarily the defence of own interests. The question of identity is of much more weight in public opinion compared to understanding identity by elites or interest groups [7]. To analyse the applicability of post-functionalism in Central European cooperation the basic mechanism is perceiving correlation to the mutual historical ties of the region or to similar historical experiences. This is what the authors describe as spontaneous people identification with territorial communities at different levels - from local towards regional, national and beyond [7].

For all EU countries not only Central European countries the very important shift is a significant strengthening of competence of the European Parliament in particular through the Lisbon Treaty. It is another step towards the democratization of European integration process and strengthening democratic legitimacy. This is one of the attributes post-functionalism works with, similarly with the term of European integration politicization [7; 8]. The politicization of EU citizens is understood in terms of mass mobilization of public opinion in relation to politics and EU institutions [9].

Politicization of masses on the issues of further development of European integration is obvious from denials in referendums on the adoption of the Treaty of Nice in Ireland in 2001, in France and the Netherlands in May and June 2005. The citizens of these states refused to ratify the Treaty on Constitution for Europe. There is a slight radicalization of the population in connection with the reluctance to transfer additional competencies to community level. In Central Europe, this politicization is apparent for example in connection with the doubts of some political elites and their political parties on the Lisbon Treaty. The most striking opponents were two countries in Central Europe - the Czech Republic and Poland. The entire European Union waited for these to ratify. The Lisbon Treaty came into force due to obstruction of the former Czech President Vaclav Klaus on December 1st, 2009. His Polish counterpart Lech Kaczynski signed the contract in October 2009.

The politicization of the masses is evident in the Czech Republic in connection with the question of accepting or rather rejecting euro. The same happened in Slovenia and Slovak Republic before they joined EMU in 2007 and 2009. However, the connotations were opposite. The majority of Slovenes and Slovaks supported the adoption of the euro, because they considered it a part of the evaluation process and convergence to the standards of European Union. Public opinion on euro in Poland was largely positive after 2010. This is related to the perceived role of Poland as the main Central European partner of integration forces, mainly Germany. In Austrian case, politicization of the masses regarding the development of European integration in the context of the EU's response to the outcome of the parliamentary elections in Austria in 1999. This resulted in petitions for a possible referendum on leaving the EU. This causa is mentioned in the text above as an example of a temporary neo-functional spill-back effect.

To conclude, post-functional theory in Central Europe can be only proven in limited access to integration which demonstrates in widening the system of multi-level governance in Central European countries, as an agreement to strengthening competencies of the European Parliament. Realistic tendencies boost in international relations, see for example the decision of the Hungarian Prime Minister Orbán on nuclear energy, Hungarian citizenship etc.

3. Europeanisation

3.1 Basic concept of the theory

Europeanisation is an institutional process on political, economic, social level focused on creating rules and standards in all dimensions of integration activities [10]. Europeanisation is a phenomenon of "formation, dissemination and institutionalization of formal and informal rules ... and sharing beliefs and norms which are first defined and consolidated in the EU political process and subsequently incorporated into the logic of speech, political structures and public policies of nation states" [11]. Europeanisation is a broad spectrum process, as its mechanisms of action have a very significant impact in following:

1. **vertical Europeanisation** – separating community, national and regional, respectively local level when Europeanisation leads to political dialogue and economic subjects of multi-layered hierarchy. Vertical Europeanization is an argument against the statements on the democratic deficit of the EC / EU;
2. **horizontal Europeanisation** – pressure of EC / EU states to adapt, not only with directive channels, but also implicitly, e.g. market adjustment due to liberalization of the internal market; absorbing norms and standards of behaviour [11];
3. **institutional adaptation** – Integration idea, beliefs, expectations of a priori lead to "moderation" in decision-making process. The increase in Community legislation ... there is an increase as the individual EU member states, Europeanisation of the decision-making processes, adapting national legislation EU - standards" [12, p. 59].

3.1.1 Real process – conformity with concept ideas (evaluation of application)

Multilevel dimension represents the core in the Central European cooperation. Closer links between local, regional authorities, perhaps on the basis international community, or vice versa on communitary or transnational cooperation. Development of real vertical, particularly branch cooperation in Central Europe came with a huge emphasis in the second half of the 90s, however more vigorously, because it was based on the bottom-up principle.

Horizontal Europeanisation is largely a manifestation of the opposite principle: top-down principle. The need to adapt *acquis communautaire* raises the need to adapt it not only legally, but also in real terms. Some Central European states struggle with this principle, e.g. the Czech Republic and its chronic problem with transposition deficit, Slovenia with dogged centralization and statism in economy, Hungary with retrenchment of certain democratic freedoms. On the contrary, today's Slovakia, Poland, Austria and Germany are straightforward patterns of horizontal Europeanisation.

The essence of Europeanisation processes is the institutional adaptation, not only in legislation but also in executive. This is apparent in all areas, at least as a result of more than twenty years spent on convergence to EU standards. The degree of institutional adaptation is very high. This is in accordance with Radaelli Europeanisation - transformation processes in domestic environment correspond with "European" standard [13]. EU membership and institutionalization of many decision making issues leads to the fact that their effects hit the domestic policy significantly. Europeanisation serves as a necessary condition for the politicization of public opinion. Europeanisation thus connects with identity formation, leading to the growth of democratic legitimacy of the European Union [8].

Institutional adaptation of post-socialist countries includes adoption of EU rules [14], consolidation [15], not so much in the sense of attachment, but unification, understanding unconditional acceptance - the Europeanization of new countries not only in transitologic terms, but a direct force. The countries of Central and Eastern Europe actually were in the role of students to take part on social learning, possibly drawing lessons [14]! Due to more than forty years of the communist regime, the suppression of personal responsibility, loss of ability to orient oneself in a market context the policy of EU adoption rules was understandable. That does not mean protests or fighting against EU pressure. The policy against EU candidate countries in the 90s was generally perceived mainly as policy of conditionality [14]. In addition it was majority accepted during the 90s as a necessary procedure to join in the EU, the integration to the West and the final detachment from the East, from Moscow. Europeanisation research focused on the impact of EU policies and institutions at the national level in standard economies, societies, but the Central European countries were in a much weaker position in the process of Europeanisation vis-à-vis the European institutions compared to Western non-member countries [14].

Indeed, Jaroslav Jakš defines Europeanisation as voluntary acceptance of institutional and legislative rules, i.e. *acquis* on which the EU works not only EU Member States, but surrounding states - especially connected to the EU internal market, i.e. for example, the European Economic Area. If Europeanization effects are apparent for outside states, it logically has a great impact on Central Europe. Anyway there are differences. - Poland,

Slovakia, Austria and Germany have a high degree of Europeanisation today. Orbán's Hungary on the other hand is different. The last season premiership is going nationalistic way including modifying certain legislative acts. The Czech Republic after having the Eurosceptic president for two terms and his Prime Minister Nečas (although not a full term, only three years, but ...) rather showed signs of de-Europeanisation, which can be defined as an effort to return to the national policy framework of reference [16]. De-Europeanisation approaches relate only to a relatively specific and clearly defined zones of integration. The Czechs do not understand it as anti-European positions.

It is possible to see the parallels with spill-back effects, possibly with retrenchment which Radaelli describes as decreasing willingness to further Europeanisation, if a Member State has the feeling pressure from the "Brussels" is too strong. If the state feels dislike for certain integration steps and either do not want to explain, or even knows why, then Radaelli indicates the position of the state as inertia or the role of "possum" in the case of unwillingness to accept EU rules - see delay implementation of the *acquis communautaire*. Unfortunately, Czech Republic provides a good example of this approach. It has a long term transposition deficit - e.g. procrastination of codification of European directives *acquis communautaire* - internal market legislation.

The concept of Europeanisation gained a whole new connotation after the fall of the Iron Curtain, even though not immediately, but at the turn of the next two decades. Theorizing about the development of post-socialist societies in the first half of the 90s was practically absent, because the prevailing view was that the former Soviet satellites need to adapt to the institutional framework of the West unconditionally and immediately. The West was represented here by the European Union. The situation had proven to be significantly more complicated, particularly for post socialist countries, although obstacles for further development arose in the EU. Primarily, the institutional system of the European Union's decision-making processes needed to be reformed, so that it does not reduce its ability to act in a highly enlarged Union; it was necessary to change the financing of integration development fundamentally and of course implement changes related with the structural reforms on most communitarized economic policies [17].

Europeanisation in Central Europe is mainly associated with democratization and emancipatory expressions of these states, particularly post-socialist societies in terms of adoption of western institutions and values. Democratic transition and Europeanisation often coincided in one stream considerations [18], when the so-called transitologic level of Europeanisation "democratic institutions and processes in the transition countries of Central and South-eastern Europe mimic the institutions and processes of democratic countries of Western Europe", including support of their transformation [19]. The Visegrad Group countries have undergone quite difficult Europeanisation especially in the 90s. This happened in top-down form, as on the economic, social and especially in institutional (i.e. political and legal) level. In addition, Central European countries could also partly europeize the EU foreign policy throughout the up-load principle, in relation to energy security, enlargement of the European Neighbourhood Policy, the Eastern dimension. The opinions and recommendations in the context of Russian-Ukrainian dispute today are clear. Indeed, a very strong recommendation across the EU came mainly from Poland in connection with the Eurozone crisis to strengthen the role of Germany in the EU. This can be regarded an Europeanisation tendency of national interests of Poland. Overall, the cooperation of the Visegrad countries can clearly be traced before each

discussion in various EU institutions. The V-4 countries agree together on common position, which seeks to promote / defend at the EU level. This is another prove of Europeanisation of the Central European countries.

The basic theoretical division applies on the opinion of competence of national governments and supranational institutions. There is a dispute between supranational and intergovernmental principle of integration development – whether community institutions should be the main drivers of integration or on the contrary if national governments should keep strong competencies; it means deciding on major issues of further development should be taken by the Member States. At the beginning of European integration in the 50th, respectively, 60s multinational principle dominated. As a result of spill-back, the tendency to intergovernmental principle started to strengthen.

Applied to Central Europe, there is a distinct tendency for the new member states, i.e. in Visegrad and Slovenia, to promote a more intergovernmental paradigm. Germany has no problem with supranationality, though in practical terms it often uses intergovernmental cooperation. Regarding the format of the Franco-German tandem, so called Paris-Bonn respectively Berlin axis determined the dynamics of integration process. On the one hand, Germany surrenders its competence to community level; on the other hand it uses its natural potential to intergovernmental negotiations. Austria does not profile anyhow specific. It is usually capable to enforce their interests on Community level. In case it fails, it solves more on a bilateral basis with the parties to the dispute - see example of Temelín. Slovenia has also minor disputes. A very significant shift occurred in Poland after 2010, along with the change of political leadership in the country. Strong intergovernmental tendencies are demonstrated particularly in relation to Germany, but also towards supranational EU institutions.

Conclusion

The theoretical reflection cooperation of Central European countries using the main integration theory of functionalism, neo-functionalism, post-functionalism concept of Europeanisation provided an explanation of behaviour of Central European countries in specific and in general cases. Not all main integration theories are applicable concerning the focus of this paper. The concept of functional cooperation, and especially neo-functionalism, theory Europeanisation have been confirmed. Post-functionalism only to a limited extent, respectively ad hoc at the national level not for cooperation in Central Europe. This list of concepts does not mean that it is not possible to apply other theoretical approaches for the Central Europe. For example realism was also present in attitudes of states and their governments, but the authors believe that the above mentioned theories are crucial. They find Europeanisation relevant for the development of the Central European region.

References

- [1] NEDOMLELOVÁ, I. Methodology and Method of Economics or Theories of Regional Development. In KOCOUREK, A. ed. *Proceedings of the 11th International Conference*

- Liberec Economic Forum 2013*. Liberec: Technická univerzita v Liberci, 2013. pp. 412–424. ISBN 9788073729530.
- [2] MITRANY, D. *A working peace system: an argument for the functional development of international organization*. London: The Royal Institute of International Affairs; New York, Toronto etc.: The Royal Institute of International Affairs, 1943. ISBN n/a.
 - [3] HAAS, E. *The Uniting of Europe; Political, Social, and Economic Forces*. Stanford: Stanford University Press, 1958. ISBN 0804705151.
 - [4] ŠUPLATA, M. *Visegrad battlegroup: A vehicle for regional defence co-operation* [online]. CEPI, 2013. [cit. 2014-11-17]. Available at: <http://www.cepolicy.org/publications/visegrad-battlegroup-vehicle-regional-defence-co-operation>
 - [5] LINBERG, L. and S. A. SCHEINGOLD. *Europe's Would-Be Polity: Patterns of Change in the European Community*. Englewood Cliffs: Prentice-Hall, 1970. ISBN 0132919974.
 - [6] SCHMITTER, P. C. A Revised Theory of Regional Integration. *International Organization*, 1970, **24**(4): 836–868. ISSN 0020-8183.
 - [7] HOOGHE, L. and G. MARKS. A Post-funkcionalist Theory of European Integration: From Permissive Consensus to Constraining Dissensus. *British Journal of Political Science*, 2008, **39**(1): 1–23. ISSN 0007-1234.
 - [8] BÓRZEL, T. and T. RISSE. Revisiting the Nature of the Beast – Politization, European Identity, and Post-funkcionalism. A Comment on Hooghe and Mark. *British Journal of Political Science*, 2009, **40**(1): 217–220. ISSN 0007-1234.
 - [9] SHMITTER, P. C. On the Way to a Post-Funkcionalist Theory of European Integration. *British Journal of Political Science*, 2008, **39**(1): 211–215. ISSN 0007-1234.
 - [10] FEATHERSTONE, K. and C. M. RADAELLI. eds. *The Politics of Europeanization*. Oxford: Oxford University Press, 2003, pp. 3–26. ISBN 9780199252091.
 - [11] RADAELLI, C. M. The Europeanizaion of Public Policy. In FEATHERSTONE, K. and C. M. RADAELLI. eds. *The Politics of Europeanization*. Oxford: Oxford University Press, 2003, pp. 27–56. ISBN 9780199252091.
 - [12] JAKŠ, J. *Quo vadis Evropská unie*. Manager Podnikatel, 1998. ISBN 80-86006-57-3.
 - [13] ČAJKA, P., P. TEREM, and D. IŽDINSKÝ. *The Dynamics of the Transformation Processes in Central Europe (The Czech Republic, Hungary, Poland)*. Univerzita Mateja Bela, Fakulta politických vied a medzinárodných vzťahov, 2008, s. 5–32. ISBN 9788080836283.
 - [14] SCHIMMELFENNIG, F. and U. SEDELMAIER. *The Europeanization of Central and Eastern Europe*. Ithaca: Cornell University Press, 2005. ISBN 9780801489617.
 - [15] HLOUŠEK, V. and P. PŠEJA. Evropeizace politických stran v České republice. In FIALA, P. a kol. *Evropeizace zájmů. Politické strany a zájmové skupiny v České republice*. 1. vyd. Brno: Mezinárodní politologický ústav, Muni press, 2009: 117–155, 39 s. Edice Monografie, sv. 27. ISBN 9788021049208.
 - [16] HANDL, V. Německo a EU, „Evropské Německo“, nebo de-europeanisation německé politiky? In ROVNÁ, L. Z. KASÁKOVÁ, and J. VÁŠKA, (eds). *Evropská unie v členských státech a členské státy v EU*. Praha: VIP Books, 2007, s. 75–118. ISBN 9788087134108.
 - [17] KUČEROVÁ, I. Regional Resistance of Europe. In Instruments of European Integration. Praha: IPS FSV UK, 2006, pp. 169–187. ISBN 8023983997.
 - [18] HLOUŠEK, V. and M. PITROVÁ. Pojem evropeizace a jeho konceptualizace. In FIALA, P. a kol. *Europeanisation zájmů*. Brno: Muni Press, 2009, str. 15–44. ISBN 9788087125076.
 - [19] DANČÁK, B., P. FIALA, and V. HLOUŠEK. Evropeizace: pojem a jeho konceptualizace. In *Evropeizace. Nové téma politologického výzkumu*. Brno: IIPS, 2005, str. 11–25. ISBN 8021038659.

Šárka Laboutková

Technical University of Liberec, Faculty of Economics, Department of Economics
Studentská 2, 461 17 Liberec 1, Czech Republic
email: sarka.laboutkova@tul.cz

Open Government Data – A Lesson to Be Learned

Abstract

This paper deals with a new instrument which has a high prospect for improving the quality of the institutional environment – open government data. Open government data are part of a process of open government. Open government focuses on three themes: transparency, participation, and collaboration. Transparency means providing the public with information about their government's activities. Participation emphasizes citizens voices in public affairs, recognizing that public officials stand to benefit from the perspective of expert and non-expert knowledge that resides outside of government. Collaboration further erodes the us-versus-them divide between citizens and government by taking participation to another level. Where government is collaborative, citizens become true partners with government, in both the identification and pursuit of public goals. Governments are increasingly making their data available online in standard formats and under licenses that permit the free re-use of data. The justifications advanced for this include claims regarding the potential for open government data to promote transparency and accountability of government, the role of open government data in supporting the reform and reshaping of public services and the economic potential of open government data. This article demonstrated that mainly targeted government policies and the strong and powerful role of government in the process of opening up public data are critical for real progress to be made.

Key Words

open government data, transparency, innovation, participation, open government, public, institutional environment, citizens

JEL Classification: H490, O170, O380

Introduction

The institutional environment is determined by the legal and administrative framework within which individuals, firms and governments interact to generate wealth. The essence of the relationship between these participants is trust. Trust is based on transparency. Transparency is one of the fundamental attributes of a fair and equitable institutional environment. Transparency is considered the traditional feature of an open government, meaning that the public should have access to government-held information and be informed of government operations. In recent years, however, the definition of open government has expanded to include expectations for increased citizen participation and collaboration in governance through the use of modern, open technologies. One of the tools for achieving greater transparency seems to be open government data (OGD). The objectives of open government data are more transparency and accountability of government, supporting reforms and improving public services and the acquisition new economic and social value.

The open-data phenomenon is in its early days, so there is not enough available scientific publishing bases. Open data is often used interchangeably with the term “big data”. The term „big data“ has recently been applied to datasets that grow so large that they become awkward to work with using traditional database management systems [1]. Big Data Analytics is where advanced techniques operate on big data sets [2].

Elragal et al. reviewed 24 publications between 2010 and 2014. They have clustered the papers revealed into three main themes, 1) technical algorithms; 2) processing, cloud computing, opportunities & challenges; and 3) performance, prediction, and distributed systems [3].

Although big data form the basis for open data and therefore these two categories have a lot in common, it is necessary to distinguish between them; big data doesn’t mean open data in terms of freely accessible data, and datasets have to be converted into information to become open data. The open definition sets out principles that define “openness” in relation to data and content. Open data is data that can be freely used, reused and redistributed by anyone for any purpose. This article focuses on open data, especially on open government data (OGD). Providing open government data is a matter of accessibility, format and license. Data must be available (generally online), in forms, and under licenses, allowing for re-use (i.e. non-proprietary formats; open license) [4].

Table 1 shows Eight Open Government Data Principles that were defined and put forward for governments’ consideration in 2007, during an Open Government Working Group Meeting held in Sebastopol

Tab. 1: The Open Government Data Principles

Completeness	All public data are made available. Public data are data that is not subject to valid privacy, security or privilege limitations
Primacy	Data are as collected at the source, with the highest possible level of granularity, not in aggregate or modified forms
Timeliness	Data are made available as quickly as necessary to preserve the value of the data
Ease of access	Data are available to the widest range of users for the widest range of purposes
Machine readability	Data are reasonably structured to allow automated processing
Non-discrimination	Data are available to anyone, with no requirement of registration
Use common data standards	Develop and use uniform, unique identifiers and data standards to ease the flow of data and reduce system complexity.
License-free	Data are not subject to any copyright, patent, trademark or trade secret regulation. Reasonable privacy, security and privilege restrictions may be allowed

Source: [5]

The consulting firm McKinsey estimated open data’s economic potential at more than \$3 trillion in additional value in the global economy. At the front of that economic windfall is government, which is ideally positioned to extract value from open data and help others do the same [6].

Debate on the topic of OGD is expanding in practice and academic literatures on latter-day governance [7,8,9,10,11,12,13]. The desirability of increased openness of government

datasets is emerging as a political standard in the USA (Obama 2010), UK (Cameron 2010; Brown 2009) and across Europe [4].

The objective of this article is to find out the role of government in opening up public data. The contribution of this paper is to provide an analysis of the current state of open government data in countries which already benefit from open data and answer the research question: What is the role of government in the process of opening up the data? Sub-questions are what benefit comes from OGD and who benefits from it?

1. Research methodology

The following section first discusses the specification of data collection, data frame creating a data sample, followed by the selection of research methods. A separate chapter will deal with the selected countries and its justification. Data will be collected from the study documents, and then proceed to create a data sample. Although the theory of the creation of a data sample (sampling theory) is usually associated with a quantitative type of research, its use is suitable for this study due to the limits of the relevant material based on the formulated research question. The basic element of the data sample is a subset of the document. The total aggregation will eventually create the data file. Character data in the file will be a type of primary data derived from secondary sources i.e. in the data file appears recategorised data from different types of formal categories of documents. The following specifications of the data sample are related to the research questions. The data sample consists of a set of official documents from selected countries dealing with OGD, and activities from the wider community of open data advocates / users. These organisations are in a strong position to communicate the demand for and the opportunity presented by the release of government data as well as to offer continued challenges.

To answer the set of research questions, the method of thematic analysis will be used. Thematic analysis lies in the process of seeking and finding the key themes appropriate to characterize the phenomenon [14]. In the structure of the analyzed documents it is possible to find a similar sequence of crucial issues that are connected to a nearly identical narrative structure. They are subsequently identified by operationalization in the form of keywords.

2. UK and USA as leaders in opening data for the public

Governments and public authorities across the world are launching open data initiatives and creating open data portals. According to the Global Open Data Index, which measures and benchmarks the openness of data around the world, simply putting a few spreadsheets online under an open license is obviously not enough. Doing open government data well depends on releasing key datasets in the right way: only 11 % of the world's published datasets are open according to the open definition [15]. Likewise the second edition of the Open Data Barometer analyses global trends, and provides comparative data on countries and regions via an in-depth methodology. This combines contextual data, technical assessments and secondary indicators to explore multiple

dimensions of open data readiness, implementation and impact and shows that there is still a long way to go to put the power of data in the hands of citizens. Just over 10% of the 1,290 different datasets surveyed for the Barometer met the criteria of open definition. From the sample of 86 countries there has been a very limited expansion of transparency and accountability impacts from OGD compare to last year. Of the countries included in the Barometer, just 8% publish open data on government spending, 6% publish open data on government contracts, and a mere 3% publish open data on the ownership of companies. Citizens have a similarly difficult time accessing data on the performance of key public services- just 7% of countries release open data on the performance of health services, and 12% provide corresponding figures on education [16]. A report published by Capgemini Consulting, which analyzed the open data policies and practices in 23 countries found that the best results came from governments - the United Kingdom, France, Canada, Australia, the USA - that were in it for the long term, rather than for short-term political gain [17]. These countries are marked as „trend setters“: they represent the current leaders in open data initiatives. According to the mentioned report these countries are characterized by their emphasis on releasing extensive amounts of datasets, which are updated at regular intervals. The Open Data Barometer evaluates the countries, which have established open data policies, generally with strong political backing as „high capacity“ countries [16]. They already have government, civil society and private sector capacity to benefit from open data. The United Kingdom, and the USA belong among the top ten countries in ranking of both the Global Open Data Index and the Open Data Barometer in 2013 and 2014. The provided analysis in this article focuses on this two “trend setters”.

3. Opening public data: irreplaceable role of government

Table 2 provides an overview of the analyzed documents and agendas in the UK and USA that included those that seemed to be most relevant in accounting for the current state in the UK and USA on open government data – trying to capture both government activities and activities from the wider community of open data advocates / users.

It is possible to identify the irreplaceable role of governments in achieving open public data in the desired quality. Governments need to develop institutions with an explicit mandate to frame and encourage the development of open data.

In the United States the opening of government data accelerated, after President Obama, on his first day in office in 2009, signed an executive order about transparency and open government stating that all government information that did not have to be kept secret for security or privacy reasons should be made public. The White House also launched the Open Government Initiative to publish government data and the data.gov website to distribute the data covering everything from weather forecasts to available parking spots. These datasets have grown from 47 “open” datasets in March 2009 to more than 125, 000 in April 2015. Over the past few years, the Administration has launched a number of Open Data Initiatives aimed at scaling up open data efforts across the health, energy, climate, education, finance, public safety, and global development sectors. The White House has also launched Project Open Data, designed to share best practices, examples, and software code to assist federal agencies with opening data. These efforts have helped unlock troves

of valuable data — that taxpayers have already paid for — and are making these resources more open and accessible to innovators and the public.

Tab. 2: Key related agendas and their timeline

United Kingdom		United States	
2009	Final Power of Information Report	2009	Memorandum on Transparency and Open Government Open Government Directive Data.gov A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs
2010	Open Government Licence Public Sector Transparency Board Data.gov.uk	2010	Guidance on the Use of Challenges and Prizes to Promote Open Government
2011	White Paper: Open Public Services A Consultation on Data Policy for a Public Data Corporation Transparent Government, Not Transparent Citizens: full report 1 st Open Government partnership UK National Action Plan Code of Recommended Practices for Local Authorities on Data Transparency	2011	1 st US Open Government National Action Plan Winning the Future through Open Innovation - a Progress Report on Our Open Government Initiative Commitment to Open Government: A Status Report
2012	Open Data White Paper: Unleashing the Potential Departmental Open Data Strategies the Public Data Principles launched UK priorities for the Open Government Partnership September 2012 to September 2013 The Open Data Institute was opened	2013	Open Government Partnership Self-Assessment Report Open Data Policy - Managing Information as an Asset Making Open And Machine Readable The New Default For Government Information – executive order US Government OGP Independent Reporting Mechanism report The Open Government Partnership: Second Open Government National Action Plan For The United States Of America
2013	2 nd Open Government partnership UK National Action Plan 2013 to 2015 Independent Reporting Mechanism's assessment (OGP) Shakespeare review: an independent review of public sector information Innovative uses of government open data – cases studies		
2014	Transparency and open data: progress against commitments	2014	Open Government Data: The Book
2015	US - UK Digital Government Partnership		

Source: author according to [4]

The United Kingdom began its open data effort in September 2009 with 2,500 data sets, which grew to more than 24,000 data sets in April 2015. Since 2009 the administration in the UK has supported the development of four key open data bodies: 1) Public Data Groups (PDG) aim to improve using and sharing of data, through collaboration and sharing of best practices; 2) Data Strategy Board (DSB) – its goals are to seek to maximize the value of data from the PDG for long term social and economic benefit and to act as an intelligent government advisor on commissioning and purchasing key data and services from the PDG; 3) Open Data Institute (ODI) is catalysing the evolution of the open data culture to create economic, environmental, and social value. It helps unlock supply, generates demand, creates and disseminates knowledge to address local and global issues, and encourages small entrepreneurs to turn available raw data into tangible and

worthwhile information; 4) Open Data User Group (ODUG) gives advice to DSB on public sector data that should be prioritized for release as open data.

Both countries belong to the founders of a multilateral initiative The Open Government Partnership (OGP) that aims to secure concrete commitments from governments to promote transparency, empower citizens, fight corruption, and harness new technologies to strengthen governance. OGP was launched in 2011 and since then has grown from 8 countries to 65 participating countries and become a global community of government reformers, civil society leaders, and business innovators, who together are advancing a new standard of good governance in the 21st century. Member governments of OGP embrace a high-level declaration of principles on transparency, participation, accountability, and innovation and develop their own individualised action plan, focused on local priorities for open government, developed through a local consultative process.

The open government guide highlights practical, measurable, specific and actionable steps that governments can, and are taking across a range of cross-cutting (9 topics) and focused areas (10 topics).

Each topic has been developed by an expert organisation and offers a flexible menu of 'illustrative commitments' which governments could adopt.

- Initial steps – actions that a country can take starting from a relatively low baseline
- Intermediate steps – actions that countries can take once they have already made moderate progress
- Advanced steps – established best practice demonstrated by the most advanced performers
- Innovative steps – new approaches which countries are trying out

The first Open Government National Action Plan of the UK was published in September 2011 and included 41 commitments. The Independent Reporting Mechanism's assessment, published in September 2013, noted that the UK government was successful in implementing many of its commitments, notably in aid transparency. A weakness was pointed out that the UK government had not consulted extensively with civil society during the development of the plan. The second National Action Plan was published in October 2013, having been developed in partnership with civil society organisations via the OGP UK Civil Society Network. A major commitment is the creation of a publicly accessible central registry of information on beneficial ownership. The created central registry will contain information on who ultimately owns all UK businesses. The UK is the first country to make this information publicly available and at the same time take into account privacy issues.

The first US Open Government National Action Plan set up 26 commitments that have increased public integrity, enhanced public access to information, improved management of public resources, and given the public a more active voice in the US Government's policymaking process. Several of the commitments in the action plan focused on improving transparency; however, open government progress has been relatively slower in controversial areas such as national security, ethics reform, declassification of documents, and Freedom of Information Act reform. The United States completed half of the commitments in its action plan, while the other half saw limited or substantial

progress. The White House is key in policy matters but has limited control over implementation given that departmental and agency budgets and mandates are set by congressional authorizing and appropriating committees. Additionally, many of the actions were carried out largely at the agency level, where there is a certain amount of discretion in implementation and many programs have public constituencies [18]. The second US Open Government National Action Plan launched 2013 serves as a roadmap for the next two years as the Administration works in partnership with the public and civil society organizations to carry out these Open Government efforts. The White House unveiled a new take on its open-government policy that includes consolidating Freedom of Information Act requests across agencies, updating policies governing federal websites and upgrading the way people can petition the executive branch.

All the analyzed documents and acts demonstrate the great support of national governments in both countries. Their effort has brought results in the form of a high degree of openness in selected datasets according to the Global Open Data Index. The Index ranks countries based on the availability and accessibility of information in ten key areas (National Statistic, Government Budget, Election Results, Legislation, National Map, Pollutant Emission, Company Register, Transport Timetables, Postcodes/Zipcodes, Government Spending) and nine parameters of their openness: if data exists and is digital, public, free, online, machine readable, available in bulk, openly licensed and up to date. The UK topped the 2014 Index retaining its pole position with an overall score of 96% (100 % openness in seven datasets and 90 % openness in pollutant emissions, national statistics and the government budget). The USA had an overall score of 70% in the 2014 Index. Even though the US belongs among the leaders on open government data there is still room for improvement: the USA does not provide a consolidated, open register of corporations (score of 15 %). There is also an unsatisfactory result of openness around the details of government spending (score of 10 %). It is necessary to emphasize that only two countries out of 97 (the UK and Greece) got full marks here and that the average score in this parameter is 17 % [15].

It has been proved that governments can use their influence to make data more open, through setting the agenda as well as dialogue and collaboration with other stakeholders. At the same time, governments must create policies that thoughtfully address issues such as privacy, confidentiality, intellectual property protection, and liability.

4. Benefits and beneficiaries from open government data with impact suggestions

The document analysis shows clear outcomes from the open government data. This corresponds directly with one of the research questions: what benefits come from OGD?

Making the government more accountable to citizens and strengthening democracy

Open government data help to fulfill the right of citizens to know what, how, and why government does what it does. It brings increased transparency and wider openness of public administration. The open data agenda has driven the release of spending data which has allowed people to see more of the Government's accounts. Journalists and

campaigning organisations use government spending data to shine a light on government decisions and to support campaigns. OGD improves communication between authorities themselves.

Bringing better public services

It has helped the state get a better deal on contracts by encouraging more innovative SMEs to bid for work. It has enabled companies outside government to identify waste. It gives citizens more choice and a stronger voice in the public services they use, prising open the bureaucracies and professions and putting information directly in the hands of the public. Open data can also help citizens make effective choices in their lives, for instance by giving people information about where they live.

Saving cost and improving service efficiencies

Providing data for citizens online in a searchable format has a direct impact in reducing the cost of servicing. Public bodies are made more accountable for financial discrepancies by cutting down on public expenditure. Integrating and publishing data can enable public bodies to improve service efficiency by enabling efficient collaboration between business stakeholders and public bodies.

Improving citizen engagement and empowerment

Participation emphasizes the citizens voice in public affairs, recognizing that public officials stand to benefit from the perspective of expert and non-expert knowledge that resides outside of government. Participation is fostered by expanding citizens opportunities to express their views about policy alternatives in ways beyond voting in elections.

Feeding economic and social growth

It represents a new source of business opportunities and innovation: stimulating the creation of firms that reuse freely available government information in innovative ways. OGD brings commercial exploitation mainly in transport and logistics, healthcare or insurance and financial services. It extends the potential business benefits of open Customs data to enable non-tech SMEs wanting to find an easy way to import or export goods to find potential partners on the other side of the world.

Three basic categories, which benefit from open data, can be pinpointed, based on the analyzed documents:

- 1. Public sector bodies** including governments (national and local level), public sector agencies, NGOs, academia organizations.

OGD provides the scope for better decisions in allocating resources, in order to improve the overall efficiency of government acts. Public datasets can easily deploy and maintain open data without IT investments. NGOs can share valuable data and better fulfill their function, e.g. in civil participations, social services, watchdog's activities, etc., collaborate and inspire more innovation and visualize impact reports and increase fundraising revenue. OGD can also be used to monitor the use of public

goods and encourage optimized investments of public goods. McKinsey took a detailed look at the impact of open data in three key economic sectors that heavily involve government and found that open data is already making substantial improvements to education, transportation and health care [5]. For example, in Boston, open data changed the methodology for public school assignments, improving what had been a contentious issue for parents, neighborhoods and schools. In Europe, open data helped school administrators forecast when certain supplies and services would be required, driving down costs by as much as 24 percent.

2. Businesses

Open data is helping bring capital to main street businesses. For example, one fast-growing lender is combining data from a wide range of government sources to make working capital loans to small businesses. Using open data on industry-level economic trends, the company is able to build finer-tuned predictive models. Another data analytics startup is working with banks to unlock insights about businesses from new government sources. Critical data about businesses are buried in unexpected places. For example, it is possible to estimate the number of employees a given company has, based on existing, publicly available data about participants in its retirement plan. The McKinsey report identified 16 categories of businesses, ranging from health care and education to energy, finance, legal and the environment that have benefited from open data produced by the federal government in the USA [6]. The data flows from all the major agencies, including NASA, Defense, Transportation, Homeland Security and Labor.

3. Citizens

Opening up public sector data has the potential to help improve the citizens quality of life. Free data sets and resources can be used to build apps that help consumers make smarter choices. They can discover the crime rate in their town, school performance ratings, childrens doctors to number of children ratios, air pollution, the current traffic situation on their way to work or restaurant health inspection scoresets. Innovative service delivery is emerging from „mashing up“ sets of data that originate from various sources, and by various parties. „Fix My Street“ in the United Kingdom and Chicago’s „311“ Internet portal in USA illustrate the intersection of mobile government and OGD. One is built by citizens, the other by government [13]. Opening up public data and arming the public with the information to make concrete policy recommendations has also improved citizen engagement and participation. Peng Shi, a graduate student, created the new methodology for public school assignments in Boston, using information released by the city on the quality and location of schools. His algorithm, which shows parents choices based on school quality and distance, was chosen over five other plans that had been developed through more traditional channels [6]. Data on education might includes information from every college, university, and technical and vocational institution that participates in the student financial aid programs. Data.gov provided the Consumer Complaint Database which contains data from the complaints received by the Consumer Financial Protection Bureau (CFPB) on financial products and services, including bank accounts, credit cards, credit reporting, debt collection, money transfers, mortgages, student loans, and other types of consumer credit. The database contains over 100,000 anonymized complaints and is refreshed daily. Data available about each complaint includes the name of the provider, type of complaint, date, zip code, and other information. The CFPB does not verify the accuracy of all facts alleged in the complaints, but takes steps

to confirm that a commercial relationship between the consumer and the identified company exists.

Conclusion

It has been shown that open government data initiatives need to be driven from the top with strong political leadership. Governments are increasingly making their data available online in standard formats and under licenses that permit the free re-use of data. The justifications advanced for this include claims regarding the economic potential of OGD, the potential for OGD to promote transparency and accountability of government and the role of OGD in supporting the reform and reshaping of public services. In these challenging times, it offers the opportunity to drive tangible economic value and stimulate growth and innovation. Providing data requires governments to not just disseminate, but to also update and standardize it. Governments must also decide which data to publish. Not all data is necessarily high-value information, and besides, it's costly to produce. So governments must decide which data sets provide the most value - not an easy undertaking.

Nonetheless, OGD are still an emerging domain; the comparability of assessment of government performance in the provision and quality of open data faces various challenges. First, strategies and policies on open government data are in constant evolution. Moreover, the administration and production of OGD is often delegated to regional and local levels of government. Third, there are no commonly agreed international definitions, e.g. of a dataset. The USA and UK have been ongoing leading innovators of open government and open data, from very early releases and collaborations on weather and mapping data to full data portals now hosted at the United Kingdom's data.gov.uk, and data.gov in the United States, which host hundreds of thousands of government data sets released to the public.

The next step in the research on this topic is finding a way to show where the value lies in open data because it is critical to its success. If the value isn't identified and measured, government officials who decide how to spend tax dollars will be less willing to make a long-term investment toward sustaining open data. Part of the problem is that what constitutes economic value is so diffuse. There are the firms that use the data directly and create new lines of business, new revenue and new jobs. But there's also the value that is created indirectly. A person who uses a transit app that's driven by a city's open data and switches from driving a car to riding a tram, could end up saving time and money. It is necessary to discover how best to capture that value and put a price tag on it.

References

- [1] ELGENDY, N. and A. ELRAGAL. Big Data Analytics: A Literature Review Paper. In *Advances in Data Mining. Applications and Theoretical Aspects - 14th Industrial Conference, ICDM 2014*. Petersburg: Springer-LNCS. 2014. pp. 214-227. ISBN 978-3-319-08976-8
- [2] RUSSOM, P. Big data analytics. *TDWI Best Practices Report*, 4th Quarter. 2011. pp. 1-38.

- [3] ELRAGAL, A. et al. *Big Data Analytics: A Text Mining-Based Literature Analysis* [online]. 2014. [cit. 2015-03-31]. Available at: <http://www.google.cz/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&ved=0CD0QFjAD&url=http%3A%2F%2Fojs.bibsys.no>
- [4] DAVIES, T. *Open data, democracy and public sector reform* [online]. 2010. [cit. 2015-04-01]. Available at: <http://www.opendataimpacts.net/report/2010/>
- [5] Open Government Working Group. *8 Principles of Open Government Data*. [online]. 2007. [cit. 2015-04-01]. Available at: <http://www.opengovdata.org/home/8principles>
- [6] McKinsey Global Institute. *Open data: Unlocking innovation and performance with liquid information* [online]. 2013. [cit. 2015-04-01]. Available at: <http://www.mckinsey.com/mgi>
- [7] PIZZICANNELLA, R. Co-production and open data: the right mix for public service effectiveness? [online]. In *Draft Papers from the 10th European Conference on eGovernment*. Limerick, Ireland. 2010. [cit. 2015-04-01]. Available at: <http://pizzican.wordpress.com/2010/05/23/coproduction-and-open-data-in-public-services/#comment-3>
- [8] LATHROP, D. and L. RUMA. *Open Government: Collaboration, Transparency, and Participation in Practice*. North Sebastopol, CA, USA: O'Reilly Media, 2010. ISBN 978-0569-80435-0.
- [9] COLEMAN, E. and L. BOLAND. Can Leviathan stop gobbling people up and start really listening to them? A call for a new form of public sector governance. In LATHROP, D. and L. RUMA. *Open Government: Collaboration, Transparency, and Participation in Practice*. O'Reilly Media, 2010. ISBN 978-0569-80435-0.
- [10] PARYCEK, P. and M. SACHS. Open Government – Information Flow in Web 2.0. *European Journal of ePractice*, 2010, **11**(9): 1–12. ISSN 1988-625X.
- [11] JANSSEN, K. The influence of the PSI directive on open government data: an overview of recent developments. *Government Information Quarterly*, 2011, **28**(4): 446–456. ISSN 0740-624X.
- [12] JANSSEN, M., Y. CHARALABIDIS, and A. ZUIDERWIJK. Benefits, Adoption Barriers and Myths of Open Data and Open Government. *Information Systems Management*, 2012, **29**(4): 258–268. ISSN 1058-0530.
- [13] UBALDI, B. Open Government Data: Towards Empirical Analysis of Open Government Data Initiatives. [online]. *OECD Working Papers on Public Governance*, No. 22, OECD Publishing. 2012. [cit. 2015-04-03]. Available at: <http://dx.doi.org/10.1787/5k46bj4f03s7-en>
- [14] DALY, J., A. KELLEHEAR, and M. GLIKSMAN. *The public health researcher: A methodological approach*. Melbourne, Australia: Oxford University Press, 1997.
- [15] *Global Open Data Index* [online]. Open Knowledge. 2014. [cit. 2015-04-11]. Available at: <http://index.okfn.org/about/>
- [16] *The Open Data Barometer Global Report* [online]. 2nd Ed. World Wide Web Foundation, 2015. [cit. 2015-04-11]. Available at: <http://www.opendatabarometer.org>
- [17] *The Open Data Economy: Unlocking Economic Value by Opening Government and Public Data* [online]. Capgemini Consulting. 2013. [cit. 2015-04-08]. Available at: <https://www.capgemini.com/resources/the-open-data-economy-unlocking-economic-value-by-opening-government-and-public-data>
- [18] *Independent Reporting Mechanism: United States Progress Report 2011–2013* [online]. Open Government Partnership, 2013. [cit. 2015-04-08]. Available at: <http://www.scribd.com/doc/178520812/United-States-IRM-Report>

Miroslava Lungová

Technical University of Liberec, Faculty of Economics, Department of Economics
Studentská 2, 461 17 Liberec 1, Czech Republic
email: miroslava.lungova@tul.cz

Difficulties with Measuring Local Economic Resilience

Abstract

The notion of economic resilience has become a buzzword especially after the latest global financial crisis of 2008. Its negative effects were also exacerbated by the existing level of globalization. This added to mutual dependence of the regional and local economies, making them more susceptible to various exogenous shocks. Thus, a question of their ability to withstand such shocks has come into the centre of attention of both, academicians and politicians. The notion of resilience is mainly associated with a capacity of a territorial unit to bounce back and/or to recover after being hit by a negative economic shock. With a rising interest in how to reinforce such a capacity at various territorial levels, a necessity arises of its operationalisation at the same time. Various indices of economic resilience have been compiled similar to those for competitiveness, usually in the national and regional level. Based on this, long-term strategies fostering the characteristics essential for economic resilience might be formulated subsequently. At lower territorial units, a measuring of economic resilience is still in its infancy, though. This paper begins with a brief introduction to the concept of economic resilience and various methods of measuring it. Then, difficulties associated with gauging local economic resilience in the Czech Republic are discussed. Drawing on existing approaches, possible indicators of local economic resilience are suggested followed with their application on selected Czech municipalities.

Key Words

municipality, resilience, employment, tax yields, gross domestic product, stability

JEL Classification: R1, R5, E3

Introduction and methodology

The notion of economic resilience has become a buzzword especially after the latest global financial crisis of 2008. Having caused serious disruptions at both national and international markets, a range of questions have arisen concerning capacities of the national, regional and local economies worldwide to withstand various external economic shocks.

The concept of resilience originates from environmental studies, where it mostly analysed vulnerability and/or capacity of systems and/or territorial units to bounce back after being hit by various natural disasters. Consequently, the notion of resilience have been taken over by economists and experts in regional studies. They enhanced the concept to capability of territorial units to withstand and/or recover from an external shock, no matter what the fundament of the shock may be (natural disaster, political turmoil and/or economic crisis).

The notion of economic resilience has been a commonly cited and applied concept lately in spite of the fact that generally accepted definition of the term and methodology of measuring it is still missing. A main purpose of this paper is not to unify all existing approaches into a single definition. It aims to explore various methods of measuring regional economic resilience instead and using the inductive qualitative method to suggest possible ways of gauging economic resilience at a local level. The paper begins with a general synthesis of the current methods of measuring economic resilience. Subsequently, difficulties in an application of the concept at a local level will be tackled followed with a quantitative analysis of selected local economies in the Czech Republic. The paper will be rounded off with suggestions of possible measures that might foster socio-economic stability and/or resilience of analysed local economies to external shocks. This paper follows up on the research done within project TD010029 financed by TA CR called "Defining sub-regions for addressing and resolving social and economic disparities".

1. Economic resilience

As already mentioned, there is no widely accepted definition of 'economic resilience', nor a single method of its operationalization, thus, the concept is argued to be 'fuzzy' by some experts [11]. The notion of resilience is used at various territorial levels, such as states, regions and localities. Only a precise delimitation of what 'regional' or 'local' means is a problem per se. For the purpose of this paper, 'regional' relates to a territorial level lower than a state, yet higher than a municipality (corresponding at least to NUTS 3 or 2 in terms of the territorial statistical units) and 'local' relates to an area of a municipality and/or its adjacent areas (corresponding to LAU 2 or an administrative district of a municipality with extended power in the Czech Republic). Firstly, resilience is defined using the regional level in following text.

Resilience of a regional economy is most commonly defined as the capability of a socio-economic system to bounce back from a shock or upheaval of any kind to its pre-shock state or path. This definition is attributed to so-called "engineering resilience" typically found in physical sciences and/or mainstream economics, where resilience would imply a 'self-correcting' market mechanism restoring the ex ante equilibrium after being pushed away from this position or path by a shock. Perception of resilience as an 'ability to absorb shocks' while maintaining its stability and function is characteristic for ecology and social ecology. Evolutionary economics considers resilience as a 'positive adaptability' (robustness). This assumes the capacity of a system to maintain core system performance through adaptability of its structure, functions and organization thus, the ability to 'bounce forward' [9, p. 4 - 5].

Briguglio [1] distinguishes strictly economic vulnerability as an inherent conditions affecting a country's exposure to exogenous shocks whereas economic resilience as actions undertaken by policymakers and private economic agents to withstand or recover from negative effects of shock. On the other hand, there are experts who already includes vulnerability into resilience, such as Martin and Sunley [9, p.15]. They highlight that resilience is a process involving several basic elements: vulnerability (the sensitivity of a region's firms and workers to shocks of various types), shocks (the origin, nature and incidence of a disturbance as well as its duration, scale and nature), resistance (the

primary effect of the shock), robustness (adjustment and adaptability of a regional economy, including public policy interventions) and recoverability (the nature of recovery and the path to which the region recovers). Others are prone to incorporate into resilience actions undertaken to improve resilience, such as Bruneau et. al. While focusing on community resilience to seismic shocks they defined four properties of resilience: redundancy, resourcefulness, robustness, and rapidity. Robustness and rapidity are deemed to be desired target, whereas redundancy and resourcefulness pose “the means” of strengthening resilience [2, p. 740]. Moreover, four dimensions of community resilience is being recognized in their study: technical, organization, social and economic. Despite its focus on seismic disruptions, these dimensions can be analogically applied to economic disruptions. Foster [5, p. 14] defines regional resilience as a region’s ability to estimate, prepare, respond and recover from an economic shock, whereas Hill [6, p. 4] describes resilience as the ability of a region to recover successfully from the shock, which has derailed or has potential to derail the economy from its growth path.

Apparently, just the conceptualization of resilience poses a problem that is underlined when trying to define adequate methodology of its measuring.

2. Methods of measuring regional economic resilience

The notion of resilience generally embraces more aspects than a concept of economic competitiveness. In spite of different wording, various experts agree on several dimensions of resilience (e. g. see [2, 5]). Resilience may bridge over aspects of economic, socio-demographic, environmental and community capacity of the area concerned. Thus, the notion of resilience can be naturally linked to a long-term economic stability, a concept that can be better comprehended in particular when addressing economic resilience at a local level.

Tab. 1: Several approaches to operationalisation of regional economic resilience

Authors	Approach to measuring regional economic resilience	Used data/indicators
Martin, Simmie (2010, 2012)	Case studies, descriptive data, resilience indices, comparative measures of resistance and recovery	GVA per capita, employment, index of sensitivity
Fingleton et al. (2012, 2013)	Statistical time series models, embedding resilience in regional economic models	Data on economic output, employment, capital, patents, high-technology employment
Hill et al. (2008)	Combination of quantitative analysis and qualitative case studies	Data on employment and gross metropolitan product
Foster (2006)	Resilience index	Resilience capacity index using 12 indicators in 3 capacity categories: economic, socio-demographic and community capacity
Briguglio et al. (2008)	Resilience index embracing four spheres: macroeconomic stability, microeconomic market efficiency, good governance and social development	Data on fiscal deficit-to-GDP ratio, unemployment and inflation, external-debt-to-GDP ratio, Economic freedom of the World Index, variables relating to income, the long-term unemployment rate, levels of education etc.

Source: [1, 4, 5, 6, 9, 13], own elaboration

According to Christopherson et al [7] the application of resilience to a local and regional development level is still in its infancy. Majority of existing studies usually analyse economic resilience at higher territorial levels (regions of greater size in terms of both its area and population, such as territorial units NUTS 1, 2, 3). Brief overview of existing methods of operationalization of the regional economic resilience shows the table above.

Tab. 1 illustrates most frequently used data/variables to measure regional economic resilience. This brings up a crucial problem when it comes to lower territorial units, such as municipalities and/or various sub-regions (functional as well as administrative). Commonly used variables and data that are deemed to best reflect the capacity of a regional economy to recover from an external shock, are rarely available at lower territorial units in the Czech Republic. Moreover, accessible data might be rather outdated since they are drawn on the population census results which only occurs once every ten years. These limits have to be taken into account while attempting to build a methodological background for an analysis of local economic resilience.

2.1 Methodological problems with measuring local economic resilience

There are various studies dealing with measuring local economic development. One of the oldest and most complex tool of community economic analysis comes from Hustede et al. (1993), with main focus on economic and financial side of the local development. Community economic resilience index (AWM Strategy team, 2010) combines a range of soci-economic indicators that are supposed to determine economic resilience of local economies. Some authors mainly target at sustainable development of localities. Hence, four basic pillars are being included: economic, social, environmental and territorial (e.g. Šilhánková, 2012).

In order to reinforce local economic resilience an attention should be paid to all above mentioned spheres: economic, socio-demographic and community capacity. Should the problems in one of these sphere remained unresolved, a socio-economic stability of the whole community may be put in jeopardy in the long term.

Based on earlier mentioned approaches, a suggestion of suitable variables to measuring resilience is made as a first step towards operationalization of local economic resilience (see table 2).

Tab. 2: Dimensions of local economic resilience: possible indicators

Economic	Socio-demographic	Community capacity
Tax yield per capita, number of active economic entities per capita, sectoral employment	Educational structure of population, the demographic dependency ratio, share of unemployed, labour force participation rate	Voters turnout, share of municipal expenditures on leisure time activities and/or social matters per capita, number of NGOs

Source: own elaboration

Tax yields per capita shows an economic performance of economic entities doing business in given area. This indicator may reflect attractiveness of a municipality for living and doing business. Diversity and stability of an economic base might be assessed through sectoral

employment, number of active business entities and/or number of natural persons per capita. Socio-demographic characteristics may be described through the total population development, the average age or the age index and/or the share of population with university degree on population older than 15. The demographic dependency ratio measures the ratio of population younger than 15 and older than 64 to population 15 – 64 (economically active population). The smaller the ratio the better from the point of view both the age structure and the macroeconomic burden of economically active population. A labour force participation rate (LFPR) is a proportion of labour force (employed and unemployed) to the working age population (older than 15). Its interpretation is more relevant when taking into account the data on unemployment at the same time. Unfortunately, the methodology of reporting unemployment rate has changed since 2013. Thus, there are no complete data about unemployment development in the Czech municipalities and those available are not really comparable. Instead of the unemployment rate (available job seekers to the whole labour force), a new indicator has been used named 'the share of unemployed persons' (available job seekers aged 15 to 64 to the population of the same age) since 2013. Community capacity may be assessed using various variables, such as number of NGO's or other active associations, quality of civic infrastructure, voting participation and/or share of municipal expenditures on leisure time or cultural activities. This should reveal viability of a community from the point of view of those who live there.

As tab. 1 suggests majority of experts focus on GDP (or GVA) development to quantify an impact of an external shock as well as rapidity and/or quality of a system's recovery. While assessing local economic resilience, the data on GVA or GDP per capita would be of crucial importance thus. Unfortunately, these data are only available at a national and/or a higher regional level in the Czech Republic currently (namely, NUTS 2 and 3). Similar situation exists when it comes to data on local sectoral employment. Estimates of sectoral employment at a local level can only be drawn on the census data 2001 and 2011, which may not capture precisely latest situation of a local economy. Taking into account that a structure of economy exhibits certain inertia, these data may be acceptable, though.

It is difficult to come up with a relevant variable that might best capture swings caused by an economic shock at a local level. A drop in the economic activity may be well reflected in municipal budgets, particularly in its revenue side. Should it reflect a decline in the local economic activity, the municipal revenues would have to be collected directly from local economic entities, though, which is not the case of the Czech Republic. Czech municipalities possess rather low financial autonomy. The most essential part of municipal budget revenues pose the tax revenues which are attributed to municipal budgets based on the Act No. 243/2000 Coll. on Budget Allocation of Revenue of Certain Taxes to Territorial Self-Government Units and to Certain State Funds (the Act on Budget Allocation of Taxes). Tax revenues are prone to external influences and thus reflect the cyclical development of the national economy as a whole. Each municipality receives its share on the gross tax yields using a set of criteria. Primarily, this includes size in terms of area and population of a municipality. According to the last amendment to this law that came into force in January 2013, several new criteria were added, such as a number of pupils in primary schools and a number of children in kindergartners weighted 7 % on account of a weight of a modified number of population. The review of latest changes in coefficients for allocation of shared taxes as opposed to the previous scheme illustrates following table 3.

Tab. 3: Changes in coefficients within shared taxes of municipalities

		2012	2013
VAT		21,4 %	20,83 %
Income tax (legal entities)		21,4 %	23,58 %
Income tax (natural person)	Withholding tax	21,4 %	23,58 %
	From dependent activities	21,4 % + 1,5 %	22,87 % + 1,5 %
	Self-employed	21,4 % out of 60 % + 30 % according to permanent residence	23,58 % out of 60 % + 30 % according to permanent residence
Property tax		100 %	100 %

Source: [14], own elaboration

In terms of a link to local economic activity, a special attention should be paid to two matters in particular. Firstly, the tax on personal income of self-employed is worthy analysing where 30 % is attributed to a municipality based on a permanent residence of a tax payer. This means that a municipal budget can benefit considerably from having a successful entrepreneur as a permanent resident. On the other hand, a municipality where the business activity is really located, thus a value is created do not benefit from it. This has already stirred up a vivid discussion in association with the most flagrant cases in the Czech Republic (e. g. Modrava, a small municipality with its prominent resident Zdenek Bakala and/or Vrane nad Vltavou with Petr Kellner etc.).

Secondly, a 1,5 % motivating component within income tax from dependent activities is interesting. It implies an existence of an employer within the municipality, thus, it may reflect local conditions for doing bussiness. Obviously, a best option for local development rests in a mixture of both, a permanent residence and a location of the business activity within a municipality. Only under these circumstances, a municipality can benefit from a larger share on the gross tax yields.

Tax revenues of municipalities per head as a mainly exogenous factor thus can be used as a signal of economic vulnerability of the locality. Since it may reveal a rate of business activity in the municipality to a certain extent, a factor of rather endogenous nature, there is a hidden potential for deeper analysis.

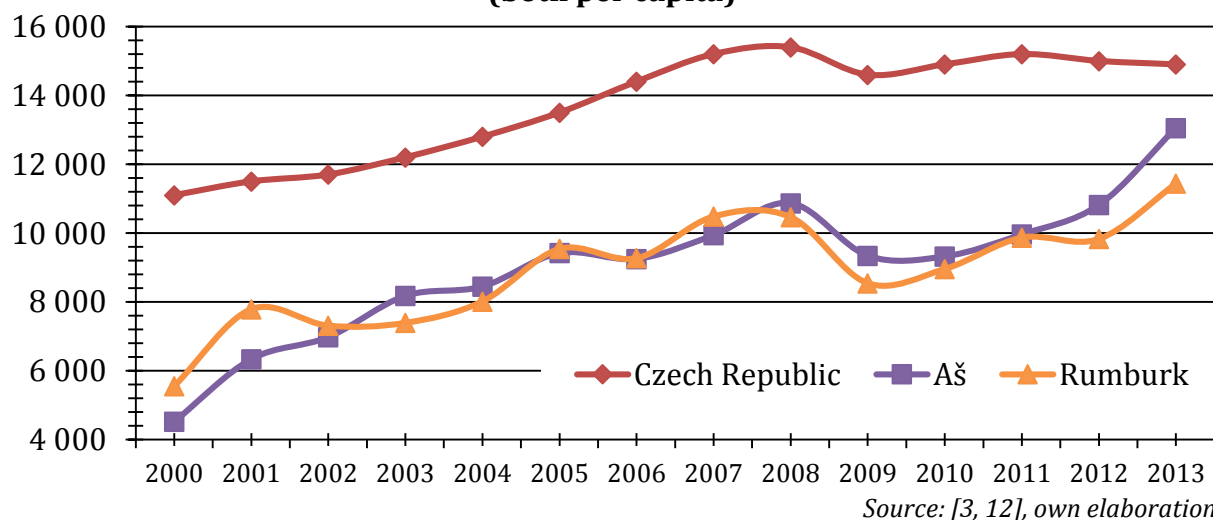
3. Assessment of local economies: Aš and Rumburk

Above suggested set of variables (see tab. 2) are used to assess economic stability of two municipalities with extended power (MEP): Aš in Aš Salient compared to Rumburk in so called Šluknov Salient. These municipalities have been selected from various reasons. Firstly, they are situated in remote, peripheral regions on the western and northern border with Germany respectively, rather distant from the central parts of the Czech Republic. They are similar in their economic structure and historical development. Textile industry used to be a traditional industrial sector in both municipalities and they were both affected by the ethnic structure of population, especially by the expulsion of Germans after the Second World War.

To begin with, economic dimension of resilience is analysed using suggested set of indicators. Firstly, vulnerability of given municipalities is assessed by comparing real GDP

development per capita of the Czech Republic to the tax yield development per capita of both concerned municipalities. Given their total population, they fit into the same size category of municipalities (with population between 10 – 20 thousands), which facilitates their comparison. Obviously, an assumption about correlation of tax yields per capita with the real GDP per capita proved to be true, as fig. 1 illustrates.

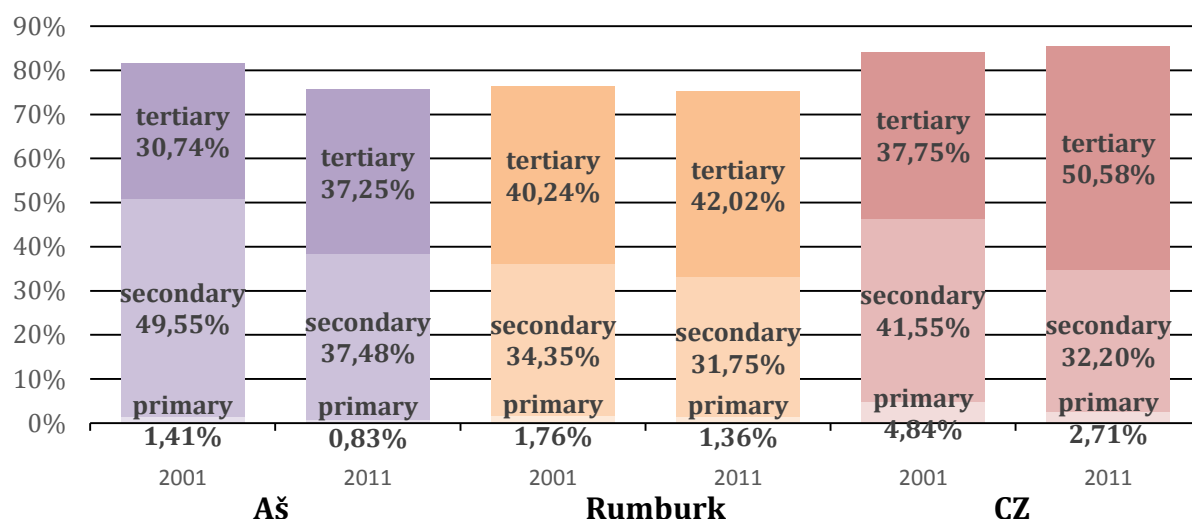
Fig. 1: Real GDP of the Czech Republic and tax yields of selected municipalities (both per capita)



There are more factors affecting tax yields over time, particularly given changes in the methodology used for allocation of shared taxes among municipalities within the last thirteen years. Yet, it is worth noting tax yields development in 2007 to 2009, where both municipalities unanimously copied the economic cycle with its peak in 2008 and a subsequent recession in 2009. Despite an economic stagnation expressed using GDP per capita in 2011 to 2013, tax yields of given municipalities show rising trend, which might be partly attributed to changes in the methodology of allocation of shared taxes (see above).

Sectoral employment seems to be of crucial importance when analysing capacity of a municipality to respond to any economic disturbance. Regions with more diverse economic structure, with higher level of firm formation and with higher share of employment in tertiary sector, especially in the public administration are generally considered to be more resilient. In following figure, changes in the sectoral employment over ten years using the census data from 2001 and 2011 in given municipalities is provided compared to the whole Czech Republic.

It is to be noted that primary sector includes agriculture, forestry and fishery, secondary sector industry and building construction, other activities are subsumed under tertiary sector, employed without specification of sector of employment have been excluded.

Fig. 2: Sectoral employment in Aš and Rumburk municipalities (%)

Source: [3], own elaboration

Fig. 2 suggests that both municipalities are traditionally industrial. Their extremely low share in agriculture well below the Czech national average is a natural result of their geographical endowment (Rumburk is situated within an upland area suitable rather for cattle and sheeps breeding and Aš do not possess suitable climate and soil conditions whatsoever). Moreover, its share shows declining trend over time. A similar declining trend is visible also in the secondary sector, at the local as well as the national level. Obviously more persistent economic structure seems to demonstrate Rumburk with only 2,6 p.p. drop in a share of the secondary sector and 1,78 p.p. increase in the tertiary sector over given period of time. Aš appears to adjust its economic structure more significantly in favour of the tertiary sector, yet, it still lags behind the Czech national average (which shows almost 13 p.p. rise over ten years). Overview of other possible indicators explaining economic and socio-demographic situation in both municipalities illustrates following tab. 3.

Tab. 3: Selected economic and socio-demographic indicators of Aš and Rumburk municipalities

	Active economic entities/100 residents		Labour force participation (LFPR)		Unemployment rate/share of unemployed persons		
	2011	2013	2001	2011	dec. 2001	dec. 2011	dec. 2014
Aš	11,49	10,28	64,3	52,9	5,7	7,6	4,8
Rumburk	11,00	10,73	64,9	53,2	12,4	11,9	8,3
CZ	13,90	13,99	61,3	57	8,13	8,6	7,6

Source: [3, 10], own elaboration

Obviously, LFPR demonstrates general declining tendency both at the national and the local level. This rate is generally affected by continuous aging of the population, thus results from the current demographic trends. Moreover, the latest economic crisis may have caused a further drop in LFPR visible in 2011 due to discouraged people who do not even try looking for work. As the table proves, this declining trend is more rapid in analysed municipalities in comparison to the national average. Rumburk shows a slight drop in unemployment rate over ten years whereas Aš reports increase in the unemployment rate almost by 2 p. p. On the other hand, its unemployment rate still

remains below the national average as the current data on the share of unemployed persons demonstrates. What might be surprising in this context that economic activity measured by the number of active economic entities per capita appears to show a slow, yet steady decline since 2011.

Tab. 4: Selected indicators of socio-demographic situation and community capacity of Aš and Rumburk

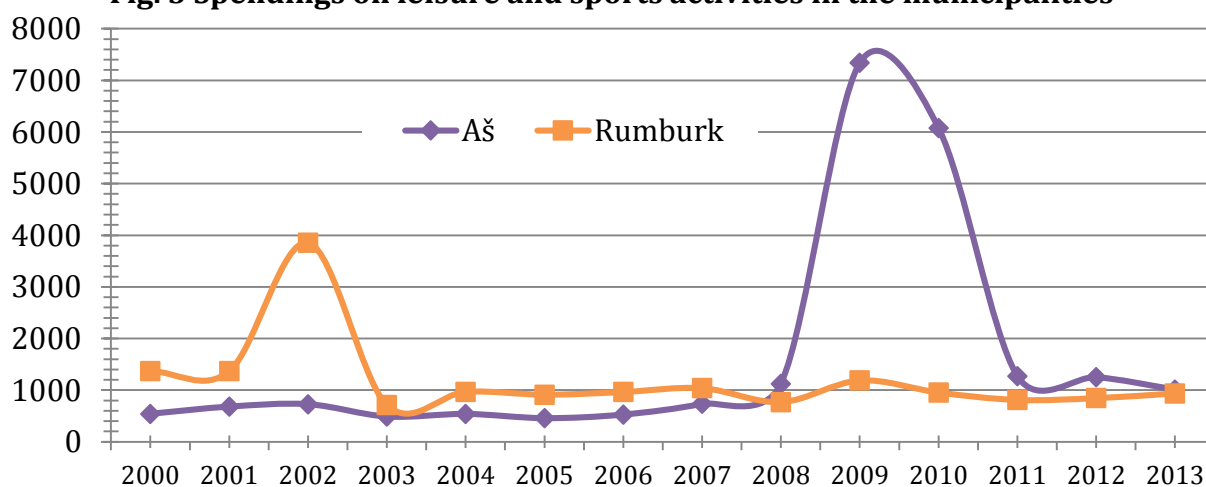
	Dependency ratio		%Uni/>15		Number of associations/100 residents		Voters turnout at elections	
	2001	2011	2001	2011	2001	2011	Parliament 2013	Municipal 2014
Aš	0,39	0,47	4,21	4,6	0,05	0,12	46,05	35,13
Rumburk	0,40	0,45	5,25	6,93	0,18	0,21	48,29	45,99
CZ	0,43	0,48	8,89	12	0,21	0,28	59,48	44,46

Source: [3], own elaboration

Dependency ratio demonstrates two mutually interlinked processes happening at both the local and the national level: it is ageing of population and raising economic burden of the economically active population (aged 15 to 64). On the other hand, a rising proportion of population with university degree is a positive feature, despite the fact that given municipalities lags behind in the pace of its change over time compared to the national average. To assess community capacity, number of associations per 100 residents may illustrate willingness of people to get actively involved into economic and social life within a municipality. Apparently, residents in Aš do not seem to be identified with its municipality to such an extent as to participate in various associations. Aš scores worse also in voters turnout as opposed to Rumburk and/or the national average. What might be rather surprising is a relatively high number of associations in Rumburk, though.

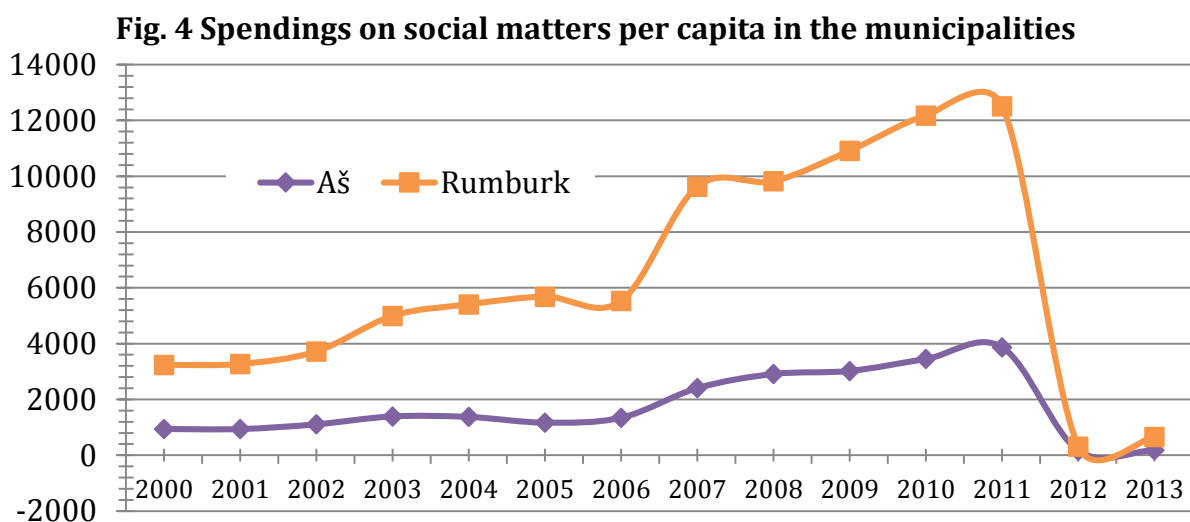
As the last indicator of community capacity was suggested a share of municipal expenditures on sports and leisure activities per capita (see fig. 3).

Fig. 3 Spendings on leisure and sports activities in the municipalities



Source: [12], own elaboration

As fig. 3 suggests both municipalities appears to show similar support of leisure and sport activities, with a significantly sharp increases due to investment into sport facilities in Aš in 2009 – 2010 and in Rumburk in 2002. While analysing their municipal budgets, one striking matter turned up though, making these two municipalities distinguishable. Municipal expenditures on social matters per capita bring in interesting facts about Rumburk (see fig. below).



Source: [12], own elaboration

Rumburk shows undoubtedly rising and significantly higher share of expenditures on social matters till 2012 when these matters were taken over by the official labour offices. These expenditures consisted in items such as a care allowance, an assistance in material poverty, benefits for disabled residents, community service within active employment policy. In its peak in 2011, expenditure on social matters reached up to 43,2% share on the total municipal spendings per capita as opposed to only 19 % in Aš in the same year. This might reveal interesting facts about possible socio-demographical problems with subsequent effects on the community capacity development. The more people are dependent on the social benefits no matter what level of the public administration pays them, the more vulnerable the whole community may become when facing any disruptions.

Conclusion and recommendation

Several conclusions might be drawn about the given municipalities based on the carried out analysis. A low share of agriculture in both municipalities may be positive in terms of labour productivity, which is relatively lower in the primary and the secondary sectors compared to the tertiary sector. On the other hand, this also signifies higher dependency of given localities on imported products from elsewhere which increases their vulnerability, thus, diminishes their resilience. Declining LFPR in both municipalities may have negative repercussions in terms of the future economic development and the social well-being. High spendings on social matters in Rumburk till 2012 revealed a potential threat for a fragile social cohesion putting in danger a socio-economic stability of the whole local community.

To foster the local stability, following suggestions might be considered for implementation:

- support local social capital: e.g. actions to support existing local businesses to improve their productivity and market share and to encourage new start-ups, creation and strengthening of business support networks, organization of regular special events such as farmers market, workshops, fun days, etc.,
- identification of local consumer needs and buying habits in order to support local producers,
- re-trainings of socially excluded people from the labour market and indentifications of their capacities to be of use to the local community, support alternative ways of active involvement of people into local economic development, such as the local exchange trading system,
- support a cross-border co-operation (at economic as well as social level) with neighbouring communities in Germany.

Supporting local economic resilience has become a hot topic currently, especially in the face of negative impacts of globalization and/or the latest economic crisis. Measuring resilience is not a target per se, though. It is just an instrument to reveal potential strenghts and threats to a long-term stability of given local economy. This paper focused on the first step towards creating a general methodology that might be easily implemented in any local economy. In a follow-up research, suggested indicators should be tested on a wider set of municipalities in order to select the most relevant ones. Subsequently, reliable long-term strategies might be created that would draw on the real socio-economic situation of a municipality and that would respond to real needs of the locality while taking into account its specificities, limits and threats.

References

- [1] BRIGUGLIO, L. et al. *Economic vulnerability and resilience concepts and measurements* [online]. UNU-WIDER, no. 2008.55. ISBN 978-92-9230-103-3. [cit. 2015-03-15]. Available at: <http://hdl.handle.net/10419/45146>
- [2] BRUNEAU, M. et al. A framework to quantitatively assess and enhance the seismic resilience of communities. *Earthquake spectra*, 2003, **19**(4): 733–752. ISSN 8755-2930.
- [3] CZSO. *Databáze Sčítání lidu, domů a bytů 2001, 2011* [online]. Prague: Czech Statistical Office, 2011. [cit. 2015-03-15]. Available at: <http://www.czso.cz/sldb2011/redak ce.nsf/i/home>
- [4] FINGLETON, B., H. GARRETSEN, and R. MARTIN. Recessionary shocks and regional employment: Evidence on the resilience of U.K. regions. *Journal of Regional Science*, 2012, **52**(1): 109–133. ISSN 1467-9787.
- [5] FOSTER, K. A case study approach to understanding regional resilience [online]. University of California Berkeley Institute for Urban and Regional Development & Macarthur Foundation Research Network on Building Resilient Regions Working paper, 2007, no. 08. [cit. 2011-07-15]. Available at: <http://iurd.berkeley.edu/wp/2007-08.pdf>

- [6] HILL, E. W., H. WIAL, and H. WOLMAN. Exploring Regional Resilience [online]. University of California Berkeley Institute for Urban and Regional Development & Macarthur Foundation Research Network on Building Resilient Regions Working paper, 2008, no. 04. [cit. 2011-07-15]. Available at: <http://iurd.berkeley.edu/wp/2008-04.pdf>.
- [7] CHRISTOPHERSON, S., J. MICHIE, and P. TYLER. Regional resilience: theoretical and empirical perspective. *Cambridge Journal of Regions, Economy and Society*, 2010, **3**(1): 3–10. ISSN 1752-1386.
- [8] LUNGOVÁ, M. The Resilience of Regions to Economic Shocks. In KOCOUREK, A. ed. *Proceedings of the 11th International Conference Liberec Economic Forum 2013*. Liberec: Technická univerzita v Liberci, 2013, pp. 363–371. ISBN 9788073729530.
- [9] MARTIN, R. and P. SUNLEY. On the Notion of Regional Economic Resilience: Conceptualisation and Explanation. *Journal of Economic Geography*, 2015, **15**(1): 1–41. ISSN 1468-2710.
- [10] MPSV. Ministry of Labour and Social Affairs [online]. [cit. 2015-03-15]. Available at: <http://portal.mpsv.cz/>
- [11] PENDALL, R., K. A. FOSTER, and M. COWELLA. Resilience and Regions: Building Understanding of the Metaphor. *Cambridge Journal of Regions, Economy and Society*, 2010, **3**(1): 71–84. ISSN 1752-1386.
- [12] ŘEZÁČ, K. Rozpočet obce [online]. Rozpočet obce, 2015. [cit. 2015-03-15]. Available at: <http://www.rozpocetobce.cz/>
- [13] SIMMIE, J. and R. MARTIN. The Economic Resilience of Regions: Towards and Evolutionary Approach. *Cambridge Journal of Regions, Economy and Society*, 2010, **3**(1): 27–43. ISSN 1752-1386.
- [14] SLÁMA, D. Rozpočtové určení daní rok po změně [online]. *Deník veřejné správy*, 2/2014. [cit. 2015-03-15]. Available at: <http://www.dvs.cz/clanek.asp?id=6649113>

Miloš Maryška, Petr Doucek, Lea Nedomová

University of Economics, Prague, Faculty of Informatics and Statistics, Department
of Information Technologies and Department of System Analysis

Náměstí W. Churchilla 4, 130 67 Praha 3, Czech Republic

email: maryskam@vse.cz, doucek@vse.cz, nedomova@vse.cz

ICT Professionals Wages Development

Abstract

The economies of EU States have undergone a dramatic trend in the past ten years. Starting with the economic boom at the beginning of the millennium, going through the economic crisis, which started around the world in the year 2008 and the consequences of which had not deeply hit the Czech economy until the year 2011, and ending with small steps toward the current recovery. The economic trend is reflected in the information and communication technology (ICT) sector as well. In ICT, the Czech Republic joined the developed European countries, which is demonstrated by the comparison of the percentage of ICT professionals on the total number of the employed population in the Czech economy in this article. Furthermore, using the data of the Czech Statistical Office, this article shows and analyzes the trend in the gross wage of ICT professionals, in particular during the consolidation of the Czech economy from the year 2011 to the year 2013. This article analyses not only the overall trend in wages but also the trend in the wages of two categories of ICT professions - ICT specialists and ICT technicians. Furthermore, this article analyzes the wages of ICT professionals by gender (the wage difference in men and women). The analysis clearly shows the wage disparity in men and women not only in the ICT sector but also in the entire Czech economy. An interesting conclusion is that the gross wage of women – ICT professionals – is higher as compared to the average gross wage of women than that of men, using the same comparison method. The last factor that we analyzed is the gross wage of ICT professionals with respect to sphere employment (business sphere or non-business sphere). Here, we can see that the wage of ICT practitioners in the business sphere is almost double as compared to the average gross wage, while the wage of ICT practitioners in the non-business sphere is almost the same as the average gross wage. For the purpose of this article, we compared both nominal wages and wages adjusted for inflation.

Key Words

human capital in ICT, wages in ICT, ICT professionals, ICT specialists, ICT technicians

JEL Classification: J24, M21

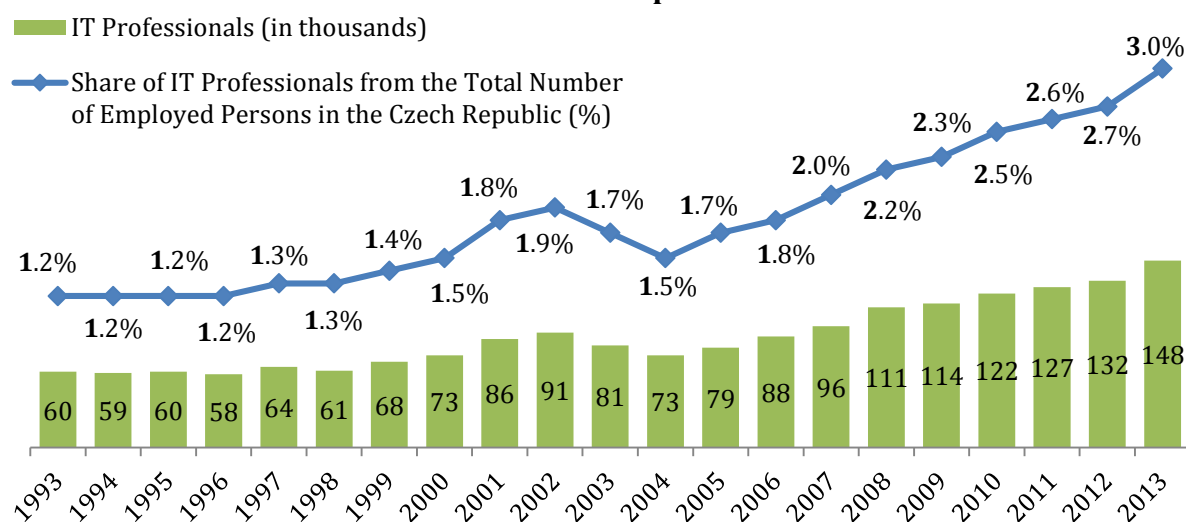
Introduction

To present the results of our analysis of the gross wages of ICT professionals, we used two fundamental factors - the number of ICT professionals, or more precisely, the share of ICT professionals from the entire employed population in the Czech economy as well as statistics concerning gross wages and their growth [8],[9],[10]. For the purposes of this article, we analyzed the growth of gross wages of ICT professionals (CZ-ISCO 25 and CZ-ISCO 35) - men and women - as well as the trend in the average gross wage in the Czech Republic.

The Number of ICT Professionals in the CR – Trend

In the past 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 [6],[7]. 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 2004, and even the economic crisis in 2008 did not stop this positive trend [11].

Fig. 1: Share of ICT Professionals from the Total Number of Employed Persons in the Czech Republic



Source: authors, data [1]

In the year 2013, there were 148,000 active IT professionals - 13,300 women and 134,700 men. A more detailed analysis of the number of ICT professionals in the Czech economy during the years of 2011 - 2013 is provided e.g. in [12]. These professionals practically worked in all sectors of the economy [13]. However, this article mainly analyzes the wages of this group of professionals.

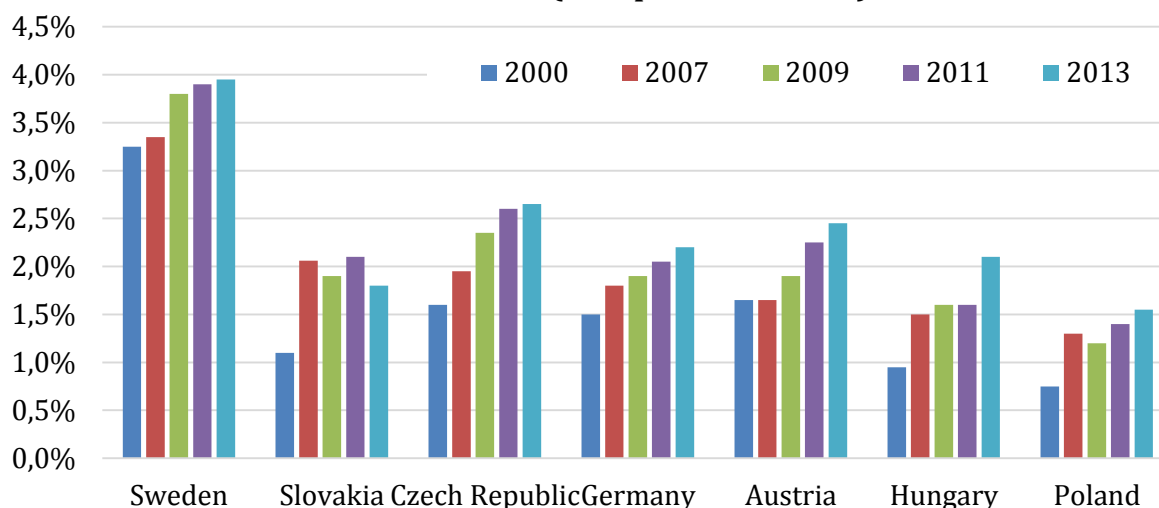
Comparison with other Member States of the European Union

Were important is comparison of the Czech Republic with other European countries in the same time-frame. This comparison is provided in Fig. 2.

The highest share of ICT professionals from the employed population is in the Scandinavian countries, fluctuating around 4% [5]. The Czech Republic ranks above the average of EU28, which is 2.3% of ICT professionals from the employed population. The lowest percentage of ICT professionals is in Greece, Romania, Latvia and Turkey, representing less than 1% and actually only 0.5% in Turkey (CZSO 2015). Fig. 2 compares the trend in the percentage of ICT professionals in the Czech Republic with that in the neighboring countries. Austria currently shows a very similar percentage as the Czech Republic, while Germany shows a percentage that is lower by 0.5%. The share of ICT

professionals from the employed population in other countries is considerably lower than that in the Czech Republic – by 0.5 to 0.9%.

Fig. 2: Comparison of the Percentage of ICT Professionals During the Years of 2000 – 2013 (European Countries)



Source: authors, data [2]

Average wage and inflation

Inflation and the trend in wages of ICT professionals represent another source and point of departure for our research as well as for our presentation of the trend in the wages of ICT professionals in the Czech economy. Both these factors and their trend during the years of 2003 – 2013 are shown in Tab. 1.

Tab. 1: Average Inflation Rate and a Year-To-Year Increase in the Wages of ICT Professionals

Variable % / Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Average Annual Inflation Rate	0,1	2,8	1,9	2,5	2,8	6,3	1	1,5	1,9	3,3	1,4
A year-to-year increase in wages in the ICT sector	11,40	6,60	6,50	6,30	13,10	8,40	0,60	0,60	-6,70	3,50	1,30

Source: [4]

1. Problem Formulation

As part of the research conducted at the Faculty of Informatics and Statistics, we analyzed different aspects of information and communication technology and their microeconomic and macroeconomic impact on human society. It concerns e.g. the informatization of the Czech society as compared to other countries – the EU or OECD, the assessment of the trend in the e-government readiness index or the competitiveness index. In this article, we present the analysis of the wages of ICT professionals in the Czech economy, in particular the trend in the wages of ICT professionals in general and by profession where

we focused on two groups based on the CZ-ISCO methodology, i.e. ICT specialists (CZ-ISCO 25) and ICT technicians (CZ-ISCO 35). We also analyzed the wages of ICT professionals by achieved education, gender and sphere employment. We analyzed not only their nominal wage but also their wage adjusted for inflation. We analyzed these wages only for the time period of 2011 -2013 because of the change in the professions classification methodology made by the Czech Statistical Office between the years of 2010 and 2011 (this is further explained in the part “Methodology”).

2. 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 gross wages of ICT professionals in the Czech economy, we used the methodology of ICT professions classification – CZ ISCO. The classification of ICT professionals is provided below.

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 [4]:

- Specialists and
- Technicians.

2.1 ICT specialists

ICT specialists (CZ-ISCO 25) research, plan, design, write, test, provide consultations and improve IT, hardware and software systems and related concepts for specific applications; prepare related documentation, including principles, policies and procedures; design, develop, supervise, maintain and support databases and other information systems in order to ensure optimal performance, integrity and data security. This group is divided into two profession groups. The first one comprises of software and computer application analysts and developers (CZ_ISCO 251), which is subdivided into 2511 – system analysts, 2512 – software developers, 2513 – web and multimedia developers, 2514 – computer application programmers and 2519 – software testing specialists and related practitioners. The second one includes database and network specialists (CZ_ISCO 252) who design, develop, supervise, maintain and support the optimal performance and security of IT systems and infrastructure, including databases, hardware, software, networks and operating systems. This group is subdivided into – 2521 – database developers and administrators, 2522 – system administrators, computer network administrators, 2523 – computer network specialists (excluding administrators) and 2529 – data security specialists and related practitioners. Technicians constitute another group that represents a major share from the number of ICT practitioners.

2.2 ICT technicians

ICT technicians (CZ-ISCO 35) support the regular operation of computer and communication systems and networks and perform technical tasks related to telecommunications, the transmission of image sound and other types of telecommunications signals on land, on the sea or in the air. The occupations in this group are subdivided into the following groups – ICT operation and user support technicians and related practitioners (CZ_ISCO 351), who support the regular operation of computer and communication systems and networks and provide technical assistance to users. This group is further subdivided into the following professions: 3511 – ICT operation technicians, 3512 – ICT user support technicians, 3513 – computer network and system technicians, 3514 – web administrators. Another group is represented by telecommunications and transmission technicians (CZ_ISCO 351), who supervise the technical functioning of devices for image and sound recording and editing and of devices for the radio and television transmission of image and sound and types of telecommunications signals on land, on the sea or in the air and perform technical tasks related to research in telecommunications engineering and to designing, production, installation, construction, operation, maintenance and repairs of telecommunications systems. These professions are subdivided into the following groups: 3521 – audiovisual recording and transmission technicians and 3522 – telecommunications and radio communications technicians.

We analyzed the data using MS Excel tools and statistical functions.

The analysis results are presented mainly for the years of 2011 – 2013 because the classification of job positions changed in the Czech Republic at the beginning of the year 2011 and the KZAM-R methodology was replaced by the CZ-ISCO methodology. Therefore, the comparison of some data by profession could be incorrect. The results are presented in Czech Crowns.

3. Results

The overall results of the analysis of the wages of ICT professionals are presented in this article based on analyzed criteria. First we analyzed the trend in the number of ICT professionals in the Czech economy, then their nominal wages and wages adjusted for inflation and finally their wages by:

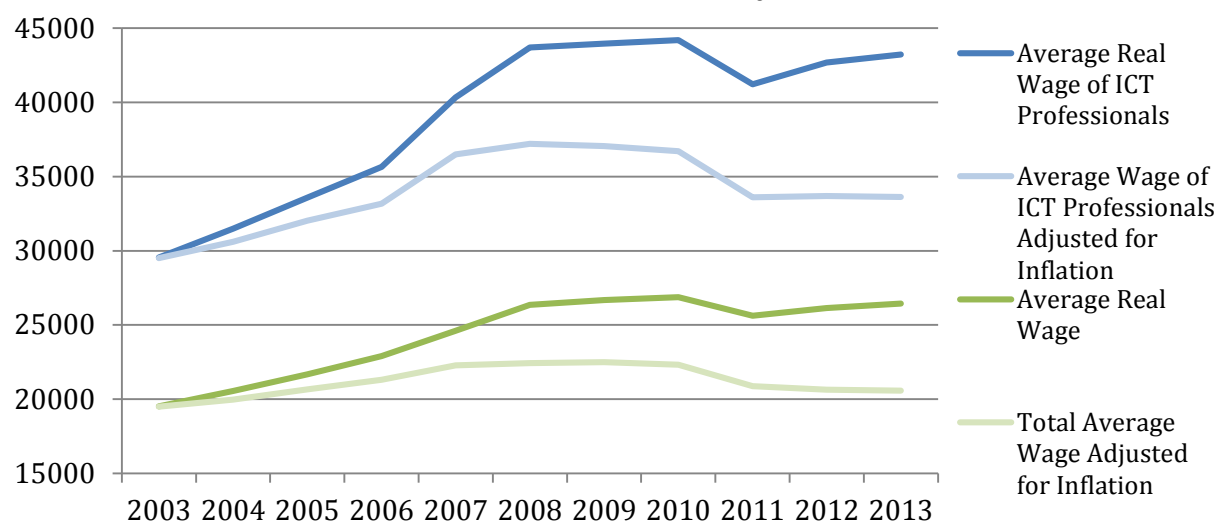
- ICT profession group;
- Gender;
- Spheres employment (business or non-business).

We performed many other analyses as part of our research, but could not include them in this article due to a lack of space.

3.1 Wages of all ICT professionals

We can see the trend in wages of all ICT professionals during a time period of 11 years. Consistent data are available from the year 2003 and are shown in Fig.3.

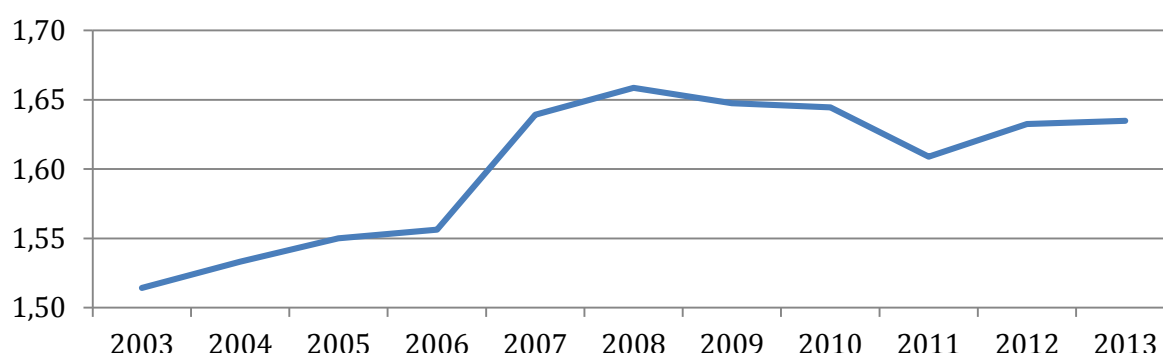
Fig. 3: Trend in the Wages of ICT Professionals as Compared to the Average Wage in the Czech Economy



Source: authors, data [1], [4]

The following figure provides interesting information. The average real wage in the CR has not practically changed during the years of 2003 – 2013. The change was very minimal - from a little bit less than 20,000 CZK to slightly over 20,000 CZK a month. On the other hand, the average real wage of ICT professionals was going up mainly until the year 2007 and then started dropping until the year 2011. Since then, the average real wage of ICT professionals has not practically changed mainly because the increase in nominal wages copied the inflation rate. For this reason, both curves of nominal wages show an increasing trend.

Fig. 4: Trend in the wages of ICT professionals in relation to the average wage adjusted for inflation



Source: authors, data [1], [4]

The analysis of wages in ICT professions clearly shows that the rapid increase in wages between the years of 2003 – 2008 was followed by a very slight increase between the years of 2008 and 2010 and finally a drop in the year 2011. As we can see, not only the

wages of ICT professionals but also the average wage in the Czech economy dropped. This can be explained by a delayed effect of the economic crisis in the Czech Republic. The drop in the wages of ICT professionals can also be the result of the changed methodology and classification of ICT professions – the switch from the K-ZAM methodology to CZ-ISCO. The drop concerns not only nominal wages but also wages adjusted for inflation. The average real wage of ICT professionals practically stagnated in 2012 and 2013, while the total average real wage in the Czech Republic slightly dropped (see Fig. 4).

The index indicating the relationship between these wages clearly shows that the wages of ICT specialists were considerably higher than the average wage. However, the scissors gap between these wages keeps changing. While it kept opening during the years of 2006 – 2008, it started closing during the years of 2009 – 2011. This gap started slowly opening again in 2012 and 2013 and currently represents approximately a 63% increase as compared to the average wage.

3.2 Wages of ICT professionals by profession group

For the analysis of ICT specialists and ICT technicians, we had to limit the time period of our research to the years 2011, 2012 and 2013 since the data were not comparable due to the change in the professions classification methodology in the Czech economy made by the Czech Statistical Office.

Tab. 2: Wages of ICT professionals by profession group

	2011	2012	2013
ICT Specialists – Nominal	45,613	47,177	47,880
ICT Specialists – adjusted for inflation	44,763	44,818	44,858
ICT Technicians – Nominal	35,008	36,099	35,970
ICT Technicians – adjusted for inflation	34,355	34,294	33,700
All CZ-ISCO – Nominal	25,625	26,149	26,444
All CZ-ISCO – adjusted for inflation	25,147	24,842	24,775

Source: authors, data [1], [4]

Based on the comparison of gross wages by profession, including the adjustment for inflation, we can see that the wages of ICT specialists are considerably higher than those of ICT technicians. This is also a result of the fact that ICT specialist professions usually require a master's degree, while ICT technician professions require only high school education or a bachelor's degree. A more detailed analysis is provided in [12]. After having adjusted the data for inflation, we can see that the real wages of ICT professionals are not going up just like the average wage in the Czech economy.

3.3 Wages of men and women

The follow-up analysis of wages by gender shows that there is something rotten in the Czech economy since the wages of men and women differ both in ICT professions and in the average wage.

Tab. 3: Wages of ICT professionals by gender

	2011		2012		2013	
	Males	Females	Males	Females	Males	Females
ICT Professionals – Nominal	42,060	35,747	43,406	37,376	44,141	36,925
ICT Professionals – adjusted for inflation	41,276	35,080	41,236	35,507	41,355	34,594
ICT Specialists – Nominal	46,473	40,018	47,983	41,446	48,953	40,531
ICT Specialists v adjusted for inflation	45,606	39,272	45,584	39,373	45,863	37,973
ICT Technicians – Nominal	35,826	29,478	36,766	30,877	36,653	31,180
ICT Technicians v adjusted for inflation	35,158	28,929	34,927	29,333	34,340	29,212
All CZ-ISCO – Nominal	28,431	22,133	28,962	22,648	29,250	22,955
All CZ-ISCO – adjusted for inflation	27,901	21,720	27,514	21,516	27,404	21,506

Source: authors, data [1], [4]

Tab. 3 clearly shows that the average gross wage of women is lower than that of men in the Czech economy. During the years of 2011- 2012, the gap was 22% on average. The only positive thing is perhaps the fact that this gap is slowly, but really very slowly, closing. During the analyzed three years, this gap closed by 0.6%.

In the case of ICT specialists, this gap is smaller, representing only 14.9% on average during the years of 2011- 2013, while in the case of ICT technicians, the average gap was 16.3%. For the entire category of ICT professionals, this gap was 15.1% also due to the fact that considerably less women work in ICT technician professions.

A comparison with the average gross wage is rather favorable for women but only because the average wage of women in the Czech economy was lower by 22% than that of men.

Tab. 4: Wages of ICT professionals by gender – average wage index by gender

	2011		2012		2013	
	Males	Females	Males	Females	Males	Females
Real ICT Professionals	1.48	1.62	1.50	1.65	1.51	1.61
Real ICT Specialists	1.63	1.81	1.66	1.83	1.67	1.77
Real ICT Technicians	1.26	1.33	1.27	1.36	1.25	1.36

Source: authors, data [1], [4]

3.4 Wages by spheres employment

The last major wage gap can be found in different economic spheres. The work in the public and state sphere (non-business sphere) is considerably worse paid than the same work in the business sphere. The following table shows the difference in gross wages earned the business sphere and the non-business sphere.

Tab. 5 clearly shows that the wages of ICT professionals working in the business sphere are higher than those earned in the non-business sphere. A comparison with the average wage in the Czech Republic is provided in Tab. 6.

Tab. 5: Average gross wage of ICT professionals by spheres employment

	2011			2012			2013		
	ICT Professionals	ICT Specialists	ICT Technicians	ICT Professionals	ICT Specialists	ICT Technicians	ICT Professionals	ICT Specialists	ICT Technicians
Business Sphere – Nominal	49,011	53,096	42,723	43,636	48,111	37,145	44,657	49,299	37,203
Business Sphere adjusted for inflation	48,097	52,106	41,926	41,454	45,705	35,288	41,838	46,188	34,855
Non-business Sphere – Nominal	27,854	30,441	24,762	27,536	30,039	24,601	28,109	30,675	25,118
Non-business Sphere adjusted for inflation	27,335	29,873	24,300	26,160	28,537	23,371	26,335	28,739	23,532

Source: Authors; data [1], [4]

However, Tab. 5 provides other interesting facts for our analysis. One of them is the drop in the wages of ICT professionals between the years 2011 and 2012 in both the business and non-business spheres. While the drop in the wages in the business sphere represented 11%, the drop in the non-business sphere was only 1.2%. The wages in both spheres went up in the year 2013 but only by approximately 2% (by 2.34% in the business sphere and by 2.08% in the non-business sphere).

Tab. 6: The index of the gross wages of ICT professionals as compared to the average wage by spheres employment

	2011			2012			2013		
	ICT Professionals	ICT Specialists	ICT Technicians	ICT Professionals	ICT Specialists	ICT Technicians	ICT Professionals	ICT Specialists	ICT Technicians
Business Sphere adjusted for inflation	1.91	2.07	1.67	1.67	1.84	1.42	1.69	1.86	1.41
Non-business Sphere adjusted for inflation	1.09	1.19	0.97	1.05	1.15	0.94	1.06	1.16	0.95

Source: Authors; data [1], [4]

An interesting finding is that the myth of high wages of all ICT professionals is not true since the wages of ICT technicians in the non-business sphere were even lower than the average wage in the Czech economy.

Conclusions

The overall findings, although for a rather short time period, show the disparity in the wages in ICT professions. The research findings mentioned at the beginning of this article

show a stable increase in the number of ICT professionals in the Czech economy during the past 11 years. We can thus say that it shows a steady growth trend. As compared to other EU States, the Czech Republic is above the EU 27 average. When analyzing the trend in the wages of ICT professionals we reached the following conclusions:

- The nominal wages of ICT professionals kept practically going up during the years of 2003 – 2013, except for the year 2011 when the wages of ICT professionals dropped from year to year by 6.70% due to the delayed impact of the economic crisis; their wages had not reached the level of 2010 by the year 2013;
- ICT specialists earn the highest wages; their average month wage is higher by approximately 8,000 CZK than that of ICT technicians;
- When comparing wages by gender, we can conclude that the wage policy of ICT professionals copies the conventions of the Czech economy – the average wage of women is approximately 20-22% lower than that of men; the positive thing is that this situation is better than in the entire Czech economy where the average wage of women is lower by another 7% than that of men; this situation is not all that bad in comparison to some Member States of the European Union [2]. We should mention the year 2012 where the wage gap was only 12%, but went back to the usual 20% the following year;
- Wages in the business sphere are considerably higher than in the non-business sphere; the average wage in the non-business sphere during the analyzed time period practically remained the same; the average wage in the business sphere shows a drop by 11% in 2012 and an increase in 2013 but only by 2.34%; the average wage in the non-business sphere dropped in 2012 by 1.2% but went up by 2.08% in 2013;
- The trend in nominal and real wages during the years of 2003 – 2013 indicates that although the wages of ICT professionals are higher than the average wage in the Czech Republic, the real wage practically stopped going up in the year 2011; during the years of 2012 and 2013, the increase in the wages of ICT professionals practically copied the inflation rate and thus the real wage went up only very little and actually dropped in 2013 (Fig. 3).

Open Issues

When researching the wages, we identified a very interesting anomaly between the wages of men and women in the Czech economy. We would like to further research this anomaly and compare it with the trend in other countries of the world and not only with EU States.

Acknowledgement

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

References

- [1] CZSO. IT odborníci v České republice [online]. Praha: Czech Statistical Office, 2015. [cit. 2015-03-20]. Available at: [http://www.czso.cz/csu/redakce.nsf/i/it_odbornici_v_ceske_republice/\\$File/it_odbornici_pocty_13.pdf](http://www.czso.cz/csu/redakce.nsf/i/it_odbornici_v_ceske_republice/$File/it_odbornici_pocty_13.pdf)
- [2] EuroStat. *Information Society* [online]. Brussels: EuroStat, 2010. [cit. 2015-02-22]. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/data/main_tables
- [3] CZSO. *Klasifikace zaměstnání (CZ-ISCO)* [online]. Praha: Czech Statistical Office, 2015. [cit. 2015-01-10]. Available at: <http://www.czso.cz/csu/2010edicniplan.nsf/p/0011-10>.
- [4] CZSO. IT odborníci [online]. Praha: Czech Statistical Office, 2015. [cit. 2015-01-10]. Available at: https://www.czso.cz/csu/czso/lidske_zdroje_v_informacni_spolecnosti_it_odbornici
- [5] EC. Europe 2020: A strategy for smart, sustainable and inclusive growth [online]. Brussels: European Commission, 2010. [cit. 2015-02-20]. Available at: <http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%2007%20-%20Europe%202020%20-%20EN%20version.pdf>
- [6] FINARDI, S., J. FISCHER, and P. MAZOUCH. Returns on private investment in education and fair tuition fees estimates: the case of the Czech Republic. In *9th International Conference on Efficiency and Responsibility in Education (ERIE 2012)*. Prague: Czech University of Life Sciences Prague, 2014. pp. 113–119. ISBN 978-80-213-2289-9.
- [7] HANČLOVÁ, J. and P. DOUCEK. The Impact of ICT Capital on Labor Productivity Development in the Sectors of the Czech Economy. In DOUCEK, P., G. CHROUST, and V. OŠKRDAL. eds. *Proceedings from the 20th Interdisciplinary Information Management Talks 2012*. Linz, Austria: Gerhard Chroust, 2012. pp. 123–133. ISBN 978-3-99033-022-7.
- [8] HANČLOVÁ, J., P. DOUCEK, J. FISCHER, and K. VLTAVSKÁ. Does ICT capital affect economic growth in the EU-15 and EU-12 countries? *Journal of Business Economics and Management*, 2015, **16**(2): 387–406. ISSN 1611-1699.
- [9] MAREK, L. Analýza vývoje mezd v ČR v letech 1995 – 2008. *Politická ekonomie*, 2010, **58**(2): 186–206. ISSN 0032-3233.
- [10] MAREK, L. Some Aspects of Average Wage Evolution in the Czech Republic. In LÖSTER, T. and T. PAVELKA. eds. *The 7th International Days of Statistics and Economics*. Slaný: Melandrium, 2013. pp. 947–958. ISBN 978-80-86175-87-4.
- [11] MOHELSKÁ, H. and M. SOKOLOVÁ. Effectiveness of Using E-learning For Business Disciplines: The Case of Introductory Management. *E+M Ekonomie a Management*, 2014, **17**(1): 82–92. ISSN 1212-3609.
- [12] NEDOMOVÁ, L., P. DOUCEK, and M. MARYŠKA. ICT Professionals in the Czech Economy, Structural Changes in Human Resources. In *Strategic Management and its Support by Information Systems*. Uherské Hradiště: VŠB – Technical University of Ostrava, 2015. [in print]
- [13] SMUTNÝ, Z., L. NEDOMOVÁ and H. MIKOVCOVÁ. Knowledge Analysis of Registered Students for Combined and Full-Time Study at the University of Economics, Prague. In *11th International Conference on Efficiency and Responsibility in Education (ERiE 2014)*. Prague: Czech University of Life Sciences Prague, 2014. pp. 751–758. ISBN 978-80-213-2468-8.

Lukáš Melecký, Michaela Staníčková

VŠB-Technical University of Ostrava, Faculty of Economics,

Department of European Integration

Sokolská třída 33, 701 21 Ostrava, Czech Republic

email: lukas.melecky@vsb.cz, michaela.stanickova@vsb.cz

RTS and Efficiency Frontier Estimation for Comparing Competitiveness: Case of EU Regions

Abstract

Efficiency is often considered as central issue in analyses of economic growth, the effects of fiscal policies, the pricing of capital assets, the level of investments, the technology changes and production technology, and other economic topics and indicators. Differences in efficiencies across different territories are seen as important policy targets by most of governments. Focus of the paper is dealing the problem of searching the efficient frontier and group of similar units using Data Envelopment Analysis (DEA) method. DEA is a suitable tool for selecting the appropriate benchmarking set (or reference set with respect to obtained efficient frontier) and understanding the implications of this choice for improving efficiency of decision making units, i.e. the European Union NUTS 2 regions based on their factor endowment identified by Regional Competitiveness Index 2013 (RCI2013) approach. Using DEA is supposed the way how to choose an optimal number of groups coming into efficient frontier analysis. Firstly it's necessary to estimate returns to scale orientation, to find the closest characteristics for a given region according to a previously specified criterion of similarity. After fulfilment this criterion and creating optimal groups of similar regions, it's possible to evaluate level of efficiency of homogenous groups. The idea laying behind this approach is that inefficient regions can learn more easily from those, that are more similar; and closer similarity may show for the inefficient regions how to achieve the improvement with less effort. This could be tool of regional strategic management to identify strengths and weakness of individual region with respect to other ones. The main contribution of this paper is thus to determine efficiency scores based on the efficient projection to the frontier along both the input and output spaces simultaneously.

Key Words

DEA in/efficiency, efficient frontier, EU NUTS 2 regions, RCI index, RTS

JEL Classification: C61, C67, R11, R13, R15, R58

Introduction

Comparative analysis of efficiency in public sector is starting point for studying the role of efficiency, effectiveness and performance regarding economic governance of resources utilization by public management for achieving medium/long-term objectives of economic recovery and sustainable development of national economies [8]. Increasing productivity is generally considered to be the only sustainable way of improving living standards in the long term. Topic of high living standards is one of the main aims of competitiveness which is a goal of economic policies in many countries, thus the European Union (EU) too, especially nowadays in economic crisis impacts [5]. Statistical evidence helps policy makers understand the routes to productivity growth, especially those which

can be influenced by government, can help lead to better policy. An economy is competitive if firm in that economy faces lower unit costs than firm from other economy. Every factor that increases the productivity and, therefore, lowers the unit costs of firms contributes to the competitiveness of the respective economy [8]. Policy makers are often faced with the task of evaluating relative performance of different politics, teams, units, settings of political aims and especially instruments etc. In cases where each of these performers has a set of common inputs that they utilize in order to produce a set of common outputs, Data Envelopment Analysis (DEA) has become one of the more popular tools for efficiency analysis. DEA is especially useful when there are multiple inputs and outputs with different units of measure. That is, in instances when it is not desirable to translate each unit of measure to a common scale, DEA is often the comparison method of choice. The purpose of these comparisons is to determine the best performers along with guidelines for improving the rest. Typically, these guidelines stem from benchmarking against a set of good performers in order for a poor performer to improve. Not surprisingly, the selection of the decision making units (DMUs) to benchmark against is a critical part of this analysis [4]. The focus of this paper is to select the appropriate benchmarking (or reference) set with respect to obtained efficient frontier and understanding the implications of this choice for improving efficiency of decision making units represented by EU28 NUTS 2 regions. The benchmark is based on factor endowment of NUTS 2 regions identified by Regional Competitiveness Index (RCI) approach.

1. Importance of the Efficient Frontier Estimation

To find the way for choosing an optimal number of groups to empirical analysis, firstly, it's necessary to find the closest characteristics for a given unit according to a previously specified criterion of similarity. Similarity can be interpreted as closeness between the inputs and outputs of the assessed unit and the proposed targets, and this closeness can be measured by using either different distance functions or different efficiency measures. Depending on how closeness is measured, the paper solves the problem of searching the efficient frontier and group of similar units by using multicriteria DEA. This approach should guarantee to reach the closest projection point on the Pareto-efficient frontier. Thus, proposed way leads to the closest targets by means of a single-stage procedure, which is easier to handle than those based on algorithms aimed at identifying all the facets of the efficient frontier. Melecký and Staníčková [6] have compared suitability of DEA and also Cluster Analysis to identify the best way how to define/divide group of units having similar efficient frontier measures. With respect to DEA characteristics and one the most important requirements on the relation between the number of units on the one side and the number of inputs and outputs on the other side; then with respect to classification method and expression similarity, DEA approach based on function of Obtain Levels seems to be more convenient way how to choose an optimal number of groups covering all evaluated units coming into further efficiency analysis.

DEA originating from Farrell's work and popularized by Charnes, Cooper and Rhodes (CCR model), provides a flexible nonparametric doctrine for empirical production analysis. In recent decades, DEA has rapidly expanded towards new application areas. DEA evaluates an efficiency of a set of homogenous group (DMUs). The aim of DEA method is to examine DMU into two categories which called efficient DMUs and inefficient DMUs, i.e. if they are efficient of inefficient by the size and quantity of consumed resources and

by the produced outputs [3]. Efficient DMUs have equivalent efficiency score. However, they don't have necessarily the same performance. DMU is efficient if the observed data correspond to testing whether the DMU is on the imaginary efficient frontier. All other DMU are simply inefficient. For every inefficient DMU, DEA identifies a set of corresponding efficient units that can be utilized as benchmarks for improvement. But this improvement could be the best, we promotes the idea that inefficient DMUs can learn more easily from those, that are more similar; and closer similarity may show for the inefficient DMUs how to achieve the improvement with less effort. DEA thus offers a possible way for creating similar groups.

The intent of frontier estimation is to deduce empirically the production function in the form of an efficient frontier. That is, rather than knowing how to convert functionally inputs to outputs, these methods take the inputs and outputs as given, map out the best performers, and produce a relative notion of the efficiency of each. The problem with the existing methods is that they each measure efficiency in a conceptually suspect, albeit computationally effective, way. If the DMUs are plotted in their input/output space, then an efficient frontier that provides a tight envelope around all of the DMUs can be determined. The main function of this envelope is to get as close as possible to each DMU without passing by any others. Evaluated DMUs can be divided into groups-levels according to all efficient frontiers via Context-Dependent DEA (CD-DEA). By this stratification, into efficiency analysis we will enter more homogenous groups of regions, which will be evaluated separately according to closer features, as was confirmed by Melecký and Staníčková [6]. Based on this approach, it's necessary to divide evaluated units (regions) into set of homogenous groups for finding relevant efficiency and inefficiency scores what will be made based on CD-DEA approach and we'll obtain levels, i.e. efficient frontiers for homogenous DMUs. It is necessary to report both the overall efficiency and inefficiency scores. In the case of inefficient DMUs, it is possible to define "peer-units" as identifications efficient targets and range of improvements.

2. Empirical Analysis: Topic of DEA and Database Specifications

The first step in efficiency analysis is Returns to Scale (RTS) estimation. Why is necessary to decide for orientation of RTS for evaluation of regions by DEA method? Various types of DEA models can be used, depending upon the problem at hand. Used DEA model can be distinguished by the scale and orientation of the model. If one cannot assume that economies of scale do not change, then a variable returns to scale (VRS) type of DEA model, the one selected here, is an appropriate choice (as opposed to a constant returns to scale, (CRS) model). Furthermore, if in order to achieve better efficiency, governments' priorities are to adjust their outputs (before inputs), then an output oriented (OO) DEA model, rather than an input oriented (IO) model, is appropriate. From this point of view, here it is necessary to note that most of mentioned studies above used only one common type of DEA model – output oriented model which is considered as suitable for measuring efficiency of regions in the case of links between competitiveness and efficiency links. But based on RTS estimation and classifications of regions into RTS, then DEA model choice will be characterized. In Table 1 is possible to see what specification of returns to scale were estimated as the best way to calculate efficiency of regions. In Table 3 and Annex 1

are concrete RTS orientation for each of evaluated NUTS 2 regions. Based on RTS specification, it was possible to calculate CD-DEA to obtain efficient frontier. Calculations were made separately for group of EU15 ('old' EU Member States) and EU13 ('new' EU Member States) regions with respect to their integration links within the EU. In following Table 1 are shown also number of identified frontiers and respected DEA model, i.e. DEA models of efficiency and super-efficiency for EU13 NUTS 2 regions. EU15 NUTS 2 regions were in the second step calculated by continuing CD-DEA and efficiency scores were obtained based on efficient levels comparison – there were identified two efficient levels, resp. group of countries. EU13 countries are thus much more homogenous group, but the distinction is not so high.

Tab. 1: RTS Estimation to EU NUTS 2 Regions for RCI2013 and DEA Model Results

EU	NUTS 2	RTS	Efficiency Frontier	DEA Model
EU15	199	Constant	Level1 (CRS) – 199 NUTS 2 Level2 (CRS) – 6 NUTS 2 (ES13, ES23, ES42, ES61, FR42, UKL1)	Context Dependent DEA
EU13	57	Constant	Level1 (CRS) – 57 NUTS 2	OO CCR CRS, OO APM CRS

Source: own elaboration, 2015

For calculations of EU13 NUTS 2 regions' efficiency it is used output oriented (OO) CCR model with CRS. The way in which DEA method computes efficiency scores can be explained briefly using mathematical notation in model (1) [3]:

$$\begin{aligned}
 &\max g = \phi_q + \varepsilon(e^T s^+ + e^T s^-), \\
 &\text{subject to} \\
 &\quad X\lambda + s^- = x_q, \\
 &\quad Y\lambda - s^+ = \phi_q y_q, \\
 &\quad \lambda, s^+, s^- \geq 0,
 \end{aligned} \tag{1}$$

where g is the coefficient of efficiency of unit U_q ; ϕ_q is radial variable indicates required rate of increase of output; ε is infinitesimal constant; T is monotonicity which means that all inputs and outputs are freely (or strongly) disposable; e denotes the convex hull; e^T means convexity what is equivalent to decreasing marginal rates of substitution (between inputs, between outputs and between inputs and outputs); $e^T \lambda$ is convexity condition, in the case of CRS: $e^T = (1, 1, \dots, 1)$; s^+ and s^- are vectors of slack variables for inputs and outputs; λ represent vector of weights assigned to individual units; x_q means vector of input of unit U_q ; y_q means vector of output of unit U_q ; X is input matrix; Y is output matrix. In CCR model aimed at outputs the efficiency coefficient of efficient DMU equals 1, but the efficiency coefficient of inefficient DMU is greater than 1.

In CCR model, efficiency coefficients of efficient units equal to 1. Depending on chosen model, but also on the relationship between number of units and number of inputs and outputs, number of efficient units can be relatively large. Due to the possibility of efficient units' classification, it is used Andersen-Petersen's model (APM) of super efficiency. Following constant return to scale (CRS) model is output oriented dual version of APM (2) [1]:

$$\max \mathbf{g} = \phi_k + \varepsilon \left(\sum_{i=1}^m \mathbf{s}_i^- + \sum_{r=1}^s \mathbf{s}_r^+ \right), \quad (2)$$

subject to

$$\sum_{\substack{j=1 \\ j \neq k}}^n \lambda_j \mathbf{x}_{ij} + \mathbf{s}_i^- = \mathbf{x}_{ik},$$

$$\sum_{\substack{j=1 \\ j \neq k}}^n \lambda_j \mathbf{y}_{rj} - \mathbf{s}_r^+ = \phi_k \mathbf{y}_{rk},$$

$$\lambda_j, \mathbf{s}_r^+, \mathbf{s}_i^- \geq 0,$$

$$j = 1, 2, \dots, n; r = 1, 2, \dots, s; i = 1, 2, \dots, m.$$

where x_{ij} and y_{rj} are i -th inputs and r -th outputs of DMU $_j$; ϕ_k is efficiency index (intensity factor) of observed DMU $_k$; λ_j is dual weight which show DMU $_j$ significance in definition of input-output mix of hypothetical composite unit, DMU $_k$ directly comparing with. The rate of efficiency of inefficient units ($\phi_k > 1$) is identical to model (1); for units identified as efficient in model (1), provides OO APM (2) the rate of super efficiency lower than 1, i.e. $\phi_k \leq 1$. For solution of DEA method we used software tool based on solving linear programming problems – the DEA Frontier – Microsoft Office Add-In Solver. In CD-DEA, basic approach in the form of CRS function for obtain levels generating all the efficient frontiers is used (see Annex 1 and Annex 2). With respect to obtained results, it's possible to say that optimal solution is presented by two groups/levels of units. The object is sorted into homogenous groups of DMUs (regions) based on the size and quantity of consumed resources and by the produced outputs. Via Obtain Levels function, a continuous calculation in CD-DEA method, initial number of eu15 NUTS 2 regions was divided in two groups. Efficiency analysis is based on RCI2013 approach, resp. on its pillars describing inputs and outputs dimensions of competitiveness. These pillars of RCI (initial variables for empirical analysis) are grouped according to the different dimensions (input versus output aspects) of competitiveness they describe. Terms 'inputs' and 'outputs' are meant to classify pillars into those which describe driving forces of competitiveness, and those which are direct or indirect outcomes of a competitive society and economy [2]. Table 2 specifies input and output dimensions of RCI2013 pillars.

Tab. 2: Input and Output Dimensions of RCI2013 Pillars

Dimension	RCI2013 Pillars
Input dimension	(1) Institutions, (2) Macroeconomic stability, (3) Infrastructure, (4) Health, (5) Basic education, (6) Higher education and lifelong learning, (7) Technological readiness
Output dimension	(1) Labour market efficiency, (2) Market size, (3) Business sophistication, (4) Innovation

Source: [2]; own elaboration, 2015

3. DEA Results for Efficiency Evaluation of EU NUTS 2 Regions in RCI2013

The best results are traditionally achieved by economically powerful regions (in most cases) old and also new EU Member States. In Table 3 and Annex 2, results are highlighted by traffic light method. Colour scale divides the relevant group of coefficient of efficiency using three colours (green, yellow, and red and their corresponding colour shadows), the middle colour scheme corresponds to 50 percentile (yellow), the other two colours are above (green – the best results, i.e. the most efficient NUTS 2 regions) and below (red – the worst results, i.e. the most inefficient NUTS 2 regions) percentile value of 50. In CD-DEA is this meaning of colour-highlighted the opposite. Comparisons can enable NUTS 2 regions to identify their strengths and weaknesses in a European context and to enrich their development strategies, project ideas and cooperation arrangements. In the core of Europe all types of regions are doing well with regard to both restructuring potential and economic situation, indicating a high potential regional competitiveness. The European territorial pattern seems mainly shaped by different national levels. In addition, a substantial difference exists between rural and urban areas. The more urbanised regions have as expected the best potentials for pursuing strategies of innovation and knowledge-economy based on a particularly creative, segment of the competitive society. Some areas more than others may take on the idea of new/creative industries, or on the idea of traditional industries as a motor for economic development and innovation.

Conclusion

Within the whole EU, there are two groups of countries – EU15, i.e. old and EU13, i.e. new Member States having different initial, not only economic, conditions for future development. A European dimension is becoming essential for effective development of smaller or larger NUTS 2 regions. Geographic, demographic and cultural heterogeneity of the EU brings also differences in socio-economic position of Member States, and especially their regions. From this point of view, it's firstly necessary to recognize specific characteristics of both groups, their advantages and disadvantages, for more efficient cooperation. The purpose of this paper was recognize how to determine the appropriate group exhibiting similar features for subsequent efficiency evaluation, and to identify (within the relevant group of evaluated units) the differences in efficiency of EU NUTS 2 regions. In the paper, the scores of efficiency and inefficiency for each region were obtained. Obtained results by DEA approach show that targets are the coordinates of the efficient projection point on the frontier and thus represents levels of operation of inputs and outputs which would make the corresponding inefficient DMU, thus EU15 and EU13 NUTS 2 region perform efficiently – but this improvement will be possible to propose based on subsequent efficiency analysis by DEA method. Based on results, it's possible in the future paper to calculate best-practice units (i.e. peer units) as a benchmark what improve. By calculating peer units, it'll get results where is convenient to decrease inputs and increase outputs and what will be much more efficient combination of inputs and outputs that the region will increase the efficient frontier. Different results in economic performance and living standards of the population indicate the status of the competitiveness of country and its regions. Each territory should know were lying its competitive advantages and advantages and try to strengthen its advantages and reduce

Tab. 3: RTS Estimation to EU13 NUTS 2 Regions for RCI2013 and DEA Model Results

NUTS 2	$\Sigma\lambda$	OO RTS	OO CCR CRS	OO APM CRS	Reordered NUTS 2		Rank
BG31	1,000	Constant	1,000	0,706	CZ01	1,000	1
BG32	1,000	Constant	1,000	0,836	CZ02	1,000	2
BG33	1,000	Constant	1,000	0,829	PL32	0,992	3
BG34	1,000	Constant	1,000	0,202	PL61	0,984	4
BG41	1,000	Constant	1,000	0,790	PL63	0,976	5
BG42	1,000	Constant	1,000	0,954	PL52	0,973	6
CY00	1,000	Constant	1,000	0,837	HU22	0,963	7
CZ01	1,000	Constant	1,000	1,000	CZ05	0,957	8
CZ02	1,000	Constant	1,000	1,000	PL21	0,957	9
CZ03	1,000	Constant	1,000	0,889	BG42	0,954	10
CZ04	1,000	Constant	1,000	0,843	PL51	0,954	11
CZ05	1,000	Constant	1,000	0,957	CZ06	0,950	12
CZ06	1,000	Constant	1,000	0,950	PL42	0,950	13
CZ07	1,000	Constant	1,000	0,923	PL41	0,946	14
CZ08	1,000	Constant	1,000	0,932	PL33	0,945	15
EE00	1,000	Constant	1,000	0,834	RO12	0,944	16
HR03	1,000	Constant	1,000	0,926	SK02	0,944	17
HR04	1,000	Constant	1,000	0,808	SK03	0,942	18
HU10	1,000	Constant	1,000	0,819	SI01	0,941	19
HU21	1,000	Constant	1,000	0,893	PL62	0,937	20
HU22	1,000	Constant	1,000	0,963	RO41	0,935	21
HU23	1,000	Constant	1,000	0,853	CZ08	0,932	22
HU31	1,000	Constant	1,000	0,824	HR03	0,926	23
HU32	1,000	Constant	1,000	0,775	CZ07	0,923	24
HU33	1,000	Constant	1,000	0,690	PL31	0,921	25
LV00	1,000	Constant	1,000	0,814	RO22	0,921	26
MT00	1,000	Constant	1,000	0,713	PL43	0,918	27
PL11	1,000	Constant	1,000	0,911	PL34	0,916	28
PL12	1,000	Constant	1,000	0,781	SK04	0,916	29
PL21	1,000	Constant	1,000	0,957	PL11	0,911	30
PL22	1,000	Constant	1,000	0,898	PL22	0,898	31
PL31	1,000	Constant	1,000	0,921	HU21	0,893	32
PL32	1,000	Constant	1,000	0,992	CZ03	0,889	33
PL33	1,000	Constant	1,000	0,945	RO11	0,873	34
PL34	1,000	Constant	1,000	0,916	SI02	0,867	35
PL41	1,000	Constant	1,000	0,946	RO31	0,856	36
PL42	1,000	Constant	1,000	0,950	HU23	0,853	37
PL43	1,000	Constant	1,000	0,918	CZ04	0,843	38
PL51	1,000	Constant	1,000	0,954	CY00	0,837	39
PL52	1,000	Constant	1,000	0,973	BG32	0,836	40
PL61	1,000	Constant	1,000	0,984	EE00	0,834	41
PL62	1,000	Constant	1,000	0,937	BG33	0,829	42
PL63	1,000	Constant	1,000	0,976	HU31	0,824	43
RO11	1,000	Constant	1,000	0,873	HU10	0,819	44
RO12	1,000	Constant	1,000	0,944	LV00	0,814	45
RO21	1,000	Constant	1,000	0,758	HR04	0,808	46
RO22	1,000	Constant	1,000	0,921	RO42	0,802	47
RO31	1,000	Constant	1,000	0,856	BG41	0,790	48
RO32	1,000	Constant	1,000	0,578	PL12	0,781	49
RO41	1,000	Constant	1,000	0,935	SK01	0,776	50
RO42	1,000	Constant	1,000	0,802	HU32	0,775	51
SI01	1,000	Constant	1,000	0,941	RO21	0,758	52
SI02	1,000	Constant	1,000	0,867	MT00	0,713	53
SK01	1,000	Constant	1,000	0,776	BG31	0,706	54
SK02	1,000	Constant	1,000	0,944	HU33	0,690	55
SK03	1,000	Constant	1,000	0,942	RO32	0,578	56
SK04	1,000	Constant	1,000	0,916	BG34	0,202	57

Source: Own calculation and elaboration, 2015

its disadvantages, i.e. key factors of competitiveness. As development potentials and opportunities and the interplay of development trends and policies differ between areas, there is no one-size-fits-all solution. Each NUTS 2 region must make its own decisions about the right combination of policy objectives in the field of competitiveness that will guide its development. DEA results should be convenient tool for identifying strengths and weakness for creating regional strategies.

Acknowledgement

This paper was created under SGS project (SP2015/106) of Faculty of Economics, VŠB-Technical University of Ostrava and Operational Programme Education for Competitiveness – Project CZ.1.07/2.3.00/20.0296.

References

- [1] ANDERSEN, P. and N. C. PETERSEN. A Procedure for Ranking Efficient Units in Data Envelopment Analysis. *Management Science*, 1993, **39**(10): 1261–1264. ISSN 0025-1909.
- [2] ANNONI, P. and L. DIJKSTRA. *EU Regional Competitiveness Index 2013*. Luxembourg: Publication Office of the European Union, 2013. ISBN 978-92-79-32370-6.
- [3] COOK, W. D. and L. M. SEIFORD. Data envelopment analysis (DEA) – Thirty years on. *European Journal of Operation Research*, 2009, **192**(1): 1–17. ISSN 0377-2217.
- [4] FREI, F. X. and P. T. HARKER. Projections Onto Efficient Frontiers: Theoretical and Computational Extensions to DEA. *Journal of Productivity Analysis*, 1999, **11**(3): 275–300. ISSN 1573-0441.
- [5] FOJTÍKOVÁ, L. Business Strategy of the European Union on the Way Out of the Crisis. In *Proceedings from the 9th International Conference Economic Policy in the European Union Member Countries*, 2011, pp. 92–104. ISBN 978-80-248-2458-1.
- [6] MELECKÝ, L. and M. STANÍČKOVÁ. NUTS 2 regions classification: comparison of cluster analysis and DEA method. In KLÍMOVÁ, V. and V. ŽÍTEK. eds. *Conference Proceedings from the 17th International Colloquium on Regional Sciences*. Brno: Masaryk University, 2014, pp. 45–53. ISBN 978-80-210-6840-7.
- [7] MIHAIU, D. M., A. OPREANA, and M. P. CRISTESCU. Efficiency, Effectiveness and Performance of the Public Sector. *Romanian Journal of Economic Forecasting*, 2010, **4**(1): 132–147. ISSN 1582-6163.
- [8] VAHALÍK, B. Export diversification of the European Union and BRICS countries. In *Proceedings of the 2nd International Conference on European Integration 2014*. Ostrava: VŠB-Technical University of Ostrava, 2014, pp. 731–739. ISBN 978-80-248-3388-0.

Annex 1: Application of RTS Estimation to EU15 NUTS 2 Regions for RCI2013

NUTS2	Σλ	OO RTS	NUTS2	Σλ	OO RTS	NUTS2	Σλ	OO RTS	NUTS2	Σλ	OO RTS	NUTS2	Σλ	OO RTS
AT11	1,000	Constant	DE72	1,000	Constant	FR22	1,000	Constant	IE01	1,000	Constant	PT15	1,000	Constant
AT12	1,000	Constant	DE73	1,000	Constant	FR23	1,000	Constant	IE02	1,000	Constant	PT16	1,000	Constant
AT13	1,000	Constant	DE80	1,000	Constant	FR24	1,000	Constant	ITC1	1,000	Constant	PT17	1,000	Constant
AT21	1,000	Constant	DE91	1,000	Constant	FR25	1,000	Constant	ITC2	1,000	Constant	PT18	1,000	Constant
AT22	1,000	Constant	DE92	1,000	Constant	FR26	1,000	Constant	ITC3	1,000	Constant	PT20	1,000	Constant
AT31	1,000	Constant	DE93	1,000	Constant	FR30	1,000	Constant	ITC4	1,000	Constant	PT30	1,000	Constant
AT32	1,000	Constant	DE94	1,000	Constant	FR41	1,000	Constant	ITD1	1,000	Constant	SE11	1,000	Constant
AT33	1,000	Constant	DK01	1,000	Constant	FR42	0,976	Increasing	ITD2	1,000	Constant	SE12	1,000	Constant
AT34	1,000	Constant	DK02	1,000	Constant	FR43	1,000	Constant	ITD3	1,000	Constant	SE21	1,000	Constant
BE10	1,000	Constant	DK03	1,000	Constant	FR51	1,000	Constant	ITD4	1,000	Constant	SE22	1,000	Constant
BE21	1,000	Constant	DK04	1,000	Constant	FR52	1,000	Constant	ITD5	1,000	Constant	SE23	1,000	Constant
BE22	1,000	Constant	DK05	1,000	Constant	FR53	1,000	Constant	ITE1	1,000	Constant	SE31	1,000	Constant
BE23	1,000	Constant	ES11	1,000	Constant	FR61	1,000	Constant	ITE2	1,000	Constant	SE32	1,000	Constant
BE24	1,000	Constant	ES12	1,000	Constant	FR62	1,000	Constant	ITE3	1,000	Constant	SE33	1,000	Constant
BE25	1,000	Constant	ES13	0,961	Constant	FR63	1,000	Constant	ITE4	1,000	Constant	UKC1	1,000	Constant
BE31	1,000	Constant	ES21	1,000	Constant	FR71	1,000	Constant	ITF1	1,000	Constant	UKC2	1,000	Constant
BE32	1,000	Constant	ES22	1,000	Constant	FR72	1,000	Constant	ITF2	1,000	Constant	UKD1	1,000	Constant
BE33	1,000	Constant	ES23	0,981	Increasing	FR81	1,000	Constant	ITF3	1,000	Constant	UKD2	1,000	Constant
BE34	1,000	Constant	ES24	1,000	Constant	FR82	1,000	Constant	ITF4	1,000	Constant	UKD3	1,000	Constant
BE35	1,000	Constant	ES30	1,000	Constant	FR83	1,000	Constant	ITF5	1,000	Constant	UKD4	1,000	Constant
DE11	1,000	Constant	ES41	1,000	Constant	FR91	1,000	Constant	ITF6	1,000	Constant	UKD5	1,000	Constant
DE12	1,000	Constant	ES42	0,982	Increasing	FR92	1,000	Constant	ITG1	1,000	Constant	UKE1	1,000	Constant
DE13	1,000	Constant	ES43	1,000	Constant	FR93	1,000	Constant	ITG2	1,000	Constant	UKE2	1,000	Constant
DE14	1,000	Constant	ES51	1,000	Constant	FR94	1,000	Constant	LU00	1,000	Constant	UKE3	1,000	Constant
DE21	1,000	Constant	ES52	1,000	Constant	GR11	1,000	Constant	NL11	1,000	Constant	UKE4	1,000	Constant
DE22	1,000	Constant	ES53	1,000	Constant	GR12	1,000	Constant	NL12	1,000	Constant	UKF1	1,000	Constant
DE23	1,000	Constant	ES61	0,971	Increasing	GR13	1,000	Constant	NL13	1,000	Constant	UKF2	1,000	Constant
DE24	1,000	Constant	ES62	1,000	Constant	GR14	1,000	Constant	NL21	1,000	Constant	UKF3	1,000	Constant
DE25	1,000	Constant	ES63	1,000	Constant	GR21	1,000	Constant	NL22	1,000	Constant	UKG1	1,000	Constant
DE26	1,000	Constant	ES64	1,000	Constant	GR22	1,000	Constant	NL23	1,000	Constant	UKG2	1,000	Constant
DE27	1,000	Constant	ES70	1,000	Constant	GR23	1,000	Constant	NL31	1,000	Constant	UKG3	1,000	Constant
DE30	1,000	Constant	FI13	1,000	Constant	GR24	1,000	Constant	NL32	1,000	Constant	UKH1	1,000	Constant
DE41	1,000	Constant	FI18	1,000	Constant	GR25	1,000	Constant	NL33	1,000	Constant	UKH2	1,000	Constant
DE42	1,000	Constant	FI19	1,000	Constant	GR30	1,000	Constant	NL34	1,000	Constant	UKH3	1,000	Constant
DE50	1,000	Constant	FI20	1,000	Constant	GR41	1,000	Constant	NL41	1,000	Constant	UKI1	1,000	Constant
DE60	1,000	Constant	FR10	1,000	Constant	GR42	1,000	Constant	NL42	1,000	Constant	UKI2	1,000	Constant
DE71	1,000	Constant	FR21	1,000	Constant	GR43	1,000	Constant	PT11	1,000	Constant	UKJ1	1,000	Constant

Note: OO RTS = Output Oriented Returns to Scale, NUTS = Nomenclature of Units for Territorial Statistics. Source: Own calculation and elaboration, 2015

Jozefína Simová

Technical University of Liberec, Faculty of Economics,
Department of Marketing and Trade
Studentská 1402/2, 461 17 Liberec 1, Czech Republic
email: jozefina.simova@tul.cz

Factors of Market Environment Affecting Retailing in the Period of Economic Crisis as Perceived by Clothing Retailers

Abstract

The paper presents how Czech clothing retailers perceived influence of environmental changes associated with the economic crisis on their retail operations and businesses in 2007-2012. For this purpose, research investigating the relationship between retailers and their retail environment, consumers, competition, and sourcing in an attempt to estimate the impact of the mentioned factors on clothing retailing in the Czech Republic was conducted in 2014. There were more than 400 clothing retailers contacted in selected towns representing all five town population categories in different regions of the Czech Republic. The research included different formats of clothing shops – department store and hypermarket, mid-range clothing store, boutique, discount and second-hand stores located in small and large towns. Consumer income and social factors were considered to have the greatest impact on changes in clothing retailing followed by the mix of factors related to retail competition and consumers' needs, behaviour and store perception. Major factors influencing activities of clothing retailing in 2007-2012 identified by factor analysis were consumers, political and legislative environment, social and economic environment, and competition (domestic and foreign). The impact of these factors on clothing retailing varied to some extent by town categories and retailers' background characteristics. The development of clothing retailing was influenced by consumers, political, legislative, social and economical factors to a great extent mainly in small and medium-size towns. In terms of the retail characteristics used in the analysis, it seems that different retail formats perceived different factors to have the main impact on their retail operations. Large retailers with more than 100 employees considered consumers to affect their business to a great extent. Retailers employing 26-50 employees stated that consumers, social and economical environment and competition had influenced their activities to the great extent. Small clothing retailers with annual turnover of less than CZK 2 million considered social and economic factors to influence their business to the greater extent than other clothing retailers.

Key Words

clothing, retailing, environment, economic crisis, change, Czech Republic

JEL Classification: M31

Introduction

Probably the most significant factor in the 21st century affecting the economic environment and market structure development was the global economic crisis in 2007-2012. The impact of the global economic crisis on companies is evident and has been described by many academics and practitioners (Hájek, Režný, 2014; Kraft, Bednářová,

Lungová, Nedomelová, Sojková, 2010; Kraft, Bednářová, Lungová, Nedomelová, Sojková 2011; Švihlíková, 2010; Kislingerová, 2010; Kohout, 2009). The new market environment has brought political, legal, social, economic and technological changes as well as changes in consumer behaviour and competition that happen more quickly and more unpredictably. Rapid changes in the market have brought considerable challenge as well as new possibilities and opportunities to companies (Antonová & Zapletalová, 2014). Many companies struggled and competition got more intense (Dědková, Blažková, 2014). Since economic development is closely related to the retailing system, changes have taken place in the retailing sector, as well.

The objective of the paper is not to give a full description of economic changes in the Czech market in the period of the economic crisis. Instead, the paper presents how clothing retailers perceived influence of environmental changes associated with the economic crisis on their retail operations and businesses. For this purpose, research focused on investigating the relationship between retailers and their retail environment, consumers, competition, and sourcing in an attempt to estimate the impact of the mentioned factors on clothing retailing in the Czech Republic was conducted in 2014. It was an analytic qualitative research orientated less towards representativeness and more towards finding associations and explanations.

1. Environmental theories of retail development

There is no doubt that changes in retailing are caused by changes in the economic, social, culture, political and technological environments of the market in which retailers operate. Besides environmental factors, other driving forces of changes in retailing are customers, competitors and retailers themselves. A number of theories can be given to support this knowledge. Environmental theory states that changes in retailing result from economic, demographic, social, cultural, legal and technological conditions of the market place. Retail institutions emerge, develop, mature and decline in direct response to changes in the business environment. Similarly, retail innovations occur when operational conditions are favourable and only those that can adapt to changing environmental circumstances are likely to survive and prosper (Brown, 1987, 1988). It is apparently very difficult to identify all environmental changes that influence the operation of retail institutions. However, changes in the consumer character (demographic, social, economic or cultural), changes in technology and changes in competition are considered to be the major types of changes in the retail environment affecting the development of retail establishments (Gist, 1968 quoted in Brown, 1988).

Different environmental theory considers specific elements of the environmental mix, such as:

- sociological forces (consumer behaviour or product preferences),
- legal constraints (e.g. anti-chain store legislation)
- technological development (mass transit, motor cars, telephones, computers, internet) to be the single and most important determinant of retail institutional change (Brown, 1987, 1988).

Some other environmental theories adapting Darwinian theory of natural selection into the context of retail institutional change contends that the retail institutions that can best adapt to environmental conditions and changes (e.g. changes in consumer behaviour and desires, in technology, in competitive behaviour, in the legal environment, etc.) are the ones most likely to prosper or survive. This explains the success of some institutional “species” and the failure of others (Gist, 1968 quoted in Brown, 1988). Dreesman (1968) using biological analogies and specified patterns to describe behaviour of retailing institutions contended that the emergence of new retail species such as department store or chain store was sudden, violent and followed by a long period of incremental development. (Goldman, 1975; Mason, Mayer, 1978). Economic parallels to ecological concepts like convergence, hypertrophy, regression and assimilation are also apparent. In relation to environmental factors, a parasitic relationship where one institution depends on another for survival (supermarkets and trading stamp companies); commensalism where different retail species share the same environment; and symbiosis where institutions benefit from their mutual dependency have also been highlighted (Brown, 1987, 1988).

The environmental theories suffer from their very environmental emphasis. They cannot predict the possible ways in which changing environmental conditions may affect a particular retail institution simply because environmental changes represent both, “friendly” and “unfriendly” factors which may determine retail operations. The theories also suffer from the fact that they consider retailers as passive when trying to adapt to the changing environmental conditions and treat them in strict biotic terms. It should be noted that the environment does not determine what will arise. It only creates possibilities which individuals or organisations may exploit or reject. Despite the fact that several scholars attempted to quantify the relationship between the changing structure of retailing and a range of socio-economic factors (e.g. population size, density and rate of growth, per capita income, employment and urban form) in order to develop models that would help to predict retail trends in one nation from developments in other, it was found that development of social, political, legal and historical forces in individual countries indicates institutional diversity rather than uniformity in retail evolution (Brown, 1987).

2. Methodology

The factors associated with changes in clothing retailing in the period of economic crisis within the Czech Republic explored by the research included the influence of environmental (political, legislative, economical, social and technological) factors on clothing retailing, the influence of consumers, competition and sourcing on clothing retailing. The objective of this paper is to identify the most important factors influencing changes of clothing retailing and to examine the extent of their impact on clothing retailing in relation to particular retail store characteristics and the population size. The extent of the influence of particular variables on changes in clothing retailing was measured by a five point rating scale.

The data were collected by personal structured interview conducted with different types of clothing retailers to achieve higher response rate and control over who answered questions. Retailers were selected by non-probability quota sampling and contacted in judgementally selected towns representing all five town population size categories

(towns up to 10,000 inhabitants, 10,000-19,999 inhabitants, 20,000-49,999 inhabitants, 50,000-99,999 inhabitants and towns with more than 100,000 inhabitants). The research included different formats of clothing shops – department store and hypermarket, mid-range clothing store, boutique, discount and second-hand stores located in small and large towns. The mid-range stores represented a category of clothing stores that could be positioned as a store between a boutique and a discount store (somewhere in the middle of the price and quality continua). This category of clothing stores comprises both multiple and small independent clothing retailers of the same price-quality market position.

Means and standard deviation were used to perform a descriptive analysis of the data. Factor analysis conducted by fifteen variables associated with changes in retailing (designed in the area of retail environment, consumers, competition and sourcing) was used to identify the main dimensions driving changes in clothing retailing. The impact of selected factors on changes in clothing retailing was examined by retail store characteristics and also by the size of population.

3. Characteristics of the sample

The sample consisted of 409 clothing retailers contacted in selected towns representing all five town population categories in various regions of the Czech Republic.

About 45 percent of clothing retailers were interviewed in the towns with more than 50,000 inhabitants. The sample included 31 percent of mid-range clothing stores, 29 percent of boutiques, 28 percent of department stores and hypermarkets selling clothes, and 12 percent of discount and second-hand stores.

Most of the interviewed retailers (67 percent) were established after the year 2000. About 55 percent of respondents have been operating within the Czech Republic for less than 10 years. From those that indicated their turnovers (87 percent), about 37 percent were small clothing retailers with a turnover of less than CZK 2 million per year, 19 percent of the retailers stated a turnover of CZK 2-5 million per year, 8 percent of clothing retailers had a turnover of CZK 5-10 million per year and 36 percent of retailers belonged to the category with more than CZK 10 million per year.

About 71 percent of selected clothing retailers were companies employing fewer than 10 people, 12 percent of them employed 11-25 people, 3 percent employed 26-50 people, 3 percent employed 51-100 and about 11 percent employed more than 100 employees.

4. Main environmental factors associated with changes of clothing retailing in the Czech Republic as perceived by clothing retailers

The economic crisis in the Czech Republic brought a rapid decline of the retail turnover (Antonová, Zapletalová, 2014). The annual decline of the non-food retail turnover reached

10.2 percent in January 2009 (Český statistický úřad, 2015). The trend of retail turnover decline was also supported by the findings of the research conducted in 2014. From those retailers who stated trends in their turnover in the period of economic crisis (about 88 percent of all respondents), 40 percent of them indicated that their turnover had declined. About 37 percent of interviewed clothing retailers expressed no changes in turnover. Only 23 percent of them declared a growth in their turnover.

The findings concerning retailers perceptions of the extent to which environmental factors, consumers, competition and merchandise sourcing have influenced changes in clothing retailing are shown in the table 1.

Tab. 1: Ranking of the environmental factors according to the extent of their impact on changes in clothing retailing in economic crisis as perceived by clothing retailers

Rank	Factor	Mean	Standard deviation
1	Consumer income	3,93	1,18
2	Social factors	3,82	1,12
3	Intra-institutional competition	3,33	1,19
4	Economical factors	3,28	1,19
5	Inter-institutional competition	3,08	1,03
6	Consumers' needs	3,07	1,12
7	Foreign competition	2,93	1,31
8	Domestic (Czech) competition	2,89	0,99
9	Consumer behaviour	2,89	1,22
10	Consumer store perception	2,82	1,20
11	Cultural factors	2,46	1,26
12	Merchandise sourcing	2,20	1,04
13	Technological factors	2,05	1,28
14	Legislative factors	1,64	1,21
15	Political factors	1,62	1,37

Legend: 0 No impact on changes in clothing retailing; 5 Very high impact on changes in clothing retailing

Source: own

Interviewed clothing retailers perceived consumer income and social factors to have the highest impact on changes in clothing retailing. Intra-institutional competition (competition among the same type clothing stores) followed by economical factors and inter-institutional competition (competition among different types of clothing stores), consumer needs, foreign and domestic (Czech) competition, consumer behaviour and store perception were also considered to influence the development of clothing retailing in the Czech Republic considerably. The factors that were perceived to influence clothing retailing to the lower extent were merchandise sourcing, technological, legislative and political factors.

To identify major dimensions affecting clothing retail development, factor analysis using a principal component method of extraction was conducted on fifteen variables discussed above. Due to the low factor loadings of two variables – technological factors (0.484) and merchandise sourcing (0.459) obtained from the first factor analysis, the number of variables was reduced from fifteen to thirteen. The final factor analysis was conducted on thirteen variables. The coefficient of Kaiser-Meyer-Olkin (KMO) measure of sampling (0.693) and Bartlett's test of sphericity (Chi-Square=817,754, sig.=0.000) obtained by the factor analysis fulfilled the conditions (KMO larger than 0.5 and the level of significance

lower than 0.05) for using factor analysis. Five components with eigenvalues larger than one were extracted. According to the results presented in the Table 2, these five components account for almost 62 percent of the total variance of changes in clothing retailing explained by the extracted factors.

Tab. 2: Results of Principal Component Analysis

Component	Eigenvalue	Percentage of variance	Cumulative percentage
1	2.898	14.31	14.31
2	1.612	13.83	28.14
3	1.265	12.99	41.14
4	1.189	11.78	52.86
5	1.034	8.67	61.52

Source: own

To make the initial component extraction more interpretable, Varimax rotation was performed. The table 3 displays coefficients (loadings) that relate variables to the five rotated factors.

Tab. 3: Varimax Rotated Factor Matrix

Factor	Component				
	Consumers	Political and legislative environment	Social and economical environment	Competition	Foreign competition
Consumer store perception	0.767				
Consumer behaviour	0.636				
Consumer needs	0.611				
Cultural factors	0.552				
Political factors		0.904			
Legislative factors		0.833			
Social factors			0.833		
Consumer income			0.706		
Economical factors			0.593		
Inter-institutional competition				0.751	
Domestic (Czech) competition				0.701	
Intra-institutional competition				0.576	
Foreign competition					0.865

Source: own

The first extracted factor is labelled as consumers. The variables strongly associated with factor one are consumer store perception, consumer behaviour, consumer needs and cultural factors representing attitudes, life style and preferences of consumers. This factor explains about 14 percent of variance in clothing retail development in the period of economic crisis.

Approximately the same percent of variance can be explained by the second extracted factor named political and legislative environment. The term “political factors” used in the study represented the impact government policy and actions in the period of economic crisis on the development of clothing retailing. Legislative factors included the impact of legislation and legislative changes made in the period of economic crisis on clothing retailing.

The third factor is interpreted as social and economical environment mainly because of high scores of economical and social factors on the third factor. These factors were associated and closely connected related to consumer income that was scoring high on the third extracted factor as well. Social factors were associated with unemployment, living standard, household incomes and expenditures. Economical factors represented the impact of economic environment on changes in clothing retailing as well as on consumers. This factor was responsible for about 13 percent of variance in changes of clothing retailing.

The fourth factor explaining about 12 percent of variance represents the competition dimension as indicated by high loadings of inter-institutional, intra-institutional and domestic competition.

The fifth and final factor is related to foreign competition that was perceived to have a high impact on clothing retailers.

The analysis described above identified five main dimensions (factors) underlying the development of clothing retailing as perceived by retailers. To examine whether (or how) differences in clothing retail development were related to the size of population in towns, the mean factor scores for various town categories were calculated. The relationship between independent variables (town categories) and the dependent variables (extracted factors 1-5) was measured by one-way ANOVA test. The results are presented in the table 4.

Tab. 4: Mean Factor Scores for Various Town Categories

Town category by population	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
	Consumers	Political and legislative environment	Social and economical environment	Competition	Foreign competition
1-9,999	-0.230	0.386	0.320	-0.092	0.010
10,000-19,999	0.146	0.195	-0.146	0.022	-0.037
20,000-49,999	-0.224	0.076	0.040	0.006	-0.070
50,000-99,999	0.120	-0.303	-0.225	0.006	-0.141
Over 100,000	0.098	-0.068	0.063	0.027	0.172
Significance	0.031	0.000	0.013	0.963	0.205

Source: own

Consumers and political, legislative, social and economic factors (factors 1, 2 and 3) have influenced changes in clothing retailing in different town categories to a different extent, the other factors related to competition (factors 4 and 5) had very similar and rather low impact on clothing retailing regardless the size of population (the mean factor scores are very low and approximately the same). Clothing retailers in small towns were influenced by political, legislative, social and economic environment to a larger extent than clothing stores in larger towns. Clothing retailers in towns with 50,000-99,999 inhabitants perceived political, legislative, social and economic factors to have rather negative impact on their retail operations. Consumers, their shopping behaviour, store perception and income spending were perceived to have a negative impact on clothing retailing. Retailers' perception of competition did not show any differences in their impacts on changes of clothing retailing in different town categories.

To examine the impact of identified factors on clothing retail development in relation to retailer background variables, the mean factor scores for various retailer background characteristic categories were calculated. The results are presented in the table 5.

Tab. 5: Mean Factor Scores for Various Retailer Background Characteristic Categories

Retail characteristics	Factor 1 Consumers	Factor 2 Political and legislative environment	Factor 3 Social and economical environment	Factor 4 Competition	Factor 5 Foreign competition
Retail format:					
Department stores and hypermarkets	0.159	-0.034	-0.023	0.258	0.156
Mid-range store	-0.229	-0.012	-0.036	-0.087	-0.323
Boutique	0.048	0.088	0.011	-0.173	0.140
Discount store	0.028	0,051	0,039	0.085	0.336
Second-hand store	-0.156	-0.112	0.291		
Significance	0.045	0.875	0.808	0.010	0.000
Number of employees					
Up to 10	-0.013	-0.005	0.081	-0.007	-0.031
11-25	0.201	0.093	-0.173	0.138	0.157
26-50	0.454	0.018	0.449	-0.619	-0.362
51-100	-0.006	-0.121	-0.226	-0.218	-0.018
Over 100	-0.324	0.101	-0.379	0.129	0.193
Significance	0.069	0.922	0.017	0.150	0.355
Turnover:					
Up to CZK 2 mil.	-0.052	0.136	0.216	-0.006	-0.082
CZK 2-5 mil.	0.084	-0.036	-0.104	0.056	0.123
CZK 5-10 mil.	0.103	-0.158	-0.168	-0.028	0.018
Over CZK 10 mil.	-0.037	-0.069	-0.071	-0.014	0.008
Significance	0.735	0.289	0.045	0.899	0.567

Source: own

The greatest impact of consumers (factor 1) on changes of clothing retailing in the period of economic crisis was perceived by mid-range clothing retailers and retailers employing more than 100 employees. Social and economic factors including consumer income positively influenced the retail activities of second-hand stores and medium-size retailers (with 26-50 employees). Clothing retailers employing 26-50 employees positively perceived the impact of consumers and social and economic factors, whereas large retailers employing more than 100 employees considered the mentioned factors to have rather an opposite impact on their retail activities. Medium-size retailers perceived competition to influence their retail operations to a greater extent than other clothing retailers. According to the mean factor scores, department stores and hypermarkets were influenced by intra and inter-institutional competition (factor 4) to a greater extent than other clothing retailers. Similarly, the greater impact of foreign competition (factor 5) on clothing retailing was considered by discount stores. There were almost no statistically significant differences in perception of the extracted factors found by clothing retailers according to their turnover. Social and economic environment (factor 3) was the only factor perceived to have greater impact on the development of small clothing stores with annual turnover of less than CZK 2 million.

Conclusion

The influence of changes in the economic environment and market structure on the development of clothing retailing associated with economic crisis in 2007-2012 was discussed in this paper. Fifteen variables generated from retail environment, competition, consumer and sourcing areas were selected to measure the contribution of each variable to changes in clothing retailing. According to retailers' perceptions, consumer income and social factors were considered to have the greatest impact on changes in clothing retailing followed by the mix of factors related to retail competition and consumers' needs, behaviour and store perception. Major factors influencing activities of clothing retailing in 2007-2012 identified by factor analysis were consumers, political and legislative environment, social and economic environment, and competition (domestic and foreign). The impact of these factors on clothing retailing varied to some extent by town categories and retailers' background characteristics. Generally, as perceived by retailers, the development of clothing retailing was influenced by consumers, political, legislative, social and economical factors to the great extent mainly in small and medium-size towns. In terms of the retail characteristics used in the analysis, it seems that different retail formats perceived different factors to have the main impact on their retail operations. The development of department stores and hypermarkets was influenced mainly by domestic competition, discount stores by foreign competition. Managers of mid-range stores perceived to have their retail activities influenced mainly by consumers. Discount stores considered social and economic factors to have the great impact on their operations. Regarding the size of clothing retail companies in terms of the number of employees, a strong impact of consumers, social and economical environment and competition was perceived by retailers employing 26-50 employees. Large retailers with more than 100 employees considered consumers to affect their business to a great extent. Size of clothing retailers in terms of their annual turnovers was not found significant when exploring the impact of environmental factors, consumers and competition on retail operations in the period of economic crisis in the Czech Republic in 2007-2012. The only exception identified by the research was related to social and economic factors that affected small clothing retailers with annual turnover of less than CZK 2 million to the greater extent than other clothing retailers.

References

- [1] ANTONOVÁ, B., Š. ZAPLETALOVÁ. The economic crisis and company management: Influences and consequences. *E+M Ekonomie a Management*, 2014, **17**(1): 4–18. ISSN 1212-3609.
- [2] BROWN, S. Institutional change in retailing: A review and synthesis. *European Journal of Marketing*, 1987, **21**(6): 3–36. ISSN 0309-0566.
- [3] BROWN, S. The wheel of the wheel of retailing. *International Journal of Retailing*, 1988, **3**(1): 16–37. ISSN 0268-3903.
- [4] CZSO. *Tržby sortimentních skupin prodejen (meziroční změny)* [online]. Prague: Czech Statistical Office, January 2009. [cit. 2015-02-15]. Available at: <http://www.czso.cz/csu/csu.nsf/informace/cm1032409.doc> -1/2009

- [5] DĚDKOVÁ, J. and K. BLAŽKOVÁ. The competitive environment among companies in the Czech art of Euroregion Neisse-Nisa-Nysa. *E+M Ekonomie a Management*, 2014, **17**(3): 86–99. ISSN 1212-3609.
- [6] DREESMAN, A. C. R. Patterns of Evolution in Retailing. *Journal of Retailing*, 1968, **44**(Spring): 64–81. ISSN 0022-4359.
- [7] GOLDMAN, A. The Role of Trading Up in the Development of the Retailing System. *Journal of Marketing*, 1975, **39**(1): 54–62. ISSN 0022-2429.
- [8] HÁJEK, L. and L. REŽNÝ. 20 let vývoje české ekonomiky – srovnání se Slovenskem. *E+M Ekonomie a Management*, 2014, **17**(1): 17–31. ISSN 1212-3609.
- [9] KISLINGEROVÁ, E. *Podnik v časech krize*. Praha: Grada Publishing, 2010. ISBN 978-80-247-3136-0.
- [10] KOHOUT, P. *Finance po krizi. Důsledky hospodářské recese a co bude dál*. Praha: Grada Publishing, 2009. ISBN 978-80-247-3199-5.
- [11] KRAFT, J., P. BEDNÁŘOVÁ, M. LUNGOVÁ, I., NEDOMLELOVÁ, and L. SOJKOVÁ. *Hospodářská krize. Vybrané makroekonomické a mikroekonomické souvislosti s projekcí na úrovni regionů*. 1st ed. Liberec: Technická univerzita v Liberci, 2010. ISBN 978-80-7372-678-2.
- [12] KRAFT, J., P. BEDNÁŘOVÁ, M. LUNGOVÁ, I., NEDOMLELOVÁ, and L. SOJKOVÁ. *Východiska z krize. Cesty zmírnění negativních efektů hospodářské krize v ČR*. 1st ed. Liberec: Technická univerzita v Liberci, 2011. ISBN 978-80-7372-787-1.
- [13] MASON, J. B. and M. L. MAYER. *Modern Retailing: Theory and Practice*. Business Publications Inc., 1978. ISBN 0-256-02072-8.
- [14] ŠVIHLÍKOVÁ, I. *Globalizace & krize. Souvislosti a scénáře*. Všeň: Grimmus, 2010. ISBN 978-80-87461-01-3.

Jolanta Solnyškinienė, Aistė Kuliavienė

Aleksandras Stulginskis University
Studentų st. 11, Kaunas District, LT-53361, Lithuania
email: jol.solnyskiniene@inbox.lt

Evaluation of Large-scale Lithuanian Milk Processors Changes in the Structure of the Export Due to Russian Embargo

Abstract

State industrial and service sectors development depends on the political role of the country in the international area. The national economy cannot grow up while being detached from the global economy without maintenance of the relationship with other countries. The more national economics are open the more foreign trade is being developed. Lithuanian dairy market is highly concentrated with powerful companies, which are able to compete and increase the volume of export in foreign markets. Currently, the political tension restricts the global trade including and Lithuanian export in Ukraine and in the Middle East. The development of Ukrainian conflict is very dynamic and may affect Lithuanian export supply and demand in different channels. Widely discussed additional restriction on trade between Russia and the EU will have both direct and indirect effects on the development of Lithuanian exports. This article aims to analyse and evaluate how will change milk processors companies indicators of final performance while changing the structure of export and direction from East to West and / or refuses the export to East. Such econometric methods as correlation – regression analysis and lag – analysis method allow to determine the relationship and format between the final performance indicators and export volume and direction of current company. It was found that there is a strong link between export, directions of the export and companies income. The results of this analysis show that Lithuanian milk processors income will change while changing the structure and direction of export. This article reveals what kind of loss companies will suffer while reorientating the export from East to West and how long it takes to smooth the income. Finally, this analysis indicates the forecast of export while changing the business conditions.

Key Words

sanctions, international trade, exporters dynamics, milk processors

JEL Classification F10, F13, F14

Introduction

The theory, as an abstract conceptual tool, intended not to be valid universally. The theories of international trade' regulation is trying to explain and understand factors at the international level, at the national level or at the sectoral level. Often is it limited to a particular period in history or to particular countries or groups of countries. There are three main strategies of international economic pressure: economical sanctions, trade wars and economic warfare [20], [25].

According to Baldwin, Cave and Lodge [2] the following principal types of international sanctions are: economical, financial, political, public and communicational. Usually there

are taken in economical (mainly arms embargo), financial (freezing of funds) and political (insurance) sanctions. Economic sanctions are considered to be civil and dual-use items, military equipment, services and technology import and export, re-export and transit, including brokering, restrictions (otherwise - the arms embargo); trading with entities on the implementation of international sanctions, limitations. Extreme economic sanctions can be called a boycott and blockade: in the first case the economical relations are cancelled and in the second and the country is physically isolated with no possibility to develop external trade.

Economic sanctions have been long used in international relations. In the literature, scholars distinguish various types of international trade regulation and sanctions [2], [7],[10],[11],[15],[17],[20],[21],[23],[24].

The most often asked questions in the literature on economic sanctions is “How do economic sanctions work?” and “Are they effective?” Economic sanctions, sometimes synonymous with “economic coercion,” are distinct from economic warfare (strategic embargo), economic inducements, and trade war. Economic warfare represents a long-term approach to dealing with adversaries while economic sanctions usually have immediate political goals.

While analysing more precisely trade sanctions: both an import and an export embargo implemented against a target country restrict the volume maximum amount of goods authorized for import and export [1]. The embargo is often considered as a measure against the other state actions. Economic sanctions seek to lower the aggregate economic welfare of a target state by reducing international trade in order to coerce the target government, this to change its political behavior [22], [25], [15].

According to Pape [25, 93 – 94] “Trade embargo is a law or policy a state initiates which prohibits or otherwise restricts the importation/exportation of goods. Trade embargoes are typically motivated by political, economic, moral, or environmental reasons, and used as a form of protest against another country's practices.” Scientists unanimously agree on the negative impact of the embargo on the country-by-side but there is disagreement on the extent of the impact strength and effects [2], [3], [7], [9], [21] .

According to Menkes [20,13] “Economic analysis of trade sanctions in particular focuses upon political considerations of decision-makers: 1) It is more possible that sanctions will achieve their goal, if sanctions (threats) costs are relatively low compared to expected benefits of success for a sanctioning State, whereas they are relatively high compared to change of behaviour costs for a targeted State. 2) Transaction costs for the sanctioning State include a direct cost of mobilisation and organisation of assets necessary for sanctions programme and an alternative costs of their use. 3) The targeted State compares costs of accepting sanctions consequences with costs of access to substitute goods or other markets. Choice of reaction strategy depends on costs of change of production structure, domestic market size and price elasticity of global markets for the sanctioned State's export. 4) The party not acting under time pressure is more likely to be successful”.

Different food safety standards and regulations naturally evolve around the world, even when countries have similar levels of economic development. These differences among countries may affect the relative risks or imports of food from different countries.

According to Buzby [6] although food safety standards are frequently viewed as technical barriers to trade, improvements in food safety and expanded international trade are likely compatible and even mutually reinforcing. The complexity of food safety issues in trade means that disputes and difficulties will continue to arise [6], [19]. Food safety concerns and food safety regulations between Russia and the European countries have led to trade frictions[14].

Admittedly, the literature of the problems of international economic sanctions, in particular the Lithuanian language is poor. Lack of information about the economical impact of sanctions on the country; of specific economical sanctions on individual sectors of the economy or businesses. Because there is not enough systematic research on existing international economic sanctions - the embargo, this article will contribute to the development of the research of international sanctions problem. Also it could have practical significance for those whose are interested in the issue of the impact of the Russian embargo on EU countries and Lithuania and for the results of specific companies.

1. Lithuanian Foreign Trade Trends and Russian Trade Restrictions on Lithuanian Export of Milk Products

Lithuania's economy annually increasingly focuses on foreign markets, as goods and services exports increase entities profitability, encourage business expansion and internationalization, the faster the return investment, create new jobs, and this has a direct impact on economic growth.

In recent years, Lithuanian export growth rate was faster than the average in the European Union Member States. The rapidly growing volume of foreign trade is likely due to Lithuania's competitive advantages: a favorable geographic position, competitive labor costs, a skilled workforce, the ability to manufacture products tailored to the needs of customers in small batches in a short period of time, better understanding of Eastern markets business needs, developed transportation and other.

According to Lithuanian Department of Statistics [14], the total Lithuanian export of goods and services for the period 2007-2012 had average annual growth of 12.4 percent and in 2012 export of goods and services amounted to 95.5 billion. Lt. According to this indicator Lithuania took first place in the EU, in the second place was Latvia, which exports an average annual increases by 8.8 percent, the third - Estonia (7.9 percent).

For the period 2007-2012 export of goods of Lithuanian origin grew fastest to the Commonwealth of Independent States (hereinafter - CIS) countries - an average of 14.5 percent annually, to the EU countries - by 10.7 percent, to other countries - 11 per cent. Lithuanian industry's export to the CIS countries share in the above mentioned period increased from 10.2 percent up to 11.8 percent, while export to the EU Member States decreased from 75.9 per cent to 74.4 percent. Export to other countries share remained at a similar level - about 14 percent [14].

In recent years, the importance of the CIS markets for Lithuanian producers gradually increased. Agricultural and food products, machinery and equipment, furniture, metal,

rubber and plastic products export was constantly increasing. In 2012 Lithuanian export was the main driver of economic growth and accounted for 84.1 percent of GDP [14]. In 2010 – 2014 period Russia has made various trade restrictions to Lithuanian dairy industry entities, which strongly affected milk processors situation.

On 7th October 2013 the import to the Russian market of the largest milk processors products was banned and less than after half-year cancelled. On the 6th of September 2014 Russia banned for one year the food and agricultural imports from the EU, US and other Western countries [19].

Russian import restrictions have a direct negative impact on the Lithuanian agricultural and the food industries. In 2013 the value of Lithuanian origin goods covered by the ban on imports amounted to 228,696 million Eur., it is 2.3 percent of total exports of goods of Lithuanian origin (excluding energy products). Milk products make nearly two-thirds of this amount (145,217 million Eur.). Lithuanian food industry is relatively concentrated, but for the most part is not aimed at export to Russia. Goods exported to Russia, which has been sanctioned, accounted for 21.3 percent, and the remaining products in this category were directed to other markets [14].

According to Kraatz [13, 4] “Russia is the second most important destination for EU agricultural products after the USA (EU volume Euro 11.3 billion in 2013, Eur 5.1 billion affected by the embargo), and the EU is most affected (73 % of imports banned). Those EU countries most concerned are the Baltic States (above all Lithuania), Finland and Poland (share GDP in 2013), Germany and the Netherlands (absolute values). However, the share of agriculture in EU GDP (1.7 %) and in EU exports (6.6 %) is relatively low.

The sectors potentially worst affected in terms of absolute value are: dairy products (1,35 billion Eur in 2013); fruit (1,26 billion Eur); meat and sausages (1.26 billion Eur). The sectors potentially worst affected with regards to the proportion of exports are: fruit and vegetables (29 % of European exports used to go to Russia); cheeses (33 % of European exports were for Russia); butter (28 % of EU exports went to Russia).” Lithuania potentially worst affected in terms of absolute value are 927 million Euro in 2013 (Poland -841 million Euro; Germany -595 million Euro; the Netherlands -528 million Euro).

Restrictions on imports of food products, including milk products, have long-term consequences. According to Lithuanian Department of Statistics, in January 2015 exports to Russia have been as much as 38 percent less than a year ago. Similar trends are throughout the CIS market - exports to them reduced by 30.7 percent. Lithuania's exports to other key markets grow successfully.

It is forecasted that exports of goods of Lithuanian origin (excluding energy products) in 2015 will grow by 6.2 percent to 10.9 billion Euros, in 2016 – by 8.7 percent to 11.9 billion Euros. Last year, Russia retains the largest export market - goods sold there for more than 5 billion Euros or 20.8 percent of Lithuania's total exports. However, only 11.7 percent of total exports to Russia are of Lithuanian origin goods, the rest - re-exports [14].

2. Russian Trade Restrictions on Imports of Lithuanian Dairy Products Impact on Milk Industry

Facilitated conditions of access to foreign markets enable to expand the number of users of export production and services in foreign markets, and the constraints – complicate. When Russia announced an embargo on agricultural products from the EU in the market excess of milk products appeared and milk prices fell by 30 percent (in Lithuania about 20 percent). Farmers, milk processors and consumers suffered. Farmers have suffered due to the embargo of 30 million Euro loss.

Farmers losses were partly compensated by the European Commission, which gave support to 14 million Euro and the Government of Lithuania, which gave 8.7 million Euro support. A number of problems encountered milk processors, who were not only experienced losses and were forced to adjust their export markets. In Russia and the CIS countries, the demand was for dairy products.

Lithuanian milk users suffered large losses also. In 2014 the average dairy industry production prices for the domestic market increased by an average of 10 percent, while export production prices fell by about 16 percent. Retail prices increased by an average of 2 percent during the year. Domestic prices decreasing until now because of their expenses producers attempt to offset reduced export earnings.

According to Lithuanian Department of Statistics [14] in Lithuanian dairy market several large almost equal dairy processors act: Pieno žvaigždės, Vilkyškių pieninė, Rokiškio sūris and Žemaitijos pienas.

Vilkyškių Pieninė until the embargo was receiving about 30 percent, Pieno žvaigždės of 30-35 percent, While Rokiškio sūris about 15 percent of the income. Until the embargo Lithuania exported to Russia about 39 percent of milk production, and milk processors exported raw milk also from neighboring countries (e.g., Latvia exported 1/5 of raw milk). Russian embargo affected milk processors performance.

In 2014 Rokiškio sūris suffered 384 thousand euros loss, while in 2013 the company received 9.495 million euro profit, the company's revenue last year fell by 0.1 percent to 249.251 million Euro. In 2014 Pieno žvaigždės received 4.9 million euros net profit – by 75 percent more than in 2013, when the profit amounted to 2.8 million euros. Company revenues grew by 8.9 percent to 239.6 million Euro. In 2014 Vilkyškių pieninė received 3.2 million euros net profit – by 14 percent less than in 2013. Group revenue during the year increased by 4 percent to 10 million Euro. Žemaitijos pienas profit in 2014 in comparison with 2013, fell by 2.6 times to 2.636 million euros, turnover increased by 5.2 percent to 161.2 million euros.

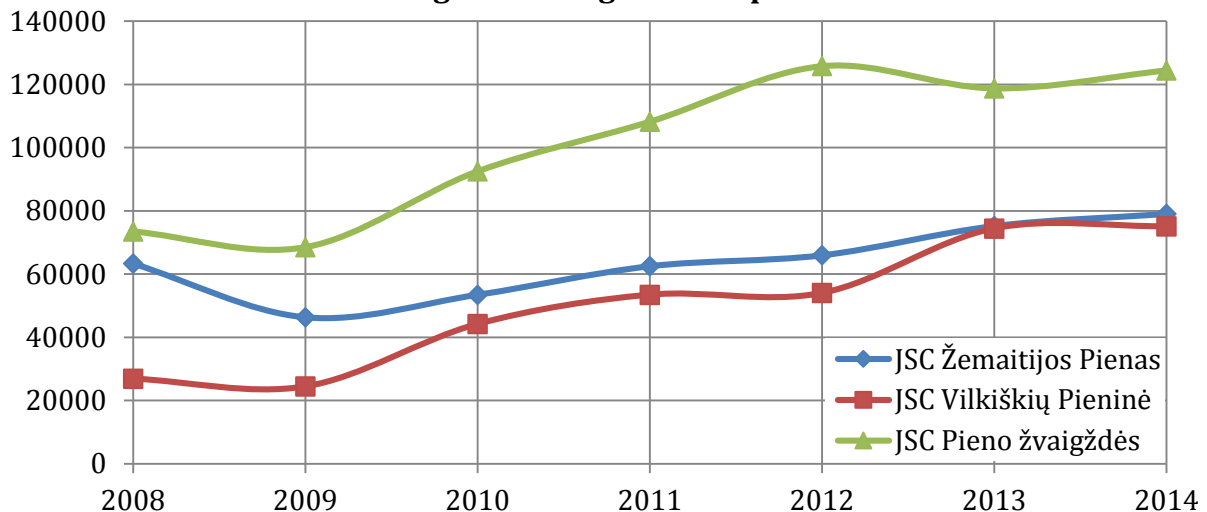
The embargo has forced milk processors not only to reduce costs, restructure production, but also in-depth review export markets. According to State Food and Veterinary Office (SFVS) the Lithuanian companies export to the United States, Kazakhstan, Vietnam, Azerbaijan, Singapore, Israel, Tajikistan, Turkmenistan, Hong Kong, Kyrgyzstan, Malaysia, Japan, Egypt, Indonesia, the Bahamas, Korea, Thailand, Morocco, Lebanon, Yemen, Saudi Arabia, Malawi, the Philippines, Bangladesh, and Pakistan [14].

3. Background of the Research and Methodology

Task of research: To evaluate the impact of Russian embargo for the dairy products producers using lag - method. While performing this research the data was taken of three greatest Lithuanian dairy products producers: JSC Žemaitijos Pienas, JSC Vilkiškių pieninė and JSC Pieno žvaigždės. As the theoretical background of the research revealed that export in the middle of 2013 tempted to decrease due to the sanctions of Russia. Such situation can be seen in the figure below.

The further research will show two situations 1st - the current, as the income of the companies continue to grow / to decrease due to a conflict situation in the East, 2nd - how the income of the companies change due to Russian embargo on exports when companies don't divide their export to other countries.

Fig. 1: Earnings from export



Source: Created by the authors, using companies database

While analysing the dynamics of dairy exports its structure and changes it is usually used such methods as: comparison of data [18], the linear regression method, which reflects the relationships and the factors influencing the strength – [4], [8],[16]. While exploring the economical processes it is often needed to estimate the delayed values of the some factors according to their values in the previous moments. What is more, the forecast will be performed just according to the constant values. For this reason the lagged models are generated. These models let us to evaluate how will change the future earnings of the companies due to the changes of exports. Nowadays to assess the unfavourable situation due to Russian sanctions for the certain food imports it is known that Lithuanian food producers suffer a negative impact for their economic welfare. It is really important aspect, how quickly income will be increased namely due to earnings from exports. This study will analyse how export earnings affect the companies income, what is the connection. In addition it is essential to carry out further investigation – to set up lagged models while identifying what kind of changes the export of Russian segment will bring for the companies income. To perform the research successfully, the theoretical background of the econometric model was selected from one of the Lithuanian scientists - Boguslauskas [5]. The further theoretical estimation is named as the equation of lagged model.

$$y = a + b_0 x_1 + b_1 x_{t-1} + \dots + b_L x_{t-L} + e_t \quad (1)$$

where: t – the moment of time; x – independent variable – Export to Russia, Europe and other countries (Using different independent variables will be performed different calculations for each company.); y – depended variable – income; L – size, which describes the impact of delays in independent variable, lag. The number of delays is determined by means of sampling, the discovery of the equation when the highest determination coefficient is found.

Before the main estimations of lagged models, the cross – correlation must be set up, to evaluate the relationship between variables using formula presented below.

$$r = \frac{\overline{xy} - \bar{x} * \bar{y}}{S_x * S_y} \quad (2)$$

There will be also used the long-term multiplier in calculations. It is calculated by knowing the equation of the regression coefficients.

$$b_0 + b_1 + \dots + b_L = b \quad (3)$$

The long-term multiplier shows how long does it take for the companies to experience the significant impact on earnings growth / decline. There can be used software package Eviews lag allocation process while transforming the model that multicollinearity problem is reduced to minimum. [12].

Holt–Winter method of time series is used to average the data for the second situation. When there is explored how income would change if the Russian export market was not reallocated to other markets. This method has a higher degree of detail for the time series. There is determined not only the research trend factor, but there are also found short - time trends.

4. Results

There were made calculations with software package Eviews integrated function PDL while researching income changes depending on export earnings in selected segments. Quarterly data was taken of 2008 - 2014 years of the selected companies: JSC Pieno žvaigždės, JSC Vilkiškių pieninė and JSC Žemaitijos pienas. The data was found on their web pages. In this case the dependent variable y - is generated total earnings, while the independent variables – earnings from exports to different segments: Russia, European countries and other countries. Companies may not always provide specific data in the reports such as – what is the percentage of income from export to Russia. As a result the current data was found in the public information resources - what percentage of the earnings derived from a particular segment. To ensure the successful development of the study there was firstly investigated the cross - correlation. The results are shown in the table below.

Tab. 1: The cross-correlation

Dependent variable	Export_Russia	Export_EU	Export_other countries
1-Income	0,89	0,54	0,87
2-Income	0,78		0,40
3-Income	0,74	0,51	0,24

Source: Created by the authors

It is important to note that the strongest correlation is then, when the correlation coefficient is from 0,7 till 0,99 value. If the correlation coefficient is below 0,5 value – correlation is still significant but not important. As the results show the strongest relation is between export_russia and income of all selected companies.

In order to identify and analyse how export earnings affects the income of dairy products producers at certain periods of time, there were calculated the relative coefficients of the equitation. They show how much over every period would change the earnings when the export would change 1 thousand euro. Furthermore, there are identified the average of lag which defines how quickly export to different segments will start to influence income. These calculations are presented in table 2. While modelling the lagged models, the most appropriate lag was identified 3 quarters. The determination of the most suitable size of lag is based on the the mapping of a higher coefficient of determination. Relative coefficients of lagged model are calculated as well as they are necessary for successful further research.

The table below shows the relative coefficients of the equatations. There in table 2 number 1 is JSC Vilkiškių Pieninė; 2 – JSC Pieno žvaigždės; 3 – JSC Žemaitijos pienas.

Tab. 2: Relative Coefficients of lagged models

Variable	Relative coefficients of the equation				The start time of the influence, quarter	The coefficient of determination
	X_t	X_{t-1}	X_{t-2}	X_{t-3}		
1.Export_Russia	0,40	0,19	0,13	0,28	2	0,92
1.Export_EU	0,36	0,12	0,13	0,39	2	0,75
1.Export_Other	0,41	0,07	0,08	0,45	2	0,79
2.Export_Russia	0,59	0,2	0,05	0,17	1	0,69
2.Export_EU_Other	0,16	0,33	0,16	1,16	1	0,67
3.Export_Russia	0,23	0,06	0,16	0,54	2	0,56
3.Export_EU	0,44	0,32	0,19	0,05	1	0,69
3.Export_Other	-	-	-	-	-	-

Source: Created by the authors

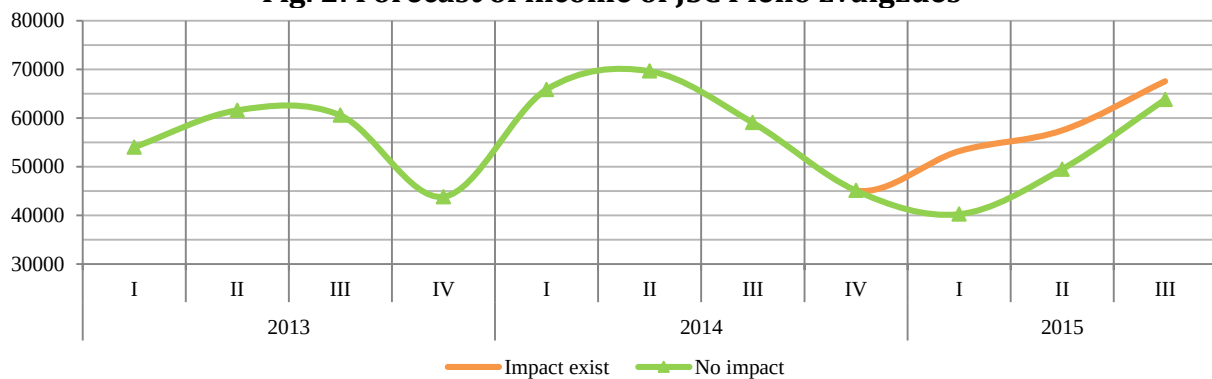
The calculations of the second situation are shown in the table 3 below. As it is seen in the first table in this second table as well – there are no data in the last rows. This appeared due to the fact that there no data or data has low statistical significance level in the equitation.

Tab. 3: Relative Coefficients of lagged models

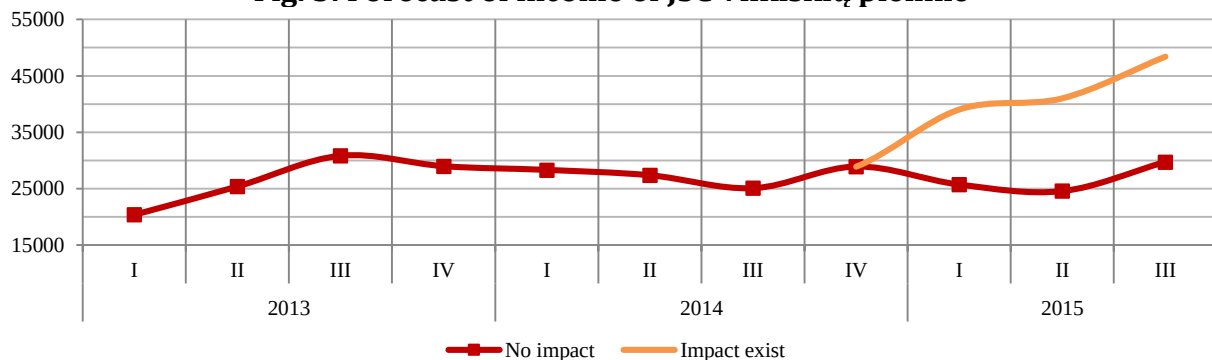
Variable	Relative coefficients of the equation				The start time of the influence, quarter	The coefficient of determination
	X_t	X_{t-1}	X_{t-2}	X_{t-3}		
1.Export_Russia	2,40	0,43	-0,41	0,59	1,5	0,84
1.Export_EU	0,26	0,03	0,10	0,67	2	0,73
1.Export_Other	1,18	0,69	1,54	0,66	5	0,87
2.Export_Russia	0,57	0,24	0,08	0,1	1	0,88
2.Export_EU_Other	1,20	-0,19	0,44	0,43	1	0,62
3.Export_Russia	0,67	0,47	0,15	0,30	2	0,97
3.Export_EU	-	-	-	-	-	-
3.Export_Other	-	-	-	-	-	-

Source: Created by the authors

While using the selected data the forecast was set up. As it was mentioned in the research earlier the optimum lag was 3 periods – in this case 3 quarters. Consequently, the forecast in the figures below is till the third quarter of 2015. The data for figures was selected from the year 2013 when the Russian sanctions for food producers started. While clarifying the depended variable for the creation of graph was chosen export earnings of Russia segment. The units of measurement are euro.

Fig. 2: Forecast of income of JSC Pieno žvaigždės

Source: Created by the authors

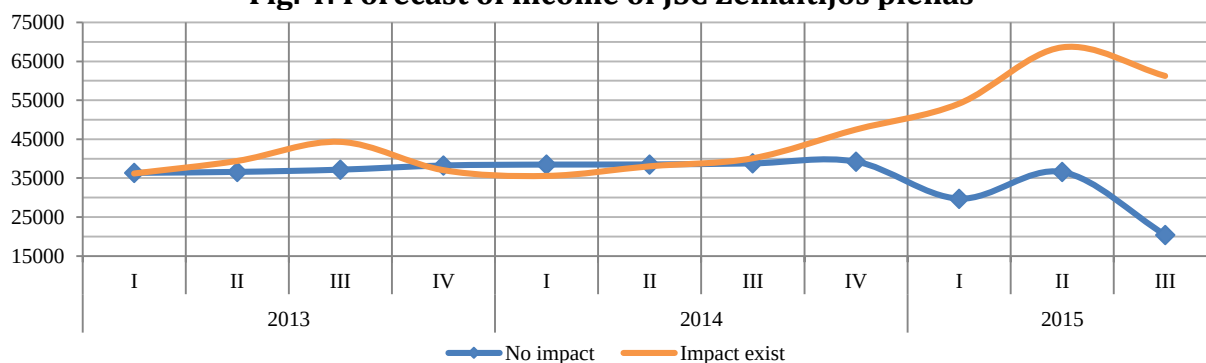
Fig. 3: Forecast of income of JSC Vilkiškių pieninė

Source: Created by the authors

The line where is “impact exist” – it means the first situation, when all calculations are made with impact of Russian sanctions (embargo) including all primary data. The line

where is “no impact” – it means the second situation when all estimations are set up with averaged data without impact of embargo.

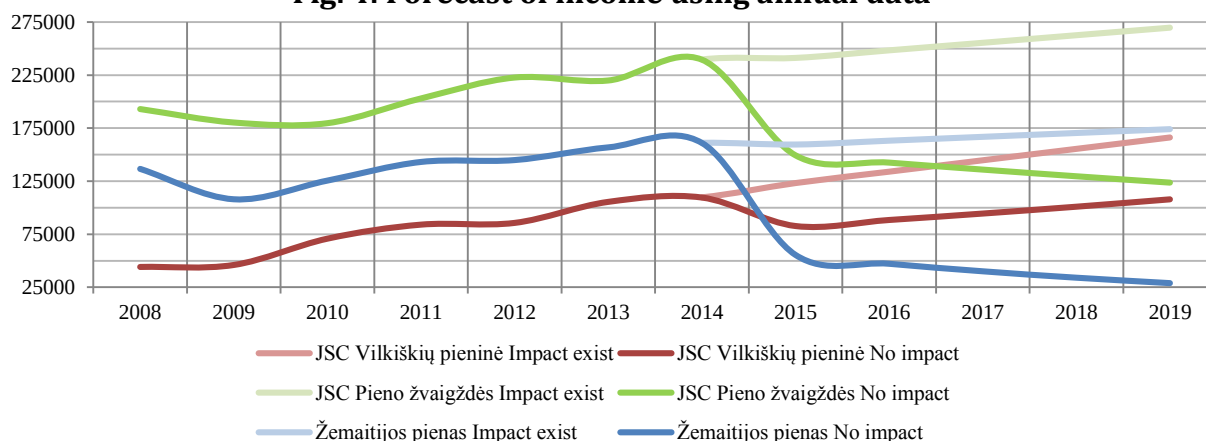
Fig. 4: Forecast of income of JSC Žemaitijos pienas



Source: Created by the authors

The differences between two situations are identified by a different colour line as it was mentioned in the research. All three companies can expect the growth of earnings at the current situation, when the export to Russia is allocated to different segments of trade zone as all three figures indicates that fact. Despite this fact, the second situation would bring the decrease of income. In the end of forecast the third quarter of 2015 JSC Pieno žvaigždės would experience 5,5% decrease of earnings, the difference between two situations is 3750 euro; JSC Vilkiškių pieninė – 38% the difference 18654 euro; JSC Žemaitijos Pienas – 66% the difference is 40816 euro while comparing with second quarter.

Fig. 4: Forecast of income using annual data



Source: Created by the authors

While using the annual data the forecast was performed till the year 2019. The forecast is presented in both situations as well as the forecast was determined in the figures above. The highest level of positive changes in the income will be in JSC Pieno žvaigždės.

Conclusions

The theoretical background of this research can be confirmed by the made estimations. The forecast of quarterly data indicates the negative impact of Russian sanctions for dairy products producers. The greatest impact would be felt by JSC Žemaitijos Pienas. This is due to the fact that JSC Žemaitijos Pienas has had a great percent of export especially in Russia. The last forecast using annual data showed that Russian embargo would bring the loss of income for the companies as well if export was't divided to other countries. The conflict in the East is still proceeding, but the companies has started to divided they export zones. The last forecast showed that companies can expect the increase of income if they divide the export zones as well. To conclude the second analysed situation would bring the decrease of income in all three companies – the decrease in all three companies would be 63221 euro at the third quarter of 2015. On the other hand , the first situation, when companies change the direction of export from Russia to ther countries, let the companies to expect the increase of income. The income of JSC Pieno žvaigždės can expect the income would increase 14345 euro, JSC Vilkiškių Pieninė - 7838 euro, JSC Žemaitijos pienas 14455 euro at the third quarter of 2015 while comparing with previous quart.

References

- [1] BALDWIN, D. A. The Power of Positive Sanctions. *World Politics*, 1971, **24**(1): 19–38.
- [2] BALDWIN, R., M. CAVE, and M. LODGE. *Understanding Regulation: Theory, Strategy, and Practice*. 2nd Ed. New York: Oxford University Press, 2012. ISBN 978-0199576098.
- [3] BERKHEIMER J. et al. *Issue Guide: Trade Embargoes, Seals, and More* [online]. Irvine: University of California, 2013. [cit. 2015-02-15]. Available at: <http://darwin.bio.uci.edu/~sustain/issueguides/Embargoes/>
- [4] BLAYNEY, P. and K. JONES. *Evaluating trade developments in dairy products* [online]. Tulsa, Oklahoma: Southern Agricultural Economics Association, 2004. [cit. 2015-02-23]. Available at: <http://ageconsearch.umn.edu/bitstream/34696/1/sp04jo03.pdf>
- [5] BOGUSLAUSKAS, V. *Ekonometrikos pagrindai*. Kaunas: Technologija, 2004. ISBN 9955-09-747-7.
- [6] BUZBY, J. C. ed. International Trade and Food Safety Economic Theory and Case Studies [online]. *Agricultural Economic Report*, 2003, November, no. 828. [cit. 2015-02-15]. Available at: http://www.ers.usda.gov/media/321575/aer828_1_.pdf
- [7] HAIDAR J. I. *Sanctions and Exports Deflection: Evidence from Iran* [online]. [cit. 2015-02-15]. Available at: <http://www.parisschoolofeconomics.eu/docs/haidar-jamal-ibrahim/sanctions.pdf>
- [8] HESSE, H. *Export Diversification and Economic Growth. Comission on growth and development* [online]. Washington: World Bank, 2008. [cit. 2015-02-15]. Avalable at: http://siteresources.worldbank.org/EXTPREMNET/Resources/489960-1338997241035/Growth_Commission_Working_Paper_21_Export_Diversification_Economic_Growth.pdf
- [9] DOUGLAS, I. A. *Free Trade Under Fire*. Princeton: Princeton University Press, 2002. ISBN 9780691143156.
- [10] KAEMPFER, W. and A. D. LOWENBERG. Targeted Sanctions: Motivating Policy Change. *Harvard International Review*, 2007, **29**(Fall): 68–72. ISSN 0739-1854.

- [11] KAEMPFER, W. H. and A. D. LOWERBERG. The theory of International Economic choice Approach. *American Economic Review*, 1988, **78**(4): 789–793. ISSN 0002-8282.
- [12] KARPUŠKIENĖ, V. *Ekonometrinis modeliavimas su Eviews. Praktinis gidas* [online]. 2010. [cit. 2015-02-15]. Available at: <http://goo.gl/AKzCvp>
- [13] KRAATZ, S. *The Russian Embargo: Impact on the Economic and Employment Situation in the EU* [online]. EN Policy Department A: Economy and Scientific Policy European Parliament. [cit. 2015-02-15]. Available at: [http://www.europarl.europa.eu/RegData/etudes/BRIE/2014/536291/IPOL_BRI\(2014\)536291_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2014/536291/IPOL_BRI(2014)536291_EN.pdf)
- [14] LITHUANIAN DEPARTMENT OF STATISTICS. International trade [online]. [cit. 2015-03-15]. Available at: <http://db1.stat.gov.lt/statbank/selecttable/omrade0.asp?SubjectCode=S6&PLanguage=0>.
- [15] MCLEAN E. V. and T. WHANG. Friends or Foes? Major Trading Partners and the Success of Economic Sanctions. *International Studies Quarterly*, 2010, **54**(2): 427–447. ISSN 1648-2478.
- [16] NIVIEVSKYI, O. and S. TAUBADEL. The determinants of dairy farming competitiveness in Ukraine [online]. *Institute for Economic Research and Policy Consulting, Policy Papers Series*, 2008, no. 23. Available at: http://pdc.ceu.hu/archive/00005125/01/agpp23_en.pdf
- [17] PALAN, R. Is the Competition State the New, Post-Fordist, Mode of Regulation? Regulation Theory from an International Political Economic Perspective. *Competition & Change*, 2006, **10**(2): 246–262. ISSN 1024-5294.
- [18] PRICE, M. Effects of US dairy policies on markets for milk and dairy products. *Technical bulletin*, 2004, no. 1910. ISSN n/a.
- [19] DW. Russia announces 'full embargo' on most food from US, EU. *Deutsche Welle*, 2014, August 7th. [cit. 2015-02-15]. Available at: <http://dw.com/p/1CqfF>
- [20] MENKES, M. *Effectiveness as a constraint to international trade sanctions legality* [online]. The European Trade Study Group, 2015. [cit. 2015-02-15]. Available at: <http://www.etsg.org/ETSG2009/papers/menkes.pdf>
- [21] GOLLIARD, M. M. *Economic Sanctions: Embargo on Stage. Theory and Empirical Evidence* [online]. Fribourg, 2013. [cit. 2015-02-15]. Available at: http://www.ers.usda.gov/media/880661/tb1910.pdf0x-_ls-.pdf
- [22] HART, J. A. and A. PRAKASH. Strategic Trade and Investment Policies: Implications for the Study of International Political Economy. In FRIEDEN J. A. and D. A. LAKE. eds. *International Political Economy: Perspectives on Global Power and Wealth*. Boston: Bedford/St. Martin's, 2000. ISBN 0-203-54705-5.
- [23] REIMER, J. J. and K. W. STIEGERT. Evidence on Imperfect Competition and Strategic Trade Theory. *University of Wisconsin, Madison Staff Paper*, 2006, no. 498.
- [24] SPENCER, B. AND J. A. BREDNER. Strategic Trade Policy. In DURLAUF, S. N. and L. E. BLUME. eds. *The New Palgrave Dictionary of Economics*. Basingstoke, Hampshire : Palgrave Macmillan, 2008. ISBN 978-0333786765.
- [25] PAPE R. A. Why economic sanctions do not work? *International security*, 1997, **22**(2): 90–136. ISSN 0162-2889.

Ivan Soukal, Jan Draessler

University of Hradec Králové, Faculty of Informatics and Management,
Department of Economics and Department of Quantitative Methods
Rokitanskeho 62, Hradec Králové, Czech Republic
email: ivan.soukal@uhk.cz, jan.draessler@uhk.cz

Price Information Asymmetry Impact on Optimal Choice – RCBS Market Case Study

Abstract

The information asymmetry influences the consumer behaviour in an undesirable and unpredictable way. This phenomenon is present on RCBS market regarding the information on price causing the unexpected consumer behaviour – suboptimal product choice regarding the price and the range of the demanded services. We study this phenomenon to identify main causes and its range. At first we present the main characteristics that increase the information asymmetry influence (low share on household expenditures) but also decrease (close substitution). Then we present the outcome of European Union wide research identifying sources of information asymmetry. Then we describe our data source (RCBS comparison tools). Based on its dataset we compute the share of optimal choices among the electronic banking users of the RCBS. We define the optimal choice as the lowest fees for the account that provides all the demanded services. The result is that the optimal share of the consumer choices of RCBS is as low as shows the confidence interval 95 % of (0.159; 0.171). The result is based on more than 14 500 individual consumer behaviour records. For the second analysis the geographical difference variables are filtered off to eliminate geographical differentiation even more. This led to expected improvement in ratio but very low one. The analysis performed on more than 9 500 individual records shows the confidence interval 95 % of (0.196; 0.213). The result show the information asymmetry has serious impact on consumer's choice due to combination of effects such as search costs and low return on search. At the end we discuss the possibility to remove the possible geographical differentiation bias by removing ATM and exclusive account form the calculation.

Key Words

price information asymmetry, consumer, optimal choice, empirical study

JEL Classification: D82, D12

Introduction

The information asymmetry is natural imperfection regarding any real world market. The retail core banking services to non-entrepreneur natural persons (thereinafter only as RCBS) in the European Union (thereinafter only as EU) are not an exception. Several large-scale surveys performed during the recent years state that RCBS market shows the signs of the information asymmetry phenomenon. On this market it is the demand side bears the impact of information asymmetry and the demand side of this market is almost the whole of the EU adult population. To be more specific the problem refers to 89 % of the EU population in age of 25-54 [7, p. 13] because the payment account (thereinafter only as account) is an essential modern service that also prevents socio-economical exclusion. From the banks' point of view it a main gateway product [3] and also it has its importance

in facing the liquidity risk. This importance will be even higher as BASEL III brings the Liquidity Coverage Ratio, see e.g. [12] for BASEL framework innovations and its impact.

Such high penetration raises a question of the adverse selection magnitude as a negative outcome of the information asymmetry. EU consumers bear the impact of the price information asymmetry that rises from the search costs problem. This problem was firstly generally modelled by G. J. Stigler, please see [2]. For more detailed view regarding the RCBS market please see the case study using the probabilistic model adjusted for the small market conditions in [1]. The prices are the subject of change on every market and so the consumer has to perform a search to gain the knowledge of the market price structure. The consumer does not know if the price revealed in the search is the lowest on the market however lowest price of all searches is preferred. With every additional price search the possible price reduction drops regardless of the market price distribution and probability of finding the optimal price increases. The opposite variable is consisted of the search costs because it takes time and attention to find the RCBS price – identify one's usage pattern, find the provider, perform a tariff calculation. It is obvious that outlined problem leads to more suboptimal solution the higher are the search costs i.e. the price information asymmetry. Consumer possessing the price structure knowledge chooses the optimal price swiftly. However as the possible price reduction drops under the additional search costs the consumer stops the process and takes the best price from only limited sample.

The next point of view comes from behavioural economics where e.g. [4] points out that people are not accustomed to think hard, and are often content to trust plausible judgement that quickly comes to mind. In other words rational agent approach or maximization approach is not a realistic one. The consumer may use intuition as fast, automatic, effortless and parallel system of thinking instead of reasoning system (slower, controlled, effortful and serial) more often than it is presumed. Although it may seem irrational it is consistent with one of the earliest ideas regarding the behavioural economics. One of the basic economic principles is based on scarce resource, its allocation and consumption. As [5] claimed we are living in an information rich world and specific resource is consumed to absorb or process the information. This scarce resource is the attention. It is useful as well as limited and so we can designate it as a scarce resource. The attention here represent the time of the recipients which they need to comprehend. This answers the problem outlined above – consumer tends to use intuitive thinking because it consumes much less attention and it generates mostly “good enough” solution. In another words it is more natural to choose satisficing instead of maximizing approach regarding less important consumer decision. Please see e.g. [6] for better insight on consumer in wide range of choices environment. If mentioned sources suggest that consumer follows “state the basic conditions -> search -> if condition met, then stop search and consume” rule instead of “search for optimal solution” approach, then the market situation fundamentally differs from the general maximization conception.

Under the outlined conditions of the search costs problem and satisfier approach we decided to study the magnitude of this problem i.e. how common is the adverse choice in the Czech Republic's RCBS market. So we pose a question what is the share of optimal RCBS choices among the RCBS consumers with activated e-banking? The answer should shed some light on the on consumer behaviour on this market as well as answer the question whether this market is strongly influenced by information asymmetry or not.

1. The problem overview

1.1 The main RCBS characteristics

The scope of our research is RCBS products with remote access provided by banks. The term remote electronic access represents the means of electronic access via e-banking, mobile banking, smart banking and telephone banking. In our study, see the chapter 2, we study the accounts with e-banking access only. We do not monitor other electronic means of communication. The specific services enumeration comes from the intersection of the study [8] and the EU Directive [9, art. 17, par. 1]:

- Account management: opening, operating and closing of an account, statement receiving, electronic remote access, services enabling funds to be placed in an account and cash withdrawals at the counter or at automated teller machines (thereinafter only as ATM);
- Card services: issuing of the first card and its replacement due to expiration, activation and management blocking on demand;
- Payment transactions: direct debits; payment transactions through a payment card, including online payments, credit transfers, including standing orders, at, where available, terminals and counters and via the online facilities.

Generally the services in c) should be provided within the whole internal market of the EU. However our scope is limited to national market from several reasons. The preference of payment services instruments differs in EU, e.g. France, Cyprus and Malta share strong preference of cheque usage over the way Scandinavian countries as well as Middle European countries do not use cheques at all. Also our case study is deals with the Czech RCBS market and we do not share the common EU currency. This means that we do not benefit fully from the internal market through the SEPA project. Although the SEPA payments are available the main benefit of having the same fees for inside the borders and cross-border payments does not apply here.

The next characteristics concerns the ease of substitution i.e. homogeneity. Similarly as [2] studied almost homogenous goods (cars of one type distinguished by only local contract differentiation) we claim the accounts accessed via e-banking are as well almost homogenous. We support this claim by finding only very few option for differentiation:

- Service range: within the frame of our RCBS definition can be claimed all RCBS providers meet the range criterion with a small exception of some low-cost providers such as mBank or ZUNO. Those providers do not offer cash utilization services at the counter and it is solved by other instruments such as cash advance on other bank branches, ATMs that allows also a deposit service, post remittances etc. It is important to mention that in our calculation we closely watch what services are demanded. So in case of consumer demanding cash utilization at the counter we do not take low-cost banks offer into the consideration. As a result we can claim within the frame of our study for each of the consumers the range of services is not a source of differentiation.
- Service quality: although the quality awards and other signals are available, such as Česká koruna, Banka roku Ernst&Young global banking survey etc., the focus on

quality is questionable within the frame of our survey. The bank services or payment instruments mentioned in bulleted list are standardized by local and EU law. If it is strictly set how long can take to transfer the money, then what other feature can describe the quality? It could be the ease of establishing the payment but this is just a question of being familiar with e-banking GUI and the banks are naturally adapting the GUI to be user-friendly. Also the reliability of payments (the possibility of errors and omissions) could be taken into consideration but the only system for interbank payments settlement is provided by the national bank and so there is no other choice (nevertheless the errors and omissions statistics are not available) and so this is not a source of differentiation. The next standardized feature concerns the deposits. In EU all the payment account deposits are insured with no participation up to the 100 000 euro. Due to this insurance and the fact that Czech bank market successfully came through its crisis in 2000 the consumers consider the banks safe and do not worry about their deposits. The last feature regarding quality of services is determined by the communication and overall consumer dealing with. However the banks all put the accent on high standard of consumer negotiation, helpfulness and politeness. Although we admit that there can be different level of communication services and staff quality in our survey we study mostly consumers preferring the e-banking communication and so the human element has almost negligible influence. We claim that within the frame of our study we find very limited service quality differentiation.

- Geographic differentiation: bank branch network density, the total number of ATMs can influence consumer decision. However due to e-banking preference, new options how to open an account without any visit at the counter and new ways of communication with the bank the bank branches network loses its importance. We have to keep in mind that we are dealing with RCBS. The importance of bank branches is now in financial and portfolio counselling. The question of ATMs is more complex and is discussed in the discussion chapter. Generally for consumer with e-banking communication channel preference the geographic differentiation is mostly limited to local ATM network however the influence is not a major one.

From the facts stated above we presume that RCBS products with remote access are closely to be homogenous i.e. very close substitutes. Then it is logical to expect that the main argument of any consumer decision should be guided by the price for demanded services.

The last characteristic to mention is the importance of RCBS in the consumer basket. During our previous cooperation with bankovnipoplatky.com we calculated that average month RCBS costs differ from 2010 to 2014 from 5.58 to 6.62 euro. This figure is 0.7 % of gross median wage. If compared to net month household expenditures [10] the share is approximately 1.5 % if we assume that both parents have their own account. In case of family account the share is just a half. From the consumer basket point of view the RCBS costs can be found in 12.621.01 sub-index of financial services where RCBS participates by 85 % on its value. So the RCBS share on consumer basket value is approximately 0.99 %. From those facts we can assume it is rational to pay attention to other items from the consumer basket that represents much higher share of total spending. This is consistent with the problem outlined in the introduction where the consumer's attention is a scarce resource. It is rational then that consumers do not "consume" scarce attention

on low-spending goods such as RCBS. However this creates almost “school-book” conditions for price information asymmetry and it prevents to overcome it.

1.2 EU-wide surveys

Although our empirical survey is focused on the Czech Republic we present and summarize the evidence from the EU-wide surveys. Those surveys included Czech Republic and they present the context overview of the problem. Three large scale studies were performed since the first note regarding the RCBS information asymmetry issue. It was in EU White Paper on Financial Services Policy (2005-2010) where as a one of the goals for the next period was stated as to undue barriers associated with all types of bank accounts and improve competition between service providers. As the following study [3] suggested one of the barriers to undue is the price comparison problem and that: “Consequently, consumers tend to use imperfect proxies for identifying alternative products (brands, reputation, proximity) instead of prices and contract terms and conditions.” [3, p. 6]. The imperfect proxies finding, instead of tariff computation, is consistent with the [4, 6] theories. Nevertheless the main finding is that RCBS prices are difficult to compare because the information is available in a way that implies high search costs. Those costs come from the problem of tariffs incompleteness, complexity and the links between the products. As mentioned earlier the search costs prevent the consumer to gain the market price structure overview.

The last issue of product links is related to term such as bundling, tying and conditional practices. This problem was studied in extensive survey [11]. Aside from the problem of getting complete information the question of product relation arises and is studied in this survey. Tying occurs when two or more products are sold together in a package and at least one of these products is not sold separately. However most of the products are linked through mixed bundling and conditional practices. The first one represents the situation when products are sold together in a package, although each of the products can also be purchased separately on the market. The latter one describes practices that entail better contract conditions or price reduction if certain condition is met. This one is also known for so called loyalty prices.

It was found [11, p. 235-238] that more than 50 % of RCBS providers estimate the share of consumers involved in some form of bundling higher than 80 %. Mixed bundling with rebates relates to 35 % and without rebate 60 % of consumers. The study mentions concerns that bundling might be used to segment the market and relax competition. Also the problem price transparency is significantly as more and more options and product links are taken into consideration. The price computation is then derived mostly from package rebates and loyalty prices.

The next study [8] focused more on the price transparency across the EU RCBS market. Interesting issue is that the researches had to contact 40 % of the providers to confirm data collectors’ interpretations of prices or additional tariff clarifications. 33 % the price information in their tariff lists was found to be incomplete. It suggests that consumer would have to perform the same additional questioning or worse - the consumer would be (un)knowingly calculating the price based on incomplete tariff data. The survey focused on RCBS tariff transparency as well as on the RCBS costs throughout the EU. Basic

RCBS usage profiles were created accordingly the national usage patterns. One of the outcomes was the transparency and price (or costs) negative correlation, see [8, p. 36].

2. Own survey

At first the data source and the methods will be presented. A web accessible RCBS comparison tool Kalkulátor bankovních poplatků (thereinafter as Calculator) is available at <http://www.bankovnipoplatky.com/kalkulator.html>. This service compares costs of the RCBS providers in the Czech Republic since 2010. The consumer inputs his or her individual RCBS usage pattern and then for every account that provides demanded services the average month charges are calculated. Calculator also takes into account the „if – then „conditions. It is common conditional practise that the consumer is freed of certain charges (e.g. account maintenance fee), if the account balance is higher than the certain level or the turnover exceeds certain level. So the consumer gains individualized market overview and our team gains the detailed consumer behaviour description.

The Calculator's database now holds the tariff data of 15 banks (more that 98 % of the RCBS market in the Czech Republic) and 38 offered accounts. The consumer submits the form regarding: account, statements, card services, electronic banking, direct payments, standing orders, direct debits, cash utilization, other services.

The Calculator does not regard the product tying, conditional price related to consumer loyalty or non-RCBS product. When the Calculator's form is filled and the price commutation starts, the inputted figures are saved. It has to be mentioned that it is in the consumer's best interest to enter as correct and precise data as possible. Otherwise the output of the Calculator (market price overview) would be inaccurate. From the marketing research point of view there are gathered data:

- multivariate – 53 variable concerning RCBS usage, 3 system variables for record identification and 61 variables containing the calculated costs for each of RCBS product (we had to take into consideration all the RCBS offer during the 30th June, 2010 to 28th December, 2013),
- primary – gathered directly from the consumer,
- subjective – RCBS usage data are based on consumer's own recognition.

There are specific limitations of analysis interpretation due to very specific data acquisition. We limit the survey population and our results to consumers that:

- has the account on the RCBS market in the Czech Republic.
- has the Internet connection or uses the Internet for communication.
- has activated e-banking service.
- possess at least the basic level of ICT literacy.

Still our target population is a major one as the share of accounts with electronic access grows every year, see [13, p. 56]. In our study we analysed the data gathered from the 30th June, 2010 to 28th December, 2013. 19 051 valid records were saved during this period. After the raw data refining (allowed values, cut-off frequency for each variable,

activated e-banking, key values missing such as what specific account is being used) 14 487 records were taken into the computation. At first the range of services is examined. Only the accounts which offer all demanded services were compared. The analysis then compared for each record if the costs of currently used account are lower or equal to the lowest costs of other accounts i.e. if the consumer chose the product offering all demanded services for the best price. If yes, then this record was marked as optimal choice.

Our analysis shows unexpected results, see the table 1 the left part. The result within the 95 % confidence interval for mean of (15.9; 17.1) percent was very low. Yet it is true that the result is influenced by geographical differentiation. This is why we limited studied population even more. The consumers that demanded any kind of at the desk services, such as establishing payment instrument at the desk, account cash deposit or withdrawal over the counter, were filtered off. A new population counted 9 601 of almost perfectly electronic communication channel preferring consumers. The only cash variable left was the ATM usage and the cash-back service. A new share of optimal choices was calculated with an increase compared to the first analysis yet not a major one. The second result is the share 95 % confidence interval for mean of (19.6; 21.3) percent.

Tab. 1: The optimum choice

Optimum; full analysis		Statistic	Optimum; e-banking and ATM services only		Statistic
Mean		16.51%	Mean		20.45%
95% Confidence Interval for Mean	Lower Bound	15.91%	95% Confidence Interval for Mean	Lower Bound	19.62%
	Upper Bound	17.12%		Upper Bound	21.28%

Source: own research.

Such a low share of optimal choice shows that the magnitude of the suboptimal choice of the RCBS products is significant. The result of the second analysis is more conclusive since the population with very limited geographical differentiation was studied. It is time to pose a question, what is the reason of such unambiguous result. Without more detailed survey it is hard to answer but from the facts stated before it is an outcome of a combination of these factors - the RCBS expenditure importance is very low and the exact price determination creates the search costs higher than possible return of search. Interesting note was made also in [3] about the imperfect proxies such as brands – RCBS and moreover controlled through e-banking are almost homogenous product.

3. Discussion

The main problem is that the result is hard to compare or verify if there is no similar study available not just regarding the Czech Republic but the EU. We performed an extensive survey to find empirical study based on detailed consumer usage patterns without a success. There are the studies focused on the fee level or what determines the fees but the consumer choice optimality study was not performed or it is not publicly accessible.

A question to discuss is whether to include into the calculation exclusive accounts and ATM usage. Exclusive are characteristic by large variety of bonuses available after hardly

achievable conditions are met. Mostly it concerns as high balance as 20 000–40 000 € and high turnover. Specific preference of those bonuses and even lower share on household expenditure of exclusive products consumers might prevent the assumption of close substitution. However those accounts were very rare in our survey sample and so the total influence on our result would be negligible. The question of the ATM is a bit more serious. In spite of all the facts supporting the close substitution assumption ATMs create limited but still present geographical differentiation. ATM network is extensive and gets more dense every year, see [13, p. 56] however the problem lies within the difference between the networks of each bank or group. The consumer is influenced more by specific location than the total number. It is because the banks' tariffs show significantly higher fees for ATM withdrawal from other network's ATM. This differentiation is almost impossible to gain data on. The next problem is that some banks cooperate or share the ATM network (ČSOB group, Raiffeisen-ZUNO, ČSOB and Sberbank). On the contrary some banks do not have their own ATM network and so all withdrawals are from other network. So the question to discuss is if the share of optimal choices should be performed on consumers without ATM services demand. But, as our data confirms, the ATM is one of the most demanded service. 94,7 % of consumers in our survey uses at least once per month ATM withdrawal. Without them our survey would be ignoring almost the whole population.

Besides the influence of the search costs higher than possible return of search and imperfect proxies a financial literacy could be discussed. As [14] found the financial literacy is generally defined through term "understanding" as a key dimension. OECD financial literacy tests PISA 2012 included few questions and tasks related to the payment account. However the problem is not with the understanding in a way of usage itself but with the choice. So it raises a question that the financial literacy may include the strategies for price searching focused on online comparison services and on price calculation under the different connected conditions. This would lead to broader way of understanding the financial market and, at least partially, be the solution of studied problem. There are some trends but two largest ones are supposed to be solved on the RCBS market during the next two years (the comparison independence and the data accuracy) due to [9] adoption, see art. 7 par. 3a. It also confirms the trend in the last decade when, as [15] claims: "Computer and financial literacy represents an inseparable part of current lives."

Conclusion

Unlike most of the markets the RCBS market is supposed to be the one where the price has almost absolute influence on the consumer's choice. It is due to account services standardization and EU or local law regulation (central bank supervision, deposit insurance, payment instrument time limits) that makes the accounts accessed via e-banking very close substitutes. However the RCBS market, from its very nature, tends to create the imperfection in form of price information asymmetry. The RCBS's household expenditure share is very low and it is not rational to pay consumers' limited attention to it. The situation is worsened by the environment where prices are difficult to compare because the information is available in a way that implies high search costs. Those costs come from the problem of tariffs incompleteness, complexity and the links between the products.

Under those conditions we studied the consumer optimal choice share on the Czech Republic RCBS market to determine the magnitude of the consumer choice problem. We perform our analysis on detailed consumer behaviour records gathered from 30th June, 2010 to 28th December, 2013 by RCBS comparison tool. We define the optimal choice as the lowest fees for the account that provides all the demanded services. Our sample counted for 14 487 records of individual RCBS usage patterns of consumers with an account and in the Czech Republic and activated e-banking service, with the basic level of ICT and Internet literacy. We calculated the share of optimal choices in this sample in the 95 % confidence interval for mean (15.9; 17.1) percent. For the second analysis we filter off the consumers demanding over the counter services to decrease the possible geographical differentiation bias. The share of optimal choice increased and the 95 % confidence interval for mean is then (16.2; 21.3) percent.

Both results are unsatisfactory because the shares are surprisingly low. It shows that in spite of possibility of close substitution the influence of search costs, imperfect proxies and low consumer attention is stronger. The next question is if the situation leads to adverse choice as an outcome of the information asymmetry. In the environment of mostly standardized product the question of quality can be replaced by the efficiency question. If mostly the same product is provided for different prices then less efficient providers can operate on the market as well as the efficient ones. Moreover if the product is sold for higher price, then the normal profit can be invested to attract more consumers to the detriment of the lower price provider. This is certainly unwanted market outcome similar to general form of the adverse selection.

References

- [1] HEDVIČÁKOVÁ, M., I. SOUKAL, and J. DRAESSLER. Probabilistic model of optimal price search on the retail core banking services market. *International Journal of Mathematical Models and Methods in Applied Sciences*, 2012, **6**(2): 386–393. ISSN 1998-0140.
- [2] STIGLER, G. J. The economics of information. *The journal of political economy*, 1961, **69**(3): 213–225. ISSN 0022-3808.
- [3] EUROPEAN COMMISSION INTERNAL MARKET AND SERVICES DG. *Expert group on customer mobility in relation to bank accounts* [online]. Brussels: European commission, 2007. [cit. 2015-03-20] Available at: http://ec.europa.eu/internal_market/finances-retail/docs/baeg/report_en.pdf
- [4] KAHNEMAN, D. Maps of Bounded Rationality: Psychology for Behavioral Economics. *American Economic Review*, 2003, **93**(5): 1449–1475. ISSN 0002-8282.
- [5] SIMON, H. A. Designing organizations for an information-rich world. *International Library of Critical Writings in Economics*, 1996, **70**: 187–202. ISBN 9781858982946.
- [6] SCHWARTZ, B. *The paradox of choice: why more is less*. New York: Harper Collins, 2004. ISBN 978-0-06-146158-3.
- [7] TNS OPINION & SOCIAL. *Special Eurobarometer 373 Retail Financial Services*. [online]. Brussels: European commission, 2011. [cit. 2015-03-20]. Available at: http://ec.europa.eu/internal_market/finances-retail/docs/policy/eb_special_373-report_en.pdf.
- [8] SPAEY, D. et al. *Market study of the current state of play in Member States regarding initiatives in bank fee transparency and comparability in personal current bank*

- accounts. [online]. Brussels: European commission, 2012. [cit. 2015-03-21]. Available at: http://ec.europa.eu/consumers/archive/rights/docs/1912012_market_study_en.pdf
- [9] EP. *Directive 2014/92/EU of the European Parliament and of the Council of 23 July 2014 on the comparability of fees related to payment accounts, payment account switching and access to payment accounts with basic features*. Brussels: European Parliament, 2014.
- [10] CZSO. *Household Budget Survey* [online] Prague: Czech Statistical Office, 2014. [cit. 2015-03-24]. Available at: [http://www.czso.cz/csu/2014edicniplan.nsf/t/EF0019A795/\\$File/1600181451.pdf](http://www.czso.cz/csu/2014edicniplan.nsf/t/EF0019A795/$File/1600181451.pdf)
- [11] CEPS. *Tying and other potentially unfair commercial practices in the retail financial services sector*. Brussels: European Commission, 2009. [cit. 2015-03-21]. Available at: http://ec.europa.eu/internal_market/consultations/docs/2010/tying/report_en.pdf
- [12] MARKOVIČ, P. and R. ANACKER. *Auswirkungen der Finanzkrise auf die Asset allocation bei Regionalbanken*. Bratislava: Kartprint, 2014. ISBN 978-80-89553-22-8.
- [13] CNB. *Financial market supervision report 2013*. Prague: Czech national bank, 2014. [cit. 2015-03-27]. Available at: http://www.cnb.cz/miranda2/export/sites/www.cnb.cz/en/supervision_financial_market/aggregate_information_financial_sector/financial_market_supervision_reports/download/fms_2013.pdf
- [14] TITKO, J. and N. LACE. Financial Literacy: Building a Conceptual Framework. In KOCOUREK, A. ed. *Proceedings of the 11th International conference Liberec Economic Forum 2013*. Liberec: Technical university of Liberec, 2013. pp. 585–593. ISBN 978-80-7372-953-0.
- [15] SVOBODOVÁ, L., M. ČERNÁ. Investment Competitions on the Current Local Scene from Students' Perspective – Case study. *Smart Innovation, Systems and Technologies*, 2015, **41**: 81–92. ISBN 978-3-319-19875-0.

Michaela Staníčková

VŠB-Technical University of Ostrava, Faculty of Economics,
Department of European Integration
Sokolská třída 33, 701 21 Ostrava, Czech Republic
email: michaela.stanickova@vsb.cz

Merging Regions and Effect on Competitiveness: Issue of EU Major Cities and Surrounding Areas

Abstract

Europe's competitiveness depends on a multiplicity of actions that can optimise the potentials within its regions. Nowadays, regions are increasingly becoming the drivers of the economy. All regions possess development opportunities – however, use these options enough and hence the competitiveness of European regions must be efficient enough. It is well-known that there are significant differences among the European Union regions which weaken its competitiveness. The paper is focused on using the Data Envelopment Analysis method for comparison the efficiency changes among selected EU NUTS 2 regions and find out the level of the EU main capital cities competitiveness and surrounding areas. The main aim of the paper is to search the efficient frontier and to find an optimal number of groups for analysis of differences in competitiveness which is linked with efficiency based on sources and results of competitive society - empirical analysis of the paper is thus solved via specified multicriteria approach. DEA seems to be suitable tool for setting an efficient and inefficient position of each region with respect to region of capital cities and surrounding areas, which are in all evaluated countries considered as traditionally powerful areas. In the paper, DEA method evaluates regional efficiency within the selected factors of competitiveness based on Regional Competitiveness Index 2010 and 2013 and recognize spatial variations in location factors influencing the attractiveness of regions. Results obtained by calculating the output oriented models with variable returns to scale (BCC model of efficiency and APM model of super-efficiency) indicate in which NUTS 2 region should be policy making authorities in order to stimulate regional development to be such efficient as region of capital cities and surrounding areas.

Key Words

capital city, DEA super/efficiency, merged NUTS 2 regions, RCI index, regional competitiveness

JEL Classification: C61, O18, R15, R58

Introduction

The European Union (EU) is going through one of the most difficult periods since its establishment, with multiple challenges facing the region's policy-makers. Recent years have seen a myriad of economic and social difficulties, i.e. stagnating economic growth, rising unemployment leading to social tensions, continuing financial troubles and sovereign debt crises in several countries, exacerbated by the fact that the future outlook remains uncertain. There is widespread agreement that the root causes of this prolonged crisis lie in the lack of competitiveness [6]. The EU faces increased competition from other territories. Territorial potentials of European regions and their diversity are thus

becoming increasingly important for the development of the European economy, especially in times of globalisation processes in world economy. Increasing the competitiveness of European countries and regions is one of the main aims of the EU. This involves focusing on growth and jobs, as well as growing the necessary preconditions for the future mainly in terms of a Knowledge Based Economy and Information Society. Only a certain type of regions appears to be really successful with regard to the EU growth strategies such as Lisbon Strategy and Europe 2020 Strategy. The key to success seems mainly to lie in the active use of territorial potentials for the development of economic functions across a wider area, and support through national policies. In short, territories have diverse potentials and challenges. [4]. All territories possess development opportunities. To make sound policy decisions requires evidence, knowledge and understanding of the position of regions and cities.

1. Issue of Competitiveness – Importance of Regions and Its EU Classification

In last few years the topic about regional competitiveness stands in the front of economic interest. In the global economy regions are increasingly becoming the drivers of the economy [9]. Current economic fundamentals are threatened by shifting of production activities to places with better conditions. Regional competitiveness is also affected by the regionalization of public policy because of shifting of decision-making and coordination of activities at regional level. Within governmental circles, interest has grown in the regional foundations of competitiveness, and with developing new forms of regionally based policy interventions to help improve competitiveness of every region and major city, and hence the economy as a whole. Regions thus play increasingly important role in the economic development of states [8]. To improve the understanding of territorial competitiveness at regional level, the EU has developed the Regional Competitiveness Index (RCI) approach which shows the strengths and weaknesses of each of EU NUTS 2 regions [2]. RCI can provide a guide to what each region should focus on, taking into account its specific situation and its overall level of development to further increase its competitiveness [1].

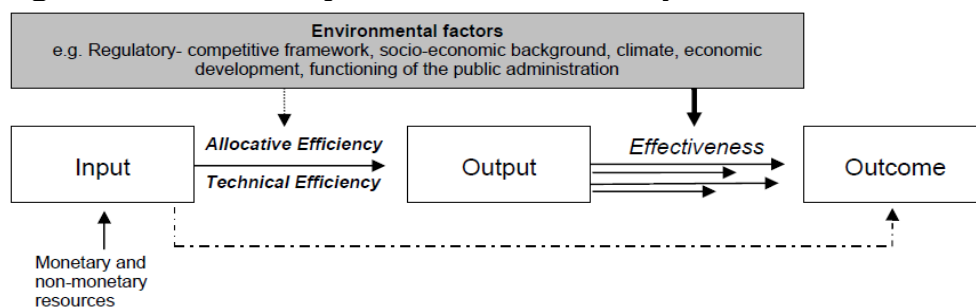
The literature raises two issues related to selection of the appropriate regional level. The first, competitiveness should be calculated for functional economic regions. The second is that region should have an important political and administrative role. In most countries, however, functional regions are not administrative and vice-versa. Thus in practice, these two recommendations can be rarely combined. The RCI focuses on NUTS 2 regions in EU. NUTS 2 regions are administrative or statistical regions which do not take into account functional economic links. For example, London and Paris are both cities of approximately the same size (7.7 and 6.7 million inhabitants). Paris is included in NUTS 2 region of Ile de France with 12 million inhabitants. This has the benefit that it includes the commuter belt around Paris. Greater London, on the contrary, is spilt into two NUTS 2 regions: Inner London (3 million) and Outer London (4.7 million) although both fall under the same mayor. In addition, these two NUTS 2 regions do not cover the commuter belt around London [1]. This problem arises for a number of cities: London, Brussels, Prague, Berlin, Amsterdam and Vienna. It is thus no random that these regions, respectively regions around these major cities, were the subject of a merging within RCI2013. For these

reasons, one important question has been asked in RCI2013, i.e. what are the consequences of not merging regions which have strong functional economic links [1]:

- It does not take into account the qualifications of the people working in the city but living in a neighbouring region. Educational attainment is measured where people live, not where work.
- It distorts GDP per head. This distortion is due to commuting patterns – people who work in city, but not live in city contribute to GDP but not the population.

Nowadays competitiveness is one of the fundamental criteria for evaluating performance and reflects the success in the broader comparison. Territories need highly performing units in order to meet their goals, to deliver the products and services they specialized in, and finally to achieve competitive advantage. Comparative analysis of performance in public sector is starting point for studying the role of its two dimensions – efficiency and effectiveness, regarding economic governance of resources utilization by public management for achieving medium/long-term objectives of economic recovery and sustainable development of economies. Increasing productivity is generally considered to be the only sustainable way of improving living standards in the long term period. Concept of competitiveness is linked with performance, because competitiveness measures “how a nation manages the totality of its resources and competencies to increase the prosperity of its people’ [9]. This understanding of competitiveness is very closely linked with understanding of efficiency and effectiveness, see Figure 1.

Fig. 1: The relationship between the efficiency and the effectiveness



Source: [7], p. 3

2. Background of Empirical Analysis – DEA and RCI Specifications

2.1 DEA Method and Its Specification for Empirical Analysis

Statistical evidence to help policy makers understand the routes to performance growth, especially those which can be influenced by government, can help lead to better policy [5]. The efficiency analysis is based on application of multi-criteria decision making method – Data Envelopment Analysis (DEA). DEA provides a relative assessment of efficiency of a set of peer entities called Decision Making Units (DMUs) which convert multiple inputs into multiple outputs. Various types of DEA models can be used, depending upon the problem at hand. DEA can be distinguished by the scale and orientation of model. If one cannot assume that economies of scale do not change, then a variable returns to scale

(VRS) type of DEA model, the one selected here, is an appropriate choice (as opposed to a constant returns to scale, (CRS) model). If in order to achieve better efficiency, governments' priorities are to adjust their outputs (before inputs), then an output oriented (OO) DEA model, rather than an input oriented (IO) model, is appropriate. In 1984, Banker, Charnes and Cooper suggested a model considering VRS (decreasing, increasing or constant) – BCC model. Assumption of VRS provides a more realistic expression of economic reality and factual relations real existing. Therefore, for calculations of regional' efficiency, it's used OO BCC model with VRS. The way in which DEA program computes efficiency scores can be explained briefly using model (1) [3]:

$$\begin{aligned} \max \quad & g = \phi_q + \varepsilon(\mathbf{e}^T \mathbf{s}^+ + \mathbf{e}^T \mathbf{s}^-), \\ \text{subject to} \quad & \mathbf{X}\lambda + \mathbf{s}^- = \mathbf{x}_q, \\ & \mathbf{Y}\lambda - \mathbf{s}^+ = \phi_q \mathbf{y}_q, \\ & \mathbf{e}^T \lambda = 1, \\ & \lambda, \mathbf{s}^+, \mathbf{s}^- \geq 0, \end{aligned} \tag{1}$$

where g is the coefficient of efficiency of unit U_q ; ϕ_q is radial variable indicates required rate of increase of output; ε is infinitesimal constant; $\mathbf{e}^T \lambda$ is convexity condition convexity condition, in the case of VRS is $\mathbf{e}^T \lambda = 1$; $\mathbf{s}^+$, and $\mathbf{s}^-$ are vectors of slack variables for inputs and outputs; λ represent vector of weights assigned to individual units; $\mathbf{x}_q$ means vector of input of unit U_q ; $\mathbf{y}_q$ means vector of output of unit U_q ; $\mathbf{X}$ is input matrix; $\mathbf{Y}$ is output matrix. In BCC model aimed at outputs the efficiency coefficient of efficient DMU equals 1, but the efficiency coefficient of inefficient DMU is greater than 1.

In BCC model, efficiency coefficients of efficient units equal to 1. Depending on chosen model, but also on relationship between number (No.) of units, No. of inputs and outputs, No. of efficient units can be relatively large. Due to the possibility of efficient units' classification, it is used Andersen-Petersen's model (APM) of super-efficiency. Following VRS model is output oriented dual version of APM (2) [3]:

$$\begin{aligned} \max \quad & g = \phi_k + \varepsilon\left(\sum_{i=1}^m \mathbf{s}_i^- + \sum_{r=1}^s \mathbf{s}_r^+\right), \\ \text{subject to} \quad & \sum_{\substack{j=1 \\ j \neq k}}^n \lambda_j \mathbf{x}_{ij} + \mathbf{s}_i^- = \mathbf{x}_{ik}, \\ & \sum_{\substack{j=1 \\ j \neq k}}^n \lambda_j \mathbf{y}_{rj} - \mathbf{s}_r^+ = \phi_k \mathbf{y}_{rk}, \\ & \mathbf{e}^T \lambda = 1, \\ & \lambda_j, \mathbf{s}_r^+, \mathbf{s}_i^- \geq 0, \\ & j = 1, 2, \dots, n; r = 1, 2, \dots, s; i = 1, 2, \dots, m, \end{aligned} \tag{2}$$

where x_{ij} and y_{rj} are i -th inputs and r -th outputs of DMU $_j$; ϕ_k is efficiency index (intensity factor) of observed DMU $_k$; λ_j is dual weight which show DMU $_j$ significance in definition of

input-output mix of hypothetical composite unit, DMU_k directly comparing with. Rate of efficiency of inefficient units ($\phi_k > 1$) is identical to model (1); for units identified as efficient in model (1), provides OO APM (2) rate of super-efficiency lower than 1, i.e. $\phi_k \leq 1$. For solution of DEA, software tool based on solving linear programming problems is used in the paper – the DEA Frontier – Microsoft Office Add-In Solver.

2.2 RCI Approach and Data Base Characteristics

Efficiency analysis starts from building database based on RCI2010 and RCI2013 approach. RCI is based on eleven pillars describing both inputs and outputs, grouped into three sets describing basic, efficiency and innovative factors of competitiveness. RCI pillars are grouped according to the different dimensions (input vs. output aspects) of competitiveness they describe. Terms ‘inputs’ and ‘outputs’ are meant to classify pillars into those which describe driving forces of competitiveness, and those which are direct or indirect outcomes of a competitive society and economy [2]. These pillars are the initial variables for empirical analysis – distribution of pillars into input/output dimensions is in Tab. 1.

Tab. 1: RCI pillars based on input and output dimensions of competitiveness

Stage of the drivers of economies	RCI pillars	
	Input dimension	Output dimension
Basic group	Institutions, Macroeconomic stability, Infrastructure, Health, Basic education	/
Efficiency group	Higher education and lifelong learning	Labour market efficiency, Market size
Innovation group	Technological readiness	Business sophistication, Innovation

Source: [2]; own elaboration, 2015

Territorial background of analysis is applied at NUTS 2 region level within EU Member States where merging of regions was made. In RCI2013 construction, some regions are merged with surrounding areas to correct for commuting patterns following the new OECD city definition. With respect to RCI2010, more capital regions are merged with their surrounding regions: Wien (AT), Brussels (BE), Praha (CZ), Berlin (DE), Amsterdam (NL) and London (UK) and with respect to revision of NUTS classification some regions in Finland (FI) were merged, see Tab. 2. But how are NUTS 2 regions selected to merge? If a region has at least 40% of its population inside the commuting zone (commuting zone of a city consists of all contiguous municipalities that send 15% or more of their working residents to the city), it is added to region which contained the city. This criterion is applied to all NUTS 2 regions, but only a few NUTS 2 regions with the capital had neighbouring regions with a high-share of its population in the commuting zone of the capital.

Tab. 2: NUTS 2 classification – changes between RCI2010 and RCI2013 approaches

Merged regions due to community patterns	Official NUTS 2 regions	New merged regions
Wien	AT12: Niederösterreich AT13: Wien	AT00
Brussels	BE10: Rég. Bruxelles/Brussels Gewest BE24: Prov. Vlaams-Brabant BE31: Prov. Brabant Wallon	BE00 (as in RCI 2010)
Praha	CZ01: Praha CZ02: Střední Čechy	CZ00
Berlin	DE30: Berlin DE40: Brandenburg (former DE41+DE42)	DE00
Amsterdam	NL23: Flevoland NL32: Noord-Holland	NL00
London	UKI1: Inner London UKI2: Outer London UKH2: Bedfordshire and Hertfordshire UKH3: Essex	UK00
Merged regions due to the revised NUTS 2 classification	Old NUTS 2 classification	New NUTS 2 classification
	FI1A: Pohjois-Suomi FI13: Itä-Suomi	FI1D: Pohjois- ja Itä-Suomi

Source: [1]; own elaboration, 2015

3. Efficiency Comparison of Regional Merging in RCI2010 and RCI2013

Following Tab. 3 and Tab. 4 show results of DEA analysis for RCI2010 and RCI2013 based on OO BCC VRS model. Based on coefficient of efficiency (CE), it is possible to see differences in efficiency among NUTS 2 regions in AT, BE, CZ, DE, FI, NL and UK – thus in countries with one of the most differences in regional economic performance, i.e. difference among capital cities/surrounding areas and rest of countries. In OO BCC VRS, CE of efficient region equals to 1, but CE of inefficient region is greater than 1. For purpose to observe the efficiency differences for all the regions, OO APM VRS model is used to evaluate efficiency regions. For regions identified as efficient in OO BCC VRS model, OO APM VRS provides coefficient of super-efficiency (CSE) lower than 1. In following tables, results are highlighted by traffic light method, three-colour scale divides the relevant group of CE and CSE using three colours (green, yellow, red colour and their corresponding colour highlight), the middle colour corresponds to 50 percentile (yellow), the other two colours are above (green – the best results = the most efficient regions) and below (red – the worst results = the most inefficient regions) percentile value of 50. Merging regions are highlighted by grey colour.

In all evaluated countries in RCI2010, it possible to seen that NUTS 2 regions of capital cities and NUTS 2 regions of surrounding areas of capital cities achieved the best results, and other NUTS 2 regions are also efficient, but in many cases inefficient. Also in RCI2013, the best results were achieved by NUTS 2 regions of capital cities and surrounding areas, but the differences in CE and CSE were not so high in RCI2013 than in RCI2010, what was caused by fact that in RCI2013 are efficiency results for merging NUTS 2 regions. It possible to state that thanks to merging of regions were decreased the differences in efficiency (levels of CE and CSE) and regional comparison is much more realistic and other

NUTS 2 regions are not so disqualified and results are not biased due to qualifications of the people working in the city but living in a neighbouring region and thus distortion of GDP per head. Results of efficiency analysis based on comparison RCI2010 and RCI2013 show a more polycentric pattern with strong capital and metropolitan regions in many parts of Europe. Some capital regions are surrounded by similarly competitive regions, but in many countries, regions neighbouring the capital are less competitive. As this was also observed for RCI2010, RCI2013 shows that in the past three years no spill-over effects helped to lift these lagging-behind surrounding regions. Despite the increasing level of mobility of economic sources, i.e. inputs to find out better condition for economic activities, access to places, and services is still difficult, what has an impact on economic development of regional areas distant from the main economic centres of the country, especially major cities and their surrounding areas. Efficiency results underline that competitiveness has a strong regional dimension, which national level analysis does not capture [1].

Capital cities are where Europe's economic and social problems are often most concentrated and most visible. But they are also the powerhouses of Europe - where the most important solutions can be found: in the fields of competitiveness, employment, education, transport, environment and innovation. This makes them crucial in lifting Europe out of crisis. Without Europe's capital cities, it cannot make the Europe2020 Growth Strategy a reality – reason for having much more activities and interest in capital cities and their surrounding areas as the main representatives of progress. This is also linked with financial sources available to support activities with respect to the aims of EU Cohesion Policy. For example, these tendencies is possible to seen in France. The French parliament is discussing the next phase of territorial reform. Among the current 22 regions of mainland France (corresponding to the Czech NUTS 3 regions) should become 13 larger areas. The explanatory memorandum states the need for larger units because of administrative savings, but also to emphasize better conditions for effective performance management. Since the beginning of discussions, the question of future capital cities of new regions is also addresses – what is not a simple matter. From this merging tendencies could develop new social units and forms of organization and functioning of territorial units. Nowadays is possible to observe trend towards 'endless cities' which could significantly affect population and wealth in the next years [10] and world's biggest cities will merge into 'mega-regions'. The phenomenon of 'endless cities' could be one of the most significant developments and problems – in the way people live and economies grow in future [10]. The trend helped the world pass a tipping point in the last years, with more than half the world's people now living in cities and urbanization is now "unstoppable". The development of mega-regions and merging of regions is possible to regard as generally positive because regions, rather than countries, are now driving wealth. Mega-regions will be also increasingly driving forces for development because capital cities and surrounding areas account the most part of economic activity and technological and scientific innovation. The growth of mega-regions and cities could also lead to unprecedented urban sprawl, new slums, and unbalanced development and income inequalities as more and more people move and will move to satellite or dormitory cities. Their expansion drives economic growth but also leads to urban sprawl, rising inequalities and urban unrest. With respect to EU Cohesion Policy, the more unequal that regions become, the higher the risk that economic disparities will result in social and political tension. The likelihood of unrest in unequal regions is high. The regions (and belonging cities) prospering the most are generally those that are reducing inequalities.

Tab. 4: Application of 00 BCC VRS models of efficiency and super-efficiency for RCI2013

Category A										Category B										Category C									
NUTS	CE	CSE	NUTS	CE	CSE	NUTS	CE	CSE	NUTS	CE	CSE	NUTS	CE	CSE	NUTS	CE	CSE	NUTS	CE	CSE									
AT11	1,000	0.929	BE10	1,000	0.999	CZ01	1,000	1,000	DE11	1,001	1,001	FI13	1,000	0.999	NL11	1,020	1,020	UKC1	1,000	0.972									
AT12	1,000	0.998	BE21	1,000	0.968	CZ02	1,000	1,000	DE12	1,000	0.954	FI18	1,000	0.924	NL12	1,053	1,053	UKC2	1,027	1,027									
AT13	1,000	0.998	BE22	1,000	0.997	CZ03	1,000	0.952	DE13	1,005	1,005	FI19	1,009	1,009	NL13	1,075	1,075	UKD1	1,000	NA									
AT21	1,000	NA	BE23	1,000	0.935	CZ04	1,000	NA	DE14	1,000	0.995	FI1A	1,000	0.999	NL21	1,031	1,031	UKD2	1,000	0.998									
AT22	1,000	NA	BE24	1,000	0.998	CZ05	1,055	1,055	DE21	1,000	0.912	FI20	1,000	NA	NL22	1,023	1,023	UKD3	1,000	0.970									
AT31	1,000	0.959	BE25	1,000	0.969	CZ06	1,000	0.862	DE22	1,029	1,029				NL23	1,000	1,000	UKD4	1,000	0.946									
AT32	1,000	NA	BE31	1,000	0.998	CZ07	1,000	NA	DE23	1,000	0.981				NL31	1,000	0.946	UKD5	1,000	0.996									
AT33	1,000	0.976	BE32	1,000	0.806	CZ08	1,000	NA	DE24	1,036	1,036				NL32	1,000	1,000	UKE1	1,000	NA									
AT34	1,000	0.999	BE33	1,000	0.968				DE25	1,000	0.964				NL33	1,028	1,028	UKE2	1,000	0.867									
			BE34	1,000	NA				DE26	1,045	1,045				NL34	1,004	1,004	UKE3	1,000	NA									
			BE35	1,000	0.964				DE27	1,037	1,037				NL41	1,000	0.999	UKE4	1,000	NA									
									DE30	1,060	1,060				NL42	1,005	1,005	UKF1	1,030	1,030									
									DE41	1,060	1,060							UKF2	1,057	1,057									
									DE42	1,060	1,060							UKF3	1,016	1,016									
									DE50	1,072	1,072							UKG1	1,015	1,015									
									DE60	1,000	0.937							UKG2	1,034	1,034									
									DE71	1,000	0.886							UKG3	1,000	0.951									
									DE72	1,084	1,084							UKH1	1,000	0.886									
									DE73	1,065	1,065							UKH2	1,000	1,000									
									DE80	1,070	1,070							UKH3	1,000	1,000									
									DE91	1,069	1,069							UKI1	1,000	1,000									
									DE92	1,068	1,068							UKI2	1,000	1,000									
									DE93	1,025	1,025							UKI1	1,000	0.836									
									DE94	1,000	0.985							UKI2	1,000	0.979									
									DEA1	1,000	0.906							UKI3	1,000	0.973									
									DEA2	1,000	0.995							UKI4	1,000	0.931									
									DEA3	1,030	1,030							UKK1	1,003	1,003									
									DEA4	1,029	1,029							UKK2	1,022	1,022									
									DEA5	1,046	1,046							UKK3	1,000	NA									
									DEB1	1,032	1,032							UKK4	1,053	1,053									
									DEB2	1,044	1,044							UKL1	1,100	1,100									
									DEB3	1,045	1,045							UKL2	1,000	0.997									
									DEB4	1,045	1,045							UKL3	1,021	1,021									
									DEB5	1,045	1,045							UKL4	1,021	1,021									
									DEB6	1,045	1,045							UKL5	1,000	NA									
									DEB7	1,045	1,045							UKL6	1,000	NA									
									DEB8	1,045	1,045							UKL7	1,000	NA									
									DEB9	1,045	1,045							UKL8	1,000	NA									
									DEB10	1,045	1,045							UKL9	1,000	NA									
									DEB11	1,045	1,045							UKL10	1,000	NA									
									DEB12	1,045	1,045							UKL11	1,000	NA									
									DEB13	1,045	1,045							UKL12	1,000	NA									
									DEB14	1,045	1,045							UKL13	1,000	NA									
									DEB15	1,045	1,045							UKL14	1,000	NA									
									DEB16	1,045	1,045							UKL15	1,000	NA									
									DEB17	1,045	1,045							UKL16	1,000	NA									
									DEB18	1,045	1,045							UKL17	1,000	NA									
									DEB19	1,045	1,045							UKL18	1,000	NA									
									DEB20	1,045	1,045							UKL19	1,000	NA									
									DEB21	1,045	1,045							UKL20	1,000	NA									
									DEB22	1,045	1,045							UKL21	1,000	NA									
									DEB23	1,045	1,045							UKL22	1,000	NA									
									DEB24	1,045	1,045							UKL23	1,000	NA									
									DEB25	1,045	1,045							UKL24	1,000	NA									
									DEB26	1,045	1,045							UKL25	1,000	NA									
									DEB27	1,045	1,045							UKL26	1,000	NA									
									DEB28	1,045	1,045							UKL27	1,000	NA									
									DEB29	1,045	1,045							UKL28	1,000	NA									
									DEB30	1,045	1,045							UKL29	1,000	NA									
									DEB31	1,045	1,045							UKL30	1,000	NA									
									DEB32	1,045	1,045							UKL31	1,000	NA									
									DEB33	1,045	1,045							UKL32	1,000	NA									
									DEB34	1,045	1,045							UKL33	1,000	NA									
									DEB35	1,045	1,045							UKL34	1,000	NA									
									DEB36	1,045	1,045							UKL35	1,000	NA									
									DEB37	1,045	1,045							UKL36	1,000	NA									
									DEB38	1,045	1,045							UKL37	1,000	NA									
									DEB39	1,045	1,045							UKL38	1,000	NA									
									DEB40	1,045	1,045							UKL39	1,000	NA									
									DEB41	1,045	1,045							UKL40	1,000	NA									
									DEB42	1,045	1,045							UKL41	1,000	NA									
									DEB43	1,045	1,045							UKL42	1,000	NA									
									DEB44	1,045	1,045							UKL43	1,000	NA									
									DEB45	1,045	1,045							UKL44	1,000	NA									
									DEB46	1,045	1,045							UKL45	1,000	NA									
									DEB47	1,045	1,045							UKL46	1,000	NA									
									DEB48	1,045	1,045							UKL47	1,000	NA									
									DEB49	1,045	1,045							UKL48	1,000	NA									
									DEB50	1,045	1,045							UKL49	1,000	NA									
									DEB51	1,045	1,045							UKL50	1,000	NA									
									DEB52	1,045	1,045							UKL51	1,000	NA									
									DEB53	1,045	1,045							UKL52	1,000	NA									
									DEB54	1,045	1,045							UKL53	1,000	NA									
									DEB55	1,045	1,045							UKL54	1,000	NA									
									DEB56	1,045	1,045							UKL55	1,000	NA									
									DEB57	1,045	1,045							UKL56	1,000	NA									
									DEB58	1,045	1,045							UKL57	1,000	NA									
									DEB59	1,045	1,045							UKL58	1,000	NA									
									DEB60	1,045	1,045							UKL59	1,000	NA									
									DEB61	1,045	1,045							UKL60	1,000	NA									
									DEB62	1,045	1,045							UKL61	1,000	NA									
									DEB63	1,045	1,045							UKL62	1,000	NA									
									DEB64	1,045	1,045							UKL63	1,000	NA									
									DEB65	1,045	1,045							UKL64	1,000	NA									
									DEB66	1,045	1,045							UKL65	1,000	NA									
									DEB67	1,045	1,045							UKL66	1,000	NA									
									DEB68	1,045	1,045							UKL67	1,000	NA									

Note: CE = Coefficient of Efficiency, CSE = Coefficient of Super-efficiency, NA = Not Available – impossible to recalculate due to level of inputs/outputs

Conclusion

The EU competitiveness depends on contributions from regions, cities and rural areas in all corners of the continent. An asset for Europe is its rich regional diversity which for each region and larger territory represents a unique set of potentials and challenges for development calling for a corresponding targeted policy mix to become reality. This regional diversity represented by specific territorial endowment is also possible to consider as a competitive advantage of each region. European policy development has thus moved towards recognizing the territorial dimension in many policies and the added value from an integrated approach when searching for development opportunities. Modern strategic objectives for territories opt both for improving the cohesion and the competitiveness of the area, and to improve both the attractiveness for investments and the livability for people. In doing so a number of territorial trends, perspectives, policy impacts and scenarios should be considered which influence policy aims of cohesion and balance and the competitiveness of territories. Opportunities and challenges of different territorial types such as regions, cities, rural areas and areas with specific characteristics and important themes as accessibility, innovation and hazards should be part of this. Territories are living legacies from the past and contain development potentials for the future. Trends and perspectives can be identified, and the impacts of policies can be seen. The interplay of all these factors underpins a territory's demographic, economic, social, cultural and ecological development dynamics. Thus each territory, be it continent, region, metropolitan area or village, has its own unique settings and development conditions. Knowledge and understanding of the territory is an important prerequisite for ensuring a future development for competitive attractive and livable places.

Acknowledgement

This paper was created under SGS project (SP2015/106) of Faculty of Economics, VŠB-Technical University of Ostrava and Operational Programme Education for Competitiveness – Project CZ.1.07/2.3.00/20.0296 and the Czech Science Foundation (GA ČR Project No. 14-31593S).

References

- [1] ANNONI, P. and L. DIJKSTRA. *EU Regional Competitiveness Index 2013*. Luxembourg: Publication Office of the European Union, 2013. ISBN 978-92-79-32370-6.
- [2] ANNONI, P. and K. KOZOVSKA. *EU Regional Competitiveness Index 2010*. Luxembourg: Publication Office of the European Union, 2010. ISBN 978-92-79-15693-9.
- [3] COOPER, W. W., L. M. SEIFORD, and K. TONE. *Introduction to Data Envelopment Analysis and its Uses with DEA-solver Software and References*. New York: Springer, 2007. ISBN 978-0-387-28580-1.
- [4] ESPON. *Mapping regional competitiveness and cohesion European and global outlook on territorial diversities*. Denmark: European Spatial Planning Observation Network, 2006. ISBN 2-9599669-2-9.

- [5] HANČLOVÁ, J. An evaluation of a production performance across the selected EU regions. A stochastic frontier approach to Malmquist productivity index. In *International Conference on Control, Decision and Information Technologies 2014*. Piscataway: IEEE, 2014, pp. 170–175. ISBN 978-1-4799-6773-5.
- [6] MELECKÝ, L. Comparing of EU15 and EU12 Countries Efficiency by Application of DEA Approach. In VOJÁČKOVÁ, H. ed. *Proceedings of 31st International Conference Mathematical Methods in Economics 2013. Part II*. Jihlava: The College of Polytechnics Jihlava, 2013, pp. 618–623. ISBN 978-80-87035-76-4.
- [7] MIHAIU, D. M., A. OPREANA, and M. P. CRISTESCU. Efficiency, effectiveness and performance of the public sector. *Romanian Journal of Economic Forecasting*, 2010, 4(1): 132–147. ISSN 1582-6163.
- [8] POLEDNÍKOVÁ, E. Multicriteria Evaluation of Regional Disparities in Visegrad Four. In LÖSTER, T. and T. PAVELKA. eds. *The 8th International Days of Statistics and Economics Conference Proceedings*. Prague: University of Economics, 2014, pp. 1197–1207. ISBN 978-80-87990-02-5.
- [9] PORTER, M. E. The Economic Performance of Regions. *Regional Studies*, 2003, 37(6/7): 549–578. ISSN 0034-3404.
- [10] VIDAL, J. ed. UN Report: World's Biggest Cities Merging into 'Mega-regions' [online]. *The Guardian*, 2010, March 22nd. [cit. 2015-04-04]. Available at: <http://www.theguardian.com/world/2010/mar/22/un-cities-mega-regions>

Lenka Strýčková

Technical University of Liberec, Faculty of Economics,
Department of Finance and Accounting
Studentská 1402/2, 461 17 Liberec 1, Czech Republic
email: lenka.stryckova@tul.cz

The Utilization of Industry Standards in the Optimization of Corporate Capital Structure

Abstract

The use of debt offers a company many advantages by creating more investment opportunities and a possible rise in the shareholder's value. On the other hand, extensive use of debt may introduce a higher risk for the investors, which may increase the interest rate and/or bring credit restrictions on the company. Utilization of traditional or modern capital structure theories assumes the proactive approach of companies towards the process of capital structure optimization. Companies may, however, exert rather a passive approach based on the utilization of industry standards for corporate indebtedness. The business sector is seen as one of the most significant elements in determining the degree of financial leverage. The sense of the use of industry standards is that the debt-equity ratios appropriate for other firms in a similar branch should be appropriate for the company as well. Industry standards can serve as a useful benchmark. If the particular company is out of line, it can be perceived as conspicuous on the market. However, it may prove difficult for an ordinary company to find concrete sectoral recommendations on the debt ratio. The aim of this paper is to make a proposal for specific industry standards of indebtedness for 14 business sectors structured according to the classification of CZ-NACE. The proposal is based on the results of two independent studies conducted by the author of this contribution. The first study was focused on the indebtedness of Czech companies and its development between the years 2006 and 2011; it was based on panel data analysis. The second study was aimed at identification and analysis of trends in the selection of sources of corporate financing in the Czech Republic in a similar period; it was based on a capital structure analysis performed on a sample of 100 randomly selected companies within each business sector. The outcome of this paper is a proposal for industry standards that might serve as a benchmark of the maximal value of the corporate debt ratio within the particular sector.

Key Words

benchmarking, business, capital structure, debt, equity, industry standards.

JEL Classification: G32

Introduction

The general attitude of companies towards corporate debt has undergone substantial development since the first theories concerning the capital structure were published in the fifties of the last century. It is obvious that the debt strategy of an enterprise isn't the result just of its own choice and characteristics, but also the outcome of the legal and financial environment and the corporate governance traditions in which the enterprise operates. The business sector is one of the most significant elements in determining the degree of financial leverage a firm can carry safely, without any risk of bankruptcy.

One of the approaches to corporate capital structure is to make a comparison with the debt-equity ratios of companies belonging to the same industry, because they have a similar level of business risk. The sense of the use of industry standards is that the debt-equity ratios appropriate for other firms in a similar branch should be appropriate for the company in question as well. Industry standards can serve as a useful benchmark. If the particular company is out of line, it can be perceived as conspicuous on the market. Still it does not necessarily mean that the capital structure of this company is inappropriate. It is possible that the other companies on the market don't use appropriate debt-equity ratios. However, the comparison with industry standards can be very helpful for the management of the company. It can point to the fact that there might be something wrong with the capital structure of the company.

This paper deals with the capital structure of companies in the Czech Republic, focusing on the utilization of industry standards. The issue of capital structure and debt ratio standards is solved within fourteen major business sectors of the Czech economy. The aim of this article is to make a proposal for specific industry standards of indebtedness on the basis of prior performed analyses. Under the term industry standard is considered the maximal value of the average corporate debt ratio in the sector.

Methodology used in this article encompasses a literature review, a description of the current status, and a proposal of maximal recommended values of debt ratio for 14 business sectors. The proposal was constructed on the basis of the results of two independent empirical analyses focused on indebtedness and the capital structure of Czech companies within the selected business sectors.

1. The impact of the industrial sector on the corporate capital structure

The capital structure is said to be optimum when the marginal real cost (explicit as well as implicit) of each available source of financing is identical. With an optimum debt and equity mix, the cost of capital is minimal and the total value of the firm is maximal. The use of debt in the capital structure or financial leverage has both benefits as well as costs. While the principal attraction of debt is the tax benefit, its cost is financial distress and reduced commercial profitability. [1]

It seems easy to define the optimal capital structure in theory, but it is very difficult to design it in practice. There are substantial differences in the capital structure among various industries and even among individual firms within the same industry. According to fundamental concepts of financial management theory, the industry is supposed to be one of the most determining factors for the corporate capital structure.

For example, Bradley, Jarrell and Kim (1984) [2] found a positive correlation between the business sector and the capital structure of companies. Firms operating in the same industrial sector tend to have similar external conditions for their business activities.

At the same time, the average indebtedness may be a factor that influences the indebtedness of a particular company: Chevalier (1995) [3] found that individual

companies compare their own debt ratios with industry averages and directly (by setting target debt levels) or indirectly adjust their own financial policy to match these averages.

A study by Schwartz and Aronson [4] finds similarities in financial leverage ratios within industries and persistent differences across industries. This suggests that the average debt ratio for an industry serves as a unique norm or target for firms within that industry.

Talberg et al. (2008) [5] dealt with the debt within a particular industrial sector and discovered the differences within individual industries. These inter-sectoral differences in capital structure the authors explained by the different level of risk within industries. In accordance with the theory of financial distress, the company with higher risk levels should become less indebted.

According to various studies, the industrial sector factor may be represented by other variables as well, such as the stage of technological development, regulations, or type of assets in the sector. For example, Almazan and Molina (2002) [6] argue that differences in technology lead to different capital structures.

Synek (2007) states that the size of corporate capital depends on many factors, particularly the size of the enterprise, the degree of mechanization and automation, the turnover period of the capital, and the sales organization. He also states that equity capital generally prevails in industrial enterprises, the proportion of equity and debt is approximately equal in business companies, and the debt dominates in financial institutions. [7]

Some leverage ratio surveys reinforce the idea that industry debt ratio norms are reasonable approximations of optimal debt ratios. For example, Bowen, Daley and Huber [8] discover that industry average leverage ratios are stable over time and firms gravitate towards such ratios as if these ratios are optimal. They suggest that a firm's industry average book value of debt to market-based equity ratio is a valid proxy for an optimal leverage ratio. Bradley, Jarrel and Kim [2] offer additional evidence that leverage ratios within industries are similar, while those across industries are different.

A study by Hull [9] has shown that the market's reaction to leverage decrease announcements depends on how a firm's debt-to-equity ratio changes relative to its industry's debt-to-equity norm. He offers various terms such as "target", "industry average", "optimum", or "relevant" for labelling the mutual relationship between capital structure optimization and industry standards.

The setting of specific corporate capital structure is fundamentally a complex process dependent on a large variety of determinants; and the chosen financial strategy therefore depends on the particular decisions of individual firms. An empirical inquiry focused on the most important determinants of the corporate capital structure from the perspective of entrepreneurs revealed that 48 % of survey respondents see the business sector as a "rather significant" determinant, whereas only 18 % of respondents considered the business sector as a "rather insignificant" determinant. [10]

2. The use of industry standards in corporate capital structure optimization

Benchmarking is a good starting point for detecting trends (if any) in a firm's performance and for making quick comparisons of key financial statement values with competitors on a relative basis. Benchmarking is a systematic, continuous process of measuring and comparing business processes and results to the processes and results of business leaders all over the world. The gathered information is used to improve company processes and thereby to improve performance. To common methods of benchmarking belong, for example, a comparison of a firm's current performance against that of its performance over another period (trend analysis), or the transformation of the income statement and the balance sheet into common size statements, which means expressing each income statement item as a percentage of sales and each balance sheet item as a percentage of total assets. The process of comparing a company's results with the industry standards is one of the most important methods of benchmarking. [11] There can be significant differences in various key areas across industries, which is why comparing company ratios with industry averages can be very useful and informative.

The availability of industry standards abroad is excellent. Companies can use various publicly available sources, such as the annual and quarterly reports of Thomson Reuters, the Bloomberg database, the statistics elaborated by Google Finance, Yahoo! Finance Stock Screener or MSN Money. Information on sectoral averages published by financial institutions, banks or organized capital markets like Nasdaq, or Euronext can also be used for benchmarking. In countries with highly developed capital markets, the businesses monitor industry standards very carefully, since any diversity may raise doubts about their economic performance.

In the Czech Republic, the analyses of sectoral development are performed periodically (annually or quarterly) by the Ministry of Industry and Trade, which processes basic economic and financial data for each sector. To the processed analyses belong, for example: the Survey of the Czech Economy and MIT Sectors, the Financial Analysis of the Business Sphere and the Panorama of the Manufacturing Industry.

Companies from the Czech Republic can also use the Benchmarking diagnostic system of financial indicators INFA. INFA focuses on three basic groups of financial indicators. The first group of indicators, called the evaluation of the level operational area (creation of EBIT/ assets), gives a view of what the business produces regardless of the origin of the capital and the taxation level. The second group of indicators evaluates the financial policy of a company (distribution of EBIT/ assets among creditors (interest), the state (taxes) and owners (net profit)). The last group of indicators is focused on the assessment of the company's liquidity level (defines the stable financial conditions under which EBIT/ assets is created and distributed).

The company Bisnode Czech Republic offers analytical sectoral studies on a commercial basis. Studies are processed separately for selected industrial segments, and include an analysis of the particular business sector, profiles of major companies operating in that sector and analytical software. The disadvantage of these studies is the high acquisition

cost of each particular study and the absence of a comprehensive analytical study for all industries.

In neither of these analytical materials it is possible to find concrete sectoral recommendations on the debt ratio.

Hrdý (2013) [12] suggests concrete values of industry standards for the debt ratio of companies in the Czech Republic. His suggestions are based on the leverage analysis based on the book and market values in selected industrial sectors. Recommended values of the debt ratio were set on the basis of comparison with foreign data from Europe and the USA. He points to similar values of corporate debt ratio in selected industries in the Czech Republic and the USA. Unfortunately, his study is limited to only five selected manufacturing sectors: the mining of coal and lignite, the production of electrical devices, railways and rail transportation, the treatment of water, and production of beverages.

A questionnaire survey focused on the determinants of corporate capital structure [10] confirmed that the majority of companies (68.8%) monitor the debt ratio, while firms prefer the use of equity over debt or a balanced proportion between equity and debt. The attitude of Czech companies towards indebtedness is still fairly conservative, so just a small number of companies indicate an active approach to capital structure optimization, based either on the indifference point or another method of optimization. The use of industry standards of debt ratio could serve here as a starting point or a benchmark for companies.

This study is further focused on the proposal for specific industry standards of indebtedness on the basis of performed analyses. Under the term industry standard is considered maximal value of an average corporate debt ratio in the sector.

3. The proposal for recommended industry standards of debt ratio for companies in the Czech Republic

The relationship between corporate capital structure and the business sector was confirmed by two independent studies conducted by the author of this contribution.

The first study focused on the indebtedness of Czech companies and its development between the years 2006 and 2011. The paper aimed to provide up-to-date empirical evidence on the relationship between the leverage and corporate performance of selected companies from the Czech Republic within 14 major business sectors. The results of this study showed that corporate leverage varied across industries, and confirmed the impact of the global financial and economic crisis on the level of corporate indebtedness. Findings also indicated that financial leverage was generally associated with positive effects on corporate profitability in most business sectors. [13]

The goal of the second study was to identify and analyse trends in the selection of sources of corporate financing in the Czech Republic in three periods: in 2000, 2005 and 2010, in the context of the external environment in the given periods for fourteen selected business activities disaggregated by CZ-NACE. The paper described trends in the selection

of sources of financing for particular business sectors. The findings of the paper also confirmed that the capital structure of companies in the Czech Republic was significantly affected by the historical context of the development of financial and capital markets. Corporate financing in the Czech Republic is based on the continental model of financing, where companies rely primarily on bank loans and not on the issue of securities on the capital market. The management of companies also preferred lower debt ratios and the ensuing elimination of possible risk. [14]

The average sectoral debt ratio set on the basis of both above mentioned studies became the basis for the proposal for recommended industry standards of the debt ratio for companies in the Czech Republic. The author of the proposal is aware of potential biases in the results due to the use of dissimilar samples for the performed analyses. The analyses can further be distorted by the outliers, and also to be reckoned with are some distortions related to the use of financial data based on the book values.

The ratio of total debt to total assets, generally called the debt ratio, measures the percentage of funds provided by the creditors:

$$\text{Debt ratio} = \frac{\text{total debt}}{\text{total assets}} \times 100 \quad (1)$$

It indicates what proportion of equity and debt the company is using to finance its assets, or, in other words, it measures the percentage of funds provided by creditors [15]. Creditors prefer low debt ratios because the lower the ratio, the greater the cushion against creditors' losses in the event of liquidation. Stockholders, on the other hand, may want more leverage because it can magnify expected earnings.

The column "Debt ratio (arithmetic mean in %) based on panel data analysis of corporate indebtedness" in table 1 (see below) contains the values of the debt ratio in 2010 for various business sectors structured according to CZ-NACE. The given values were obtained via panel data analysis of corporate indebtedness. In the analysis, the yearly observations of hundreds to thousands of companies were implemented within each business sector. The corporate financial data used in this study were obtained from the commercial database of companies and institutions Creditinfo Albertina GOLD, which contains an overview of all registered business entities in the Czech Republic, including the basic economic results of the companies listed in the Business Journal. Panel data were used in this study; selected companies were divided into fourteen groups by business sector according to the classification CZ-NACE. The economic results of randomly selected companies (joint-stock and limited companies) were investigated within each business sector. The number of companies within each group depended on the particular business sector (the number of companies selected in each sector was determined by the specified multiple of a random number) and on the availability of the economic data required for the analysis. [13]

The values in the column "Debt ratio (arithmetic mean in %) based on the capital structure analysis performed on a sample of 100 randomly selected companies within each business sector)" give average values of the proportion of total debt to total assets for various business sectors in 2010. The values were obtained via analysis of trends in

the selection of sources of financing. All economically active companies in the Czech Republic served as the population of the investigation. The database Albertina was used as the source of data on the subjects, as in the first study. The population was made up of all business companies; sampling was conducted in 14 industrial sectors according to CZ-NACE, while within each sector 100 companies were randomly selected (using a random number generator). The sample therefore consisted of 1400 companies. [14]

Tab. 1: The proposal for recommended industry standards of the debt ratio for companies in the CR

Business sector according to CZ-NACE	Debt ratio (arithmetic mean in %) based on panel data analysis of corporate indebtedness [13]	Debt ratio (arithmetic mean in %) based on the capital structure analysis performed on a sample of 100 randomly selected companies within each business sector) [14]	Proposal for max. recommended value of debt ratio (in %)
A – Agriculture, fishery, and forestry	58.80	40.94	50.00
B – Mining and quarrying	55.62	32.07	45.00
C – Manufacturing	64.32	52.97	60.00
D – Electricity, gas, steam and air conditioning	55.69	50.38	55.00
E – Water supply; sewerage, waste management and remediation activities	55.50	40.55	50.00
F – Construction	64.71	70.88	70.00
G – Wholesale and retail trade; repair of motor vehicles and motorcycles	73.43	58.99	70.00
H – Transportation and storage	74.54	30.32	55.00
I – Accommodation and food service activities	91.13 ¹	82.59	90.00
J – Information and communication	63.25	33.88	50.00
K – Financial and insurance activities	53.94	77.40	70.00
L – Real estate activities	72.18	67.26	70.00
M – Professional, scientific and technical activities	61.30	47.41	55.00
N – Administrative and support service activities	69.96	58.09	65.00

Source: own investigation

Values in the last column of table 1, called “Proposal for max. recommended value of debt ratio (in %)” represent suggested industry standard benchmarks for the corporate debt ratio. The proposal is based on the results of two independent studies, mentioned above, related to indebtedness and the investigation of corporate capital structure. Although the outcomes of both studies are based on the various number of data, the representativeness of both data sets was ensured, and therefore it is possible to consider both resulting values

¹ For sector I – For information and communication the median was used instead of the mean of the debt ratio, due to the high proportion of firms with negative equity.

as equivalents. The proposal for recommended debt ratio values is then elaborated as the simple arithmetic mean of the two conducted empirical surveys; the resulting figure is rounded up to the nearest value of the pental series.

The recommended industry standards were defined as the maximum value of the corporate debt ratio. The values of the proposed debt ratio in given business sectors vary from 45 % to 90 %. Lower values of recommended industry standards can be found in the following sectors: mining and quarrying; agriculture, fishery, and forestry; water supply; sewerage, waste management and remediation activities; and information and communication. Higher values are tolerated in these sectors: construction; wholesale and retail trade; repair of motor vehicles and motorcycles; real estate activities; and financial and insurance activities. The conducted investigations of indebtedness revealed an extremely high value of the debt ratio, a negative value of the debt to equity ratio and a very low level of the profit effect of financial leverage in the sector of accommodation and food service activities. Therefore, the maximum recommended value of the debt ratio for this sector reaches up to 90 % of the total assets. In the other business sectors, a balanced proportion of debt and equity capital prevails, with a moderate predominance of the debt sources.

4. Discussion

The problem of the determination of industry standards as benchmarks of corporate indebtedness is definitely an area that should be given more attention by experts than previously. The methodology for the standard definition of sectors hasn't been conclusively determined yet. As it is obvious from table 1, the two different approaches of computing debt ratio provide two different results. I think that this observation could be proven by testing a statistical hypothesis. Therefore, I can see the significant research potential of this topic for the future. Because it is unrealistic to obtain financial data and calculate the debt ratios of all business companies, it is necessary to count with some distortions in the resulting values. Moreover it is necessary to take into consideration not just the particular financial results of the companies, but primarily the specific features and potential of individual business sectors, and related values of sectoral risk (these values are at present obtainable as minimal recommended business risk values for the model INFA). Future research should continue to explore the role of industry debt ratio norms, whereby it could be focused on the interrelationship of the firm's debt ratio and its industry standard.

Conclusion

The aim of this contribution was to make a proposal for specific industry standards of indebtedness on the basis of previously performed analyses for 14 business sectors structured according to the classification of CZ-NACE. Under the term industry standard is considered the maximal value of the average corporate debt ratio in the sector. The sense of the use of industry standards is that the debt-equity ratios appropriate for other firms in a similar branch should be appropriate for the company in question as well. The process of comparing a company's results with the industry standards is one of the most

important methods of benchmarking. If the particular company is out of line, it can be perceived as conspicuous on the market.

The availability of industry standards for companies in the Czech Republic is quite limited in comparison to foreign countries. There are several institutional and some commercial analyses and indicators available, but in none of these analytical materials is it possible to find concrete sectoral recommendations on the debt ratio. The methodology for the standard definition of sectoral debt benchmark hasn't been conclusively determined yet, indicating the significant research potential of this topic for the future.

The values of the proposed debt ratio in given business sectors vary from 45 % to 90 %. Lower values of recommended industry standards can be found in the following sectors: mining and quarrying; agriculture, fishery, and forestry; water supply; sewerage, waste management and remediation activities; and information and communication. Higher values are tolerated in these sectors: construction; wholesale and retail trade; repair of motor vehicles and motorcycles; real estate activities; and financial and insurance activities. The conducted investigations of indebtedness revealed an extremely high value of the debt ratio in the sector of accommodation and food service activities.

In conclusion, the leverage ratio research suggests that the market views a company's debt ratio as a wealth maximizing norm. Consequently, a company's industry debt ratio standard is usable in empirical tests as a benchmark to set a firm's financial position.

References

- [1] KHAN, M. Y. and P. K. JAIN. *Basic Financial Management*. 2nd ed. New Delhi: Tata McGraw-Hill Education, 2007. ISBN 0-07-059943-2.
- [2] BRADLEY, M., G. A. JARRELL, and E. H. KIM. On the Existence of an Optimal Capital Structure: Theory and Evidence. *The Journal of Finance*, 1984, **39**(3): 857–878. ISSN 1540-6261.
- [3] CHEVALIER, J. A. Do LBO Supermarkets Charge More? An Empirical Analysis of the Effects of LBOs on Supermarket Pricing. *The Journal of Finance*, 1995, **50**(4): 1095–1112. ISSN 1540-6261.
- [4] SCHWARTZ, E. and J. R. ARONSON. Some Surrogate Evidence in Support of the Concept of Optimal Financial Structure. *The Journal of Finance*, 1967, **22**(1): 10–18. ISSN 1540-6261.
- [5] TALBERG, M. et. al. Capital Structure Across Industries. *International Journal of the Economics of Business*, 2008, **15**(2): 181–200.
- [6] ALMAZAN, A. and C. A. MOLINA. Intra-Industry Capital Structure Dispersion. *SSRN Electronic Journal*, 2012. ISSN1556-5068.
- [7] SYNEK, M. *Manažerská ekonomika*. 4th ed. Praha: Grada, 2007. ISBN 9788024719924.
- [8] BOWEN, R. M., L. A. DALEY, and C. C. HUBERT, Jr. Leverage Measures and Industrial Classification: Review and Additional Evidence. *Financial Management*, 1982, **10**(11): 10–20.
- [9] HULL, R. M. Leverage Ratios, Industry Norms, and Stock Price Reaction: An Empirical Investigation of Stock-for-Debt Transactions. *Financial Management*, 1999, **28**(2): 32–45.

- [10] STRÝČKOVÁ, L. Faktory determinující kapitálovou strukturu firem v ČR z pohledu podnikatelských subjektů. *E+M Ekonomie a Management*, 2015, **18**(2): 40–56. ISSN 1212-3609.
- [11] BROOKS, R. *Financial management: core concepts*. 2nd ed. Boston: Pearson, 2013. ISBN 978-013-2671-033.
- [12] HRDÝ, M. Vybrané problémy optimalizace kapitálové struktury konkrétního podniku. In *Sborník příspěvků z mezinárodní vědecké konference Nové trendy 2013*. Znojmo: Soukromá vysoká škola ekonomická Znojmo, 2013, **8**(2): 26–34. ISBN 978-80-87314-54-8.
- [13] STRÝČKOVÁ, L. Corporate Indebtedness: Bane Or Blessing? Empirical Evidence from the Czech Republic. In *Proceedings of the International Conference Hradec Economic Days 2014*. Hradec Králové: Univerzita Hradec Králové, 2014. pp. 360–369. ISBN 978-80-7435-370-3.
- [14] STRÝČKOVÁ, L. Trendy při volbě zdrojů financování obchodních společností v ČR. In *Sborník příspěvků z mezinárodní vědecké konference Mezinárodní Masarykova konference pro doktorandy a mladé vědecké pracovníky 2012*. Hradec Králové: Magnanimitas, 2012. pp. 1593–1603. ISBN 978-80-905243-3-0.
- [15] BRIGHAM, E. F. and J. F. HOUSTON. *Fundamentals of financial management*. 13th ed. Mason, Ohio: South-Western Cengage Learning, 2013. ISBN 05-384-8212-5.

Jan Sucháček, Petr Sed'a, Václav Friedrich

VŠB-Technical University of Ostrava, Faculty of Economics, Department of Regional and Environmental Economics, Department of Mathematical Methods in Economics

Sokolská 33, 70121 Ostrava, Czech Republic

email: jan.suchacek@vsb.cz, petr.seda@vsb.cz,

vaclav.friedrich@vsb.cz

Location Preferences of Largest Enterprises in the Czech Republic and Their Differentiation

Abstract

Largest enterprises create rather relevant components of economies. Researches devoted to largest enterprises became standard part of economic and geographical theory and practice in virtually all advanced countries. Naturally, headquarters of these enterprises represent decisive nodes affecting enterprise organizational structure and behavior. That is why our paper focuses just upon these headquarters or on their location preferences, more precisely. Results of our paper are underpinned by qualitative research. The analysis itself was based upon annually published top 100 databases, where one hundred largest enterprises in the Czech Republic – in terms of their turnover – can be found. Basic sample for qualitative part of this research was composed of 190 enterprises. This was brought on by their repetitive presence in top 100 databases as well as by bankruptcy of some of them. On the whole, 53 valid questionnaires returned to the researchers, which means rate of return was roughly 28%. The main objective of our article is to show the differentiation of large enterprise headquarters in the Czech Republic just according to their location preferences. Apart from traditional factors, such as geographical location or agglomeration economies, several other factors, such as infrastructure, proximity of customers, proximity of suppliers, availability or quantity of local work force or quality of entrepreneurial milieu turned out to be important. The above differentiation will be accomplished by means of cluster analysis, which proved its usefulness for our purposes. The results of our paper provide us with alternative view on the location preferences of one hundred largest enterprises in the country.

Key Words

largest enterprises, Czech Republic, cluster analysis, location preferences, differentiation, headquarters

JEL Classification: D22, L10, R10, R12

Introduction

Location preferences and organizational hierarchy of large enterprises attract voluminous attention in virtually all advanced countries, which concerns both theoretical and practical spheres. Economic and geographical literature accentuates relations between large firms and territorial economies of various scales [1, 6, 7]. [14] even speak about demography of firms. Apart from traditional hard location factors, soft factors of location play increasingly important role [13].

Surprisingly, location preferences of largest enterprises have been severely underrated in our country so far. Taking into account the size of the country's economy as well as the fact that it finds itself in post-transition phase of its development, the role of large enterprises is apparent. Location of head offices of largest enterprises can affect not only competitiveness but also cohesion of whole territories. Put succinctly, geography of enterprise matters [1, 2, 7, 10, 14]. Other relevant functions of large enterprises have been discussed elsewhere [3, 6, 11, 12].

There are numerous conceptions related to the questions the development of collocation and organizational structures of large enterprises. Spatial divisions of labor [7] shows the interconnectedness of labor market and spatial organization of the economy. While managerial and R&D functions tend to concentrate mostly into metropolitan territories, their counterparts are 'sentenced' mainly to manufacturing. Connectedness between enterprise and regional hierarchies was contemplated many times [1, 7, 10].

Affiliates of large enterprises represent the most vulnerable organizational units, which can be closed just due to their positions within enterprise hierarchy [2, 7]. Several authors, such as [7] suggest that manufacturing and managerial and/or R&D functions should not be spatially divided. In reality, numerous peripheral economies are actually controlled externally [10].

Regions, which are happy enough to lure managerial and R&D functions, typically enjoy advantages of primary labor markets. Centralization of economic power in several exclusive places in a way forms a certain parallel to the political-administrative centralization in some countries.

The main objective of this paper consists in the differentiation of large enterprise headquarters in the Czech Republic just according to their location preferences. In order to accomplish the afore mentioned task, cluster analysis has been utilized.

1. Materials and Methods

In the eminent world literature, the geographical distribution of headquarters of five hundred biggest firms in the country's territory is perceived as the indicator of the concentration of economic power [6]. Size of the enterprise is most commonly measured by its turnover. Regarding the small availability of relevant data as well as the size of the Czech Republic, this research will focus on the spatial distribution of one hundred largest enterprises in the Czech Republic. Size of enterprise will be embodied by its turnover.

The analysis itself is based upon annually published top 100 databases. Basic sample for qualitative part of this research consisted of 190 companies. This was caused by their repeated occurrence in top 100 databases as well as by liquidation of some of them. Altogether 53 valid questionnaires returned to the researchers, which means that rate of return reached approximately 28%. The questionnaire first reached top managers of individual enterprises via e-mail. In case, the manager of enterprise did not respond, he or she was contacted through phone call and after an explanation of the research purpose he or she received questionnaire via e-mail again.

1.1 Cluster analysis and Inner Consistency of Questions

The method of cluster analysis is an approach that will be used to verify main objective of this paper as defined in the Introduction section. Cluster analysis represents a multivariate technique that can be utilized for exploratory statistical data analysis in various fields of investigation including economic tasks. Clustering itself represents a tool of grouping a set of observed multivariate data called objects. To be more precise, objects in the same group that are called clusters are more similar to each other than to objects in other clusters. At the beginning of clustering we don't have any knowledge about which object belong to which cluster.

The aim of cluster analysis is to maximize a similarity of objects within each cluster and simultaneously maximizing dissimilarity between meaningful clusters. Individual items in each taxonomy or cluster are similar to each other, and on the other hand dissimilar to those in other clusters.

Results of task can be achieved by various algorithms that may differ significantly. Cluster analysis can be thus defined as a multivariate optimization problem. This approach can be considered as some kind of iterative process of knowledge discovery that may naturally lead to trial and failure. It should be stressed that cluster analysis doesn't distinguish between dependent and independent variables at all. It means that the entire set of mutual relationships in observed data sample is analysed. To sum up, the main goal of cluster analysis is to reduce the number of objects by clustering them into a smaller set of clusters. For the purpose of this paper a hierarchical cluster analysis will be utilized.

Hierarchical cluster analysis is tightly connected with inner consistency of evaluated questions in the questionnaire. This consistency can be usually measured by Cronbach's alpha. This statistics explains dependence among individual items of the battery of questions having the same ordinal scale of values. Cronbach's alpha statistics therefore represents rate of inner consistency of this battery. Value of Cronbach's alpha determines to what extent are the values of each item in the battery similar or different [5].

This statistics takes values from 0 to 1. Small values ($\alpha < 0.5$) indicate low consistency or high diversity in evaluated items. On the contrary, a value close to 1 ($\alpha > 0.9$) denotes that there is strong inner dependency between individual items of the battery. This value does not necessarily mean that all items have similar values, but that all evaluators have similar or analogous preference.

Cronbach's alpha can be calculated as follows:

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum_{i=1}^k s_i^2}{s^2} \right), \quad (1)$$

where s_i^2 are variances of particular items of the battery of questions, s^2 is variance of total score of the battery, i.e. sum of values of all items, and k denotes number of items in the battery.

When using hierarchical cluster analysis it is recommended that the value of Cronbach's alpha is neither too low, nor too high. Optimally it should range around the value of 0.7. In this case, the individual items are mutually very well distinguishable and variability of evaluation of all items is comparable.

1.2 Distance Measures and Linkage Rules in Hierarchical Cluster Analysis

Hierarchical cluster analysis is statistical method that is suitable for finding relatively homogeneous clusters of objects. These objects are always characterized by multivariate characteristics. When generating clusters by hierarchical cluster analysis it is necessary to measure distances between objects [9].

Distances in hierarchical cluster analysis can be measured and calculated in several ways. A number of distance measures are available within the IBM SPSS software that was used for the purpose of our paper. For instance Euclidean, Manhattan, Cosine, Minkowski or Chebychev distances can be applied. However, there are also other measures available. One of possible approaches is to measure distances using squared Euclidean measure as applied in our paper. The Euclidean distance is the most commonly used one and can be defined as follows:

$$\text{distance}(x, y) = \sum_{i=1}^n (x_i - y_i)^2, \quad (2)$$

where $x(x_1, x_2, \dots, x_n)$ and $y(y_1, y_2, \dots, y_n)$ are multivariate objects. The procedure of clustering can be characterized as follows:

1. At the beginning, the distance is measured and calculated between all initial clusters. Initial clusters are usually represented by individual objects, i.e. there are as many objects as clusters.
2. Next, two most similar objects are joined into one cluster and all distances are recalculated by chosen distance measure. We connect more and more objects together and create greater and greater clusters. This procedure is repeated until all object are linked into one cluster. In other words, our aim is to reduce the number of clusters at each step until all objects are joined together as one cluster.

In order to show all linkage points a hierarchical tree diagram called a dendrogram can be drawn. In this tree diagram, one of the axes always represents the linkage distance. When looking on the tree diagram, we can identify a criterion distance at which the respective objects were matched together into new cluster. It must be hold that respective clusters are linked at increasing levels of dissimilarity.

When constructing the dendrogram, we need to find some linkage rule to find out whether two different clusters are similar enough to be linked together. The IBM SPSS software offers us several options to verify the distances between particular clusters. There exist numerous linkage rules like nearest neighbour or single linkage, furthest neighbour that is also called complete linkage, unweight pair-group average, weighted pair-group

average, unweight pair-group centroid or Ward's method. For the purpose of our paper just the Ward's linkage method will be utilized. This linkage rule differs significantly from all other methods since it is based on Analysis of Variance (ANOVA) approach. The Ward's linkage method minimizes the Sum of Squares of any two theoretical clusters that can be generated at each step of clustering, see [15]. In general, the Ward's method is considered as very efficient, as it tends to create clusters of small sizes. This method is very appropriate to the size of our data sample.

To sum up, in this paper it will be utilized the hierarchical cluster analysis using Ward's method, and applying squared Euclidean distance as the similarity measure. This process helps us to determine optimal number of clusters we should work with.

2. Results and Discussion

The main part of the questionnaire is formed by two identical batteries comprising 22 items. While the first battery served to monitoring, which location factors were decisive for the location of enterprise headquarters, the latter concentrated on factors determining the location of enterprise affiliates. Individual items of both batteries were based on seven degree ordinal symmetric scale ranging from "no influence" to "absolutely decisive". In this article, we are concentrating exclusively upon enterprise headquarters.

2.1 Analysis of the Consistence of Evaluation Battery

In order to find the inner consistence of evaluation battery from aggregate point of view, Cronbach's alpha was utilized. Belonging of individual items into evaluation battery was measured via correlation coefficient of the item in question with the summary of the whole battery. Assessment of the location of headquarters confirmed that there is a very large degree of battery consistence. Cronbach's alpha reached the value 0.869. Correlation among individual items of the battery and the summary of the battery was positive in all case and reached statistical significance. The respective values ranged between 0.207 and 0.7.

All of these indicators show large interval consistence of opinions for the battery. In other words, questioned managers assessed individual location factors in a similar way. On the other hand, if Cronbach's alpha is less than 0.9 we are able to differentiate individual items. In order to search for items with similar characteristics, we are entitled to use cluster analysis [4].

2.2 Ranking Priorities according to Mean Value

To disclose, which location factors – or items of evaluation battery – were decisive for the location of enterprise head offices, we focused upon mean values of these items (Tab.1). Albeit it is ordinal scale, we are dealing with items of the same battery and that is why it is legitimate to utilize arithmetic mean for the purposes of their comparison [8].

In case of headquarters' location, the most important items with mean evaluation higher than 1.7 were as follows: infrastructure, geographical location and quality of entrepreneurial milieu. On the other hand, the bottom of the ladder characterizing location factors of head offices is occupied by the quality of the environment and cultural and sport facilities.

Tab. 1: Location Factors Ranking

Factor	Headquarters	
	Mean	Order
Infrastructure	2.32	1
Geographical location	2.15	2
Quality of Entrepreneurial Milieu	1.77	3
Proximity of Suppliers	1.58	4
Availability of the Labour	1.57	5
Quality of the Labour	1.56	6
Proximity of Customers	1.54	7
Agglomeration Economies	1.49	8
Availability of Raw Materials	1.32	9
Low Salary Requirements	1.23	10
Image of the Place	1.19	11
Proximity of Similar Branches	1.19	12
Proximity of Competition	1.17	13
Nearness of Decisive Institutions	1.13	14
Willingness of Managers to Move	1.13	15
Price of the Land	1.02	16
National Policies	0.92	17
Public Administration	0.88	18
Quality of Environment	0.41	19
Determined Historically	0.40	20
Cultural Facilities	-0.17	21
Sport Facilities	-0.38	22

Source: authors

In other words, traditional hard location factors are still preferred to the detriment of their soft counterparts. At the same time, it should be mentioned that managers declared their fidelity to their enterprises in that way; in reality they do consider quality of environment, sport as well as cultural facilities but do not mention it openly as above mentioned facilities are only loosely connected to the firm productivity.

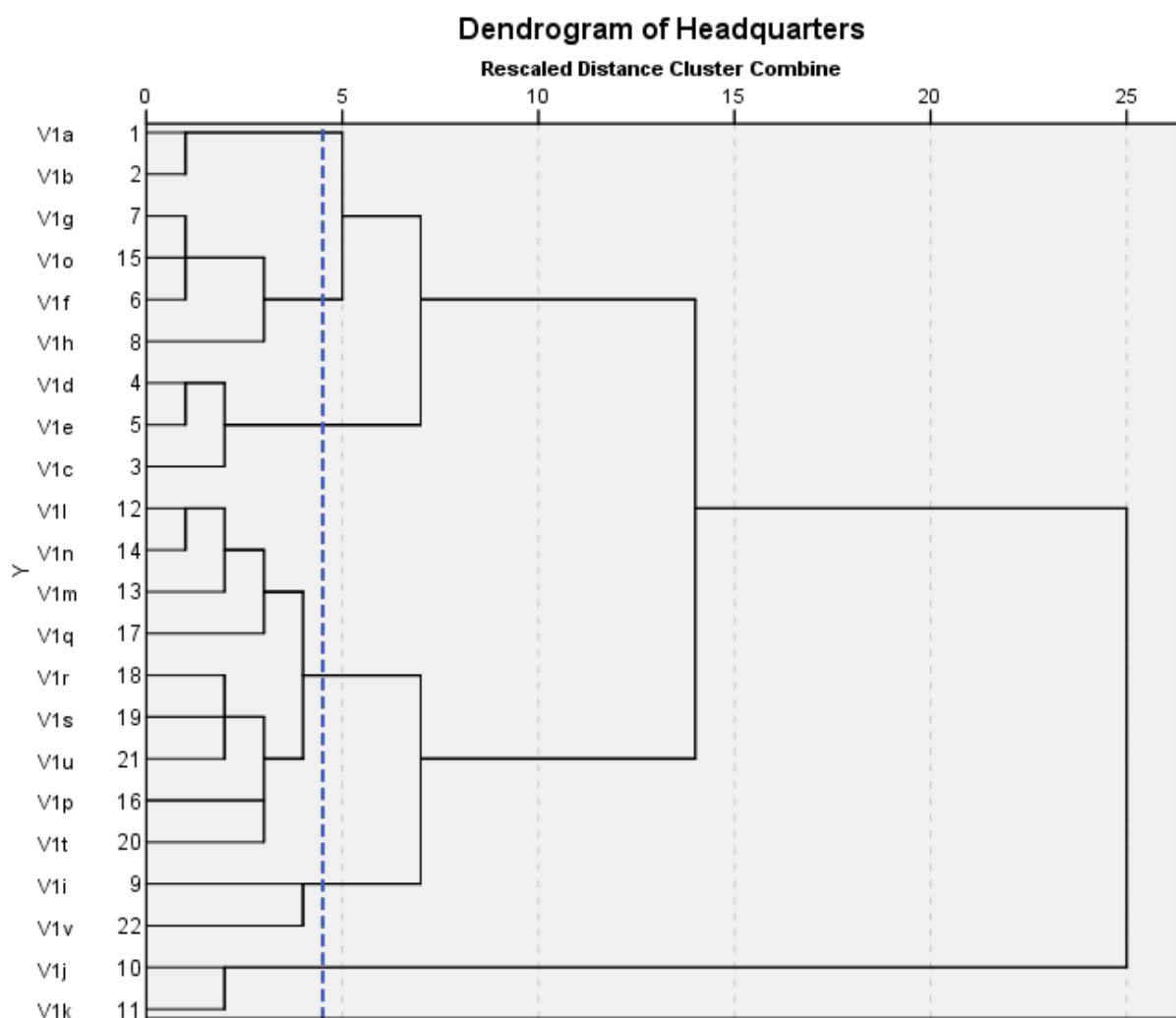
2.3 Cluster Analysis

In order to grasp similar location factors of enterprise headquarters into compact sets, hierarchical cluster analysis was executed. Ward method of cluster creation and square of Euclidean distance as a metrics for measuring similarity or dissimilarity of items and clusters is recommendable for ordinal items. As it can be derived from dendrogram (Fig. 1), optimal amount of clusters is 3, 5 or 6.

Since Cronbach's alpha reaches high values, some numbers of clusters cannot be accomplished (for instance 4 or 7 clusters). If there would be higher amount of clusters than 6, "orphans" or clusters comprising just one item would be formed. In spite of the

fact Ward method usually leads towards even distribution of items among individual clusters, in this case we got one large cluster with 9 items against 3 clusters with 2 items.

Fig. 1: Dendrogram for Enterprise Headquarters



Source: authors

In case that 6 clusters would be created, which can be treated as their maximum reasonable distinguishable amount, individual clusters would be as follows (mean value of items for the given cluster is stated in parentheses):

1. a, b – geographical location and infrastructure - place (2.24)
2. f, g, h, o – quality of the labour, availability of the labour, low salary requirements and quality of entrepreneurial milieu – human resources (1.62)
3. c, d, e – availability of raw materials, proximity of suppliers and proximity of customers – supplier-customer relations (1.48)
4. l, m, n, p, q, r, s, t, u – prestige of the place, nearness of decisive institutions, proximity of similar branches, proximity of competition, willingness of managers to move, public administration, national policies, agglomeration economies and price of the land – regional and political factors (1.12)
5. i, v – quality of environment and determined historically – sustainable development (0.41)
6. j, k – sport facilities and cultural facilities – leisure facilities (-0.28).

Cluster denoted as (4.) includes nine location factors. Naturally, it was the most demanding task to find brief and pregnant name for that cluster. Naming other clusters turned out to be much easier and more natural. However, from synthetic perspective, the number of 6 clusters serves well for the purposes of our analysis.

Conclusion

Our research confirmed that largest enterprises in the Czech Republic still accentuate traditional hard location factors in their location decision-making processes. These factors include infrastructure, geographical location, quality of entrepreneurial milieu, nearness of suppliers and customers as well as quality and availability of the labour. While top priority of these factors is far from surprising, the least important factors were represented by sport and cultural facilities. These results are not in consonance with generally perceived move from traditional hard location factors to their softer counterparts. Phenomenon observed within this paper can be accounted for by less sincere attitude of managers that answered our questionnaire: in reality they take into account also soft factors of location but these are not directly involved in enterprise productivity. This offers quite plausible explanation of the above issue.

Cluster analysis proved its pertinence for our analysis and individual location factors are rather satisfactorily classable under individual cluster named place, human resources, supplier-customer relations, regional and political factors, sustainable development and leisure facilities. Ranking of these clusters shows how economy matters in location decision-making of largest enterprises in the Czech Republic.

Acknowledgements

The support provided by VSB-TU Ostrava under the SGS project SP2015/111 and by Operational Programme Education for Competitiveness, Project No. CZ.1.07/2.3.00/20.0296 is kindly announced.

References

- [1] DUNNING, J. H., LUNDAN, S. M. *Multinational Enterprises and the Global Economy*. Cheltenham: Edward Elgar Publishing, 2008. ISBN 978-1-84376-525-7.
- [2] FOTHERGILL, S. and GUY, N. *Retreat from the Regions. Corporate Change and the Closure of Factories*. London: Jessica Kingsley Publishers, 1990. ISBN 1853021016.
- [3] HLAVÁČEK, P. The Foreign Direct Investments in the Usti Region: Theory, Actors and Space Differentiation. *E+M Ekonomie a Management*, 2009, 12(4): 27–39. ISSN 1212-3609.
- [4] KOZEL, R., H. POŠTULKOVÁ, V. FRIEDRICH, and Š. VILAMOVÁ. The Cooperation of Teachers and Students on Facebook. In DOUCEK, P., G. CHROUST, and V. OŠKRDAL. eds. *Proceedings from the 20th Interdisciplinary Information Management Talks 2012*. Linz, Austria: Gerhard Chroust, 2012. pp. 277–285. Jindřichův Hradec, 2012. ISBN 978-3-99033-022-7.

- [5] KREIDL, M. Metody měření reliability a validity. [online]. *Socioweb*, 2004, no. 1–2. Praha: Sociologický ústav AV ČR. ISSN 1214-1720. [cit. 2015-03-04]. Available at: <http://www.socioweb.cz>
- [6] LYONS, D. I. Changing patterns of corporate headquarter influence 1974-89. *Environment and Planning*, 1994, **26**: 733–747. ISSN 0308-518X.
- [7] MASSEY, D. *Spatial Divisions of Labour: Social Structures and the Geography of Production*. 2nd ed. London: Macmillan, 1995. ISBN 0-333-59493-2.
- [8] NORMAN, G. Likert scales, levels of measurement and the “laws” of statistics. *Advances in Health Sciences Education*, 2010, **15**(5): 625–632. ISSN 1382-4996.
- [9] ŘEZÁNKOVÁ, H. *Shluková analýza dat*. Praha: Professional Publishing, 2006. ISBN 978-80-8694-681-8.
- [10] SUCHÁČEK, J. and BARÁNEK, P. Headquarters of Largest Enterprises in the Czech Republic from Regional Perspective. In JIRČÍKOVÁ E., E. PASTUSZKOVÁ, and J. SVOBODA. eds. *Finance and the Performance of Firms in Science, Education, and Practice 2011*. Zlín: Tomáš Baťa University, pp. 469–478. ISBN 978-80-7454-020-2.
- [11] SUCHÁČEK, J. Urban Potential for Investment Attraction in the Czech Republic. In JIRČÍKOVÁ E., A. KNAPOVÁ, and E. PASTUSZKOVÁ (eds.) *Finance and the Performance of Firms in Science, Education, and Practice 2013*. Zlín: Tomáš Baťa University, pp. 718–727, ISBN 978-80-7454-246-6.
- [12] SUCHÁČEK, J. Investment Location from the Perspective of Urban and Regional Activities in the Czech Republic. In CULIK, M. ed. *Financial Management of Firms and Financial Institutions 2013*. Ostrava: VŠB-Technical University, pp. 851–858. ISBN 978-80-248-3172-5.
- [13] SUCHÁČEK, J., SEĎA, P., FRIEDRICH, V., and KOUTSKÝ, J. Media portrayals of regions in the Czech Republic: selected issues. *E+M Ekonomie a Management*, 2014, **17**(4): 125–140. ISSN 1212-3609.
- [14] VAN DIJK, J. and PELLENBARG, P. The demography of firms: progress and problems in empirical research. In VAN DIJK, J. and P. PELLENBARG. eds. *Demography of firms. Spatial dynamics of firm behaviour*. Groningen: Rijksuniversiteit, 1999. pp. 325–337. ISBN 90-6809-285-5.
- [15] WARD, J. H. Hierarchical Grouping to Optimize an Objective Function. *Journal of the American Statistical Association*, 1963, **58**: 236–244. ISSN 0162-1459.

Jarmila Šebestová

Silesian University in Opava, School of Business Administration in Karvina,
Department of Business Economics and Management
Univerzitní nám.1934/3, 733 40 Karviná, Czech Republic
email: sebestova@opf.slu.cz

Regional Business Environment and Business Behaviour of SME's in Moravian-Silesian Region

Abstract

A country and its entrepreneurial tradition may well identify specific factors, which have an influence on public policy success. But not only have those factor had an influence on business behaviour. The main goal of the paper is to reflect on the challenging economic environment. Many of the trends found were less than positive, although there were some new positive trends that could be identified as a source of sustainability in the area of the connection between the sector of small and medium sized enterprises and the local entrepreneurship environment. They also try to encourage entrepreneurs by promoting a positive image of entrepreneurs or by way of an appropriate business education system. Moreover, the frequency of co-operational activities with local government was investigated. Questionnaire-based research was undertaken within 194 organizations of various legal forms operating in the area of the Moravian-Silesian Region. The main factors, which had an influence on their current business stage (49.5% in the growth stage, 9.8% in stagnation, 31.96% in decline and the other 0.52% in crisis), were the locality in the region, the quality of the labour force, cooperation with local public bodies and the business relationships between suppliers. Finally, we have defined three groups of entrepreneurs, based on their satisfaction and sensitiveness to regional business environment.

Key Words

business stage, cooperation, entrepreneurship, Moravian-Silesian region, local government, policy layer

JEL Classification: E32, M19, L26, R11

Introduction

In the past decades, an increase in interest could be found in examining the relationship between entrepreneurship in society and shifting forces coming from local government and public and private organizations. Policy makers place great emphasis on supporting the outcomes of entrepreneurship, because this generates economic development in the examined area. Little is known about the influence of entrepreneurship on economic performance [13],[11].

The aim of this paper is to highlight the relationship between the business lifecycle in the sector of small and medium sized entrepreneurs, when their contribution to the economic structure is almost 99% of active business units [5]. The paper is divided into three parts. The first part is focused on the relationship between entrepreneurship and the entrepreneurial model of business environment and culture - a two layered model is defined. The second part is presented by own research findings within the Moravian-

Silesian Region based on previous literature framework classifications. Finally three groups according sensitiveness to the local entrepreneurial policy is made.

1. Regional business environment and its influence on the local entrepreneurship activity

Locally embedded values and attitudes towards entrepreneurship exert a strong influence on the rate and level of entrepreneurial activity in regions. The concept of the regional entrepreneurship culture aims to capture such a phenomenon, and refers in a general sense to the level of social acceptance and encouragement of entrepreneurs and their activities in a region [4],[2]. A historically rooted social acceptance of entrepreneurship in a region may thus influence entrepreneurship in a direct way, but also in an indirect way through long-term influence on the 'formal rules of the game' in the region as well as 'playing the game' [1]. A country and its entrepreneurial tradition may well identify specific factors, which have an influence on public policy success. Governmental policies are crucial, because they set the rules for "playing" in the market.

For years policy makers have paid great attention to supporting and encouraging entrepreneurship and for this reason they often modify their approach and initiatives according to the economic cycle through tax reductions and education [10]. Previous studies showed a much broader view in this initiative in the national and regional context [8],[14]. The impact of this situation is well documented and reduces the level of uncertainty for entrepreneurs, but the whole connection must produce more entrepreneurial activity and progress, which predominantly supports start-up stages, but not a transition among the lifecycle stages of businesses [10].

Policy layer in regional structure represents the supportive infrastructure for entrepreneurship such as entrepreneurship-friendly laws and regulations in the area of establishing a business, the existence of supporting services for business founders as well as for established firms, including good access to financial resources for start-ups and small businesses as well as training and consulting services. The existence of regional entrepreneurship cultures is one theoretically plausible explanation for spatial variations in entrepreneurship activity [1].

2. Research methodology

Each region has its own entrepreneurial culture, based on local business environment. It is the same case of the Moravian-Silesian Region. According to the two layers of entrepreneurial culture influencing regional environment, based on previous studies [1],[6] the survey based research was conducted. The questionnaire consisted of eight main parts, which were to predominantly describe the current stages of entrepreneurial culture and describes current business behaviour of SMEs.

- Political layer - consists of the evaluation of the business environment and its structure, firstly the main barriers which have an influence on behaviour, secondly the relationship with local government and municipalities.

- Normative-cognitive layer - includes the main motivation to start the business, strategic, personal policy, innovations and communication strategy and finally a demographic description of the examined business unit.

The questionnaire survey was conducted with owners and managers of small and medium sized businesses (fewer than 250 employees) in the Moravian-Silesian Region, operating between the years of 2009-2013. The companies fulfilled the criteria of (1) being designated as small and medium sized companies by their number of employees – fewer than 250, (2) operating a business in the area of the Moravian-Silesian Region and (3) agreeing to a personal visit during autumn 2014. In the Moravian-Silesian Region, 250,028 business units were in operation in 2014, the growth rate in 2014 was +0.6% regarding the number of start-ups (CSO,2015). The minimum sample size (n) was calculated by using the formula recommended by Olaru, Dinu, Stoleriu, Șandru and Dincă [9] in confidence level of 0.95, when the response rate was 153 companies.

The instrument was validated through the assessment of scale reliability, construct validation and un-dimensionality of the research constructs. Cronbach's Alpha was used to assess the scale reliability of each construct in the research model. The alpha of every factor was greater than the suggested threshold value of acceptable reliability of 0.6. Results were graded using the Likert scale (1-5 for non-numerical data) so as to be comparable with other sections of the questionnaire (41 items). As a supporting analysis, cross-tabs were used to identify significant and non-significant values. Data obtained from questionnaires (194 companies) is to be analyzed through the SPSS statistical packet programme.

3. Results and Discussion

All the analysis is based on the relationship of the business lifecycle and other variables, which have an influence on regional business behaviour and connection to policy layer. The economic activity was mainly in trade (37.1%) and services (35.6%).

Tab. 1: Relationship between Business lifecycle and Legal form

	JSC	COOP	NGO	SP	LLC	SO	GP	Total
Growth	7.22%	0.52%	1.03%	15.98%	23.71%	1.03%	0.00%	49.48%
Stagnation, Maturity	1.03%	0.00%	0.00%	5.15%	3.61%	0.00%	0.00%	9.79%
Decline	2.06%	0.00%	0.00%	15.46%	13.92%	0.00%	0.52%	31.96%
Crisis	0.52%	0.00%	0.00%	0.52%	1.03%	0.00%	0.00%	2.06%
Destruction and decease	0.00%	0.00%	0.00%	0.00%	0.52%	0.00%	0.00%	0.52%
Missing	1.03%	0.00%	0.00%	2.58%	2.58%	0.00%	0.00%	6.19%
Total	11.86%	0.52%	1.03%	39.69%	45.36%	1.03%	0.52%	100%

Legend: JSC – joint stock company, COOP – cooperative, NGO – non profit, SO – state-ownership, GP – general partnership

Source: own research

As can be seen (Table 1), the sample consists of 194 active business units, where the main group reports growth in the last three years and it is based mostly on sole proprietors (SP) and limited liability companies (LLC).As being said. All companies were older than 3 years to eliminate start-ups and an influence of the new conditions of LLC company establishment.

The relationship between the current stage and the legal form was not confirmed (Cramer's $V=0.126$, $Sig.=0.987$, confidence level 0.95).

If we continue in the sample description, in the number of employees, there is quite a similar situation, where the most companies in growth are in size of 1-9 employees (21.13%) and 10-49 employees (12.89%). In the contrast of that, decline stage was confirmed by 15.98% of companies, so net growth rate (growth stage – decline stage) was 5.48%.

We may deduce, from the numbers in the table that the main growth of business units is in those with up to 9 employees and is connected with sole proprietors and limited liability companies. It may be influenced by the better reputation of the business type of a Limited Liability Company. The relationship between these factors was not confirmed (Cramer's $V=0.154$, $Sig.=0.545$). Finally, the relationship between the current lifecycle stage and annual turnover was examined (see tab. 2).

Tab. 2: Relationship between Business lifecycle and average annual turnover in CZK

	<1 mil.	1–10 mil.	10–100 mil.	100–250 mil.	250 mil. –1 bil.	>1 bil.	Total
Growth	9.79%	17.53%	14.43%	3.09%	3.61%	1.03%	49.48%
Stagnation, Maturity	2.58%	3.61%	1.55%	1.03%	0.52%	0.52%	9.79%
Decline	9.79%	11.34%	9.79%	0.52%	0.52%	0.00%	31.96%
Crisis	1.03%	0.52%	0.52%	0.00%	0.00%	0.00%	2.06%
Destruction and deacease	0.00%	0.00%	0.52%	0.00%	0.00%	0.00%	0.52%
Missing	2.58%	1.55%	2.06%	0.00%	0.00%	0.00%	6.19%
Total	25.77%	34.54%	28.7%	4.64%	4.64%	1.55%	100%

Source: own research

As companies, which stated that they were growing, made up the main percentage share, we were not surprised to discover that given the small size of the companies (see table xxx), the turnover of the companies was relatively small (mostly up to CZK 10 million). For the third time, the relationship between the lifecycle and turnover was not confirmed (Cramer's $V=0.133$, $Sig. =0.898$). The only positive relationship to be confirmed was between the company size and the turnover, which is connected in the case of the EU definition of Small and Medium sized entrepreneurs (Sperman's coeff. 0.753, sig. =.000). Unfortunately, the distribution of the sample has a little bit disproportion to organizational structure of Moravian-Silesian (MS) region in 2014 in case of economic activity and size. This was connected by availability of reviewed companies.

Tab. 3: Relationship between sample and regional structure

Economic activity	Sample	MS Region	Legal form	Sample	MS Region
Agriculture	1.5%	6.5%	Sole proprietors	39.69%	88.9%
Manufacturing	10.3%	22.6%	Companies	60.31%	29.2%
Construction	12.4%	20.3%	Size (employees)		
Trade activities	37.1%	-	1-9	57.21%	73.9%
Services	35.6%	50.6%*	10-49	28.4%	13.9%
			50-249	14.4%	3.4%

*Source: own research; CSO, 2015, * trade and services together*

On the other hand, the number of employees from Moravian-Silesian region and sorting by economic activity is based mainly on company data. Finally, they do not sort trade and services in organizational structure in business units on regional level.

In accordance with the previously mentioned model, we divided our main findings into two layers i.e. the Political layer and the Normative-cognitive layer where the most important factors are summarized in the Table 4 below. When we used the Likert scale (1 – the worst, 5- the best), we obtain the first draft of the current state of regional culture. Most factors with the higher mark in the responses (top five), have the same rate of standard deviation (fluctuation) in the responses. The more stable group is to be seen in the last five factors, which have a minimum rate of deviation. It can be seen, that regional culture may have a group of subcultures, dependent on the location in the region.

Tab. 4: Significant factors influencing business behaviour

Top 5	Mean	Std. Deviation	Last 5	Mean	Std. Deviation
Ample amount of customers	3.90	1.442	Cluster cooperation*	2.34	0.190
Quality of labour force*	3.17	1.396	Regional export support*	2.32	0.171
Location in region	3.13	1.253	Brownfield regeneration policy*	2.19	0.171
Local Bureaucracy*	3.11	1.193	Lack of alternative financial sources*	2.10	0.122
Legislation*	3.08	1.138	Available housing for employees*	1.87	0.122

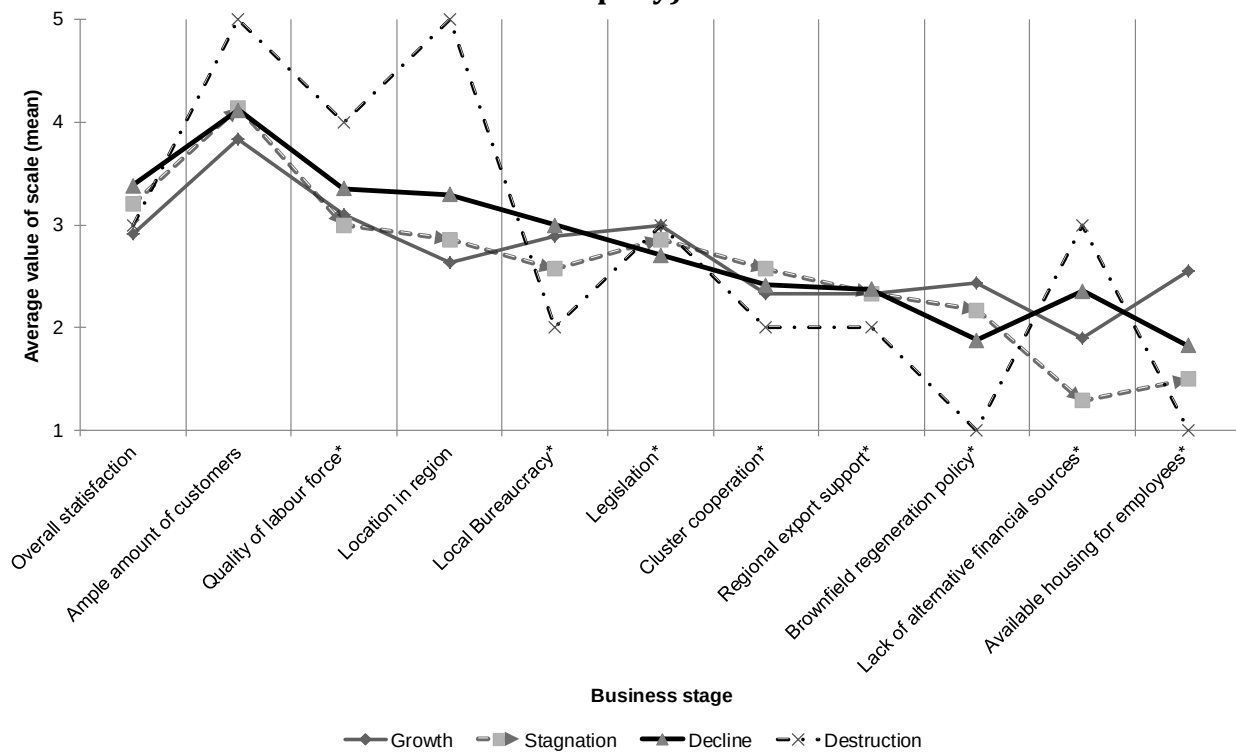
Source: own research

When the number of employees has positive relationship with annual turnover, comparison between preferences and typical behaviour could be based on one variable (turnover) only. We are able to model typical preferences due to current business stage in background of size and turnover. The model is based on significant factors in the table 4 and gives us an example of change in preference during the life cycle of business. As a case study we used a company in size of 19 employees, with turnover between 1-10 mil. CZK.

Typical behaviour of growing company is overall satisfaction with external conditions, willingness for cooperation (clusters), low level of problems to solve, because of success. Very different is sensitiveness to local government and legal environment. Untypically, when they got older they do not care about the local government and its evaluation. The positive relationship we found between location and infrastructure (cor.coeff .865; sig. =.000).

It is significant, that we found sensitivity of location in the region as it is mentioned by [15], where the factor of “domicile attractiveness” was defined. Surprisingly, there is no connection with entrepreneurial traditions in the region, entrepreneur active involvement into local policy and entrepreneurial interest on official informational source from local authority. Our findings are comparable with the results of [7], who stated, that main factors, influencing small and medium sized entrepreneurs are availability of additional services, possible cooperation with competing enterprises (we added cluster policy), qualified human resources, state of transport infrastructure (in our findings it was in the middle of significance) and shipping costs (we didn’t examined).

Fig. 1: Sensitiveness on the main factors during the business stage (micro company)



Source: own research

Overall satisfaction could be compared with main findings of [3], who mentioned that entrepreneurs generally evaluate the approach of the state to their needs and interests negatively, when 12.78% of their sample in Zlínský kraj (bordering with Moravia-Silesia Region) and 5.49% of companies in Jihozápadní kraj (neighbouring region, cooperation within automotive cluster) stated that the government fulfil its role in duties. Finally, they evaluated potential risks on the market, and they find quite similar traits of entrepreneurs like lack of contracts, poor staff, legal risks and financial sources.

Conclusion

All of our work is limited by the intervals of company evaluation and the availability of data which is a common problem among other studies [12], but further research must be conducted to improve the quality and predictive power of the presented models to avoid bias and to be able to describe more factors influencing local entrepreneurial environment. This model supports our research issue, that there are existing subcultures within region, dependent on the region location.

Cross-tab divided our companies into three groups, influenced by the regional entrepreneurship policy, based on number of employees, turnover and business stage. Those groups are characterized by these indicators (based on the table 4):

- Satisfied entrepreneurs (average scale value between the values of 1 and 2.5). This group consists from companies in growth and average turnover till 1.mil CZK and 10-49 employees and the stagnation companies with 1-9 and 10-49 employees and

turnover till 1 mil.CZK. Two quite continuing groups by the stage, where maximum turnover is 1 million of CZK. Typical behaviour: cooperation with clusters, export support, disappointment with the local policy, bureaucracy and their location in the region.

- Mid – satisfied entrepreneurs (average score in the middle of Likert scale 2.5-3.5). This group isn't so homogenous. It differs in economic vitality (all scale) and consists from all stages; there is no significant cut-off value for the next group. Main problems are ample amount of customers, quality of labour force, location and the local (municipal) approach to entrepreneurship.
- Dissatisfied entrepreneurs (average score more than 3.5). The group is base on companies in decline, sized 50-249 employees and with the 100-250 mil. CZK. Typical behaviour is overall dissatisfaction with most of the factors.

As being said, spatial analysis is needed to find deeper connections with the location of the company and their local business condition to evaluate regional business environment in Moravian-Silesian Region.

Acknowledgements

This paper was supported by the Ministry of Education, Youth and Sports Czech Republic within the Institutional Support for Long-term Development of a Research Organization in 2015.

References

- [1] ANDERSSON, M. Start -Up Rates , Entrepreneurship Culture And The Business Cycle – Swedish Patterns From National and Regional Data. In BRAUNERHJELM, P. ed. *Entrepreneurship, Norms and the Business Cycle*, 2012. Stockholm: Swedish Economic Forum Report, pp. 93–112. ISBN 91-89301-45-5.
- [2] AUDRETSCH, D. B. and M. KEILBACH. Entrepreneurship capital and economic performance. *Regional Studies*, 2004, **38**(8): 949–959. ISSN 0034-3404.
- [3] BELÁS, J., V. DEMJAN, J. HABÁNIK, M. HUDÁKOVÁ, and J. SIPKO. The business environment of small and medium-sized enterprises in selected regions of the Czech Republic and Slovakia. *E+M Economics & Management*, 2015, **18**(1): 95–110. ISSN 1212-3609.
- [4] BEUGELSDIJK, S. Entrepreneurial culture, regional innovativeness and economic growth. *Journal of Evolutionary Economics*, 2007, **17**(2):187–210. ISSN 0936-9937.
- [5] CZSO. *Nejnovější data o kraji: Moravskoslezský kraj* [online]. Praha: Czech Statistical Office, 2015. [cit. 2015-03-14]. Available at: <http://www.czso.cz/x/krajedata.nsf/kra-jenejnovejsi/xt>
- [6] FRITSCH, M. and M. WYRWICH. The role of a regional entrepreneurship culture – evidence and consequences. In BRAUNERHJELM, P. ed. *Entrepreneurship, Norms and the Business Cycle*, 2012. Stockholm : Swedish Economic Forum Report, 75–92. ISBN 91-89301-45-5.
- [7] JIRÁSKOVÁ, E. A comparison of location factors evaluation in the secondary and tertiary sectors. *E+M Ekonomie a Management*, 2015, **18**(1): 46–56. ISSN 1212-3609.

- [8] LUNDSTRÖM, A. and L. STEVENSON. *Entrepreneurship Policy: Theory and Practice*. Boston: Kluwer Academic Publishers, 2005. ISBN 978-0-387-24140-1.
- [9] OLARU, M., V. DINU, G. STOLERIU, D. ȘANDRU, and V. DINĂ. Responsible Commercial Activity of SMEs and Specific Values of Sustainable Development in Terms of the European Excellence Model. *Amfiteatru Economic*, 2010, **12**(27): 10–26. ISSN 1582-9146.
- [10] PETTY, J. S. and J. BONARDI. Public Policy: Moving Beyond Firm Creation [online]. Kauffman, 2006. [cit. 2015-02-24] Available at: <http://sites.kauffman.org/irpr/resources/Petty,Jeffrey-PublicPolicyMovingBeyondFirmCreation.pdf>
- [11] TOMA, S. G., A. M. GRIGORE, and P. MARINESCU. Economic Development and Entrepreneurship [online]. *Procedia Economics and Finance*, 2014, **8**: 436–443. ISSN 2212-5671.
- [12] VON STEIN, J.H. and W. ZIEGLER. The prognosis and surveillance of risks from commercial credit borrowers. *Journal of Banking and Finance*, 1984, **8**(2): 249–268. ISSN 0378-4266.
- [13] WENNEKERS, S. and R. THURIK. Linking Entrepreneurship and Economic Growth. *Small Business Economics*, 1999, **13**(1): 27–56. ISSN 0921-898X.
- [14] ZAHRA, S. A. and M. WRIGHT. Entrepreneurship's Next Act. *Academy of Management Perspectives*, 2011, **25**(4): 67–83. ISSN 1558-9080.
- [15] ŽIŽKA, M. Methodology of Assessment of Disparities on Municipality Level as a Part of Territorial Planning. In KOCOUREK, A. ed. *Proceedings from the 10th International Conference Liberec Economic Forum 2011*. Liberec: Technical University of Liberec, 2011. pp. 614–622. ISBN 978-80-7372-755-0.

Jana Šimanová, Aleš Kocourek

Technical University of Liberec, Faculty of Economics, Department of Economics
Studentská 1402/2, 461 17 Liberec 1, Czech Republic
email: jana.simanova@tul.cz, ales.kocourek@tul.cz

Nominal vs. Real Regional Income Disparities in Selected Cities of the Czech Republic

Abstract

The paper brings first results of applied research related to the measurement of the real regional disparities in the Czech Republic. The research hypothesis claims that the level of nominal income of regional inhabitants is compensated for by the level of costs of living. Therefore, it is highly inaccurate to consider socio-economic situation of the region's population by comparison of nominal income variables such as net disposable household income (NDHI) without taking the interregional price differences into account. The paper briefly outlines the methodology for the construction of spatial cost-of-living index (CoLI) based on the adjusted consumer basket for consumer price index. Authors then estimate the values of NDHI on the level of district cities (since the data is available on the level of NUTS3 only). These two indicators enable verification of research hypothesis. The results correspond to the fact that the disparities in real incomes are lower than those in the nominal incomes. Therefore, assessing the real regional social-economic disparities yields more accurate results about the social-economic position of regions which is a crucial finding especially for the process of creation and implementation of economic, social, and cohesion policies.

Key Words

cost-of-living index, regional disparities, real disparities, nominal indicators, net disposable household income

JEL Classification: C21, R13, R31

Introduction

The paper is aimed at the issue of regional price disparities in the context of assessment of the standard of living in the selected cities of the Czech Republic, or more specifically on the identification of possible trade-off between the levels of prices and of nominal incomes across the Czech Republic. The main subject of the research lies in the construction of a Regional cost-of-living index (CoLI) based on the generally well-known and widely used consumer price index (CPI). This task is significantly preconditioned by the quality of periodical price investigation in the areas for which the index is to be constructed. Such investigations are carried out in 36 district cities of the Czech Republic and the results are published monthly on the aggregate level in the form of CPI. In the second step, the CoLI is applied as an instrument of rectification of nominal net disposable household income (NDHI).

The fundamental research hypothesis claims, the higher levels of income of households (measured by the nominal NDHI) generally tend to be compensated for by higher levels of consumer prices. Therefore, the comparison of nominal values of NDHI across regions

does not illustrate the real social-economic position of the region's inhabitants, although the nominal NDHI is generally used as the measure of social-economic ranking of regions in the Czech Republic and other European countries.

The quantification and evaluation of regional disparities remains one of the most up-to-date topics of regional politics. According to Czech as well as foreign authors, the role of the supply side is often overestimated in the regional policy at the expense of the demand side, or more specifically of the real income per capita. The effect of the level of real living costs is perceived by the current theories of regional development as an impact of localization of corporations. It is presumed (to a great extent controversially) that the consumer prices are lower and the real estate prices are higher as a result of economies of agglomeration [16]. According to Viturka [17], the price factors belong to the group of moderately important determinants of regional competitiveness. Kahoun [9] considers the fact that the regional differences in price levels remain neglected highly limiting for accountable regional comparison, especially because the difference in price levels between the Czech regions (cities) are significant.

In the German NUTS3 regions, the regional cost-of-living index (CoLI) was calculated in 1995 and 2004 on the basis of cost-of-goods index (CoGI) and housing rent index (HRI). [11][15] The spatial CoLI patterns were found relatively stable over time. The real regional disparities were proved to diminish at a higher pace than the nominal ones, especially across the East German regions. [14] In the United Kingdom, the issue of real regional disparities has been tackled by Overman and Gibbons [7], who focus solely on the prices of housing. During their research in 1998 – 2008, a significant trade-off between the level of wages and the costs of living was identified. Therefore, they recommend the economic policies should target the individual inhabitant and should attempt to improve his/her individual position, which will result in raising the situation of the whole region more efficiently than focusing on a geographically determined region. [7]. In the USA, the researchers from the Bureau of Economic Analysis are deeply engaged in the issue of metropolitan and nonmetropolitan price indices and also in the context of real income of population. They discovered a higher variability in real incomes in the nonmetropolitan areas than in the metropolitan ones. [1]

1. Methodology of Estimation of the Regional Cost-of-Living Index

For the construction of regional Cost-of-Living Indexes it is important to define the following:

1. Area for which it will be calculated.
2. Consumer basket.
3. The basic period and area to relate the value of CoLI to (Cost-of-Living Index formula).
4. Source of the data.

Ad 1) The fact that the price investigation carried out by the Czech Statistical Office is rather extensive and covers 36 districts (out of 76) of the Czech Republic represents an indisputable advantage. Prices of goods and services are usually collected in cities which

are the centres of districts/counties (referred to as "district cities"). Therefore, the areas for which the index will be calculated correspond with catastral territories of the 36 district cities in the Czech Republic.

Ad 2) The consumer basket should be the same across the regions in order to ensure the condition of temporal and territorial comparison. The weights of the commodities in the consumer basket in the Czech Republic are revised according to the data from household panel survey. The consumer basket is identical in terms of structure in all the regions, it means that the price of all representatives has to be investigated or calculated for all the 36 cities. In the years 2011 - 13, this condition is met by 92.7 % of commodities of the consumer basket for CPI. The representatives of the consumer basket can be clasified into the following groups from the CoLI point of view:

- a) representatives, which households can purchase only regionally (locally) and which can to a certain extent contribute to interregional differences in price levels. These representatives constitute 59 % of the consumer basket. They are imputed in the consumer basket in the prices investigated in the given territory.
- b) representatives where the purchase is usually performed transregionally, these representatives do not create regional differences (e.g. electricity, gas, coach transport, etc.). These representatives constitute 28 % of the consumer basket. They are imputed in the consumer basket in the average price for the whole Czech Republic.
- c) representatives where the prices are fixed across the regions (fee stamps, cigarettes, magazines...) These representatives constitute 5.7 % of the consumer basket. These are imputed into the consumer basket in the same price for which they are purchased.

Ad 3) In general, an actual or fictive area may be chosen as the base (reference) region. When only national consumption patterns are available, the use of national average prices would be in accordance with the pure Laspeyres approach. In the Czech Republic, we use the city average prices which represent the fictive "average territory". Thus, the Laspeyres modified CoLI used for the calculation could be written as:

$$CoLI_r = \frac{\sum_{i=1}^N p_{ir} q_i}{\sum_{i=1}^N p_{ia} q_i} = \sum_{i=1}^N \frac{p_{ir}}{p_{ia}} \frac{p_{ia} q_i}{\sum_{i=1}^N p_{ia} q_i} = \sum_{i=1}^N \frac{p_{ir}}{p_{ia}} w_i \quad (1)$$

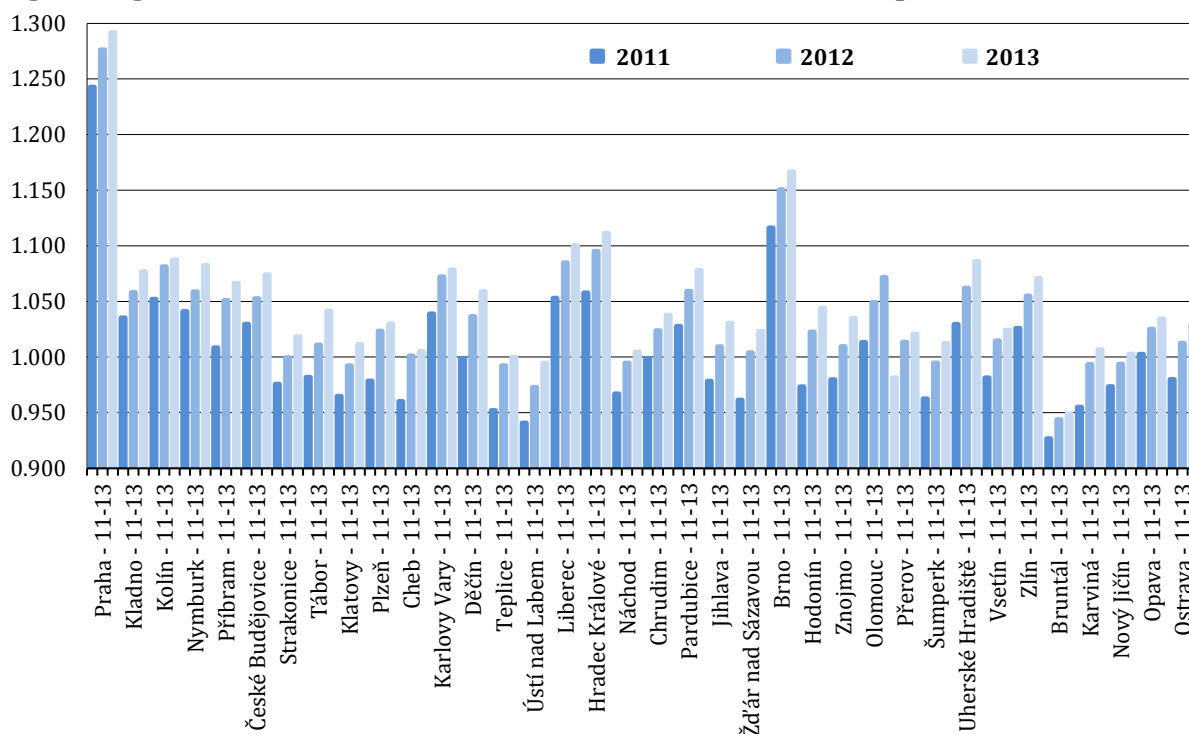
where p_{ir} is the price and q_i is the quantity of goods or services i consumed in a region r , p_{ia} stands for the mean price, in this case the average price of the 36 cities in 2011. As can be seen, Laspeyres index is the sum of all relative prices between the region of interest and the regional average price (in this case the average price of the 36 district cities) in the base year 2011, weighted by the expenditure weight w_i of each individual representative in the regional consumer basket. [6][10][12]

Ad 4) The source of the data is the price survey of goods and services in the Czech cities which is carried out by the Czech Statistical Office twice a month on average. In the majority of cases, for each representative of the consumer basket three prices are

collected. Another source of data for regional CoLI estimation in the cities is the data from survey of prices of real estate – housing rent index – which are published every year by the Czech Statistical Office on the basis of data supplied by the Ministry of Finance of the Czech Republic.

Results of regional CoLI in the 36 Czech district cities in 2011 – 2013 are shown in Fig. 1.

Fig. 1: Regional CoLI in Selected District Cities of the Czech Republic in 2011–2013



Source: authors' own calculations, data from [5]

2. Methodology of Estimation of the Nominal Net Disposable Household Income on the Level of District Cities

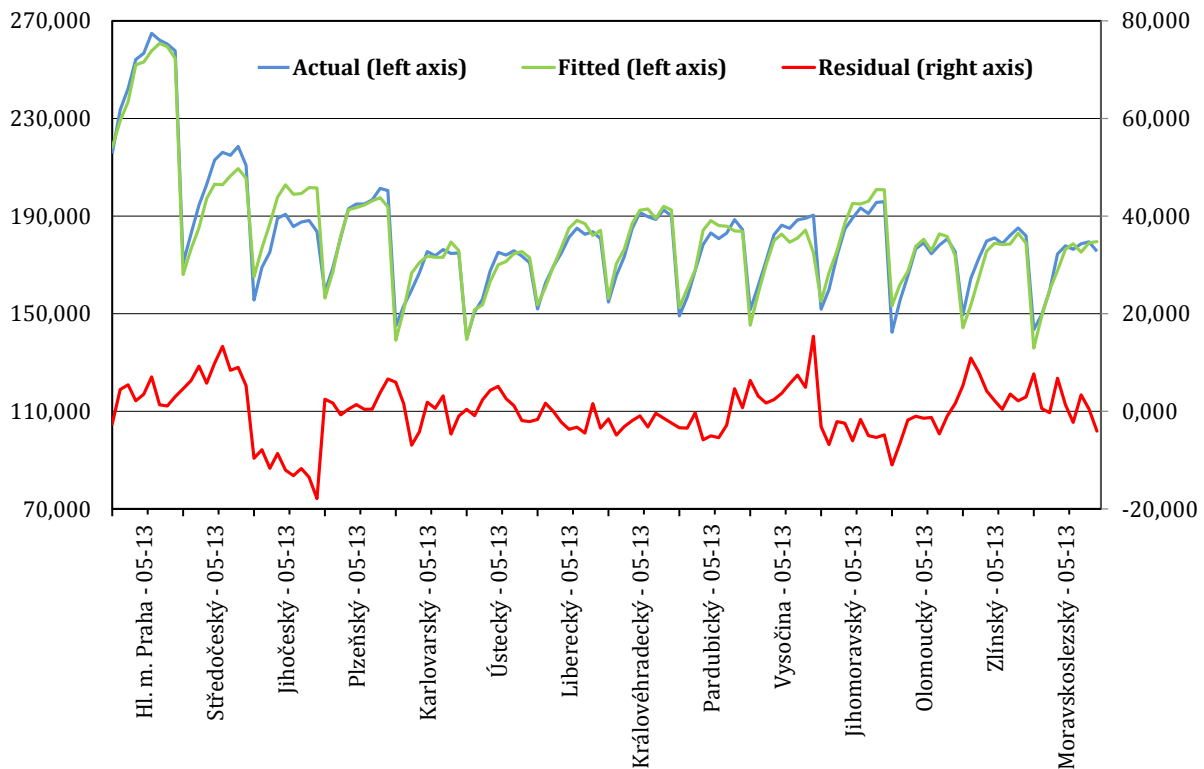
The net disposable household income (NDHI) is the result of balance of revenues and expenditures recorded at the secondary distribution of income account. It shows how is the surplus/deficit of primary incomes redistributed through the taxes, social benefits and other transfer payments [13]. The NDHI as such represents a value of money the households are at their disposal for final consumption, savings, or assets accumulation. The indicator illustrates the material wealth of households with permanent residence in the particular region or locality. [6]

Since the value of NDHI is not published on disaggregated to the level of district cities in the Czech Republic, but only to the level of regions (NUTS3), it was necessary to select potential regressors on the regional (NUTS3) level available also for the district cities (NUTS5) to estimate the income indicator NDHI per capita in the requested territory and time [4]. Among the potential regressors, the following were tested:

- PRIMEMP: Share of employees in the primary sector on the economically active population.
- SECEMP: Share of employees in the secondary sector on the economically active population.
- UNEMP: Share of unemployed on the economically active population.
- PRIMEDU: Share of population of 15 and older that has attained pre-primary or primary levels of education only.
- UNIEDU: Share of population of 15 and older that has attained tertiary level of education.
- REGION: The belonging of a district city to a certain region using a dummy variable.

$$NDHI = 220,721.532 - 2,708.365 * PRIMEDU + 1,268.094 * UNIEDU - 1,955.267 * REGION \quad (2)$$

Fig. 2: Fitted, Actual and Residual Values of the Regression Model of Regional Nominal NDHI in the Czech NUTS3 Regions in 2005–2013



Source: authors' own calculations in eViews 8.1

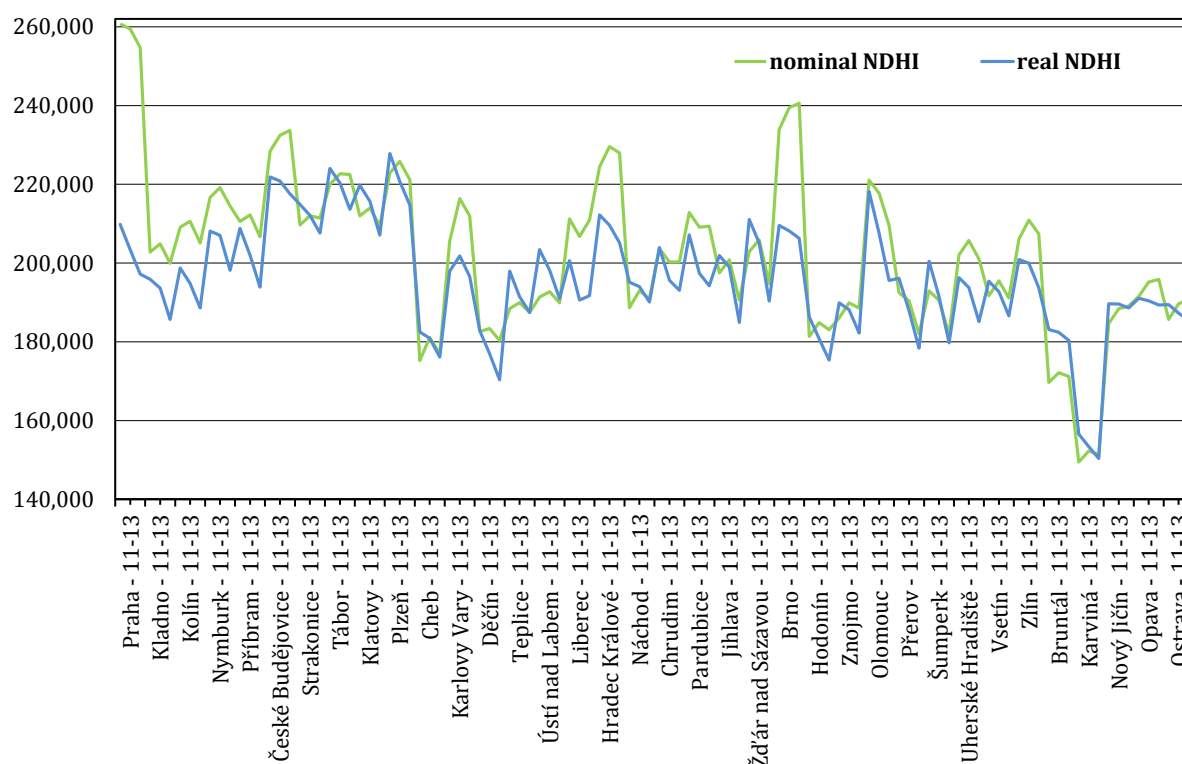
For the estimation of model, the panel data analysis methods were applied using the software eViews 8.1. Since the aim of the estimation is to regionally disaggregate the data (not to perform forecasting or extrapolation in time), we will consider our data geographically stationary [2] and cointegrated. Regarding the characteristics of the data, fixed effects were chosen for the period and ordinary least square (no effects) for the cross-section dimension. The results of the model are summed up in the equation (2) above and in the figure 2 showing the model performance on the real actual data on the regional (NUTS3) level.

The statistically significant regressors of NDHI on the level of regions (NUTS3) included PRIMEDU and REGION with negative influence on the NDHI and UNIEDU with a positive influence on the NDHI. These three variables are capable of explaining 94,5 % of variability of the data, the robustness of the model was also verified using F-statistics and Jarque-Bera test for normality of residuals.

3. Results

The software eViews 8.1 was then employed to estimate the values of NDHI on the “lower” level of district cities. The results can be found in the figure 3, illustrated as the nominal NDHI values for the 36 district cities in the years 2011 – 2013 (only for these three years the regional CoLI values have been computed so far).

Fig. 3: Nominal vs. Real Regional NDHI in Selected District Cities of the Czech Republic in 2011–2013



Source: authors' own calculations in eViews 8.1

In the following step of the analysis, the results of regional CoLIs were confronted with the values of nominal NDHIs per capita and year in the 36 district cities. The real NDHIs per capital and year were calculated for the selected 36 district cities and for years 2011 – 2013. The results are shown in figure 3. As expected, the most pronounced differences are recorded for the largest cities of Prague and Brno. Figure 3 as well as descriptive statistics shown in table 1 suggest, there might be some trade-off between the regional values of nominal NDHI per capita and the regional CoLI: the higher nominal NDHI per capita seems to be compensated for by the higher values of CoLI.

Tab. 1: Basic statistic characteristics in the sample of nominal and real NDHI

Indicator	Standard deviation	Mean	Median
Nominal NDHI	20 125	202 266.34	202 427.73
Real NDHI	14 102	196 166.20	195 479.84

Source: authors' calculations in eViews 8.1

The main hypothesis of this article was focused on validation of the statistically significant influence of regional price levels on the extent of recorded interregional nominal social-economic disparities. We used five tests on homogeneity of variance (F-test, Siegel-Tukey test, Bartlett test, Levene test, and Brown-Forsythe test). The results of all these tests are summed up in the table 2. All of them give very similar results.

Since the p -value exceeded the 5% level, the null hypothesis of homogeneity of variances is rejected and we can conclude the regional CoLIs reassess the nominal regional disparities significantly. The interregional differences measured by nominal NDHI per capita are significantly wider than the real disparities.

Tab. 2: Results of the Tests on Homoscedasticity

Method	Degrees of Freedom	Value	p -value
F-test	(107, 107)	2.0365	0.0003
Siegel-Tukey		2.8752	0.0040
Bartlett	1	13.1943	0.0003
Levene	(1, 214)	10.7091	0.0012
Brown-Forsythe	(1, 214)	10.7781	0.0012

Source: authors' calculations in eViews 8.1

Conclusion

First, the regression analysis on panel data showed that NDHI is mainly influenced by the rate of unemployment and the rate of inhabitants with basic education – both regressors lower the NDHI value.

Second, the results of analysis across all examined district cities of the Czech Republic verified the statistically significant trade-off between the CoLIs and NDHIs, when higher NDHIs imply higher CoLIs. This finding is, however, fundamentally biased by the cities of Prague and Brno. The analysis of the variability of the statistical set of regional nominal NDHIs per capita was tested against the variability of the regional real NDHIs per capita. The significant impact of application of CoLI was verified at the 5% level of significance. The nominal indicator of social-economic position of an average individual in the selected district cities of the Czech Republic recorded significantly higher variability than the real indicator. Thus, the differences in prices across regions decrease the interregional disparities and to some extent improving the social-economic situation of inhabitants of problematic regions of the Czech Republic.

Although differences in the quality of services such as education or health care which were examined by Horváthová and Abrhám [8] are not included into the comparison, spatial assessment of the relative regional price differences has the potential of improving

the understanding of some of the market problems and represents an important mean of more precisely targeted interventions of economic policy. The regional price levels play a crucial role in consumers' decision making, in localization of economic subjects, and as such can influence the extent of regional disparities. [2]

More precise definition of localities as well as methods of assessing the real economic and social disparities (using the regional Cost-of-Living Index) is desirable for increasing the efficiency of applied instruments of regional policies. [3] It seems useful to focus the policies of regional development on the real social-economic situation of the individuals and implicitly on the position of geographically determined region.

Acknowledgment

This article is a part of the applied research project TD020047 "Regional Cost-of-Living Index as the Indicator of the Real Social and Economic Disparities" supported by the Technology Agency of the Czech Republic, the Omega Programme.

Our special thanks belong to the staff of the Price Statistics Department of the Czech Statistical Office for their willingness to provide data and consultancy.

References

- [1] ATEN, B., E. FIGUEROA, and T. MARTIN. *Real Personal Income and Regional Price Parities for States and Metropolitan Areas, 2007–2011* [online]. Washington, USA: U.S. Bureau of Economic Analysis, 2013. [cit. 2014-04-06]. Available at: [http://www.bea.gov/scb/pdf/2013/08 August/0813_regional_price_parities.pdf](http://www.bea.gov/scb/pdf/2013/08%20August/0813_regional_price_parities.pdf)
- [2] BRANDOVÁ, B. Regional Economic Growth. In KOCOUREK, A. ed. *Proceedings of the 10th International Conference Liberec Economic Forum 2011*. Liberec: Technical University of Liberec, 2011. pp. 34–42.
- [3] ČAJKA, P. Regionálna politika v kontinentálnom kontexte. In KOSÍR, I. et al. eds. *Rozširovanie Európskej únie na juhovýchod a Slovenská republika*. Bratislava: Ekonóm, 2007. pp. 14–50.
- [4] CHANDRA, H., N. SALVATI, R. CHAMBERS, and N. TZAVIDIS. Small Area Estimation under Spatial Nonstationarity. *Computational Statistics and Data Analysis*, 2012, **56**(10): 2875–2888. ISSN 0167-9473.
- [5] CZSO. *Data from Internal Database of Czech Statistical Office*. Praha: Czech Statistical Office, 2014.
- [6] CZSO. *Indexy spotřebitelských cen (životních nákladů) – základní členění únor 2015* [online]. Praha: Czech Statistical Office, 2015. [cit. 2015-03-11]. Available at: [http://www.czso.cz/csu/2015edicniplan.nsf/t/000038003F/\\$File/012018-150206.pdf](http://www.czso.cz/csu/2015edicniplan.nsf/t/000038003F/$File/012018-150206.pdf)
- [7] GIBBONS, S., H. OVERMAN, and G. RESENDE. Real Earnings Disparities in Britain. *Spatial Economics Research Centre Discussion Paper*, 2011, iss. 65 (January), 44 pgs.
- [8] HORVÁTHOVÁ, Z. and J. ABRHÁM. Health Insurance System Revision in the Czech Republic, Finland, France, Germany and the Slovak Republic. *Mediterranean Journal of Social Sciences*, 2015, **6**(2): 286–291.

- [9] KAHOUN, J. Měření regionálního HDP: důchodový a produkční přístup. *Ekonomické listy*, 2011, 2(5), 3-13.
- [10] KOCOUREK, A., J. ŠIMANOVÁ, and J. KRAFT. Regionalization of the Consumer Cost-of-Living Index in the Czech Republic. In LÖSTER, T. and T. PAVELKA. eds. *The 8th International Days of Statistics and Economics Conference Proceedings*. Praha: University of Economics, 2014. pp. 1487–1496. ISBN 978-80-87990-02-5.
- [11] KOSFELD, R., and H. ECKEY. Market access, regional price level and wage disparities: the German Case. *Jahrbuch für Regionalwissenschaft*, 2010, 30(2), 105–128.
- [12] MARŠÍKOVÁ, K., and A. KOCOUREK. Shifts in Income Expectations of Czech Students at Selected Economic Faculties Over the Years 2001 – 2012. *Ekonomický časopis*, 2013, 61(4), 358–375.
- [13] PAVELKA, T., M. SKÁLA, and J. ČADIL. Selected Issues of the Minimum Wage in the Czech Republic. *E+M Ekonomie a Management*, 2014, 17(4), 30–45.
- [14] ROOS, M. W. Earnings Disparities in Unified Germany: Nominal versus Real. *Jahrbuch für Regionalwissenschaft*, 2006, 26(2): 171–189.
- [15] SCHULTZE, C. L. The Consumer Cost-of-Living Index: Conceptual Issues and Practical Suggestions. *Journal of Economic Perspectives*, 2003, 17(1): 3–22.
- [16] ŠIMANOVÁ, J. and F. TREŠL. Vývoj průmyslové koncentrace a specializace v regionech NUTS3 České republiky v kontextu dynamizace regionální komparativní výhody. *E+M Ekonomie a Management*, 2011, 14(1): 38–52.
- [17] VITURKA, M. Konkurenceschopnost regionů a možnosti jejího hodnocení. *Politická ekonomie*, 2007, 55(5): 638–658. ISSN 0032-3233.

Tomáš Tichý¹, Miloš Kopa², Sebastiano Vitali³

¹ Technical University Ostrava, Faculty of Economics, Department of Finance
Sokolská 33, 701 21 Ostrava, Czech Republic

email: tomas.tichy@vsb.cz

² Institute of Information Theory and Automation of the ASCR, Department
of Econometrics, Pod Vodárenskou věží 4, 182 08 Prague, Czech Republic

email: kopa@karlin.mff.cuni.cz

³ University of Bergamo, Department of Management, Economics and Quantitative
Methods, Via dei Caniana 2, Bergamo, Italy

email: sebastiano.vitali@unibg.it

The Bandwidth Selection in Connection to Option Implied Volatility Extraction

Abstract

Among various kinds of options we can find at the market, some are traded at organized exchanges and therefore are quite liquid, while others are traded only between particular parties. Whereas there is no need to look for a model to price liquid exchange traded options, since their price is generally accepted by the demand and supply, for illiquid or even exotic options new efficient models are still developed. The current market practice is to obtain the implied volatility of liquid options as based on Black-Scholes type (BS hereafter) models. Since the BS model at one time moment can be related to a large set of IVs as given by different parameters (maturity/moneyness relation) of tradable options leading to IV curve or surface. Since there is no continuum of options with various parameters, the curve / surface must be obtained by suitable smoothing and interpolation. However, it can bring an arbitrage opportunity, if no-arbitrage conditions on state price density (SPD) are ignored. The focus of this paper is to study the behavior of IV and SPD for several kernel functions and with respect to different choices of bandwidth parameter h . Specifically, we show several interesting implications of the change of h on the violation of no arbitrage condition and the total area of SPD under zero.

Key Words

arbitrage opportunity, implied volatility, option pricing, time grid, state price density

JEL Classification: C46, E37, G17, G24

Introduction

At the market, we can identify various kinds of options. Some of them are traded at organized exchanges and are quite liquid. Others are traded only between particular parties. The volume of traded options increased sharply in 70's just after introducing the famous Black and Scholes model (1973). Thus, at that time the practice was to assume Gaussian distribution as a reliable proxy to the empirical observations of stock price or FX rate returns. Soon however, it was documented that the returns can be very far from the assumption of Gaussianity and thus the Black and Scholes model can be used only indirectly – take the market price of liquid option, invert the Black and Scholes formula,

obtain a volatility (ie. implied volatility), put it into the formula by setting the parameters of illiquid option and get the price.

For example, Rubinstein (1994) or Bakshi et al. (1997) show for S&P 500 options (ie one of the most liquid underlying assets) that implied volatility is not flat but can be strongly curved with changing maturity or/and moneyness. We call the behavior of the implied volatility its curve (assuming just one variable, ie. moneyness) or surface (assuming both the maturity and moneyness). Clearly, the behavior can be very different for various markets and underlying assets, which is probably related to particular market imperfections, such as restricted borrowing or lending. Such differences are evident especially when FX rate options are compared with equity options. Obviously, the set of parameters is not continuous and therefore, some non-parametric smoothing (and extrapolation) is needed to estimate the implied volatility function.

When we extract the implied volatility curve or surface from market prices of liquid options, we can use them to price the illiquid options or even options exotic, which we can trade only OTC. These, however, mostly have different parameters (moneyness, maturity) than those of traded options.

Notwithstanding, the implied volatility function must be calculated carefully – there exist several conditions on the price of call and put options, that must be fulfilled. Otherwise an arbitrage opportunity can arise, ie. riskless profit higher than common riskless return. Clearly, there exist many technics that can be used to adjust the observations and transform them into smooth function.

In this paper, and in line with Benko et al. (2007), we apply relatively classic approach of local polynomial smoothing techniques and study the bandwidth selection process in more details of recent data of DAX option prices (December 2011). In particular, we change h and examine the impact on the interval of moneyness that brings arbitrage opportunity and on the total degree of no-arbitrage violation.

We proceed as follows. In the following section we briefly review the problem of option pricing (Tichý, 2011). Next, we provide some basic facts about the implied volatility modeling and analyze the behavior of the implied volatility surface and potential arbitrage error for a given day using DAX options data.

1. Option valuation and the concept of implied volatility

Options are nonlinear types of financial derivatives, which gives the holder the right (but not the obligation) to buy the underlying asset in the future (at maturity time) at prespecified exercise price. Simultaneously, the writer of the option has to deliver the underlying asset if the holder asks.

Options can be classified due to a whole range of criterions, such as counterparty position (short and long), maturity time, complexity of the payoff function, etc. The basic features are the underlying asset (S), which should be specified as precisely as possible (it is important mainly for commodities), the exercise price (K), and the maturity time (T).

If the option can be exercised only at maturity time T , we call it the European option. By contrast, if it can be exercised also at any time prior the maturity day, ie. $t \in [0, T]$, we refer to it as the American option. A special type of options, possible to be classified somewhere between European and American options is the Bermudan option, which can be exercised at final number of times during the option life.

In dependency on the complexity of the payoff function, we usually distinguish simple plain vanilla options (PV) and exotic options. However, by a plain vanilla option we generally mean call and put options with the most simple payoff function. Sometimes, by plain vanilla options we mean any option which is regularly traded at the market, ie. it is liquid and no special formula is needed to obtain its price.

Thus,

$$\begin{aligned}\Psi_{call}^{vanilla} &= (S_T - K)^+ \text{ for vanilla call, and} \\ \Psi_{put}^{vanilla} &= (K - S_T)^+ \text{ for vanilla put, where } (x)^+ \equiv \max(x, 0).\end{aligned}\tag{1}$$

Due to the definition of an option – it gives a right, but not an obligation to make a particular trade – we can deduce basic differences between the short and the long position. While the payoff resulting from the long position is non-negative, either 0 or $S_T - K$, the payoff of the short position will never be positive, ie. it is either $K - S_T$ or 0. Moreover, it is obvious, that the long call payoff is not limited from above, but the short position payoff function goes only up to the exercise price (underlying asset price is zero).

Options are quite important type of financial derivatives since they allow to fit even very specific fears (hedging) and outlooks (speculation) about the future evolution. Due to the nonlinear payoff function and potential high sensitivity to changes in the input factors, such as volatility or even maturity, options are very challenging also for modeling purposes.

Obviously, since the standard option valuation model of Black and Scholes (and Merton) was based on the assumption of normally distributed returns, the presence of skewness and kurtosis at the market complicates the situation significantly. A common market practice is to use the market price as an exogenous variable to be put into the BS formula (Black and Scholes, 1973). Thus, a so called implied volatility is obtained, ie. a number that assures that BS model provides the right price. Such implied volatility can subsequently be used to value even exotic options, which are not traded at the market.

Generally, the price of European option f at time t with maturity T and payoff function Ψ is given by the payoff expected under risk neutral probabilities Q discounted by the risk less rate to the beginning (t), ie. by setting $\tau = T - t$:

$$f_t = e^{-r\tau} E_{t,T}^Q[\Psi_T]\tag{2}$$

since the payoff at maturity is obviously identical to the European option value at the same time.

For example, assuming the payoff function of plain vanilla call and the normal distribution we get the valuation formula as follows (BS model for vanilla call):

$$f_{call}^{vanilla}(\tau, S, K, r, \sigma) = S F_N(d_+) - e^{-r\tau} K F_N(d_-) \quad (3)$$

Here, S is the underlying asset price at the valuation time (t) and it is supposed to follow log-normal distribution, τ is the time to maturity, r is riskless rate valid over τ , σ is the volatility expected over the same period, both per annum, $F_N(x)$ is distribution function for standard normal distribution and

$$d_{\pm} = \frac{\ln\left(\frac{S}{K}\right) + (r \pm \sigma^2/2)\tau}{\sigma\sqrt{\tau}}. \quad (3)$$

If the price of some options is available from the market, we can invert the formula to obtain the implied volatility, ie. the number that makes the formula equal to market price. Besides the important works, whose authors analyzed the impact of implied volatility on option price, belongs, besides others Dupire (1994), who formulated a process followed by the underlying asset price in dependency on the moneyness and maturity, and Rubinstein (1994), who formulated a discrete time model, the implied binomial tree.

Obviously, the implied volatility will differ for various input data, especially due to the moneyness (relation of the spot price and exercise price) and the time to maturity – otherwise the model could not provide correct price. The dependency of the implied volatility on these two factors can be explained by the risk of jumps in the underlying asset price or other deviations from the assumption of Gaussianity. For example, Yan (2011) carefully analyzed the impact of jump risk on the slope of the implied volatility function, which is informally referred to as the smile, and showed some interesting relations between the returns and the slope.

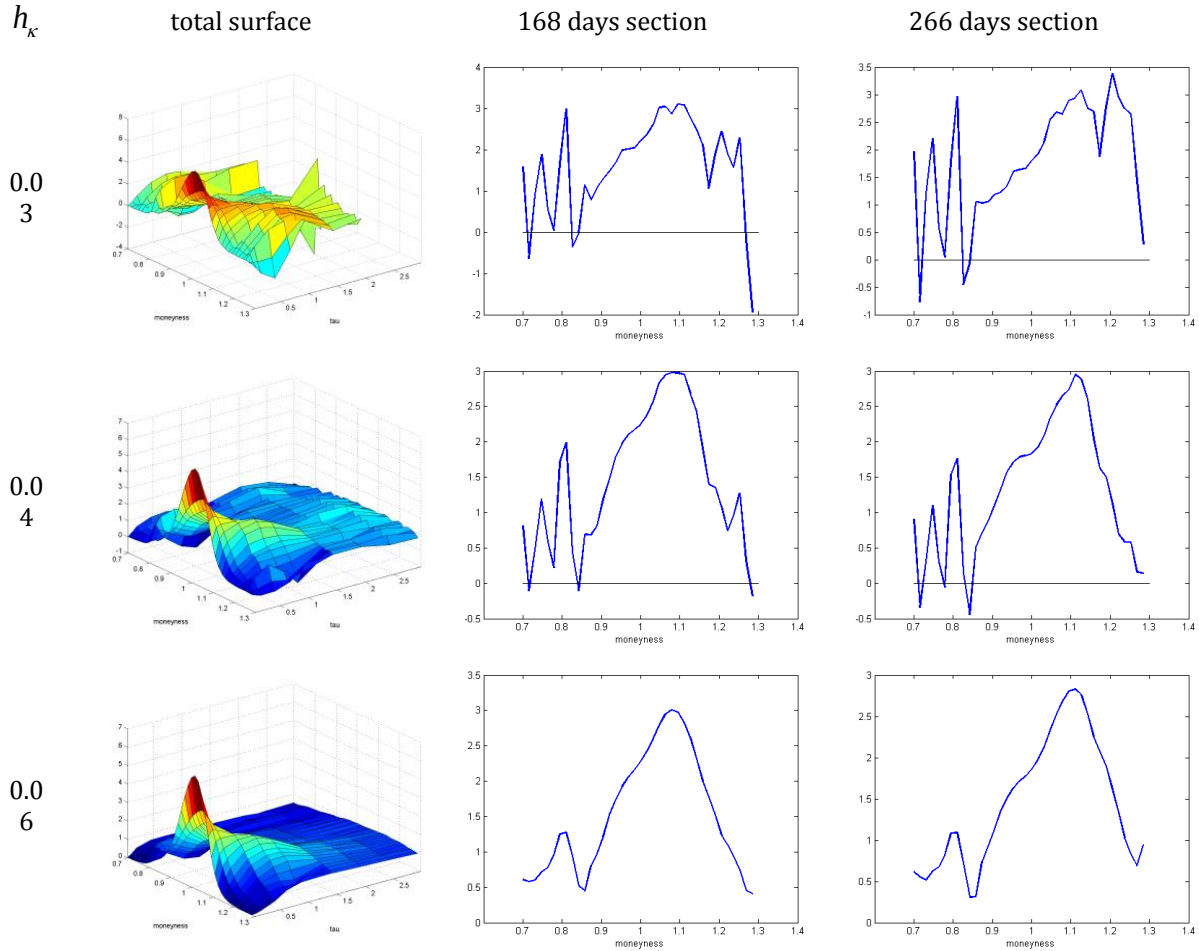
Although there exist many various approaches for the construction of the volatility curve or surface, including some recent alternatives, such as the application of radial basis function (see eg. Glover and Ali (2011) and references therein), we follow here relatively conservative approach adopted by Benko et al. (2007).

2. Implementation

In this section we present the analysis concerning the three dimensions case. We use as dataset all the options on DAX listed on 30 December 2011 with all the maturities. Following Benko et al. (2007) we compute the unconstrained estimation of the IV surface. The estimation with Epanechnikov kernel function, for moneyness bandwidth $h_k = 0.04$ and for maturity (calendar) bandwidth $h_\tau = 1$ provides us clear picture of IV smile for small maturities and becomes less noticeable as the maturity increases.

In order to analyze the arbitrage presence, we produce the corresponding estimations for the state price density (SPD) again using fixed calendar bandwidth $h_\tau = 1$ (see Figure 1).

Fig. 1: 3D estimation of SPD for DAX options (Authors' calculation in Matlab)



Source: authors' own calculations

The computation is done again with Epanechnikov kernel function and with three representative bandwidths for moneyness $h_K = 0.03, 0.04, 0.06$ and bandwidth $h_\tau = 1$ for maturity (τ). Besides each surface we propose also cuts for maturities (τ) equal to 168 days and 266 days. The negative parts of SPD violates the moneyness arbitrage free condition, see Benko et al. (2007) for more details. Hence, the results show some arbitrage behavior for moneyness around 0.8. We study more in deep the case with $h_K = 0.04$ (see Figure 2).

In Figure 2a we show the arbitrage moneyness intervals (intervals with negative SPD) for each maturity. It is clear that the arbitrage chance is real and does not depend on the maturity. Indeed, the critical situations seem to be persistent among the increasing maturities. To evaluate the size of the arbitrage we compute Arbitrage measure as the volume of negative SPD for all considered moneyness bandwidths (0.03 – 0.08). The larger the measure is, the stronger arbitrage free violation is presented.

Fig. 2a: Arbitrage intervals for various maturities

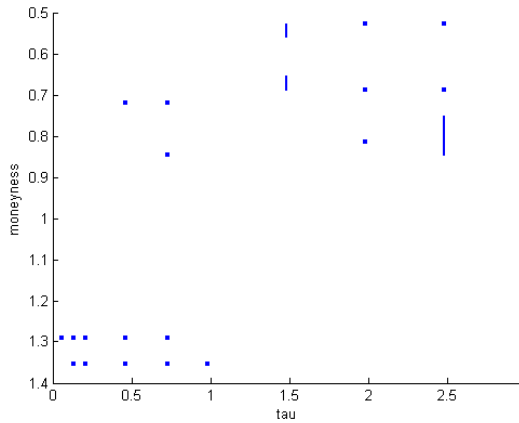
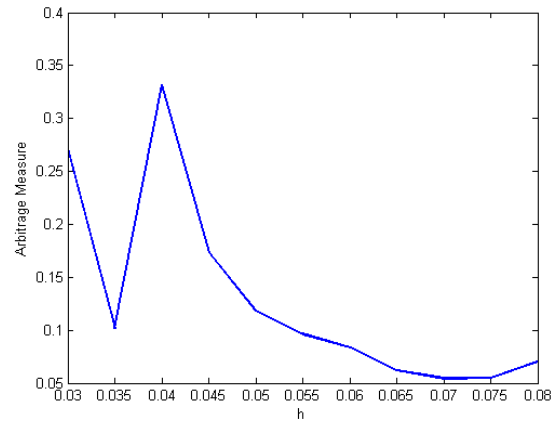


Fig. 2b: Arbitrage measure for DAX options IV surface



Source: authors' calculation in Matlab

From Figure 2b we can notice that the curve is not strictly decreasing and this reinforces the idea that the magnitude of the arbitrage is not depending by the choice of the bandwidth but it is a genuine feature of the market. Moreover, to investigate the Arbitrage measure for various types of the kernel functions, we compare the Arbitrage measure for the different kernel functions and for three bandwidths used previously in Table 1.

Tab. 1: Arbitrage measure volume for DAX options IV surface

h	0.03	0.04	0.06
Uniform	0.0865	0.1689	0.0441
Triangular	0.2482	0.2401	0.0196
Epanechnikov	0.2719	0.3219	0.0156
Quartic	0.2554	0.0765	0.0334
Triweight	0.3306	0.1887	0.0558
Tricube	0.2952	0.0485	0.0412
Gaussian	0.1282	0.2026	0.0253
Cosine	0.2610	0.2955	0.0180
Logistic	0.1585	0.1933	0.0336

Source: authors' calculation in Matlab

We compute again the IV and SPD surface using unconstrained semiparametric estimation proposed in Benko et al. (2007), but now with a non-fixed calendar bandwidth. The computations are done again with Epanechnikov kernel function and with three representative moneyness bandwidths $h_k = 0.03, 0.04, 0.06$.

If we compare these results with those we obtained for fixed calendar bandwidth, we can notice that the arbitrage measure seems to be smaller for all choices of moneyness bandwidth, see Fig. 3a. This behavior is due to the fact that the main arbitrage occurs for long maturities so a smaller bandwidth doesn't include those maturities in the estimations. On the other hand, with a large fixed calendar bandwidth the estimation for the shorter maturities are in some way disturbed by the turbulence that persists for the long maturities.

Finally we compute also the Calendar arbitrage measure as the volume of negative first derivative of total variance, see Benko et al. (2007). In this case we do not observe any

violation of Calendar arbitrage free condition. We demonstrate it in Figure 3b where we show that indeed the total variance is strictly increasing in the calendar (maturity) direction for all moneyness values.

Fig. 3a: Arbitrage Measure for fixed calendar bandwidth (upper blue line) versus Arbitrage Measure for increasing calendar bandwidth (lower red line)

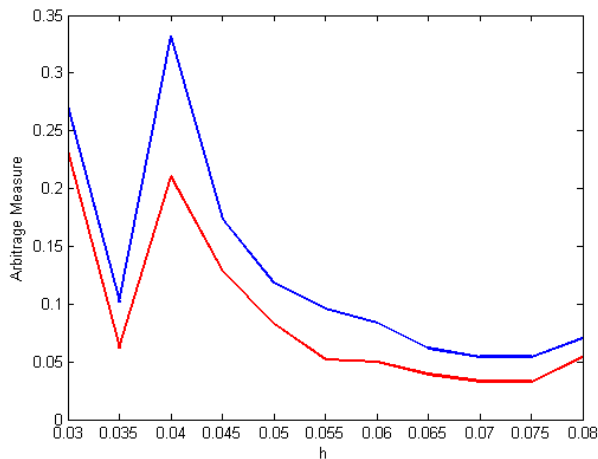
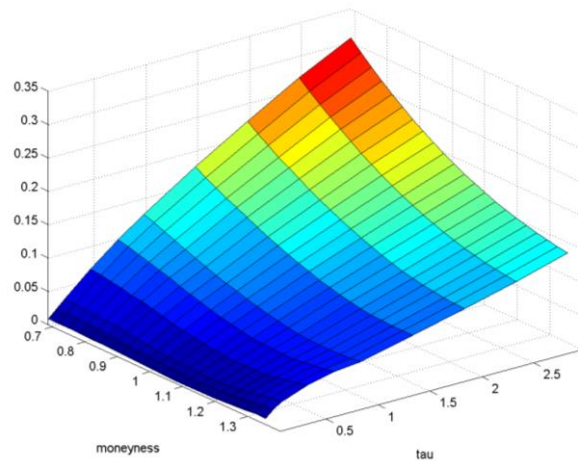


Fig. 3b: Total variance



Source: Authors' calculation in Matlab

Conclusion

Option pricing crucially relies on the model selection. Despite many deficiencies, most of the practitioners still uses the Black-Scholes type models. However, in such case a so called implied volatility must be extracted from market prices of liquid options. Since the moneyness and maturity of implied volatilities often do not match the data of valued options (non-liquid, exotic, etc.), some sort of smoothing and interpolation is necessary. If no-arbitrage conditions (especially non-negativity of SPD) are ignored, the results can be theoretically incorrect and can actually lead to riskless earnings.

In this paper, we have analyzed the behavior of SPD (state price density) with respect to changes in bandwidth parameter of various kernels, which provided us a whole set of various results. Using option data on DAX index it was documented that the no-arbitrage violating intervals of moneyness as well as the total area of SPD under zero heavily depends on the choice of this parameter.

Acknowledgement

The research was supported by the Czech Science Foundation under project 13-25911S. The second author was supported also through the European Social Fund (CZ.1.07/2.3.00/20.0296) and SP2015/15, an SGS research project of VSB-TU Ostrava. The support is greatly acknowledged. All computations were done in MatLab 2009 and GAMS 23.5.

References

- [1] BAKSHI, G., C. CAO, and Z. CHEN. Empirical performance of alternative option pricing models. *Journal of Finance*, 1997, **52**(5): 2003–2049. ISSN 1540-6261.
- [2] BENKO, M., M. FENGLER, W. HÄRDLE, and M. KOPA. On Extracting Information Implied in Options. *Computational statistics*, 2007, **22**(4): 543–553. ISSN 0167-9473.
- [3] BLACK, F. and M. SCHOLES. The pricing of options and corporate liabilities. *Journal of Political Economy*, 1973, **81**(3): 637–659. ISSN 0176-2680.
- [4] DUPIRE, B. Pricing with a smile. *Risk Magazine*, 1994, **7**(1): 18–20. ISSN 0952-8776.
- [5] GLOVER, J. and M. M. ALI. Using radial basis functions to construct local volatility surfaces. *Applied Mathematics and Computation*, 2011, **217**(9): 4834–4839. ISSN 0096-3003.
- [6] RUBINSTEIN, M. Implied binomial trees. *Journal of Finance*, 1994, **49**(3): 771–818. ISSN 1540-6261.
- [7] TICHÝ, T. Lévy Processes in Finance: Selected applications with theoretical background. *Series on Advanced Economic Issues*, 2011, **3**(9), 146 pgs. ISBN 978-80-248-2536-6.
- [8] YAN, S. Jump risk, stock returns, and slope of implied volatility smile. *Journal of Financial Economics*, 2011, **99**(1): 216–233. ISSN 0304-405X.

Jaromír Veber, Tomáš Klíma

University of Economics Prague, Faculty of Informatics and Statistics,
Department of Systems Analysis
W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic
email: jaromir.veber2@vse.cz, xklit10@vse.cz

Mapping of ISO 27000 Digital Evidence to Processes of Digital Forensics Lab

Abstract

International management system standards deployment, can significantly improve organization function with regard to quality management system, communication with partners and in particular increase customer satisfaction. If an organization wants to deploy universally recognized standard ISO 9000 it is necessary, inter alia, to document their processes. For digital forensic laboratory there were no specific requirements how such processes should look like. Even though ISO/IEC 17025 specifies some requirements on laboratory work, they are not directly applicable for digital forensic laboratory, because digital investigation differs significantly from conventional laboratory work. Nowadays emerging standards ISO/IEC 27041:2015, ISO/IEC 27042:2015 and ISO/IEC 27043:2015 are focused on digital evidence analysis procedures. These procedures are the main activities of digital forensic laboratories; however such procedures might also be conducted in other organizations. Standards listed above describe best practices of digital investigation in certain level of detail. Deploying these standards should improve communication with other parties involved in digital investigation and also improve quality of analysis of digital evidence. It is however a challenge to put these new standards into practice. In this article we'd like to introduce business process map for digital forensic laboratory considering recommendations mentioned in standards. We have designed BPMN process map, which covers not only the main process (digital evidence analysis) but also secondary process (digital evidence analysis method construction). Our research should help all organisations which plan to implement listed ISO/IEC standards. The model can also serve other parties which perform analysis of digital evidence as an inspiration of how the process could / should look like.

Key Words

standardization, ISO, business process, digital evidence analysis, process mapping, digital forensic laboratory

JEL Classification: L15, M15

Introduction

During the investigation of various incidents, for example crime, the clues to solve the case may also be found in digital form. Traces of incident are often in system logs, surveillance systems, e-mails, hard disks, flash discs, mobile devices etc. To identify such an evidence and present it to the court it is necessary to conduct a digital investigation (relevant data collection and analysis and identification of any information that may lead to incident resolution).

More and more crime in a cyberspace is committed internationally and different countries have different methods for digital investigation so the sequential exchange of digital evidence inter alia encounters different quality of identified digital evidence. This means that there is a need for international standards that would specify how the digital investigation should be conducted and how the evidence should be presented to the court. In the past few years ISO 27000 family standards have been developed with a focus on this problem. Family ISO 27000 standards are focused on information security and digital investigation. The standards of ISO 27000 family containing best practice for digital evidence analysis are ISO/IEC 27041:2015, ISO/IEC 27042:2015 and ISO/IEC 27043:2015. Deployment of standards of digital investigation process ensures steady quality of investigation outcome and also clear understanding of identified digital evidence internationally.

We have to bear in mind that deployment of any new standard into practice is the real challenge. The aim of this article is the design of digital evidence analysis process using recommendations of listed standards. The content of the article might inspire anyone who is interested in the digital evidence analysis process especially digital forensic laboratories all over the world, but also court experts focused on digital investigation and maybe even some bigger companies deploying digital investigation process. The presented BPMN process model covers not only main process of digital evidence analysis, but also secondary process for digital investigation method construction.

The model introduced in this article presents the main business process of digital forensic laboratory using recommendations of ISO 27000 family. It should be helpful for all digital forensic laboratories over the world to create process map for this process or even improve existing process to be conformant with words best practice.

1. Motivation

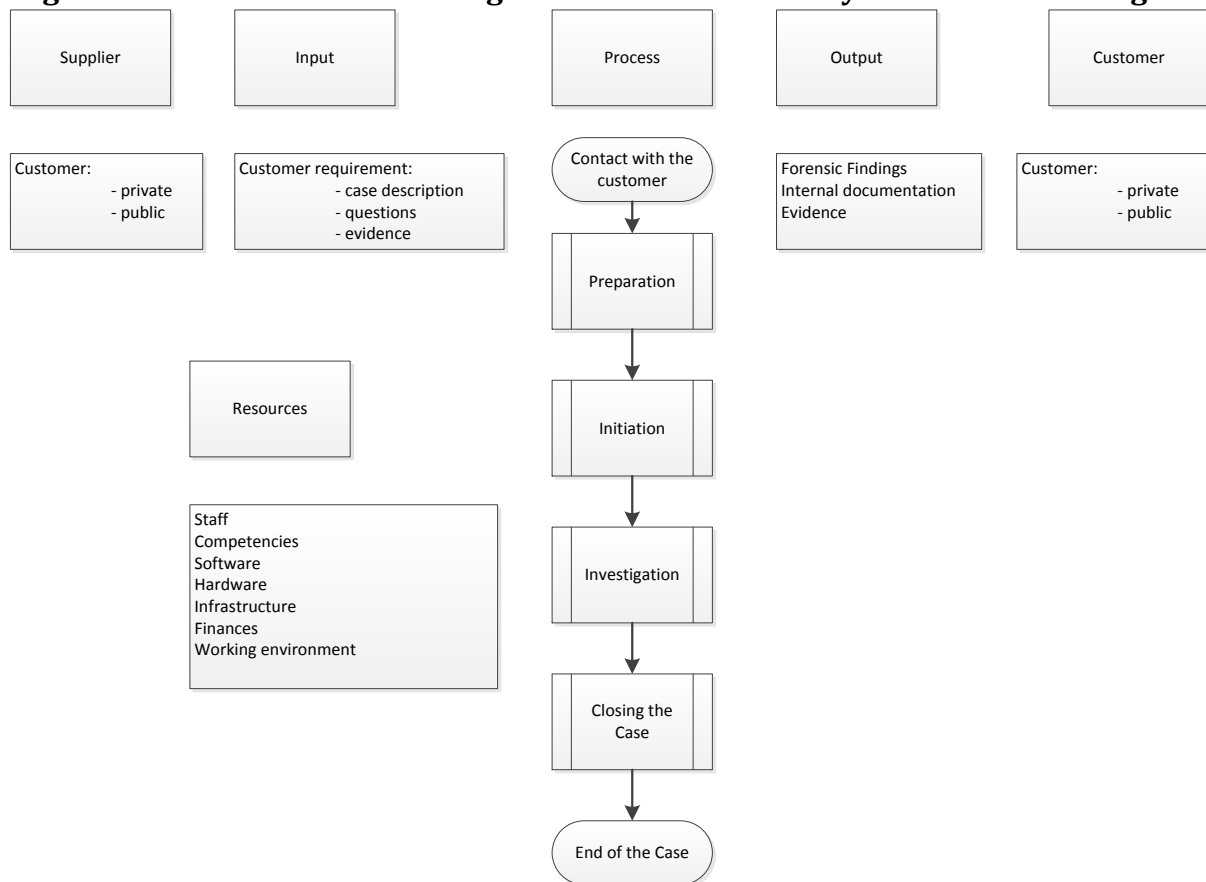
Field of digital forensic investigations is fairly new (in comparison with other forensic disciplines), and probably that why the managing of digital labs is not much explored area. But management of digital forensic laboratory means a lot of challenges. The uniqueness of digital forensics lab lies in the fact that contracts may vary considerably, and no small number of them is resolved through the project. Also the number of contracts for the laboratory depends on the number crimes related to computer technology, that must be investigated. Thus, the demand for digital lab services, can't be influenced by marketing. It is also difficult to estimate the number and volume of future contracts.

Our model should help to address some of mentioned issues. For example, introduces the design that is based completely on process management. Even through the project part is not eliminated completely our model introduces unification for the process of potential digital evidence analysis.

2. Research Methodology

During the development of this article the further mentioned methodology has been followed. First of all communication with digital forensic laboratory has been established in order to construct simple process map. Then the digital evidence handling standards of ISO 27000 (family) have been analysed to identify all described activities focused on digital evidence analysis. The activity connections and scope have been identified according the standards. Then the modified detailed process map has been constructed – the same level of detail as the ISO 27000 family was chosen. After the map was constructed it was discussed with forensic laboratory to review the results (and to find out how it is/should be deployed into practice).

Fig. 1: Realization of the Main Digital Forensic Laboratory Process SIPOC Diagram



Source: [2]

3. Simple process map introduction

Two teams currently work on the project “Innovation of digital forensic laboratory management system”. First team is focused mainly on laboratory business management, and deploys ISO 9000 and other management methodologies like six-sigma, ISO 17025 [1]. The second team is focused on security and evidence collection. Of course, work of both teams overlaps a bit because analysis of digital forensic laboratory employs both

business management view and IT security view. In this article we'd like to introduce the simplified process map for main business process of digital forensic laboratory as the first team purposed. We introduce this model now just for an idea how the simplified version of process map looks like and also how it looks without consideration of ISO/IEC 27000 digital analysis specifics.

For our process map we decided to use BPMN descriptive method [3], because for purpose of this article it is an ideal solution. Even though the previous mapping was designed using SIPOC method [4], it was designed for different purpose. BPMN allows us to describe more than only management of process but also the inter-process communication and data/document objects for better modelled process deployment as described in [5].

4. ISO 27000 family for digital evidence analysis activities

As was presented last year in [6] there are three standards of ISO/IEC 27000 family primary focused on digital evidence analysis (the main activity of digital forensic laboratory):

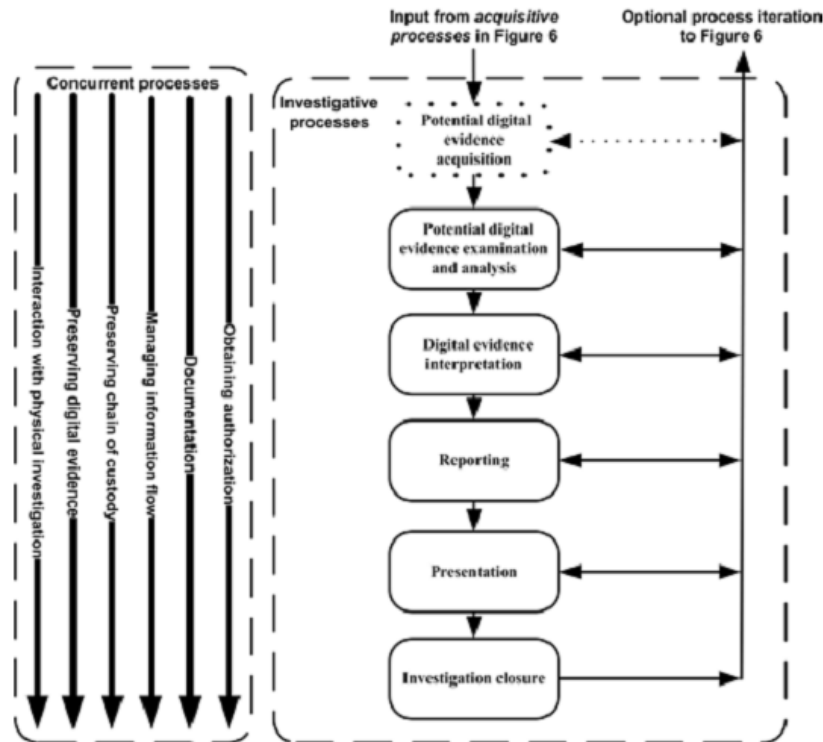
- ISO/IEC 27041 -- Guidance on assuring suitability and adequacy of incident investigative method. [7]
- ISO/IEC 27042 -- Guidelines for the analysis and interpretation of digital evidence. [8]
- ISO/IES 27043 -- Incident investigation principles and processes. [9]

Since our last examination the documents evolved to next stage of ISO standard evolution. Thus now the documents are all released this year (ISO/IES 27043:2015, ISO/IEC 27042:2015 & ISO/IEC 27041:2015). Recent development also clearly shows that the issue is actual.

ISO/IEC 27043 has got much wider scope than only digital evidence analysis. It describes the whole process of digital incident investigation including incident detection & reaction, potential digital evidence collection and potential digital evidence analysis (Fig. 2). The last part is interesting for us as it identifies key activities connected to the digital evidence analysis. Activities described as concurrent processes on Fig. 2 are:

- interaction with physical investigation,
- preserving digital evidence,
- preserving chain of custody,
- managing information flow,
- documentation,
- obtaining authorization.

Fig. 2: Investigative process of digital evidence



Source: [9]

Activities described as main analysis process on Fig. 2 are:

- potential digital evidence acquisition,
- potential digital evidence examination and analysis,
- digital evidence interpretation,
- reporting,
- presentation,
- investigation closure.

ISO/IEC 27041 is strictly focused on investigative methods construction which is actually only small part of overall digital analysis process. In mentioned standard we may identify activities and their connections to investigative method construction process. Let's mention that there is a need for a lot of different methods of digital evidence analysis depending on what we are looking for, what kind of source data we acquired etc. Also the digital investigation sometimes requires to construct a new method of analysis to gather required data. Thus this standard describes the procedure of construction of such method. If we simplify the content of the standard we can identify these main activities:

- requirements capture and analysis,
- process design,
- process implementation,
- process validation,
- confirmation,
- deployment,
- review and maintenance.

ISO/IEC 27042 describes (in detail) best practice and necessities that should be fulfilled to conduct valid digital evidence analysis process. It also describes in detail different investigation stages and its connections and requirements. Standard notes that process of “Potential digital evidence examination and analysis” is a bit more complex – consisting of iterative process identification and evaluation of digital evidence where each iteration of digital evidence evaluation leads to reconsideration of identification phase. Also process of digital evidence evaluation consists of digital evidence examination and digital evidence interpretation and digital evidence examination may lead to many analyses of one or more potential digital evidence samples using different methods. Standard also notes that “digital evidence interpretation” may require repetition of digital evidence analysis and/or collection.

Let’s mention that currently there are no similar process maps focused on digital forensic investigation. Even though there were in the past presented different frameworks and models focused on digital investigation (most of them were sources for ISO 27043); however, all models were focused on investigation procedures not on the process flow.

Also there is no clear description of the investigative stage and unfortunately neither ISO 27042 provides clear model of this phase. So in order to describe it we took into account the various references from ISO 27042 and ISO 27043 and constructed the investigation phase by ourselves.

5. Activity mapping

Fig. 3 introduced the proposed process map considering all recommendations mentioned in ISO/IEC 27041, ISO/IEC 27042 and ISO/IEC 27043. It covers the main business process of digital forensic laboratory – digital evidence analysis but it also includes secondary process of digital evidence analysis method construction

The main process is composed of the blocks mentioned on Fig. 2 but there was also necessary to implement somehow concurrent processes activity into process map design and also recommendations mentioned in ISO/IEC 27042 about the flow of the process. Once the laboratory acquires data of potential digital evidence, it must also obtain authorization to work with provided data. The data must be also stored in storage facility in order to preserve digital evidence at least until the case is resolved.

Next step is potential digital evidence examination and analysis. During this step every digital data manipulation must be recorded in digital evidence analysis documentation in order to preserve chain of custody and also documentation concurrent processes. The documentation is also an input for final report that is often presented during case resolution (output of reporting activity and may also be input for presentation activity).

Digital evidence identification and examination is an iterative process thus we introduced gate where the worker performing the process should decide whether to search for other evidence or not. Once there is enough identified evidence it should be interpreted. We need to find a meaning of the evidence to the case. If there is not enough evidence for

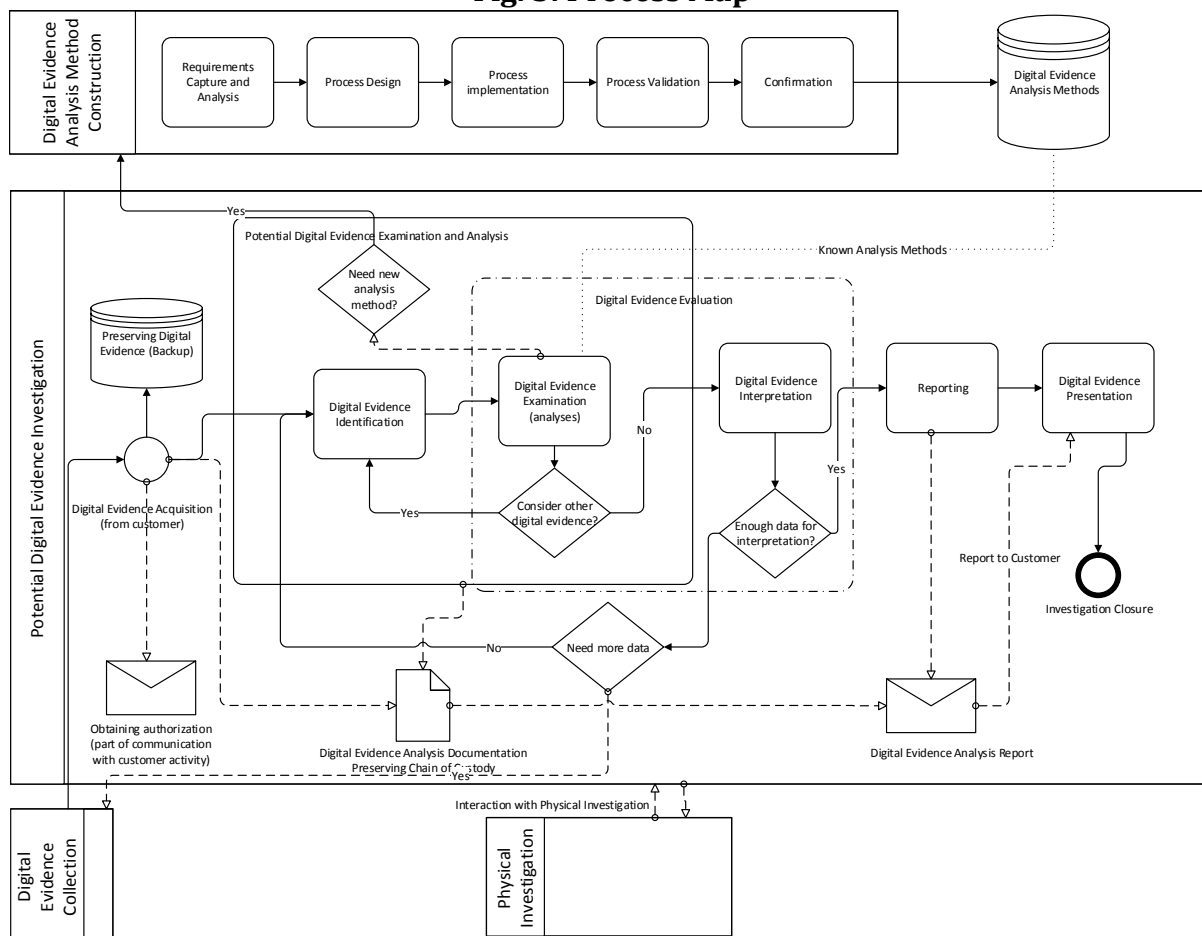
interpretation, we can try to search for more evidence either in process input data or ask for collection of more data.

Once we create a report for the customer during the reporting activity it is often required also to present the findings at the court. It might also require the report itself and sometimes clarify the methods used to the court. Once the evidence is presented investigation ends. There is a small branch for selection of analysis method. This part of the investigation may lead to construction of new analysis method as ISO/IEC 27041 and our secondary process describe it. An interaction with physical investigation is an additional inter-process communication, as some clues identified in digital evidence may require actions in physical investigation and conversely.

6. Discussion

Most of the activities mentioned in the standard can be found in process map on Fig. 3. Some of them are visualised as an inter-process communication. We have decided to ignore some activities as standards mention them because those would require us to introduce much more secondary processes far above the scope of this article.

Fig. 3: Process Map



Source: own

The data objects and resources (people, hardware, software) used by the process are not mentioned in this process for simplicity; however, are necessary part of the process. Actually resource management of the process is almost the biggest challenge once you have the process model. This outline of main process is only a fractional part of our research and we will continue improving it in our future articles.

Current solution we presented here was not yet tested as we expect it to be tested together once the management concept of all related processes and its interactions is finished.

Conclusion

The article introduced latest ISO 27000 family standardization efforts in the field of digital investigation and suggested how to deploy the recommendations into practice of digital evidence analysis. We analyzed all the recommendations and restrictions mentioned in the standards and we have tried to reflect the content of the standards in the operation of digital evidence analysis process.

The standard for overall digital forensic laboratory management similar to ISO/IEC 17025 is still missing; however documents and process map introduced in this article provide guidance for design of digital evidence analysis process and also for other attached (secondary) processes.

We in close cooperation with digital forensic lab further improve purposed models for the management of this specific kind of organization in order to improve not only the quality of investigation results but also the effectivity of finance management and data management.

Acknowledgement

The article was prepared with the help of a grant from the Internal Grant Agency of University of Economics, Prague: IG409024 – “Innovation management system, digital forensics labs”. The authors wish to thank to Marian Svetlik (Risk Analysis Consultants) for the helpful comments while developing this paper.

References

- [1] HYKŠ, O. and K. KOLIŠ. Development of the Digital Forensic Laboratory Management System Using ISO 9001 and ISO/IEC 17025. In DOUCEK, P., G. CHROUST, and V. OŠKRDAL. eds. *Proceedings from the 22nd Interdisciplinary Information Management Talks 2014*. Linz, Austria: Gerhard Chroust, 2014. pp. 87–94. ISBN 978-3-99033-340-2.

- [2] HÁJEK, J., O. HYKŠ, K. KOLIŠ, and J. VEBER. Selected Problems in Digital Forensic Laboratory Management. In *The 8th SIGSAND/PLAIS EuroSymposium on Systems Analysis and Design*. Gdańsk & Sopot, Poland: University of Gdansk, 2015. ISBN n/a.
- [3] WONG, P. Y. and J. GIBBONS. A process semantics for BPMN. *Formal Methods and Software Engineering: Lecture Notes in Computer Science*, 2008, **5256**: 355–374. ISBN 978-3-540-32250-4.
- [4] JOHNSTON, M. and D. DOUGHERTY. Developing SIPOC Diagrams. *Six Sigma Forum Magazine*, 2012, **11**(2): 14–18. ISSN 1539-4069.
- [5] WHITE, S. Using BPMN to model a BPEL process. *BPTrends*, 2005, **3**(3): 1–18. ISSN 0117-2012.
- [6] VEBER, J. and T. KLÍMA. Influence of Standards ISO 27000 Family on Digital Evidence Analysis. In DOUCEK, P., G. CHROUST, and V. OŠKRDAL. eds. *Proceedings from the 22nd Interdisciplinary Information Management Talks 2014*. Linz, Austria: Gerhard Chroust, 2014. pp. 103–114. ISBN 978-3-99033-340-2.
- [7] ISO. *ISO/IEC 27041:2015 – Information technology — Security techniques — Guidance on assuring suitability and adequacy of incident investigative method*. ISO. ISO/IEC JTC 1/SC 27. Geneva, Switzerland: International Organization for Standardization, 2015.
- [8] ISO. *ISO/IEC 27042:2015 – Information technology — Security techniques — Guidelines for the analysis and interpretation of digital evidence [online]*. ISO. ISO/IEC JTC 1/SC 27 [online]. Geneva, Switzerland: International Organization for Standardization, 2015. [cit. 2015-04-05]. Available at: <https://sites.google.com/a/ist033.org.uk/public/home/4/cg-ip/27042>
- [9] ISO. *ISO/IEC 27043:2015 Information technology -- Security techniques -- Incident investigation principles and processes*. ISO. ISO/IEC 27043:2015. Geneva, Switzerland: International Organization for Standardization, 2015.

Pavel Zdražil

University of Pardubice, Faculty of Economics and Administration,
Institute of Regional and Security Sciences
Studentská 95, 532 10 Pardubice, Czech Republic
email: pavel.zdrazil@upce.cz

The Impact of Public R&D Expenditure on Private R&D Expenditure: The Evidence of Regions of EU Less Developed Countries

Abstract

One of the never-ending discussions in economics is connected to government policies and interventions for development in various domains of human society. The topic of science, research and innovation in a global economy belongs to one of them. There are many studies that analysed impacts of public R&D on private R&D among countries but for the regional level they are missing. The aim of this paper is to examine the influence of public R&D expenditure on private R&D expenditure of the regions of EU less developed countries. This aim has been achieved by correlation analysis, and reviewing relations of development of examined volumes. The results have been discussed with some relevant studies in the field of public R&D expenditure impacts on private R&D investment. Based on our findings, we can suggest that there is no common pattern for public R&D influences on private R&D among the regions of EU less developed countries. Furthermore, there are no basic differences between the direct and indirect (i.e. via universities and public institutes) R&D funding for government. We can suggest beyond, it could be even better for government to looking for another effective ways of increasing private R&D, since the changes of private sources which may follow public funding are lesser, then one can expect. At least we can say that public sources are causing crowding out effect of private R&D investment, not the crowding in, which is undesirable; therefore, interventions connected only to increasing funding are simply not part of what regional or central governments may aim at all.

Key Words

R&D expenditure; sectors by performance; EU regions; less developed countries

JEL Classification: O30, R10

Introduction

Strategies for growth and development of many countries emphasize the importance of science, research and innovation in a global economy. There is no doubt that knowledge and innovation belong to the key factors for job market improving and economic development [1], [8], [9] which also contributes to improvement of living conditions of inhabitants [15]. Furthermore, most development strategies would certainly include links to regional-based approaches in the purpose to achieve their goals, since the importance of regional level has been increased in the field of development policy shaping during past decades. Beyond that, innovations have moved to the foreground in regional policy, while concrete policies shaping by well performing regions were derived [14]. Many empirical studies advocate a conclusion that proves that innovation strong regions, with large share

of high-tech and knowledge-intensive industries, are connected with higher performance of economy [10].

In the case of Europe, we must point out the basic strategic document, called Europe 2020. The Europe 2020 promotes the heavy focus of public policy on smart, sustainable and inclusive growth, where the main goal can be divided into five following targets: employment; research and development (R&D) investment; energy and resource efficiency; advent of education; and fighting poverty and social exclusion [3]. All the targets are closely tied to one another; focusing on one of them can impact the others. We can suggest beyond, meeting the targets of improving employment, energy and resource efficiency, and social cohesion can be largely achieved through better education and improvements in the field of R&D activities [15]. Since all the goals are primarily connected to improving conditions for innovation, and advent of education, in addition to increasing public and private investment in R&D; the smart growth dimension holds pre-eminent position in the whole strategy. It is pretty clear that science, research, innovation and technical and technological progress are determined not only by market forces or private entities, respectively; but they are largely influenced by policy and public sector as a whole [9]. Even though the Europe 2020 is an overall EU policy agenda, it underlines fundamental issues regarding the nature of growth and development processes at the local and regional levels [13]. And so we can mention many fields of national policy where positive effects of decentralization on the development of regions prevails [11]. In other words, regional framework can be considered as the truly level, where all development processes take place.

1. Statement of a problem and background to the research

The funding of R&D is usually divided between two main sources - public and private sector; while for public sources we can distinguish between government and higher-education. We can say, probably, that R&D expenditure of higher-education sector (i.e. mostly universities and public research institutes) is indirect form of government funding. However, higher-education sector has been established to produce “essential knowledge of society”, which goals and aiming are different in general but which is also the reason to suggest, that it should be better to examine both direct and indirect approach separately. The role of government should be to support R&D investment as much as possible, even though the effect of such an effort can lead to various consequences. This claim sounds pretty logical, since differences among the regions are responsible for different capability of implementation or development of new innovation [7]. Public funding of R&D is largely varied across countries as well as the regions, and it tends to change over time; however, there are four main channels for government to support the R&D [6]: a) directly fund business for carrying out research via special programmes or as a grants; b) tax incentives; c) perform it itself via public institutes; d) university research.

We don't deal with the way of tax incentives in this study but we focus on public funding of R&D via the direct channels (own expenditure on R&D) and indirect channels (universities and public institutes research). We can assume that government spending may crowd in private investment on R&D (complementary effect) or crowd out (substitution effect). We focus on regions of EU less developed countries, since those

countries don't belong to the most innovativeness states with very high development potential [10], which can be said about most of their regions as well; hence, their capability to produce innovations is limited; their public sources to support R&D are limited as well; and the share of private R&D expenditure is often very low in many of them. The examined regions or countries, respectively; have been selected based on their GDP level. Simple summary of selected countries is shown in Tab. 1 below. Furthermore, we can provide simple comparison of the structure of R&D expenditure by sector of performance i.e. business enterprise sector (BES), government sector (GOS), higher-education sector (HES) and non-profit sector (NPS) in EU28 (28 countries of the EU) and countries related to the regions under examination in 2000 and 2013, see Fig. 1.

Tab. 1: GDP levels of countries related to the regions under examination (2013)

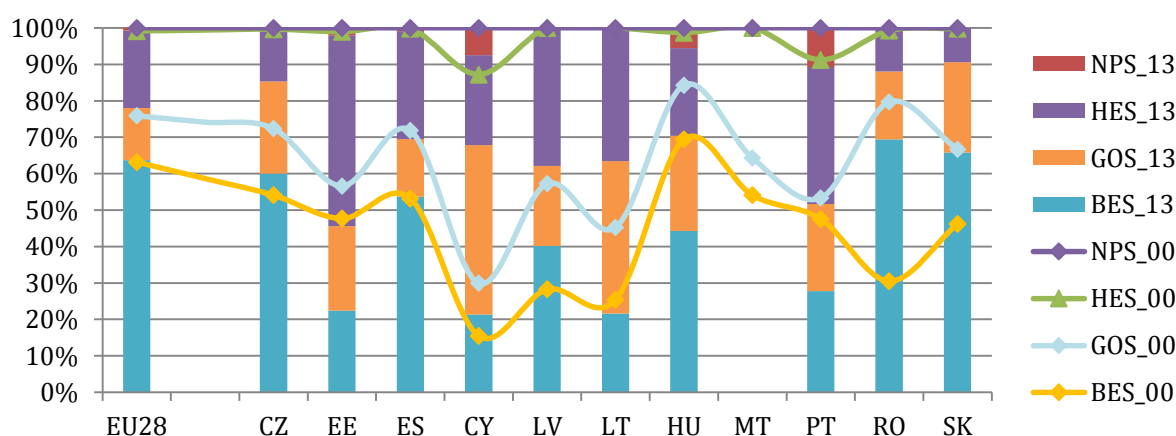
	CZ	EE	ES	CY	LV	LT	HU	MT	PT	RO	SK
GDP level	79.9	73.0	95.2	86.1	67.3	74.2	66.8	88.2	75.5	54.1	76.3

Notes: GDP level refers to a percentage of EU28 average GDP per capita (PPS) level in 2013; not every country below the EU28 average has been selected due to the availability of desired data, for the full list of unselected countries, country names and abbreviations see Methodology part below

Source: [4]

In Fig. 1, we can see that the structures of R&D expenditure in examined countries are pretty variegated but they show one common characteristic - the private expenditure on R&D is late at the EU28 average (excluding Hungary in 2000, Romania in 2013 and Slovakia in 2013). Therefore, the private sector of these countries looks to be undeveloped in the aspect of R&D investment (compared to the developed EU countries), and the governments should looking for tools to support them. We may ask if the share of public expenditure is not oversized, and then we only have to advice for reduce it; however, we can assume, probably, that the issue is rather connected to the private sector which is undersized and needs to be provoked by substantial interventions. We may ask beyond, if the public expenditure on R&D is filing the goal to initiate additional R&D expenditure of private sector.

Fig. 1 R&D expenditure by sector of performance in countries and EU28 average (2000 & 2013)



Notes: data on Malta for 2013 haven't been disclosed yet; if need see Methodology section below

Source: own calculations, based on [4]

Based on these crucial questions, we have established the aim of this paper, which is to examine the influence of public R&D expenditure on private R&D expenditure of the

regions of EU less developed countries. The main purpose of this study is to give an answer to the question: “Does the private R&D expenditure follows the public R&D expenditure?” Because if so, we would be able to suggest whether public R&D expenditure represents significant pro-growth driver of region. And if it doesn’t, it would be even better for the government to looking for another more effective ways of increasing private R&D.

2. Methodology

To fulfil its objective, the analysis has been developed as follows. The level of NUTS II has been chosen as a reference. In this study, our attempt is to examine the relationships between public R&D expenditure and private R&D expenditure as low as possible. And so regions at NUTS II level offer themselves as a reference, since they are important pieces for the EU cohesion policy, big enough to exclude merely local events and statistical data are commonly available for them. Even though not in every country is importance of NUTS II regions connected with more than European cohesion policy, EU funds aiming mainly to support the less developed regions or countries, respectively; and as we have said before, investment in R&D belong to the key goals of overall EU strategy [3].

The analysis covers 56 regions of 11 European less developed countries which mean their GDP per capita level is late at the EU28 average, see Tab. 1 above; here they are: Czech Republic (CZ; covers 8 regions), Estonia (EE; 1), Spain (ES; covers only 17 regions – ES63 and ES64 were excluded due to the missing values), Cyprus (CY; 1), Latvia (LV; 1), Lithuania (LT; 1), Hungary (HU; 7), Malta (MT; 1), Portugal (PT; 7), Romania (RO; 8) and Slovakia (SK; 4). The information on regional R&D expenditure for other countries below the EU28 average, i.e. Bulgaria, Greece, Croatia, Italy, Poland and Slovenia, have not been disclosed; hence the presented analysis does not cover the regions of these countries.

The data on R&D expenditure (i.e. total intramural research and development expenditure) have been linked in the purchasing power standard per inhabitant at constant (2005) prices i.e. the volumes are not burden for inflation. The volumes have been linked in a breakdown by sector of performance i.e. business enterprise sector (BES), government sector (GOS) and higher-education sector (HES). This breakdown follows the traditional classifying of national economy by sector of performance, well established by OECD and Eurostat [5]. The last category or data on non-profit sector, respectively; have not been taken into account for this study, since their shares in total amount of R&D expenditure in examined regions are very low or unavailable. The simple comparison of structure of total R&D expenditure among the EU28 average and national economies related to regions under examination in 2000 and 2013 is shown in Fig. 1 above. All the data have been collected from the Eurostat Database [4], and they cover the period from 2000 to 2012 or 2013 for the national comparison, respectively.

The main analysis is based on correlation relationships of volumes. To get as much accurate results as possible, the first step must be connected to check for stationary of the volumes. To determine the stationary, this analysis applies the augmented Dickey-Fuller unit root test (ADF), where the most suitable lag lengths are identified via the Akaike’s information criterion (AIC). The null hypothesis of ADF suggests that a volume has unit root, i.e. non-stationary; and if it can’t reject, then employing of differences can be

considered as necessity. This analysis uses the 2nd difference, since non-stationary of volumes has been found, and no lower than at the 2nd difference level has been largely eliminated (see Tab. 2 below).

After removing the above-mentioned non-stationary issue, we can develop the main part of this paper, i.e. examining the relationships between the development of public R&D expenditure (i.e. GOS and HES volumes) and private R&D expenditure (i.e. BES volume) within the regions. The relationships have been examined via the correlation analysis of volumes, where the options of time-lags in the effect have been taken into account. The maximum lag length has been established for 3 years because the number of observations is limited, and working with longer lag means loss of more than one quarter of examined period which should lead to an undesirable inaccuracy. Such a decision means that long-run effects cannot be captured enough by this study; however, the lack of data means an impassable issue that we are not able to solve.

3. Analysis results and discussion

Since the correlation analysis requires stationary volumes, the unit root tests have to be employed. Almost every volume has been found to be burden for non-stationary. To avoid such an issue, we have to applied classical series transformation in its difference. We have found that the volumes are mostly integrated of order two for the regions considered; therefore, the volumes have been transformed and analysed in the form of their 2nd difference. The results of ADF unit root tests on variables of BES, GOS and HES – applied on transformed volumes - are shown in Tab. 2 below. We can see that applied transformation provides a pretty solid basis for further analysis.

Tab. 2 Results (*p*-values) of ADF unit root tests on R&D expenditure by sector of performance

region	BES	GOS	HES	region	BES	GOS	HES	region	BES	GOS	HES
CY00	0.0243	0.0281	0.0009	ES42	0.0000	0.0494	0.0012	PT15	0.0087	0.0434	0.0892
CZ01	0.1656	0.0186	0.0009	ES43	0.0179	0.0208	0.0273	PT16	0.0499	0.0528	0.0049
CZ02	0.0475	0.1101	0.0076	ES51	0.0002	0.0355	0.0008	PT17	0.0033	0.0765	0.1071
CZ03	0.0627	0.0021	0.0157	ES52	0.0040	0.0003	0.0060	PT18	0.0043	0.0029	0.0201
CZ04	0.0106	0.0003	0.0358	ES53	0.0003	0.0681	0.0071	PT20	0.0049	0.0001	0.0161
CZ05	0.0036	0.0598	0.0004	ES61	0.0022	0.0003	0.0301	PT30	0.0004	0.0000	0.0168
CZ06	0.0014	0.9441	0.0280	ES62	0.0107	0.2095	0.0084	RO11	0.0005	0.0391	0.0265
CZ07	0.0094	0.0025	0.9885	ES70	0.0001	0.0055	0.0008	RO12	0.0080	0.0011	0.0182
CZ08	0.0003	0.0002	0.0040	HU10	0.0171	0.0003	0.0003	RO21	0.0450	0.0180	0.1117
EE00	0.0257	0.0011	0.0006	HU21	0.0016	0.0951	0.0414	RO22	0.0975	0.0142	0.6181
ES11	0.0233	0.0041	0.0001	HU22	0.0032	0.0068	0.1050	RO31	0.0210	0.1998	0.0411
ES12	0.0286	0.0036	0.0007	HU23	0.0049	0.0041	0.0492	RO32	0.0288	0.0346	0.0166
ES13	0.0003	0.0016	0.0024	HU31	0.0281	0.0112	0.0161	RO41	0.0015	0.0075	0.0109
ES21	0.0054	0.0230	0.0123	HU32	0.0142	0.0065	0.0058	RO42	0.0045	0.0002	0.0028
ES22	0.0093	0.0102	0.0035	HU33	0.1305	0.0158	0.0367	SK01	0.0000	0.0100	0.0186
ES23	0.0146	0.0116	0.0402	LT00	0.0027	0.0022	0.0039	SK02	0.0282	0.0011	0.0011
ES24	0.0014	0.0024	0.0199	LV00	0.0024	0.0240	0.0147	SK03	0.0001	0.0068	0.0277
ES30	0.0410	0.0678	0.0058	MT00	0.0010	0.0002	0.0015	SK04	0.0033	0.0073	0.0041
ES41	0.0034	0.0936	0.0005	PT11	0.1021	0.0417	0.0001				

Notes: *p*-value means probability of null-hypothesis that a volume has unit root, and therefore bolded figures refer to situation where it cannot reject at the significance level of 0.10 which means non-stationary (undesired outcome)

Source: own calculations

Based on presented summary (Tab. 2), the volumes where non-stationary still persists have been excluded. This has been done due to useless of non-stationary volumes within the main analysis. More concretely, 3 regions have been excluded from the correlation analysis (keeping them in the sample makes no sense if non-stationary of BES variable persists): CZ01, HU33 and PT11. Furthermore, in the analysis of relationships between GOS and BES, 4 non-stationary volumes (CZ02, CZ06, ES62 and R031) have been excluded; and, in the analysis of relationships between HES and BES, the requests for stationary for 5 volumes (CZ07, HU22, PT17, R021 and R022) have not been met. Therefore, the correlation analysis examines 49 regions for the GOS - BES relationships or 48 regions for the HES - BES relationships, respectively.

3.1 Relations between public R&D expenditure and private R&D expenditure

Now, after dealing with the non-stationary issue, correlation analysis based on Pearson's coefficients may to be done. The first part of the analysis of public R&D expenditure impact on private R&D expenditure focused on the sector of government. A summary of the results is presented in Tab. 3.

Tab. 3 Correlation coefficients between government R&D and private R&D expenditure

region	no lag	lag 1	lag 2	lag 3		region	no lag	lag 1	lag 2	lag 3	
CZ03	-0.0481	0.0922	-0.0305	0.2282		HU10	-0.0005	0.0430	-0.5720	0.3177	
CZ04	0.0096	-0.4553	0.5929	-0.5418		HU21	0.3535	-0.3678	0.3017	-0.3840	
CZ05	-0.5542	0.5614	-0.0840	0.1335	*	HU22	0.4420	-0.1905	-0.5609	0.7718	*
CZ07	0.6434	-0.4229	-0.4392	0.7440		HU23	-0.1804	0.0521	-0.5724	0.4516	
CZ08	0.5687	-0.4281	-0.2546	0.5870		HU31	-0.0816	-0.2439	0.2074	0.2538	
EE00	0.1756	-0.0567	-0.2689	0.5484		HU32	0.0415	-0.0852	-0.1381	0.1695	
ES11	-0.3402	0.3987	-0.2278	0.4881		MT00	0.2136	-0.7459	0.8604	-0.3667	*
ES12	0.0986	-0.0350	-0.3243	0.2666		PT15	0.0901	-0.1516	0.0269	0.0080	
ES13	0.1770	0.0733	-0.3907	0.0331		PT16	0.6396	-0.0014	-0.1890	-0.0979	
ES21	0.3133	-0.6506	-0.1217	0.3144		PT17	0.5437	0.3754	-0.0677	-0.3122	
ES22	0.5520	-0.6059	0.4902	-0.2546	*	PT18	0.5140	-0.0831	-0.0300	-0.1061	
ES23	0.7018	-0.0895	-0.4331	0.1422		PT20	0.0158	-0.0099	0.0106	-0.1370	
ES24	-0.4371	0.7396	-0.4600	0.1445		PT30	-0.0575	0.0521	0.0503	-0.0592	
ES30	0.1722	0.3975	-0.3645	0.0100		R011	-0.1819	0.0377	-0.7637	0.7632	*
ES41	0.3487	-0.3985	-0.3764	-0.1818		R012	-0.4422	0.2677	0.7027	-0.6978	*
ES42	0.0032	0.3323	-0.8218	0.3755		R021	0.2546	-0.0918	0.7398	-0.8348	*
ES43	-0.6235	0.4818	-0.1375	-0.1714		R022	-0.7283	0.0445	0.6862	0.0258	*
ES51	0.1891	-0.0606	-0.3272	0.0807		R032	-0.0722	-0.2575	-0.0251	0.3882	
ES52	0.0650	0.2554	-0.6584	0.7745	*	R041	0.4730	-0.3343	0.3234	-0.1832	
ES53	0.1672	0.0454	-0.3926	0.2410		R042	0.2262	-0.2650	0.0424	-0.1843	
ES61	0.3291	-0.4045	0.4261	-0.1671		SK01	0.1994	-0.2270	-0.0001	0.3481	
ES70	0.1740	-0.2256	0.0021	0.0739		SK02	0.6712	-0.7489	0.6135	-0.5322	*
CY00	0.2180	-0.2125	-0.0933	0.7162		SK03	0.4878	-0.1892	-0.2106	0.4083	
LV00	-0.2347	-0.0698	-0.1057	0.3178		SK04	0.3054	0.1468	-0.6950	0.2955	
LT00	-0.0475	-0.3952	0.6221	-0.0760							

Notes: bolded figures refer to rejection of null-hypothesis (i.e. no relationship between volumes exists) at the significance level of 0.10; bolded, italicized figures... at the significance level of 0.05 (both desired outcomes); lag refers to the time (years) it takes for the effect of independent variable to dependent variable (R&D expenditure of private sector); * refers to regions, where it seems that substitution of R&D expenditure in time has been found.

Source: own calculations

We can see that the immediate impacts of GOS on BES (column called “no lag”) in 11 of 49 regions i.e. 22.4%, (8 times positive; i.e. 16.3%) have been found. If we include one-year lag in the equation (“lag 1”), then we can see 6 significant cases i.e. 12.2% (2; i.e. 4.1%); 14 significant cases i.e. 28.6% (7; i.e. 14.3%) by including two-year lag, and by including three-year lag the count is 7 cases i.e. 14.3% (5; i.e. 10.2%).

Another part of analysis is focusing the influence of higher-education sector R&D expenditure on private R&D expenditure. The analysis outputs separated by varying time-lags are shown in Tab. 4 below. With no-lag included, we can see 13 of 48 regions i.e. 27.1% (8 times positive; i.e. 16.7%), where the null-hypothesis rejects. By including the lag of one, 7 relevant cases i.e. 14.6% (3; 6.3%) have been found. With two-year lag in the equation, significant correlation coefficients in 9 regions i.e. 18.6% (5; 10.4%) have been measured. Furthermore, three-year lag in the relationship is connected with 3 significant cases i.e. 6.1% (2; 4.2%).

Tab. 4 Correlation coefficients between higher-education R&D and private R&D expenditure

region	no lag	lag 1	lag 2	lag 3		region	no lag	lag 1	lag 2	lag 3
CZ02	0.0836	-0.1714	-0.0593	0.1462		CY00	0.3561	-0.3278	0.2068	0.2646
CZ03	0.3210	-0.1981	-0.5091	0.5021		LV00	0.0029	-0.0741	-0.1888	0.1538
CZ04	0.1176	-0.0196	0.2713	-0.6003		LT00	-0.2880	-0.0978	0.1586	-0.0732
CZ05	-0.6406	0.8500	-0.7003	0.6108	*	HU10	0.3728	-0.3509	-0.3667	0.3347
CZ06	0.3972	-0.4726	0.6447	-0.2344		HU21	-0.2728	0.6858	-0.3404	0.0563
CZ08	0.5971	-0.5517	0.1258	-0.4738	*	HU23	-0.0032	0.2065	-0.0827	-0.0819
EE00	0.3939	-0.2163	-0.5533	0.6123	*	HU31	0.0179	-0.2575	-0.1655	0.6929
ES11	-0.5136	0.0157	-0.0470	0.0628		HU32	-0.0988	0.1678	-0.4250	0.3238
ES12	0.4501	-0.3394	-0.1901	-0.2039		MT00	0.2567	-0.4929	0.8254	-0.4713
ES13	0.1723	-0.2805	0.7073	-0.5503		PT15	0.4085	-0.1298	-0.4327	0.3259
ES21	-0.5889	-0.1634	0.6518	-0.3700	*	PT16	-0.0194	0.0105	-0.1304	0.1694
ES22	0.4255	-0.5614	0.6392	-0.5565	*	PT18	-0.1931	0.0348	0.0425	-0.0567
ES23	0.0134	-0.4822	0.0574	0.0574		PT20	0.8452	-0.4451	-0.1482	0.1978
ES24	0.1632	-0.3276	0.0177	0.5033		PT30	0.4978	-0.0847	0.0231	-0.2484
ES30	0.3941	0.2176	-0.5958	0.3429		RO11	-0.1753	0.2145	-0.5144	0.3898
ES41	-0.3695	0.2223	-0.0564	-0.5638		RO12	-0.7447	0.3109	0.5418	-0.7810
ES42	0.5433	-0.2175	0.0576	-0.2134		RO31	-0.1399	-0.0849	0.1090	-0.2836
ES43	0.0009	-0.3742	0.2245	0.3897		RO32	0.0316	-0.3266	-0.1442	0.1688
ES51	-0.4140	0.2470	-0.6555	0.5581		RO41	0.5647	-0.1492	-0.2313	0.0974
ES52	-0.6776	0.3103	0.0677	-0.3483		RO42	-0.0891	0.2372	-0.1638	-0.0946
ES53	-0.3321	-0.0243	0.1020	-0.3577		SK01	-0.4694	0.0448	0.5393	-0.2734
ES61	0.6594	-0.4985	0.1935	-0.2402		SK02	0.7974	-0.7779	0.4476	-0.1226
ES62	-0.0420	0.0689	-0.1709	0.1113		SK03	-0.3935	0.6319	-0.0091	-0.3988
ES70	0.6357	-0.7103	0.4281	-0.3567	*	SK04	0.2409	-0.3759	0.2351	-0.0418

Notes: see notes under Tab. 3.

Source: own calculations

Based on these findings, we can suggest that the results of both parts of analysis look pretty similar. By abstracting the lagged impacts of public R&D expenditure, the most countable relationships (nearly one quarter of cases) have been found in both GOS and HES. However, relationships are present in only about 16% of regions. Even though the positive impacts of public R&D expenditure prevail as compared to the negative ones, we can suggest that these findings are as convincing as one can expect to achieve from logical considerations. Classical studies in this field [6], [2], [12] advocate positive effects of public R&D expenditure on private R&D expenditure much more significant than our

findings suggest, albeit their reference level is higher (country) instead of our level of regions (NUTS II). The notable gap between referred studies and our results rests in significance of lag lengths; let us show some of them.

For example Guellec and van Pottelsberghe [6] claim that the influence of government R&D expenditure on private R&D expenditure is lagged from one to two-years. Another study [2] points out that there is a lag between public expenditure and private reaction; and features one period lag to be connected with significant and positive relations; however, the same study claims that some further positive effects can be clearly seen after six or more lagged periods. Guellec and van Pottelsberghe argue that even four-year lag might be too short to capture the long-term effects of many basic researches [6]. Although we can partially agree with those logical arguments since the real-world experience provides many lessons, we can oppose that examination of longer periods can be affected by many other factors such as technical-technological-economic progress [9] which would be hard to filter out; hence, including too long periods in the calculation could be a double-edged sword - good as well as bad. Unfortunately, due to lack of long-time data on European regions, the hypothesis of influence of government R&D expenditure on private R&D expenditure by including longer lag lengths cannot be checked by this study. We consider here only results with up to three-year lag included.

Still, by including one-year lag to the calculations of correlation coefficients, our findings report very low number of significant cases while negative relations prevail, hence we cannot affirm that a lag of one period is relevant and positive for our sample. If we include two-year lag, then the figures of significant relations rise but they are positive in about one half of these cases only. The government R&D expenditure influences private R&D expenditure in about 14% of regions positively while the higher-education sector influences only about 10% of regions. And so this is pretty ambiguous evidence for legitimacy of public sector actions. By including three-year lag, the findings are pretty similar in both government and higher-education sector, but slightly weaker in a general sense. The positive cases have been measured in about two thirds of significant relationships; however, it is only about 10% of regions influenced by the government sector or about 4% of regions influenced by the higher-education sector, respectively. So, once again, this is pretty ambiguous evidence of positive impacts of public R&D expenditure on private R&D expenditure, as they virtually are here.

With our findings in mind, we can say obviously, that positive effects of public R&D expenditure on private R&D expenditure are not as strong as one can expect. However, we can point out the study of Lööf and Heshmati, who suggest that the effectiveness of public money invested on R&D is pretty ambiguous in a general sense, especially in the domain of large enterprises (whose expenditure on R&D so widely prevails), but more likely unambiguous in the domain of small and medium sized enterprises, where the effectiveness of public policy impacts private expenditure on R&D a lot [12]. Considering these proposals, we may perhaps think that the efficiency of public funding on R&D doesn't have to be as low as we have found, if the government primarily focuses on small and medium enterprises. Unfortunately, such a hypothesis cannot be examined by this study.

3.2 Crowding in or crowding out effects of public R&D expenditure?

Still there are some differences between the impacts of government and higher-education sector expenditure on R&D and private R&D expenditure – not an essential one; another interesting phenomenon has been found. This phenomenon is related to the basic question of “Can be the public R&D expenditure marked as complements rather than as substitutes for the private R&D expenditure; or perhaps not being relevant at all?” Based on analysis results, we can suggest that some evidence of influence exists, since so many significant cases don’t look like any true randomness – the analysis found at least one significant correlation relationship between GOS and BES in 26 of 49 regions (i.e. 53.1%), and between HES and BES in 23 of 48 regions (i.e. 48.0%).

Let us look on Tab. 3 and Tab. 4 again. We can see, in many cases, that the regions where significant relationships have been measured are connected with more than one significant relationship. We can assume that possible complementary effect, i.e. crowding in; of public R&D expenditure on private R&D expenditure would be revealed by positive and significant coefficients of correlation, which would indicate the growth of total expenditure on R&D or provoke additional investment resources, respectively. We can assume beyond, that possible substitution effect, i.e. crowding out; of public R&D expenditure on private R&D expenditure would be linked to negative and significant coefficients of correlation, which would indicate a lessening of private R&D expenditure while the development of total expenditure on R&D would be pretty ambiguous, since it depends on the amount of public contribution. Anyway, the advocacy of public interventions is challenged and lacks its original purpose, in such a case.

With varying time-lags in mind, we can say that more than one positive relationship while no negative association has been measured only in one region (CZ07; GOS - BES analysis part). Similarly, more than one negative relationship while no positive association has been found only in one region (RO12; HES - BES part). However, we have found many regions, where positive relationships are balanced by negative relationships; such the net effect of public R&D expenditure is ambiguous again. These regions are marked with star in Tab. 3 and Tab. 4. The described phenomenon have been measured in 10 regions (GOS - BES relationships) or in 7 regions (HES - BES relationships), respectively. We can suggest that such spilling over period effects are lowering the advocacy of interventions in the name of public interest; because the public resources only substitute the private resources. The task of policy support business R&D by increasing own participation in this field looks to be pretty ineffective in regions under examination. However, only the tendencies of relationships between variables have been examined, for now. Since we have not estimated the effects themselves, there is a chance that the positive effect prevail the negative one in net expression of this issue. On the other hand, our results are pretty similar to the findings of David, Hall and Toole who estimated the one-third of public R&D funding behaves as a substitute for private R&D investment [2]. We have found 10 of 26 (GOS - BES relationship) or 7 of 23 (HES - BES) cases, respectively; which means indication of very similar shares to the afore-mentioned study.

Conclusion

The aim of the paper is to examine the influence of public R&D expenditure on private R&D expenditure of the regions of EU less developed countries, and answer the question whether private R&D expenditure follows public R&D expenditure. Based on our findings and the discussion to relevant studies, we can conclude that public R&D expenditure provokes some additional investment contemporaneously; but if we include time-lags to the calculation, then is the positive influence of public resources pretty ambiguous. Furthermore, we have found that spill-over period effects of public R&D funding, within the relationship to private R&D expenditure, exist. We have suspicion that public resources behave as a substitute for private R&D funding. These conclusions are in accordance with results of some previous studies which are discussed above. With our results in mind, the advocacy of policy interventions look to be completely unnecessary in the field of support the R&D activities.

We have found beyond, that the efficiency of government sector R&D expenditure i.e. direct funding; is a little bit higher (but pretty much the same) than the efficiency of higher-education sector R&D expenditure i.e. indirect funding via universities and public institutes. Hence, there is no serious reason to protect one over the other. However, such a finding may tend to partial protection of higher-education sector, since its goals and aims are much wider and cover overall “essential knowledge of whole society”. But certainly, all depends on specific conditions and authorities’ priorities which ensure the development of regions. Furthermore, we have found that there is no pattern among the regions of EU less developed countries. Therefore we can suggest that differences among the national policies don’t play the crucial role by research and development progress of examined regions.

Acknowledgement

The University of Pardubice, Faculty of Economics and Administration, Project SGSFES_2015001, financially supported this work.

References

- [1] BAUMOL, W. *The Free-Market Innovation Machine: Analyzing the Growth Miracle of Capitalism*. Princeton: Princeton University Press, 2004. ISBN 978-0-691-09615-5.
- [2] DAVID, P., B. HALL, and A. TOOLE. Is public R&D a complement or substitute for private R&D? A review of the econometric evidence. *Research Policy*, 2000, **29**(4): 497–529. ISSN 0048-7333.
- [3] EC. *Europe 2020: A Strategy for smart, sustainable and inclusive growth* [online]. Brussels: European Commission, 2010. [cit. 2015-03-11]. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF>
- [4] EUROSTAT. *Database* [online]. Brussels: EuroStat, 2015. [cit. 2015-03-11]. Available at: <http://ec.europa.eu/eurostat/data/database>

- [5] EUROSTAT. *Synthesis of National Quality Reports for 2009 R&D and GBAORD statistics* [online]. Brussels: EuroStat, 2012. [cit. 2015-03-11]. Available at: http://ec.europa.eu/eurostat/cache/metadata/Annexes/rd_esms_an2.pdf
- [6] GUELLEC, D. and B. VAN POTTELSBERGHE. The Impact of Public R&D Expenditure on Business R&D. *OECD Science, Technology Industry Working Papers*, 2000, no. 4. ISSN 1815-1965.
- [7] HLAVÁČEK, P. Economic and Innovation Adaptability of Regions in the Czech Republic. In KOCOUREK, A. ed. *Proceedings of the 11th International Conference Liberec Economic Forum 2013*. Liberec: Technická univerzita v Liberci, 2013, pp. 194–203. ISBN 978-80-7372-953-0.
- [8] KARLSSON, C., B. JOHANSSON, and R. STOUGH. *Innovation, Technology and Knowledge*. London: Routledge, 2012. ISBN 978-0-203-61533-1.
- [9] KRAFT, J. and I. KRAFTOVÁ. Innovation – Globalization – Growth (Selected Relations). *Engineering Economics*, 2012, **23**(4): 395–405. ISSN 1392-2785.
- [10] KRAFTOVÁ, I., Z. MATĚJA and P. ZDRAŽIL. Innovation Industry Drivers. In KOCOUREK, A. ed. *Proceedings of the 11th International Conference Liberec Economic Forum 2013*. Liberec: Technická univerzita v Liberci, 2013, pp. 334–342. ISBN 978-80-7372-953-0.
- [11] LABOUTKOVÁ, Š., P. BEDNÁŘOVÁ, and A. KOCOUREK. The influence of decentralization on the economic development gap between regions. In LÖSTER, T. and T. PAVELKA. eds. *The 6th International Days of Statistics and Economics*. Praha: Vysoká škola ekonomická v Praze, 2012, pp. 634 – 645. ISBN 978-80-8617-579-9.
- [12] LÖÖF, H. and A. HESHMATI. The Impact of Public Funds on Private R&D Investment. *MTT Discussion Papers*, 2005, 3: pp.1 – 26. ISSN 1795-5300.
- [13] MCCANN, P. *The Regional and Urban Policy of the European Union: Cohesion, Results-Oriented and Smart Specialisation*. Cheltenham: Edward Elgar, 2015. ISBN 978-1-78347-951-1.
- [14] TÖDTLIG, F. and M. TRIPPL. One size fits all? Towards a differentiated regional innovation policy approach. *Research Policy*, 2005, **34**(8): 1203–1219. ISSN 0048-7333.
- [15] ZDRAŽIL, P. The influence of innovation potential on living conditions development of Central and Eastern European countries population. In *Conference Proceedings from the 17th International Colloquium on Regional Sciences*. Brno: Masaryk University, 2014, pp. 209–216. ISBN 978-80-210-6840-7.

Section II

Strategic Enterprise Performance Management

John R. Anchor, Abdallah Amhalhal, Shabbir Dastgir

University of Huddersfield, Business School,
Department of Strategy, Marketing, and Economics
Queensgate, HD1 3DH Huddersfield, United Kingdom
email: j.r.anchor@hud.ac.uk, a.amhalhal@hud.ac.uk,
s.dastgir@hud.ac.uk

The Use of Multiple Performance Measures and Organisational Performance in an Emerging Market

Abstract

The performance measurement diversity approach suggests that organisations attain superior performance when they place greater emphasis on a broad set of financial (FPMs) and non-financial performance measures (NFPMs). This study is an empirical investigation of the relationship between multiple performance measures (MPMs) and organisational performance (OP) in a Libyan context. Cross-sectional questionnaire survey data was obtained from 132 Libyan companies (response rate of 61%). The results indicate that MPMs are commonly used by both manufacturing and non-manufacturing companies in Libya. However, these companies still rely heavily on financial performance measures. The relationships between NFPMs and OP, and MPMs and OP are positive and highly significant. The relationship between FPMs and OP is positive but not significant.

Key Words

multiple performance measures, organisational performance, emerging markets

JEL Classification: M16

Introduction

An effective performance measurement system may be based on using a balanced set of key financial and non-financial critical success factors and key performance indicators which stimulate involvement in continuous improvement. Therefore, organisational performance may depend on the diversity of performance measures used. However, although multiple performance measures (such as quality, productivity, innovation and customer satisfaction) have received a lot of attention from practitioners and academics since the early 1990s, many empirical studies have failed to provide clear evidence about the effectiveness of these measures, particularly in emerging market contexts.

The focus of this study is concerned with the extent of the use of MPMs in a Libyan setting and the relationship between multiple measurement techniques and organisational performance. It might be expected that in an emerging market, organisations may be likely to be less aware of and less likely to use NFPMs than in developed economies.

The next section outlines the literature and hypotheses development. The research method applied is described in section 3. Section 4 introduces the study findings and discussion. The conclusion and limitations appear in the final section.

1. Literature and Hypotheses Development

The results of the empirical studies which have focused implicitly or explicitly on the measurement diversity approach-performance relationship are inconsistent. This may be due to the variation in the design and ways in which these multiple measures are used. Although there is widespread interest in diverse performance measurement systems (e.g. Balanced Score Card); so far few empirical studies have looked directly at the effectiveness of MPMs' usage (i.e. how these measures are used). Indeed, the association between non-financial measures and organisational performance has been found to be unclear in a number of previous studies.

A number of studies have found a positive relationship between the use of multiple performance measures and organisational performance[1]. However others [13] have obtained contradictory evidence. Therefore it is unclear if there is a positive association between the use of MPMs and organisational performance. So the aim of this research is to re-investigate the relationship between the use of multiple performance measures and organisational performance in a new (Libyan) setting.

The following hypotheses were developed:

1. H₁: Organisational performance is negatively associated with the extent of the use of financial performance measures.
2. H₂: Organisational performance is positively associated with the extent of the use of non-financial performance measures.
3. H₃: Organisational performance is positively associated with the extent of the use of multiple performance measures.

2. Sample and Research Strategy

The population of this research is defined as all Libyan companies, manufacturing and non manufacturing, whether small, medium or large, except for: new companies with little experience (less than three years of age, because the respondents were asked to describe selected research variables during the previous three years) and very small companies (less than 10 employees). Earlier studies indicate that the use of management accounting and financial performance measures within small companies is generally very low [15]. Accordingly, the sampling frame included 226 Libyan companies in a variety of industries (76 manufacturing and 150 non-manufacturing). Only headquarters were included in order to obtain a more homogenous sample; subsidiaries, divisions and branches were excluded.

Primary data for the research was collected using a self-administered survey questionnaire. The questionnaire was divided into three main parts. All three parts included closed questions, i.e. all the questions had a range of potential answers and the respondents had to select one. The first part consisted of questions concerning general information about the characteristics of participants and their organisations. The second and third parts were concerned with the independent and dependent variables of the study. In these parts, the questions were based on a 5-point Likert scale. 226

questionnaires were distributed and 141 were returned. However, only 132 questionnaires were usable and valid for analysis (which represents a 61 % response rate). This is a good rate compared with other similar studies [8]. The instrument was checked by a pilot study and a reliability test¹. An assessment of normality was performed for the dependent variable only. The Kolmogorov-Smirnov test was used to evaluate the normality of the dependent variable (organisational performance). The findings confirm that the dependent variable follows a normal distribution².

In addition, and consistent with the literature, the questionnaire survey targeted finance directors, vice-managers, financial controllers and senior accountants because they are likely to be the people who are responsible for designing and operating the performance measurement systems in their companies [9].

3. Measurement of Variables

This section describes how the research variables were measured. It is worth noting that during the preparation of measures and constructs for the research variables, any terms or measures which were specific to a particular sector were excluded in order to make the questionnaire applicable to all sectors (manufacturing and non-manufacturing). The conceptual definitions of these variables are provided in the next sub-sections.

Multiple performance measures' usage (MPMs) refers to the extent to which directors utilise a broad scope of information, resulting from financial and non-financial measures, for assessing performance. This approach was spilt into five major categories which are commonly used by both manufacturing and service organisations. The first four categories were based originally on the work of [7]. The fifth category (community/environment perspective) was modified from the work of [3]. The instrument includes 41 different measures³. The respondents were requested to indicate on a five-point Likert-type scale ranging from 1 (not used at all) to 5 (used considerably), the extent of their organisation's use of the identified performance measures over the previous three years. The extent of MPMs' usage is the overall mean of responses for all the 41 measures indicated above.

Organisational performance (OP) refers to the extent to which the organisation is successful in achieving its planned targets or stated aims [12]. It is described as the ultimate outcome variable (dependent variable) in the contingency literature because it explains the implications of a suitable fit between control systems design and other organisational characteristics of a company. It was assessed by a self-rating multiple instrument. The scale included 13 items originally developed by [4] and used in several

¹ The results indicate that Cronbach's alpha coefficients of all the variables were above the minimum acceptable level of 0.60: Multiple performance measures usage (0.919), Financial performance measures (0.767), Non-financial performance measures (0.939) and Organisational performance (0.800).

² The Kolmogorov-Smirnov test reports the following results: Statistic (.078), df (.132) and Sig. (.059).

³ Firstly, the extent of FPMs usage is the overall mean of responses for the first 11 measures. Secondly, the other 30 measures were selected to measure NFPMs' usage. Thirdly, the extent of MPMs usage is the overall mean of responses on all 41 measures.

previous studies. Respondents were required to rate each of the 13 dimensions on a five-point Likert-type scale, ranging from 1 (poor) to 5 (outstanding), to assess their organisation's performance compared to that of their main competitors over the previous three years. Organisational performance is the overall mean of responses for all items and the score for each organisation was calculated by taking the average for all items [2].

4. The relationship between MPMs' usage and organisational performance

This section deals with the testing of the three hypotheses of the research (H1-H2-H3). The statistical technique employed for testing these hypotheses was simple regression analysis. This section seeks to assess the nature and type of direct relationships between the use of financial performance measures, non-financial performance measures, multiple performance measures, and company performance.

Tab. 1: Relationship between MPMs' Usage and Organisational Performance

Variable (Predictors)	Dependent variable (Organisational performance)				
	Unstand. coefficient		Stand. coefficient	t-value	Sig.
	B	Std. Error	Beta		
FPMs' usage	.110	.090	.107	1.223	.223
R = .107, R ² = .011, Adjusted R ² = .004, F-value = 1.496, Sig. = .223					
NFPMs' usage	.365	.061	.467	6.022	.000
R = .467, R ² = .218, Adjusted R ² = .212, F-value = 36.26, Sig. = .000					
MPMs' usage (overall)	.477	.078	.471	6.083	.000
R = .471, R ² = .222, Adjusted R ² = .216, F-value = 37.000, Sig. = .000					

Source: own

Financial performance measures (FPMs), non-financial performance measures (NFPMs), and multiple performance measures (MPMs) were employed as independent variables (predictors), with organisational performance (OP) as a dependent variable in all three models respectively. Table 1 presents the regression analysis-based statistical findings concerning these hypotheses (H1-H2-H3), which predict a direct relationship between FPMs, NFPMs, MPMs and OP respectively. The results indicate that the effect of FPMs on organisational performance was positive; however, it is not statistically significant ($R^2 = .011$, $\beta = .107$, $p > .05$). On the other hand, the impacts of both NFPMs and MPMs on organisational performance are positive and statistically highly significant ($R^2 = .218$, $\beta = .467$, $p < .05$; $R^2 = .222$, $\beta = .471$, $p < .05$ respectively). Therefore, FPMs' usage has no significant effect on organisational performance. This confirms that relying solely on FPMs is not sufficient for enhancing company performance. Hypothesis H1 was not supported at the .05 significance level. It can also be concluded that the use of non-financial measures has a significant impact on organisational performance, i.e. the use of NFPMs significantly improves the ability to predict (self-rating) organisational performance. Hypothesis H2 was supported at the .05 significance level. It is clear from the results above that MPMs introduce valuable diverse information which contributes to improving business performance. This suggests that the more extensively multiple performance measures (financial and non-financial measures) are used, the better the organisational performance. Hypothesis H3 was supported at the .05 significance level.

However, this does not imply that FPMs are not important. In this context, FPMs are still crucial in assessing performance in any organisation, as they are necessary in order to track revenue, profit and costs [6,10,7]. Using NFPMs does not suggest that non-financial measures have to replace FPMs. Instead, it means supplementing FPMs with a diverse set of NFPMs that are believed to provide better information and contribute to improving organisational performance. This can be noted in the results for H2 and H3, where the performance effect of the usage of both NFPMs and MPMs was positive and significant.

One explanation for the positive results regarding the NFPMs-OP relationship (H2) is that the NFPMs are future-oriented measures. Hence, top management tries to rely heavily on these measures in making decisions that will be useful to their organisations in the long run [11].

The significant and positive findings in relation of H3 are consistent with most previous research which finds that the use of the combination of FPMs and NFPMs is positively associated with organisational performance [5]. However our results in relation to H3 contrast with others who have found no evidence for the proposition that measurement diversity is positively associated with organisational performance [13].

Conclusions

The results of the regression analysis indicate that NFPMs and MPMs have a significant positive effect on Libyan companies' performance. However, this positive effect was not significant in the case of FPMs. Consequently, the results supported and accepted the hypotheses H2 and H3, while the hypothesis H1 was rejected.

This study has investigated the use of 41 financial and non-financial measures in Libya. Therefore, it provides a practical checklist of the measures which might assist Libyan companies in improving and developing suitable performance measurement systems to reach their strategic goals. Additionally, the findings indicate that Libyan companies should be encouraged to put a balanced emphasis on all measures, particularly non-financial measures (e.g. customer, employee, innovation and environment-based measures) in order to enhance the loyalty of customers and attract new ones and serve other needs of stakeholders.

References

- [1] AKGUN, A., H. INCE, S. IMAMOGLU, and H. KESKIN. The mediatory role of learning capability and business innovativeness between total quality management and financial performance. *International Journal of Production Research*, 2014, **52**(3): 888–901. ISSN 0020-7543.
- [2] DUSTERHOFF, C., J. CUNNINGHAM, and J. MACGREGOR. The effects of performance rating, leader-member exchange, perceived utility and organisational justice on performance appraisal satisfaction: applying a moral judgment perspective. *Journal of Business Ethics*, 2014, **119**(2): 265–273. ISSN 0167-4544.

- [3] FAKHRI, G. *The analysis of the factors affecting performance measurement in the Libyan banking industry: a contingency approach*. [unpublished Ph.D. thesis]. Liverpool, UK: Liverpool John Moores University, 2010.
- [4] GOVINDARAJAN, V. Appropriateness of accounting data in performance evaluation: an empirical examination of environmental uncertainty as an intervening variable. *Accounting, Organizations and Society*, 1984, **9**(2): 125–135. ISSN 0361-3682.
- [5] HO, J. L. Y., A. WU, and S. Y. C. WU. Performance measures, consensus on strategy implementation and performance: evidence from the operational-level of organisations. *Accounting, Organisations and Society*, 2014, **39**(1): 38–58. ISSN 0361-3682.
- [6] KANG, W. and M. MONTTOYA. The impact of product portfolio strategy on financial performance: the roles of product development and market entry decisions. *Journal of Product Innovation Management*, 2014, **31**(3): 516–534. ISSN 1540-5885.
- [7] KAPLAN, R. and D. NORTON. The Balanced Scorecard measures that drive performance. *Harvard Business Review*, 1992, **70**(1): 71–79. ISSN 0017-8012.
- [8] KOUFTEROS, X., A. VERGHESE, and L. LUCIANETTI. The effect of performance measurement systems on firm performance: a cross sectional and a longitudinal study. *Journal of Operations Management*, 2014, **32**(6): 313–336. ISSN 0272-6963.
- [9] MACBRYDE, J., S. PATON, M. BAYLISS, and N. GRANT. Transformation in the defence sector: the critical role of performance measurement. *Management Accounting Research*, 2014, **25**(2): 157–172. ISSN 1044-5005.
- [10] NEELY, A. The performance measurement revolution: why now and what next. *International Journal of Operations and Production Management*, 1999, **19**(2): 205–228. ISSN 0144-3577.
- [11] O'CONNELL, V. and D. O'SULLIVAN. The influence of lead indicator strength on the use of nonfinancial measures in performance management: evidence from CEO compensation schemes. *Strategic Management Journal*, 2014, **35**(6): 826–844. ISSN 1097-0266.
- [12] PINHO, J. C., A. P. RODRIGUES, and S. DIBB. The role of corporate culture, market orientation and organisational commitment in organisational performance: the case of non-profit organisations. *Journal of Management Development*, 2014, **33**(4): 374–398. ISSN 0262-1711.
- [13] SCHULZ, A., A. WU, and C. CHOW. Environmental uncertainty, comprehensive performance measurement systems, performance-based compensation and organizational performance. *Asia-Pacific Journal of Accounting and Economics*, 2010, **17**(1): 17–40. ISSN 1608-1625.
- [14] VAN DER STEDE, W. A., C. W. CHOW, and T. W. LIN. Strategy, choice of performance measures, and performance. *Behavioral Research in Accounting*, 2006, **18**(1): 185–205. ISSN 1050-4753.
- [15] VERBEETEN, F. H. and A. N. BOONS. Strategic priorities, performance measures and performance: an empirical analysis in Dutch firms. *European Management Journal*, **27**(2): 113–128. ISSN 0263-2373.

Klára Antlová

Technical University of Liberec, Faculty of Economics,
Department of Informatics
Studentská 1402/2, 461 17 Liberec 1, Czech Republic
email: klara.antlova@tul.cz

Agility Approach in Innovation Projects

Abstract

Article brings the current view in management of innovation projects and new ideas about improvements in processes of innovation projects - agility approaches. This necessity of new quality is supported by results of the author's surveys about the main reasons of the most often project failures in Czech companies. These problems are generated by organisational and human factors, financial aspects and difficulties with business processes. Are the Czech companies ready to implement these new agile approaches? This question was investigated during the second author's survey. The results of this survey proved that agile approaches are used in most projects of software and Internet organizations. Here the project managers also have the greatest knowledge of agile principles. However, it is essential that organizations must have corporate culture, which allows the greatest possible extent an appropriate communication of team project members and also to communicate with the customer. Therefore in the last part of the article the experience: how to implement this new approach and how to communicate in innovation projects is mentioned; the solution could be the knowledge network model. In one big international company this knowledge network model was implemented. Benefits of this implementation were shortening of time innovation and reduction of costs.

Key Words

project management, innovation process, agile methodology, co-creation, knowledge network

JEL Classification: L150, O210

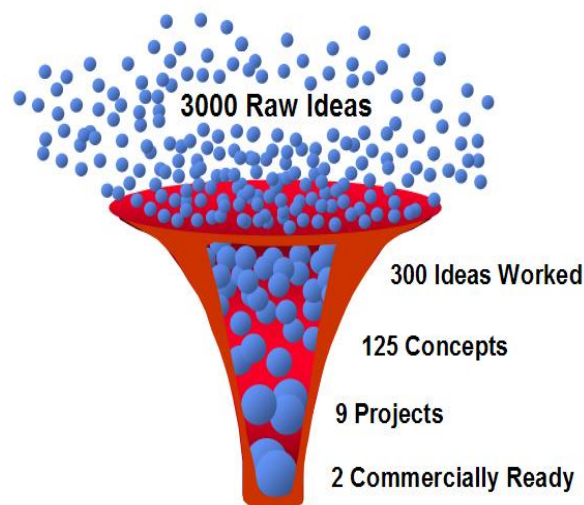
Introduction

The conventional approach cannot ensure the practice and theorizing of project innovativeness, because of its weakness to deal with different levels of uncertainty and complexity. Innovativeness refers to the level of novelty or originality by virtue of introducing new ideas or innovations. Originality depending on the ability to think and act independently in order to achieve innovativeness; innovativeness also refers to the tendency to adopt-use innovation and is also an capability to create something new or make renewals and changes through a process of idea generation. This very much depends on interaction and communication. Novelty, originality and creativity can be viewed from many different angles, depending on the unit of analysis; either project, person or whole system. The world moves too fast today to make a stable and rigid product definition possible for some businesses and projects. Often customers are not clear on what they want (or need) in the first place, so it's impossible to get a 100 percent accurate product definition prior to development. As Steve Jobs, never a proponent of traditional market research, famously said, "People don't know what they want until you

show it to them” [5]. And quite often the requirements simply change in the time that passes between the beginning and end of development - a new customer need, a new competitive product, or a new technological possibility emerge, and the original product definition is no longer valid.

How to realise these changes in convenient time, quality and costs? How to establish the success criteria of innovation project and how to measure expecting benefits? How to realise more project from the ideas and concept? These questions are still the main discussed topic among the project managers. Figure num. 1 brings the ratio of innovations in one international company where the process if improving projects was established. This company is mentioned in case study of this article (part 4 of this article).

Fig. 1: Innovation Funnel



Source: [6]

In the next part of this article the methodology of surveys is mentioned, next the new approach – agility is explained and the last part brings the case study where the implementation of knowledge network is described.

1. Methodology and results of the survey – main failures in innovation projects

Forty companies (all from the Czech Republic) have been analysed during qualitative research for 14 years (2000-2014). According the number of employees more than the half of the companies (30) belong to small medium types and the rest are the big enterprises. These organizations also cooperate with Technical University in providing a one-year, educational industrial trainee program for students studying Computing and Business. This cooperation has been active for 14 years, enabling students and their teachers to participate in innovation projects dealing with current problems. This cooperation was also supported and financed by the European Social Fund Operational Program Human Resources 3.2. (CZ.04.1.03/3.2.15.2/0211): "Increasing the education process efficiency in the context of cooperation between the university and the business environment". During face to face discussion with the project managers we can analyse the weakness in conventional project management methodologies. These methodologies

are designed to make the processes of a project predictable enough to be managed, but are unable to encapsulate ways to manage the evolutionary nature of processes in innovation projects. In Table one the results of the survey explain the most often reasons of various failures in innovation projects from different points of view.

In questions concerning the main factors of success, most project managers agreed to the following factors:

- organizational (strong support leadership, co-operative and cultural environment, communication, project team members, team members are able to organize a series of activities themselves, high motivation of team members, team members have the appropriate skills and knowledge),
- procedural (project teams are adaptive, the need for implementation of the timetable, the appropriate communication tools, documentation of the project),
- and on the approach to the customer (the presence of the customer, good relationships with the customer).

Tab. 1: Failures of innovation projects in searched companies

Organizational factors	Human factors	Business processes	Technology	Financial Aspects
Insufficient support by management	Insufficient knowledge and skills of project management	Insufficient defined project process	Unsuitable communication and technological tools	Costs were increasing during realisation of project
Size of organization (organization is too big)	Insufficient experience of project managers Language barrier (in int. companies)	A poorly-defined division of the project, the project scope and milestones	Lack of knowledge and skills in ICT	Difficulties with reporting of project cash-flow
Traditional organization culture	Resistance of the staff with changes The lack of communication of the project team and management	Customer is not involved in the project Inconvenient project plan	Psychological barriers and distrust of using ICT	Costs were underestimated

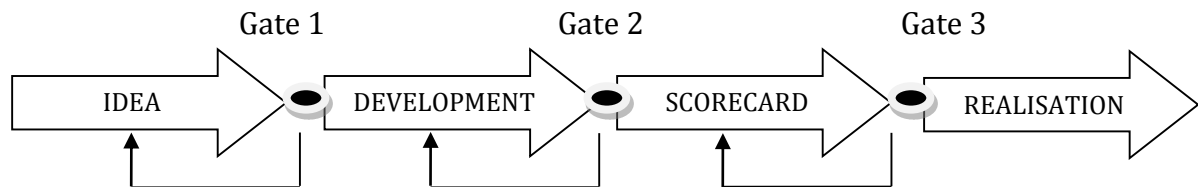
Source: [2]

2. Success criteria – using of “Gates” method

Almost in all big examined companies from the survey the method Stage – Gates is used in innovation process. A Stage-Gate® process is a conceptual and operational map for moving new projects from idea to launch and beyond – a blueprint for managing the new product or service development process to improve effectiveness and efficiency [4]. But the main problem is how to implement the success criteria of projects, how many controls and levels of formalisations have to be used during the innovations projects? How to measure the effectiveness and efficiency? Each gate checks the feasibility of ideas so the poor projects are spotted and stopped or changed. In five searched companies the Scorecard method is used (figure 2). The Scorecard verifies the benefits and success of the project. It means that key factors of success are defined (market readiness, costs, alignment with business strategy, resources etc.). But quality control check points are not

successful in many companies. Another problem is that the delay between the gates brings extension of the whole project or that the customers are not satisfied with quality of project results. The necessity to be adaptive and flexible arises more and more in the last years. In the next part of this article the agile approach is explained.

Fig. 2: Stage-Gate method



Source: [4]

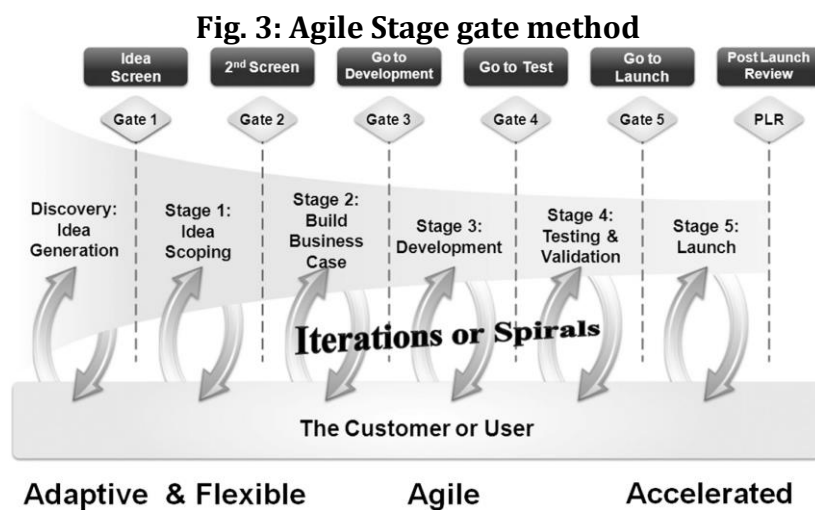
3. Agile approach

What the word "agile" mean? According to the dictionary of foreign words it means vivid or active. Basic condition of agility in the context of the development of the project is the ability to change an entry in project development. The customer then has the option to modify requirements during running project, without a massive re-engineering of work already carried out, and the unnecessary waste of time and resources for all involved. Agile methodology arose in the mid-1990 years of the last century as a response to difficult traditional methodology, which has been criticized for bureaucracy, rigidity and inability to respond flexibly to changes. Series of publications dealing with the agile approaches stem from the different theoretical foundations, such as the Lean manufacturing (Lean Production), the theory of constraints, Cooperative Game theory, Six Sigma and Chaos Theory.

Agility is characterized by the breakdown of work in short, regular and frequent cycles of finished tasks, involvement of the customer in the process of planning and, of course, the organization of the team. One of the most innovative agile approaches is Scrum process, whose aim is to break down large and complex projects, that it is hard to comprehend at once. Scrum divides large areas into smaller units and sets out the priority of each task. Agile Manifesto declares the agile approaches to software development and was published in February 2001 by a group of seventeen programmers (agilemanifesto.org). The term comes from the rugby scrum, where it is used for the re-launch of the game after the short interruption. Progress of the project in accordance with the methodology continues like match rugby-team progresses forward as a harmonious whole, taking the ball (symbolizing the status of the project) bobbing alternately back and forth. The first time was "rugby approach" to the project management was introduced in 1986, by Hirotaka Takeuchi and Ikudziro Nonaka [7] when the authors explained the methodology increasing the flexibility and quickness.

The methodology of this approach is the practical experience of various companies in the automotive, polygraphs and the printing industry. The original methodology was designed by Ken Schwaber (www.scrum.org) in his company in the 1990s. During other

years with other people he named this methodology and developed. Scrum process is one of the most frequently used method in Agile methodology. Scrum allows you to supply regular iterations (Sprints) with customer value, always on time, every time and it's what the customer expect (see Fig. 1). The process is built on teamwork, getting frequent feedback and transparent communication within the team and the firm, but also towards the customer. The whole Scrum process takes place in regular cycles, which should generally not be longer than 30 days. The length of the Sprint to the finish depends on the nature of the project, but should be able to complete common tasks in the framework of one Sprint. The advantage of Sprints is regularity. Each Sprint team presents its work and presents the results. Then the job is always checked and, where appropriate, shall be adjusted at the end of the process.



Source: [4]

Agile approach involves the customers to the innovation process [6]. This strategy focusing on customer experience and interactive relationships is a new technique called value Co-creation. Co-creation allows and encourages a more active involvement from the customer to create a value rich experience. We can find many different types of co-creation happening today, including [1]:

- co-creation within communities,
- co-creation inside companies and organizations,
- co-creation between companies and their business partners,
- co-creation between companies and the people they serve, who are variously called customers, consumers, users or end-users.

3.1 Agile approach in the Czech companies

The agile approach is more and more known among the project managers. Therefore last year (2014) the research about the using and the knowledge of agile methods in innovation projects has been organised in 40 Czech big companies (more about 100 employees). Ten companies were ICT organisations, 8 companies were from Automotive, 5 of them were production organisations and the rest (11) were service oriented companies. The questionnaire had a total 20 questions about the use of different project

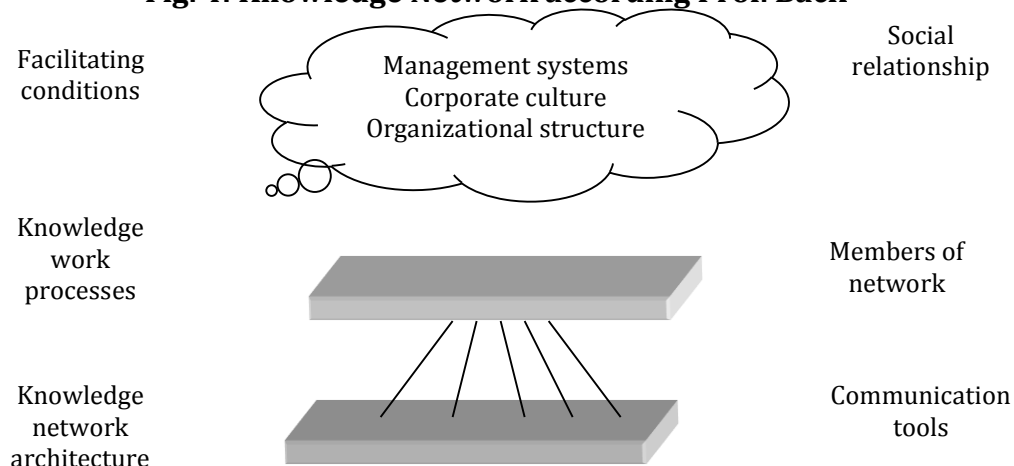
management methods, about the results and problems of the already finished innovation projects and about the knowledge of agile approach.

In the ICT companies the knowledge of agile approaches is much greater than in the other companies (8 project managers agile approaches used). Also all the organizations in the area of innovation projects from car industry used the Stage gate method and 5 project managers has some awareness of agile approaches. The situation is worse in organizations from the construction industry, where only 3 managers are using the principles of project management and the agile approaches are unknown. In the six logistics companies, project management is used during innovation (in 2 companies it is used a standard methodology, the others have their own design rules), only 2 project managers are familiar with the concept of the agile approach. In the remaining service organizations (11) just five major companies the project management is using during innovation projects.

Co-creation not only describes a trend of jointly creating products. It also describes a movement away from customers buying products and services as transactions, to those purchases being made as part of an experience. Value is co-created with customers when a customer is able to personalize his/her experience using a firm's product-service proposition to a level that is best suited to get his/her job(s) or tasks done. How to cooperate and communicate? Next part of the article brings the experience with implementation of knowledge network which has been established in bid international company.

This cooperative work model is corresponding with similar approach used in Knowledge network reference model according prof. Back [2] (2005) from University in St. Gallen. This knowledge network (fig number 4) consists of people, organization resources and relationships among them, who are assembled in order to accumulated and use knowledge primarily by means of knowledge creation and transfer processes, for the purpose of creating value.

Fig. 4: Knowledge Network according Prof. Back



Source: [2]

4. Case study: Implementation of Knowledge network

The knowledge network was implemented in one big international company which is big leader in production of building material. In this company the project leader started (beginning 2013) to create the knowledge network, so in the innovation processes were involved the suitable R&D workers from different areas and from different countries. The main idea was to improve the cooperation between all producing branches (glass, insulation and gypsum) and to cooperate in innovation projects together. In knowledge work processes (according above mentioned model) was applied the not just the concept of agility and coo-creation but also the concept of process maturity. This concept was created in the Total Quality Management movement, where the application of statistical process control techniques showed that improvement the maturity of any technical process leads to the things: a reduction in the variability inherent in the process, and an improvement in the mean performance of the process. Maturity is the quality or state of being mature. If we apply the concept to an organization it might refer to a state where the organization is in a perfect condition to achieve its objectives. Project maturity would then mean that the organization is perfectly conditioned to deal with its project. In the real world we will not find the fully matured organization. No one has reached the stage of maximum development. Therefore it makes sense to talk about certain a degree of maturity and make an effort to measure or characterize the maturity. This model follows the five evolutionary maturity levels. It is also possible to examine the maturity development across nine knowledge areas in the Project Management Institute's (PMI) A Guide to the Project Management Body of Knowledge (PMBOK Guide). The five project management maturity levels are defined as follows:

- Level 1 - Initial Process: Processes are ad hoc. Management is aware of project management, but hasn't yet taken steps to formalize it.
- Level 2 - Structured Process and Standards: Basic processes are defined, but not used on all projects. Management supports the use of project management processes.
- Level 3 - Organizational Standards and Institutionalized Process: The processes are repeatable and standard for projects.
- Level 4 - Managed Process: Project management processes have become integrated with corporate processes. Management mandates the use of the project management processes.
- Level 5 - Optimizing Process: The focus now is on continuous improvement of the processes.

In this case study the main benefits of implementation of these new approaches are: using the agility during stage gate system and co-creation approach and new knowledge network caused the increasing of new innovation projects and especially their final realisation for customers – satisfied customers in much shorter time than before.

Conclusion

The results of the survey showed that agile approaches are still used in most projects, software, and Internet organizations. Here the project managers also have the greatest knowledge of agile principles. However, it is essential that organizations must have

corporate culture, which allows the greatest possible extent an appropriate communication of team project members and also to communicate with the customer. It is also essential that the members of the project teams were constantly acquainted with new trends in project management. Agile methods are a set of best practices and recommendations, but like any other methodology must be taken not dogmatically. From this point of view, these methods are rather loose philosophy that is supported by corporate culture rather than strict rules. Above mentioned case study illustrates the way how to integrate the involved R&D workers to the innovation projects. In future research the author would like to continue in investigation about the improvement of implementation of agile principles and the key factors of success in innovation projects.

References

- [1] DOMIGALL, Y., A. ALBANI, and R. WINTER. Identification of Customer Preferences for New Service Development in the Electricity Domain. In *The 16th Conference on Business Informatics*. Geneva, Switzerland: IEEE, 2014. pp. 207–214. ISBN 978-1-4799-5779-8.
- [2] BACK, A. *Putting Knowledge networks in to Action*. Berlin, Germany: Springer, 2005. ISBN 3-540-40574-7.
- [3] COLNFORTO, E. C., E. REBENTISCH, and D. C. AMARAL. *Project Management Agility Global Survey*. Cambridge, MA, USA: Massachusetts Institute of Technology, Consortium for Engineering Program Excellence – CEPE, 2014.
- [4] COOPER, R. G. What is next, after Stage-Gate? *Research-Technology Management*, 2014, **57**(1): 20–31. ISSN 0895-6308.
- [5] ISAACSON, W. *Steve Jobs: The Exclusive Biography*. New York, USA: Simon & Schuster, 2011. ISBN 978-1-4516-4853-9.
- [6] HIGHSMITH, J. *Agile project Management*. Boston, MA, USA: Addison-Wesley Professional, 2009. ISBN 978-0-32165839-5.
- [7] NONAKA, I. and H. TAKEUCHI. *The Knowledge Creating Company*. New York, USA: Oxford Press, 1995. ISBN 978-0-19-509269-1.

Pavol Budaj, Miroslav Hrnčiar

Catholic University of Ružomberok,
Faculty of Pedagogy,
Department of Management
Hrabovská cesta 1A, 034 01
Ružomberok, Slovak Republic
email: pavol.budaj@ku.sk

University of Žilina,
Faculty of Management Science and
Informatics
Univerzitná 8215/1, 010 26 Žilina,
Slovak Republic
email: miroslav.hrnčiar@fri.uniza.sk

The Importance of Risk-Based Thinking for Enterprise Performance Planning

Abstract

Organisations use various methods of performance planning, which are designed to optimise the use of resources and achieve high levels of work productivity. The achievement of objectives can be affected by many chance factors. The effect of uncertainty on the achievement of objectives is addressed by risk management. The planned revision of ISO 9001:2015 introduces the concept of "risk-based thinking". When making decisions in specific situations, organisations must apply the well-known approach now explicitly required by quality management standards, of taking account of the context and managing risk systematically, which means identifying, investigating and modifying risks. This paper presents a case study of a decision on capacity planning in which risk is taken into account in capacity planning for an industrial enterprise.

Key Words

risk management, performance management, queueing theory

JEL Classification: L15, L57, D8

Introduction

Changes in the business environment mean that decisions made in the context of ongoing globalisation and permanent turbulence must not only respond to Risk management is a relatively recent corporate function. In its development it was focused primarily on financial risk [12]. Nowadays is risk management considered a competing protection tool that complements several other risk management activities. Duckert [13] emphasizes that risk management approach opportunities but must also make provision for threats through risk management. shall utilize actual business data to estimate probability and impact of key risk in an organization.

In the new version of the ISO 9001 standard, risk is an important factor and becomes an integral part of the enterprise management system through "risk-based thinking", which is applied in decision-making on every organisational level [19].

1. Risk management

The ISO 31004 standard defines the principles of risk management, which include "Risk management creates and protects value"[15]. For the organisation this means that risk management contributes to the demonstrable achievement of objectives and improvement of performance in various areas where risk can materialise. The framework classifies risk according to four objective categories[6]:

- strategic risk - risks should be lined up with strategic objectives and aligned with and supporting the mission of the organization.
- operational risk: risk management should consider the events that might compromise the effective and efficient use of resources.
- financial risk: risks should cover the reliability of an organization's reporting, including both the internal and external reporting of financial and nonfinancial data.
- compliance risk: risks that regard compliance with applicable laws and regulations.

On the tactical level of management, the main problem is operational risk. This type of risk can result from internal factors (people, processes and systems within the organisation) or external factors (chance events in the external environment such as floods and fires or interventions and recommendations from incompetent consultants and outsourced services). Risk is often characterized by reference to potential "events" and "consequences".

The functions most frequently analysed for operational risk are maintenance and capacity planning. Solutions for these functions must take account not only of the skills of operators but also technical problems (equipment breakdowns) as factors affecting the achievement of the expected results. As regards the control of multiple machines the main drivers are the skill of the operator and the capacity of the machines expressed in terms of their breakdown rate. Breakdowns are thus events that can cause stoppages, stoppages lead to downtime and this has consequences - losses for the enterprise. According to the Taguchi methods [10] and the logic of loss reduction, all losses connected with a decision must be taken into account.

Measures for reducing risk that the enterprise does not want to accept can be summarised as [15]:

- avoiding risk,
- taking a risk in order to pursue an opportunity,
- eliminating the risk source,
- changing the likelihood or consequences,
- sharing the risk,
- retaining risk by informed decision.

Measures are chosen according to the severity of the risk and the enterprise's situation – in all cases the cost of implementing the measures must be lower than the cost of dealing with the consequences. If the measures are too costly, the enterprise may decide to accept the risk. Likewise – there are practically no measures that can entirely eliminate all

probability or consequences of a risk. After every measure a degree of residual risk is accepted (by informed decision).

2. A practical example of risk-based thinking in performance planning

The aim of the performance planning decision to which risk-based thinking was applied was to optimise the number of operating personnel for knitting machines in a Slovak hosiery manufacturing firm. The planning task made use of queueing theory, which can be [2][3] characterised as "a set of mathematical methods used to model and optimise processes involving streams of objects passing through servers that carry out specific operations on them." The function and practical objective of queueing theory can be defined [1] as the analysis of queueing systems and the design of queueing systems in which the time lost while waiting for service and the losses resulting from such unproductive downtime is minimised. The practical objective of research into queueing systems using the methods of queueing theory is to propose changes that improve the operation of the system [3].

2.1 Analysis of a selected business process

The basic process of the business process to which risk-based thinking was applied are set out in table 1. The characteristic of the number of machines operated by one operator was determined using conventional methods for labour standardisation.

Tab. 1: Process characteristics

Indicator	Value (characteristic)
The firm's area of activity	Hosiery manufacturing
Number of machines in workshop	200
Number of machines operated by one operator = number of places in the system (m)	35
Main work activities of operator	Setting up machines for new patterns (new products), checking quality, routine maintenance (e.g. "lubrication" of machines), repair of machine breakdowns
Most frequent machine breakdowns (causes of downtime)	Electrical faults, material tearing, slippage, broken needle, program wiping, damaged insulation, dropped stitches, holes in seams
Average number of breakdowns per machine per day = number of arrivals in the system (λ)	0.60

Source: our own processing

The key events with regard to risk are breakdowns of the knitting machines. The risk assessment requires determination of the characteristics of a random variable expressing the breakdown rate. These characteristics will be taken into account in the analytical calculation of queueing for the planning of operational capacity.

2.2 Risk assessment – modelling the occurrence of breakdowns of selected machines

Risk was evaluated by determining the probability of an event's occurrence. The random variable expressing the incidence of breakdowns was modelled using a standard procedure:

- Determination of whether arrivals in the system occur according to a Poisson process (using a χ^2 goodness of fit test). Testing used a dataset representing the number of breakdowns that occurred on one machine in one day and how many times the given situation occurred on 35 machines during a period of observation of 89 days. The test found that the critical value of $\chi^2(0,05, 3) = 7.81$ satisfies $\chi^2 \leq \chi^2(0,05, 3)$, for adoption of the hypothesis that the random variable expressing the incidence of breakdowns has a Poisson distribution.
- Modelling of a M/G/1 closed system
Given that in our scenario one worker is assigned to supervise 35 BUZI machines of the same type and carry out certain operations on them and that these operations may be required at random intervals in a Poisson distribution, the scenario corresponds to queueing model of type M/G/1 in Kendall notation.
- Calculation of the mean time that a machine spends waiting in the queue, i.e. unproductive downtime and use of the use of the operator's working time.
 - The mean value for the duration of service τ (average length of service activity) = 22 min.,
 - shifts: 3 shifts
 - duration of service = 7.3 min. (= 0.12 hours = τ)
- Calculation of P_0 using a matrix of (thirty five) equations and a scaling condition:

$$P_0 = (P_0 + P_1)\pi_{1,0}$$

$$P_1 = (P_0 + P_1)\pi_{1,1} + P_2\pi_{2,0}$$

$$\vdots$$

$$P_{34} = (P_0 + P_1)\pi_{1,34} + P_2\pi_{2,33} + P_3\pi_{3,32} + P_4\pi_{4,31} + P_5\pi_{5,30} + P_6\pi_{6,29} + P_7\pi_{7,28} + P_8\pi_{8,27} + P_9\pi_{9,26} + P_{10}\pi_{10,25} + P_{11}\pi_{11,24} + P_{12}\pi_{12,23} + P_{13}\pi_{13,22} + P_{14}\pi_{14,21} + P_{15}\pi_{15,20} + P_{16}\pi_{16,19} + P_{17}\pi_{17,18} + P_{18}\pi_{18,17} + P_{19}\pi_{19,16} + P_{20}\pi_{20,15} + P_{21}\pi_{21,14} + P_{22}\pi_{22,13} + P_{23}\pi_{23,12} + P_{24}\pi_{24,11} + P_{25}\pi_{25,10} + P_{26}\pi_{26,9} + P_{27}\pi_{27,8} + P_{28}\pi_{28,7} + P_{29}\pi_{29,6} + P_{30}\pi_{30,5} + P_{31}\pi_{31,4} + P_{32}\pi_{32,3} + P_{33}\pi_{33,2} + P_{34}\pi_{34,1} + P_{35}\pi_{35,0}$$

The scaling condition is: $\sum_{k=0}^{34} P_k = 1$. To simplify the calculation of probability the scaling condition is adjusted as follows:

$$\sum_{k=0}^{34} P_k = 1 \quad \frac{\sum_{k=0}^{34} P_k}{P_0} = \frac{1}{P_0} \quad (1)$$

By substituting $\frac{P_k}{P_0}$ with the coefficient q_k and making the same substitution in the matrix equations, it is possible to obtain the value of q_k (table 2).

Tab. 2: Value of qk for the studied machines

k	q _k	k	q _k	k	q _k
1	10.79179035	13	2030121595	25	30751415476
2	90.28225125	14	5115489265	26	14366684717
3	679.7969011	15	11517280481	27	5496044301
4	4667.217752	16	23095292520	28	1688668522
5	29206.80674	17	41102421662	29	406425839.9
6	166376.1608	18	64664024256	30	74090428.74
7	861493.8714	19	89532458829	31	9753168.462
8	4048461.125	20	1.08553E+11	32	861269.6823
9	17237255.01	21	1.14597E+11	33	44786.76772
10	66372683.93	22	1.0465E+11	34	1010.96671
11	230666982.6	23	82044576283		
12	721952563.5	24	54736136090		
				Σ	7.55473E+11

Source: our own processing

Given the relationship $\sum_{k=0}^{34} q_k = \frac{1}{P_0}$ this means that: $P_0 = \frac{1}{\sum_{k=0}^{34} q_k} = 1.32367E - 12.$

The same procedure can be used to calculate the other conditional probabilities P_k, that there will be an arrival in the system when there are already k places in the system.

- Calculation of the mean waiting time before a machine is repaired:
 $EW = (m - 1) \tau = (35 - 1) \cdot 0.12 = 2.413333 \text{ h / machine.}$ (2)
- The mean cycle for each machine is made up of the following mean values:
 - 1.67 h operation outside the system, i.e. the machine is working,
 - 2.41 h waiting for repair,
 - 0.12 h duration of repair,
 - giving a total of 4.2 h. This value is the mean length of a cycle.

The model of the M/G/1 closed system created for the enterprise's knitting operations on the studied machines indicates a large amount unproductive downtime of the machines even though the operators are working at full capacity. Operators carry out other activities besides repairs such as setting up machines for new patterns, checking quality and carrying out routine maintenance, which means that the waiting time in the queue is even longer.

2.3 Risk assessment – identification of consequences

Given the current number of assigned machines (m=35), an operator needs to carry out 8.33 repairs per hour, which given the average repair time (τ = 0.12 h) occupies 99.96% of their hourly working time.

On the other hand there is a great deal of unproductive machine downtime (the proportion of the average cycle length spent waiting for repair:

$$\text{unproductive machine downtime} = 0.5738, \text{ i.e. } 57.38\%. \quad (2)$$

The combination of a high probability of a breakdown of one of the 35 machines and the percentage of time lost as unproductive downtime indicates that measures should be taken to reduce risk. One approach would be to address the causes of breakdowns (to reduce the probability of occurrence of an event) and another would be to mitigate the consequences of the potential event's occurrence. For the purposes of this example we will consider a measure to mitigate the consequences of the event, i.e. "a reduction in the number of machines assigned to one operator".

2.4 Measures to mitigate the consequences of risk (proposal for a change in the number of machines operated)

Risk could be reduced by a change in the organisation of work – by reducing the number of machines operated by a single operator to **25** machines.

Such a measure would result in the following changes in the given model:

- The number of equations in the matrix is reduced to 25 and the scaling condition will be: $\sum_{k=0}^{24} P_k = 1$.
- By solving the matrix of equations according to the method set out in chapter 1, the new value of the coefficient q_k is obtained for the 25 machines (table 3)

Tab. 3: Value of q_k for 25 machines

k	q_k	k	q_k	k	q_k
1	4.7070179	10	2326.063928	19	8.749884615
2	15.39483286	11	2455.617324	20	1.62279221
3	43.48503972	12	2242.495446	21	0.239982727
4	109.6032664	13	1758.140724	22	0.046254313
5	246.767181	14	1172.982815	23	0.026214647
6	494.834969	15	659.0311593	24	0.023185988
7	880.6519069	16	307.9250037		
8	1385.551404	17	117.8303047		
9	1918.451072	18	36.23413419		
				Σ	16186.47584

Source: our own processing

- The values of q_k are used to obtain the conditional probability P_k of an arrival in the system when there are already k positions in the system of 25 machines (Tab. 4).

The data in table 4 indicates that $P_0 = 6.178E-05$. The mean value of the waiting time of a machine waiting to be repaired in this arrangement is:

$$EW = (m - 1) \tau = (30 - 1) \cdot 0.12 = 1.21 \text{ h/machine.} \quad (3)$$

The mean cycle for each machine is made up of the following mean values:

- 1.67 h operation outside the system, i.e. the machine is working,
- 1.21 h waiting for repair,

- 0.12 h duration of repair,
- giving a total of 3.00 h. (= mean duration of cycle).

Tab. 4: Conditional probabilities P_k for 25 BUZI machines

k	P_k	k	P_k	k	P_k
0	6.178E-05	9	0.118521851	18	0.002238544
1	0.000290799	10	0.143704161	19	0.000540568
2	0.000951092	11	0.151707966	20	0.000100256
3	0.002686504	12	0.138541302	21	1.48261E-05
4	0.006771287	13	0.108617882	22	2.85759E-06
5	0.015245269	14	0.072466844	23	1.61954E-06
6	0.03057089	15	0.040714926	24	1.43243E-06
7	0.054406649	16	0.019023598		
8	0.085599325	17	0.007279553		
					1

Source: our own processing

2.5 Evaluation of the measure's effectiveness

If the number of machines operated by one operator is changed from 35 to 25, the system has the following parameters:

- Number of machines in the system $m = 25$
- Machine repairs needed per hour: 8.25
- Duration of one repair: $\tau = 0.12$ h.
- Load for operators: 99% ($= 0.12 \times 8.25$)
- Unproductive machine downtime = 0.4033, i.e. 40.33%.

In general, it can be said that the reduction in the number of machines shortens the time machines have to wait to be repaired and this extends their effective use.

By comparing the results obtained from the M/G/1 closed system models representing current arrangements for operation of the knitting machine and the proposed new working arrangements for the operators of the hosiery knitting machines, the studied firm obtained ideas for increasing the effectiveness of its processes (table 5).

Tab. 5: Comparison of selected indicators after implementation of the measure

Indicator	Current arrangements	Proposed arrangements
Number of machines operated by one operator (pcs.)	35	25
Unproductive machine downtime (%)	57.38	40.33
Change in machine performance – reduction in downtime (%)	0	17.05
Average productive activity of machine (%)	42.62	59.67
Number of operators in workshop per shift	6	8
Change in the number of operators per shift	0	2
Increase in annual personnel costs per shift (EUR '000)	0	26

Source: our own processing

Implementation of the proposed change requires the hiring of two new operators per shift (i.e. 6 workers for 3 shifts), resulting in an annual increase in personnel costs of around EUR 79,000. This increase in personnel costs increases machine capacity by around 17%, which represents an increase in revenue of around EUR 5,100,000 which, at the achieve profit rate for income greatly exceeds the personnel costs mentioned above (plus other costs connected with an increase in production). Other benefits include more humane working conditions, better quality of products by reducing rejects etc.

Conclusion

Risk assessment techniques can be classified in various ways to facilitate a better understanding of their relative strengths and weaknesses. The case presented herein shows how approaches based on queueing theory can be used for risk assessment. The case study also includes a proposal and reasoning for measure to mitigate the consequences of risk.

In many areas of management and production improvement, queueing theory can be replaced by other methods that use simpler mathematical operations. Queueing systems use complicated mathematical models, which is one of the reasons discouraging the use of this theory in practice. In comparison, setting performance standards is a matter of a few simple mathematical operations but as the example shows, this can result in a higher level of risk. An indubitable benefit of queueing theory is that it takes account of the economic aspects of the given problem [4], as was shown in this case.

No proposed measure can eliminate risk entirely. Good risk management does not imply avoiding all risks at all cost. It means making informed choices regarding the risks the company wants to take in pursuit of its objectives and the measures to mitigate those risks.

This paper presents just one of the ways in which the operational risk from defective machinery could be handled. Other possibilities could include the use of an extended analytical framework for risk evaluation that would take account of risks of various characters to generate candidate measures for reducing the probability of breakdowns or ensuring faster repairs. Further research could focus on a more precise analysis not only of the occurrence of breakdowns but also their consequences, which could differ in significance depending on the age of the machine and its operational load.

Best-of-class companies do not discuss and design their risk management as an isolated add-on process, but as an integral part of their strategy design and execution. It is therefore necessary to bear in mind that while the frameworks for evaluating operational risks consider several factors, the key distinction for assessing operational risks is the use of a boundaryless view of the enterprise that takes into consideration the interests and requirements of relevant stakeholders and the organisation's strategic objectives.

References

- [1] BUDAJ, P. et al. *Gestion des opérations*. Fribourg: Association internationale S. É. C. T, 2013. ISBN 978-2-9700892-3-0.
- [2] KLUVÁNEK, P. and F. BRANDALÍK. *Operační analýza I. Teorie hromadné obsluhy*. Bratislava: Alfa, 1981. ISBN 63-759-82.
- [3] SIXTA, J. and M. ŽIŽKA. *Logistika: Metódy používané pre riešenie logistických projektov*. Brno: Computer Press, 2009. ISBN 978-80-251-2563-2.
- [4] ŠLAICHOVÁ, E. *Význam vybraných metod měření productivity práce*. Liberec: Geoprint, 2013. ISBN 97-80-7474-007-1.
- [5] HEIKO, L., Y. RANKIN, R. ENZEDI, and ANDERSON, L. C. Process variation: Analysis using Empirical Methods. *Business Process Management: Lecture Notes in Computer Science*, 2011, **6896**: 62–65. ISBN 978-3-642-23059-2.
- [6] DELOACH, J. Alternatives to Traditional Risk Assessments [online]. *Corporate Compliance Insights*, 2013, November 7th. [cit. 2015-03-05]. Available at: <http://corporatecomplianceinsights.com/alternatives-to-traditional-risk-assessments/>
- [7] JANSONE, I., and I. VORONOVA. Risks Matrixes – Risks Assessment Tools of Small and Medium Sized Enterprises. In KOCOUREK, A. ed. *Proceedings of the 11th International Conference Liberec Economic Forum*. Liberec: Technical University of Liberec, 2013. pp. 249–257. ISBN 978-80-7372-953-0
- [8] GLEISSER, W. *Wertorientiertes Risiko-Management für Industrie und Handel: Methoden, Fallbeispiele, Checklisten*. Berlin, Germany: Gabler, 2001. ISBN 978-34-091-1699-2.
- [9] MICCOLIS, J. et al. *Overview of Enterprise Risk Management* [online]. Arlington, VI, USA: Casualty Actuarial Society, 2003. [cit. 2015-03-02]. Available at: <https://www.casact.org/area/erm/overview.pdf>
- [10] TAGUCHI, G. et. al. *Taguchi's Quality Engineering Handbook*. Hoboken, NJ, USA: John Wiley & Sons, 2005. ISBN 978-0-471-41334-9.
- [11] HEAD, G. L. *Risk Management – Why and How. An illustrative introduction to risk management for business executives*. Dallas, TX, USA: International Risk Management Institute, 2009. ISBN 978-1-933686-16-5.
- [12] DIONNE, G. *Risk management: History, Definition and Critique*. [online] Montreal, Canada: Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation, 2013. [cit. 2015-04-05]. Available at: <https://www.cirreлт.ca/DocumentsTravail/CIRRELT-2013-17.pdf>
- [13] DUCKERT, G. H. *Practical Enterprise Risk Management – A Business Process Approach*. Hoboken, NJ, USA: John Wiley & Sons, 2010. ISBN 978-0-470-55985-7.
- [14] *IEC 61882, Hazard and operability studies (HAZOP studies) – Application guide*.
- [15] *ISO 31000:2009 Risk management. Principles and guidelines*.
- [16] *ISO/TR 31004: 2013 Risk management guidance for the implementation of ISO 31000*.
- [17] *ISO Guide 73: 2009 Risk management. Vocabulary*.
- [18] *IEC 31010: 2009 Risk management. Risk assessment techniques*.
- [19] *ISO/DIS 9001: 2015 Quality management systems. Requirements*.

Iwona Gorzeń-Mitka, Małgorzata Okręglika

Czestochowa University of Technology, Faculty of Management
ul. Armii Krajowej 19 B, 42-200 Czestochowa, Poland
email: iwona.mitka@zim.pcz.pl, m.okreglicka@wp.pl

Review of Complexity Drivers in Enterprise

Abstract

Complexity has been widely researched in the science literature, nowadays also in the management literature. Complexity and the way to deal with its increasing in the company itself and its environment has become a key competitive factor. Studies on complexity in organization indicate the different complexity drivers and classifying the drivers according to the way they are generated. A great deal of research has focused on complexity, but the question “Which complexity drivers increase the frequency of disruptions in company management?” has not received much attention from empirical research.

The main our research questions were: what are the typical complexity drivers in different types of organization activity area. With this paper, we aim to contribute to the literature of complexity drivers. This paper contains the results of study that were made in the context of a state of the art in the complexity drivers in enterprise.

Key Words

complexity, management, complexity drivers

JEL Classification: D21, D78, M20

Introduction

Complexity and the uncertainty of the environment in which today's organisations determines the search for new approaches to management. The inclusion of complexity in management discourse is therefore a natural consequence. Organizational literature has considered complexity as an important factor in influencing organizations. Business environment is characterized by growing dynamics and diversity. If a business wishes to succeed it must adjust to the complexity of its internal and external business environment [2] [14]. Managing increasing complexity is absolutely necessary to companies to compete better in global market. A great deal of research has focused on complexity, but the question “Which complexity drivers increase the frequency of disruptions in company management?” has not received much attention from empirical research. According A.T. Kearney study Complexity Management – Chances amid the crisis [1] complexity is a key cost driver for 84% of the companies and a key differentiating factor in the competitive landscape for 56% of all companies that participated in study. Most companies place tremendous importance on complexity, however, companies assess their own competence in complexity management as insufficient. The main goal complexity management is minimized value-destroying complexity and efficiently controls value-adding complexity. Therefore, knowledge of the complexity driver in organization is the necessary to development of management strategies [12].

This paper has been developed as a literature synthesis. The main purpose is to provide a better understanding and awareness of the complexity drivers. This paper's main goal is to identify the typical complexity drivers in different types of organization activity area. A complexity driver in the context of this article is therefore defined as a phenomenon which prompts a system to increase its complexity.

1. Research methodology

In order to identify a complexity drivers in academic management literature the most references databases were searched (SCOPUS, Google Scholar, Emerald, Elsevier). We observe an increasing number of publications related to complexity in academic literature. Based on number, scope and diversity of publications in management area we selected Elsevier database as representative to our study. For example, according to Elsevier journals database, the number of articles in our study area in the 2000-2014 period in social science literature increased almost sixfold (the biggest increase being from 2010-2014). Complexity within the management context was linked with such topics as: software, supply chains, delta, information systems, neural networks, health care, climate change (over 1000 publications in each of these topics). Based on number, scope and diversity of publications in management area we selected Elsevier database as representative to our study.

The literature review was conducted in a systematic manner. Our starting point was the definition of the paper's scope. Consequently, we found necessary to follow a drill-down procedure, starting from the wider topic of complexity in management literature and reaching the more specific topic of interpretation of the complexity drivers and searching areas of the organization where talks about drivers of complexity. We used Elsevier journals database to conduct the search of literature. The search key words and the results obtained from each database are shown in table 1. The search was limited to articles between the years of 2010 and 2014, and within the Journals of Business, Management and Accounting section. For each search result, we reviewed the title and abstracts of the articles to select the ones that contributed to achieve the objective of the paper. We focused on finding cases of study that provide examples of interpretation of the complexity drivers and searching areas of the organization where talks about it.

Tab. 1: Number of relevant literature

Search terms	Search field			
	title-abstract-keywords	title	abstract	keywords
Complexity + drivers	28	2	28	-
Complexity drivers	28	2	28	-
Complexity management + drivers	10	-	8	-
Complexity management drivers	34	3	17	2

Source: own study based on Elsevier journals database

The final selection was done after reading thoroughly the initial selection of articles. We also found necessary to include other articles of complexity drivers previous to the year 2010, as they were mentioned in several occasions in the literature and constitute some of the most important articles in the general topic of complexity in management literature. The final literature used to develop this paper is composed by a set of 10 articles.

2. Complexity drivers – ways to description

We begin exploring the description of complexity drivers in management in business management literature. Our aim is to clarify how the literature understood these concepts.

2.1 Exogenous versus endogenous complexity drivers

In the first identify differentiation, researchers distinguish complexity in companies is a result of exogenous, supply and/or demand interface and endogenous drivers. But external and internal drivers are to some extent interconnected. Dynamics in the environment surrounding the companies are reflected in external drivers. Organizations have to reduce and avoid both internal and external complexity, so as to obtain more reliable, more predictable and less complex system [7] [12] [8].

According Marti [11] exogenous (external) complexity, encloses many business challenges. It is caused by stakeholders in the company's environment who are in a direct relationship with the company. Customers, suppliers, distributors and regulatory bodies influence the business landscape and therefore internal assets and processes. External complexity also strongly influences internal organization of processes. According Isik [7] for example, in supply chain complexity, external complexity driver is related with material and information flows exported by other business partners (customer and supplier) to a single business partner in a supply chain. Globalisation, technological innovation, high competition and customer demand variety are some of the external drivers of the supply chain complexity. External supply chain drivers can be reduced and avoided by more corporations between the partners to get a more reliable system. External drivers are generated through mechanisms that the company has little, if any, control over such as market trends, regulations and other various environmental factors [16] [9].

Also Gorzeń-Mitka and Okręglińska [5], describing complexity in organization, introduced exogenous and endogenous complexity drivers. They indicate three exogenous complexity drivers determining market complexity: demand - the increasingly individualized demand leads to fragmented markets with decreasing customer target group sizes and fast changing customer needs; competitive - global and deregulated markets, powerful competitors and the shift from seller to buyer markets increase the market intensity and dynamics. These factors often cause a necessity for competitive differentiation and a broad and individualized product portfolio; technological - new technologies based on formerly distinct technologies merging into one discipline and shortening product life cycles cause a high degree of technological complexity.

Endogenous (internal) complexity is experienced within the company when translating customer requirements into products. This type of complexity affects the entire value-chain not only single processes [4]. For example, in supply chain complexity, internal complexity is associated with material and information flows within single business partner of a supply chain. This type of complexity is related with the structure of this single business partner, which covers such as process, product, production and

organizational uncertainties [17]. Some specific examples for internal supply chain complexity are process deficits, material shortfall, machine breakdowns, lack of management, large product variety, etc. Internal drivers can be reduced and avoided by improving information and material flows within the single business partner [7]. Internal drivers are generated by decisions and factors within the organization such as the product and processes design. These drivers are relatively easier to leverage since they remain within the span of control [16]. Another category of complexity drivers is related to organizational and individual behaviour within the company. These internal drivers [11] [12] [14] are the level of vertical integration (i.e. the extent to which the company covers the value-adding processes internally), the organizational structure (i.e. the amount of hierarchy levels and the resulting lengthiness of decision-making), the production structure (i.e. the organization of the production network and of the individual plants) and the company culture (i.e. the behavior of individuals in the organization).

However, Gorzeń-Mitka and Okreglicka [5] indicate four additional endogenous complexity drivers describing what he called autonomous enterprise complexity. They do not directly reflect the company's environment: production complexity, organizational complexity (enterprise processes become highly fragmented due to a strong orientation along functional lines and due to specialization. The interface density and fragmented responsibilities generate a high degree of organizational complexity), task complexity (enterprises pursue a large variety of objectives in parallel) and fabrication system complexity (manufacturing systems adhering to a horizontally and vertically undifferentiated value chain are directed by a central and deterministic control system).

Both internal and external sources may be originated from operational, structural and behavioural uncertainties in a company system [7].

Additional differentiation on complexity drivers is presented by Serdarasan [16]. It is a supply and/or demand interface. Drivers generated within supply and/or demand interface (in cooperation with suppliers/customers) are related to the material and information flows between suppliers, customers and/or service providers. These drivers are somewhat manageable since they remain within the span of influence and the level of coordination between supply chain partners plays a significant role when dealing with these drivers. Thus, power and trust mechanisms that affect the nature of supplier/customer relations are also important factors which need to be considered as complexity drivers.

As seen in the related literature mainly focuses on internal and interface complexities and the number of studies dealing with the external complexity drivers appears to be smaller in number. This is mainly due to the fact that the external drivers are outside the system boundary of the supply chain, i.e. out of the span of control of the decision maker, yet they can be monitored, analyzed, and acted upon with robust decisions to adapt and change [16].

2.2 Complexity drivers by area

According second identified differentiation in management literature is a result of drivers by areas such customers and markets, suppliers, environment of companies and product.

The predominant drivers of complexity are related to customers and markets; such as [6] [12] [13] size of the company's customer base (i.e. the amount of customers served); globalization of the company's customer base (i.e. the global spread of the customers or markets served); product requirements of the company's customers (i.e. the degree of individualization demanded by customers) and variability in customer demand (i.e. the fluctuation in orders and order volumes).

Suppliers are another source of complexity because interfaces between the companies need to be managed. Supplier-related drivers include [8] [17] [6] size of the supplier base (i.e. the amount of suppliers delivering to the company); globalization of the supplier base (i.e. the global spread of the suppliers) and unreliability of the suppliers (i.e. the incapability of the suppliers to deliver their components, material, products in the right quantity and quality and on time).

The environment of companies is also characterized by actions of competitors. Main complexity drivers in this area is introduce new products, expand to serve new regional markets, rising power of regulatory bodies, which leads to standards and regulations to be fulfilled by companies [4] [2].

Last group of complexity drivers in this classification is product drivers. According few researchers [6] [11] [14] product-related drivers include as following:

- mix of different products offered to the market place (different products could mean the number of different product lines, products with different core technologies or multiple degrees of product customization);
- length of the product life cycle (i.e. the lifespan of the product from market introduction to the end of customer use);
- architecture of products (i.e. the technical structure of products provided to the market place).

2.3 Complexity drivers – other classification

In literature we find a more specify approaches to complexity drivers identification and description by a variety of business activity sources. For example is a classifications by type or by level.

Classification complexity drivers by types of complexity indicate as static, dynamic and decision making drivers. This classification corresponds with the classification of complexity drivers according to the way they are generated: via physical situation (e.g., number of products), operational characteristics (e.g., process uncertainties), dynamic behavior (e.g., demand amplification), and organizational characteristics (e.g., decision making process, IT systems) [16].

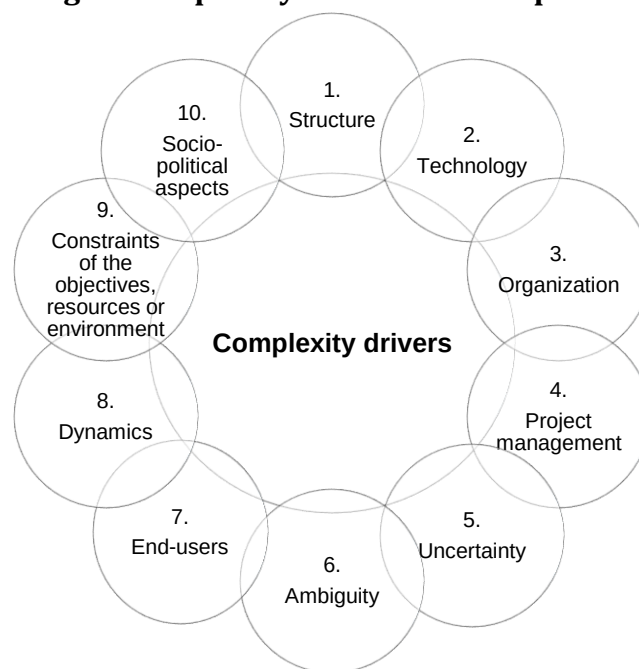
However, Perona and Miragliotta [12] use complexity drivers in order to measure the system's complexity level. The six complexity sources of Kim and Wilemon [8] could be regarded as such drivers.

In turn, Lebcir and Choudrie [9] indicate that project complexity is driven by four factors: project uncertainty, product newness, product interconnectivity, and product size as is the most influential factor on project cycle time comparatively to the other factors.

A. Simon et al. [17] analyse complexity and its influence on values in family firms. They define complexity in relation to three characteristics (drivers) that can be found in any type of system: the number of elements, the heterogeneity of elements and the interdependence and interrelatedness of these elements. This is a classical point of view on complexity inspired by systems theory. This approach also presents by Sipa [18] and Lemańska –Majdzik [10].

As we indicate before, in literature we find a more specify approaches to complexity drivers. Our investigation we present on figure 1. We singled out (based on A. Botchkarev and P. Finnigan [3] approach) ten complexity drivers in the following areas: structure (scale), technology, organization, project management, uncertainty, ambiguity, end-users, dynamics, constraints of the objectives, resources or environment and socio-political aspects. It is one of the extensive reports in relation to this area.

Fig. 1: Complexity drivers in enterprise



Details of complexity drivers:

1. number of users; number of use cases; number of user departments; multiplicity of geographical locations at which work is performed; interfaces. inter-connections; number of data elements; number of components; number of infrastructure products (databases, operating systems). number of infrastructure services; number of infrastructure requirements.
2. technological newness; interdependency of technologies; interfaces between various systems/subsystems.
4. size of the project; leadership style; task ambiguity; scope changes; internal complexity of project elements; lack of robustness of project elements.
5. knowable / unknowable; goals and methods; environmental uncertainty; people uncertainty (social interactions, rules of interactions).
7. willingness to adapt. ability to contribute.
10. stakeholders, diversity of expectations, needs, behavioural, personalities of team members, complexity of interaction.

Source: own study based on: [2] [3] [4] [9] [14] [13] [15] [5]

As shown above, complexity drivers in management areas has many facets and cannot be fully described by one or two aspects. All of these classifications have interpreted different aspects of complexity drivers in management, but they do not cover the full meaning.

The study has certain limitations. The proposed review contains a limited set of complexity attributes. The conclusions and recommendations of this paper are to be considered in the context of this study. The conclusions may or may not be applicable to many other vast and diverse fields where the notion of complexity is used.

Conclusion

Complexity is a unique problem facing modern companies. Although complexity is a characteristic of modern organization management which obviously influences important decisions, complexity as such is often taken intuitively or from previous experiences. Complexity cannot be entirely eliminated from organizations; however it can be reduced to manageable levels. A literature review shows that existing identify complexity drivers helps to develop management strategies. Analyzing and understanding complexity drivers helps us to develop and implement right strategies when dealing with complexity.

Research into the concept of complexity drivers has been conducted for last years. There is no single concept of complexity driver classification. Complexity drivers can be understood in different ways, not only in different fields but also has different connotations within the same field. A review of the literature reveals complexity drivers in management to be a multidimensional construct with no agreed upon classification.

References

- [1] A.T. KEARNEY. Complexity Management – Chances amid the crisis [online]. November 2009. [cit. 2015-04-14] Available at: http://www.mycomplexity.com/complexity_management_publications/Complexity_Management_Study_Results_sent_internally.pdf
- [2] BACCARINI, D. The concept of project complexity—a review. *International Journal of Project Management*, 1996, **14**(4): 201–204. ISSN 0263-7863
- [3] BOTCHKAREV, A. and P. FINNIGAN. Complexity in the Context of Systems Approach to Project Management. *Organisational Project Management*, 2015, **2**(1): 15–34. ISSN 2203-6156.
- [4] DUNOVIĆ, I. B., M. RADUJKOVIĆ, and K. A. ŠKREB. Towards a New Model of Complexity—The Case of Large Infrastructure Projects. *Procedia – Social and Behavioral Sciences*, 2014, **5**(119): 730–738. ISSN 1877-0428.
- [5] GORZEŃ-MITKA, I. and M. OKRĘGLICKA. Improving Decision Making in Complexity Environment. *Procedia Economics and Finance*, 2014, **2**(16): 402–409. ISSN 2212-5671.
- [6] GÖTZFRIED, M. *Managing Complexity Induced by Product Variety in Manufacturing Companies Complexity Evaluation and Integration in Decision-Making* [PhD Thesis]. Bamberg: Difo-Druck GmbH, 2013.

- [7] ISIK, F. An entropy-based approach for measuring complexity in supply chains. *International Journal of Production Research*, 2010, **48**(12): 3681–3696. ISSN 1366-588X.
- [8] KIM, J. and D. WILEMON. Sources and Assessment of Complexity in NPD Projects. *R&D Management*, 2003, **33**(1):16–30. ISSN 1467-9310.
- [9] LEBICIR R. M. and J. CHOUDRIE, A Dynamic Model of the Effects of Project Complexity on Time to Complete Construction Projects. *International Journal of Innovation, Management and Technology*, 2011, **2**(6): 477–483. ISSN 2010-0248.
- [10] LEMAŃSKA-MAJDZIK, A. *Czynniki sukcesu firm powstałych w wyniku samozatrudnienia*. Częstochowa: Sekcja Wydawnictwa Wydziału Zarządzania Politechniki Częstochowskiej, 2009. ISBN 978-83-61118-13-8.
- [11] MARTI, M. *Complexity Management: Optimizing Product Architecture of Industrial Products*. Wiesbaden: Deutscher Universitäts-Verlag, 2007. ISBN 978-3835008663.
- [12] PERONA, M. and G. MIRAGLIOTTA. Complexity management and supply chain performance assessment. A field study and a conceptual framework. *International Journal of Production Economics*, 2004, **90**(1):103–115. ISSN 0925-5273.
- [13] PIGAGAITÉ, G., SILVA, P. P., and D. A. HUSSEIN. Sources of Complexities in New Product and Process Development Projects [online]. In *International Workshop of Advanced Manufacturing and Automation (IWAMA 2013)*. Trondheim, Norway: Centre for Research-based Innovation, 2013. [cit. 2015-04-14] Available at: http://www.researchgate.net/publication/259997703_Sources_of_Complexities_in_New_Product_and_Process_Development_Projects
- [14] RAMASESH, R. V. and T. R. BROWNING. A conceptual framework for tackling knowable unknown unknowns in project management. *Journal of Operations Management*, 2014, **32**(4): 190–204. ISSN 00272-6963.
- [15] ROSSITER HOFER, A. and A. M. KNEMEYER. Controlling for logistics complexity: scale development and validation. *The International Journal of Logistics Management*, 2009, **20**(2):187–200. ISSN 0957-4093.
- [16] SERDARASAN, S. A review of supply chain complexity drivers. *Computers & Industrial Engineering*, 2013, **66**(3): 533–540. ISSN 0360-8352.
- [17] PILAR, S. A., M. A. BIKFALVI, and M. DOLORS MUÑOZ. Exploring value differences across family firms: The influence of choosing and managing complexity. *Journal of Family Business Strategy*, 2012, **3**(3):132–146. ISSN 1877-8585.
- [18] SIPA M. Wyzwania globalne i lokalne a proces umiędzynarodowienia małych i średnich przedsiębiorstw. In SIPA, M. *Wyzwania globalne i lokalne zarządzania podmiotami gospodarczymi*. Częstochowa: Sekcja Wydawnicza WZ Politechniki Częstochowskiej, 2013. ISBN 978-83-7193-571-8.

Jana Holá, Jan Čapek

University of Pardubice, Faculty of Health
Studies, Department of Informatics,
Management and Radiology
Studentská 95, 532 10 Pardubice, Czech
Republic
email: jana.hola@upce.cz

University of Pardubice, Faculty of
Economics and Administration
Institute of System Engineering and
Informatics, Studentská 95, 532 10
Pardubice, Czech Republic
email: capek@upce.cz

Evaluation of the Relevance and Effectiveness of Internal Communication Elements

Abstract

This article describes the case study of the evaluation of the relevance and effectiveness of internal communication elements. The main aim of the case study was to demonstrate how significantly managers perceive individual elements of internal communication in theory and practice, how they evaluate their effectiveness in practice and then compare and show the differences between theoretical and practical concepts. The methods of qualitative and quantitative research were used. The definition of Internal Communication System and its elements are based on extensive research: extensive literature review, various surveys of internal communication issues, on published research results of selected audits of internal communication. The internal communication system consists of 10 elements: company culture based on moral and ethical values, unified management team and full responsibility for company communication, declared organizational strategy and company communication strategies, formal communication settings - organization structure, main organization processes etc., declared HR and social policy supported by personal work with the aim of finding mutual respect between the organization and employees, setting communication standards that ensure integration of new employees into organization, explaining the company business, providing information on the main objectives, efficiently set internal marketing, mainly internal public relations influencing the relationship of the worker to the organization, communication competencies of the managers, open communication including feedback and ICT setting information and communication infrastructure for internal communication needs.

Key Words

internal communication, case study, management

JEL Classification: M31, M12

Introduction

G.B. Shaw: „The biggest single problem in communication is the illusion that it has taken place“. Many managers make this basic error causing misunderstanding, they deny the fact that the message sent is not the same as the message delivered. The problems with company inefficient internal communication can be found in many companies. According to the survey of the European Agency for Safety and Health at Work [4] – committed to making Europe a safer, healthier and more productive place to work, and promoting a culture of risk prevention to improve working conditions in Europe – it is possible to highlight several findings regarding the most frequent sources of stress in the workplace,

i.e. the impacts which influence work stress. On the other hand, inefficient communication can easily cause work dissatisfaction, employee fluctuation and poor business performance [18]. Further research shows that communication is one of the most significant sources of conflict, stress and dissatisfaction but also a source of understanding, mutual cooperation difficulties and enhanced work performance leading to competitiveness and innovation. Some research also proves the impact of internal communication on employee engagement [5]. The main aims of internal communication can be formulated as follows: 1) information transfer necessary for work performance, 2) information and motivation link necessary for co-operation and sharing know-how, 3) and forming of desired morale, labour behaviour and attitudes necessary for reaching employee stability [6]. The presented article follows this structure: First, it focuses on literature review, then, internal communication will be defined, followed by the research of the relevance internal communication elements evaluation, and finally, the summary.

1. Literature review

Research by Yates [19] and Gallup Consulting [5], as well as further Robson a Tourish research [14] provide empirical evidence for a positive relationship between internal communication and organizational effectiveness. Internal communication increases productivity, reduces absenteeism, increases the quality of products and services and reduces costs; in addition it also increases innovation potential. Its significance cannot be speculated. Diversity and fragmentation of its content, however, is sometimes an obstacle to the practical application. It is therefore necessary to define internal communication as a separate discipline, as one of the domains of management so that each line of any organization is able to understand it and implement it. An article by Verčič et al. [18] brought the results of research on the topic of definitions and parameters of internal communication. Within the Delphi study, which involved members of FEIEA (www.feiea.com) was agreed a common term for the internal communication, a term that is already in place and refers to the communication activities related to the internal environment within the PR, corporate communications, employee communication, strategic communication, communication management, personnel management, organizational culture, and other internal communication forms. All communication within the organization can be summarized under the term called internal communication, and most of it is linked to the organizational culture, employee motivation and engagement, organization communication - communication between management and employees. Simultaneously, this study also shows the internal connections with the use of communication media and technologies. The study [18] suggests that internal communication is an interdisciplinary issue and is integrated with elements of internal marketing, especially PR, personnel management and technologies, but also basic communication in the framework of the ongoing collaboration across the enterprise. Internal communication is therefore strongly connected with the management and it is primarily a practical discipline that draws from many disciplines ranging from psychology to technology.

The legitimacy of the independence of internal communication as a discipline is also highlighted by the fact that the relationship between the members of the organization is fundamentally different from relations with other groups of organizational partners [2]. In practice, there are departments of internal communications, internal communications

managers and specialists self-established in internal communication in the companies, but in most organizations the content of internal communication is an integral part of Human Resource management or Marketing [16]. Internal communication discipline also faces obstacles in their emancipation. Internal communication is confronted with a shortage of theories for training and professional development. Recently, however, there are a lot of activities and institutions, such as the Institute of Internal Communication (www.ioic.org.uk; www.institutik.cz) appointed to improve the situation.

Independence of internal communications discipline can be based on numerous opportunities for how the internal communication can deliver added value to the management. A new digital and social media, changes in communication channels, employee engagement, the crisis in communication, cultural diversity, trust and credit of leaders require special attention [18]. Although these issues are serious part of strategic solutions for the organization, often they lead to a simplified management concept and implementation of a tactical plan. If the internal communication is not solved within a consistent and transparent communication strategy, and if it is not a part of the organizational culture, communication becomes untrustworthy and all activities do not bring success. Ruck and Welch [15] report abuse preference tactics over strategy in the field of internal communication. This article is based on a comparison review of audits of internal communication as an initial step to improve internal communication. Many audits consistently criticize the approaches and practices focusing on the quantity of the communication activities but not their content. Managers mostly ignore the fundamental issues of internal communication such as the goal to fulfill the information needs of employees which are crucial for them.

A survey of internal communication in the Czech Republic [10] which targeted almost 18,000 respondents from the Czech companies, brings results confirming that nearly half of the companies - respondents have in their company a clear (declared) internal communication strategy and almost $\frac{3}{4}$ of the involved companies do not evaluate their internal communication. An interesting result which appeared in the finding was that despite the growing tendency towards using communication technologies, especially intranet; traditional forms - meetings, formal and informal events and message boards are most frequently used. Therefore the importance of personal communication, where the aspect of personal persuasion can be used is indispensable and traditionally strong. The above mentioned research, among other aspects also shows that most companies have internal communication identifies with specific communication tools and most internal communication does not include a systematic approach and strategy.

1.1 Internal communication definition

A very useful tool for setting a definition of internal communication, its content, tools and targets, can be an audit of internal communication. Its content can be based on questionnaires such as Communication Satisfaction Questionnaire [1] or ICA Questionnaire [13]. These questionnaires are focused on the content of internal communications in different topics: culture and social climate feedback, appreciation, knowledge, strategies and key objectives. This overview shows the main elements of internal communication. The basic definition of internal communication by Smith [16] is “internal communication is the communication connection within organization that sets

cooperation and coordination processes necessary for the operation of the company and sufficient stimulation for the performance of all employees, presents the internal communication as a complicated and complex system". According to Holá [7] the effective internal communication is a communication which ensures that workers in every aspect of their behaviour in organizations are aware of "what to do, how to do it and why to do it." A similar definition also provides Jackson [9]. Communication is a complicated process where it is necessary to observe all factors which can influence it [11]. If the communication is sufficient and functional, the company will recognize it thanks to feedback [2]. Communication process is also the basis for knowledge and know-how transfer [12]. For a successful co-operation it is necessary to share and connect the knowledge which brings new findings and information. The comprehensive content of internal communication shows that it is a matrix of personal work, internal marketing and managerial communication. The basic assumptions which set the proper function of internal communication system are as follows:

- company culture based on moral and ethical values,
- unified management team and full responsibility for company communication,
- declared organizational strategy and company communication strategies and a communication plan,
- formal communication settings defined by work duties, organizational structure, main organization processes etc.,
- declared HR and social policy supported by personal work with the aim of finding mutual respect between the organization and employees,
- setting communication standards that ensure the integration of new employees into the organization, explaining the company's business, providing information on the main objectives and financial performance of the company, staff assessment and career management and others,
- efficiently set internal marketing, mainly internal public relations influencing the relationship of the employee with the organization,
- communication competencies of the managers,
- open communication including feedback, and
- technologies, ICT – setting information and communication infrastructure for internal communication needs.

All these above-mentioned elements create efficient internal communication system and in synergy they represent quality of communication [7].

2. Case study

The main aim of the case study was to demonstrate how significantly managers perceive the individual elements of internal communication in theory and practice, how they evaluate their effectiveness in practice and then compare and show the differences of theoretical and practical concepts. The methods of qualitative and quantitative research were used, all data were processed in statistical programme STATISTICA®. The combination of qualitative and quantitative research makes it possible to reach better results and interpretation of the researched problem as it was proven for example by [16].

The procedure also corresponds with the methods used in research management, in the book of Management Research [3]. The focus group included 9 managers (who are appointed to be responsible for communication or HR managers responsible for communication) in companies which focus on internal communication improvement. The scope of internal communication and each its element were defined before the discussion and then edited and adapted into their final form within the focus group as follows:

Company culture is based on moral and ethical values includes behaviour and actions of an organization and of its personnel outward and inward, the overall atmosphere, common values and goals, fairness and transparent environment, willingness to solve problems, fostering innovation and commitment, and engagement of staff, suppression of workplace bullying and injustice, discrimination, etc., regular evaluation and interest in keeping the views of staff, the existence of ethical rules, etc.

Unified management team and full responsibility for company communication mean the unity and integrity of management communication was defined as follows: content, unified management's communication, transparency of information, uniform standards in communication - workshops, meetings, evaluation, mutual respect and cooperation of the management organizations, etc.

Declared organizational strategy, company communication strategies, and communication plan present company's strategy and the communication strategy, usually in the form of regularly communicated and accessible documents, that is available and is the basis for the main goals of the organization, that are realized by the daily activities of all employees.

Formal communication settings means defining and setting the division of labour within the organization, organizational structure, setting the major processes including supporting documentation, e.g. internal rules governing directives, guidelines, then setting basic information systems for information flow, functioning Intranet guaranteeing the availability of documents including minutes of meetings, setting basic communication channels including regular meetings and agreed meetings etc.

Declared HR policy is supported by the resources work in order to find a mutual respect between company and employees (willingness of the management to listen to comments from employees, conceptual company policy defining employee relations, benefits, incentives and motivation, leadership principles, management and staff development, etc.).

Communication standards ensure an integration of new employees into organization, explaining the company's business, providing information on the main objectives and financial performance of the company, staff assessment and career management and next. Setting communication standards relating to communications plans and standards, e.g. standards in the field of integration of new employees and work performance management standards. Next communication standards are clarifying the corporate business, include campaigns and workshops, and provide description of internal procedures and various manuals. Communication standards define internal training, knowledge sharing, etc.

Effective setting of internal marketing systematically deals with the concept of setting organization relationship with employees as "internal" customer-partners. Especially efficient internal PR leads to common goals and explains what the company offers to its employees. Internal marketing is encouraging engagement by positive news about the success, leading to loyalty and to spreading company reputation, providing information about people in the organization. Internal marketing tools are analogous to conventional marketing tools with an emphasis on internal PR (briefings, meetings, social events, motivational workshops, magazines, etc.)

Communication competencies of the managers include skills and abilities to achieve understandable expression, transfer and share of information and know-how, interpretation strategy and its transmission to each team, skills and abilities in leadership discussions, support and motivation, etc.

Open communication including feedback means the discussion in the organization, the initiative of management is indeed increased and promotes new ideas, important information is reported in time, the changes are explained and discussed, the management is interested in improving and trying to involve workers, feedback is a part of communication and is regularly evaluated as a reflection of the management.

Technology (ICT) includes setup information and communication infrastructure in the organization for the needs of internal communication - information systems, remote access, equipment and facilities, availability, reliability, safety, quality, intranet, etc.

Effective internal communication ensures that all employees know all that they need to know, they know what to do, how and why and with whom, without unnecessary misunderstanding. Internal communication provides the information necessary for the work and cooperation within the company. Internal communication is driving for engagement and commitment of the employees, it ensures mutual respect and stabilizes employees.

3. Results

Each assumption (theoretical concept) and element (practical concept) was included in the survey. Together with a range for their evaluation they were defined in the context of qualitative research. The managers rated the importance of each assumption for effective communication and simultaneously they assessed the situation of those elements in their company by means of the questionnaire. Therefore managers evaluated elements in theory and practice. Each element was briefly defined on the basis of previously agreed definitions in the focus group and tested in the pilot stage of research. Assumptions are referred to as A, and elements are referred to as E. Managers' evaluation was performed on the scale of 1 (min) to 10 (max). Managers of focus group accepted the scale: 1-4 almost insignificant (ineffective), 5-8 significant (effective), 9-10 highly significant (highly effective). The same scale was used for evaluating of effectiveness of internal communications (IC). The online survey conducted from November 2012 to February 2013. We addressed 120 companies that cooperate with the Institute of Internal Communication, 70 fully completed questionnaires were used for evaluation.

One of the objectives of this case study is a comparison of meaning internal communication elements (assumptions A1 – A10) and their importance in practice (elements E1 – E10) - their effectiveness within the functioning of the company. The Table 1 shows that the importance attributed to individual elements in the theoretical assessment of managers is higher than assessing their own performance in practice.

Tab. 1 Comparison of statistical indicators of assumptions (A) and elements (E)

element/assumption	N	mean	median	modus	sum	min	max	variance
A1 culture	70	8,96	10,00	10	627,00	3,00	10,00	2,88
E1 culture	70	6,56	7,00	8	459,00	1,00	10,00	4,19
A2 unified management	70	9,03	10,00	10	632,00	3,00	10,00	2,58
E2 unified management	69	6,74	7,00	8	465,00	1,00	10,00	4,81
A3 strategy	70	9,04	10,00	10	633,00	4,00	10,00	1,81
E3 strategy	70	6,57	7,00	7	460,00	1,00	10,00	5,70
A4 formal setting	70	8,60	9,00	10	602,00	2,00	10,00	3,34
E4 formal setting	70	7,00	8,00	8	490,00	1,00	10,00	4,72
A5 HR policy	70	8,50	9,00	10	595,00	3,00	10,00	2,78
E5 HR policy	70	6,59	7,00	8	461,00	2,00	10,00	4,10
A6 com.standards	70	8,57	9,00	10	600,00	3,00	10,00	2,83
E6 com.standards	70	6,31	6,00	6	442,00	2,00	10,00	4,51
A7 int.mkt.	70	7,97	8,00	10	558,00	3,00	10,00	4,64
E7 int.mkt.	70	6,36	6,00	5	445,00	1,00	10,00	4,99
A8 com.competencies	70	9,04	10,00	10	633,00	3,00	10,00	2,42
E8 com.competencies	70	6,50	7,00	7	455,00	2,00	10,00	3,88
A9 open comm.	69	9,19	10,00	10	634,00	5,00	10,00	1,54
E9 open comm.	70	6,60	7,00	8	462,00	1,00	10,00	4,79
A10 ICT	70	8,30	9,00	10	581,00	2,00	10,00	4,04
E10 ICT	70	7,41	7,50	10	519,00	2,00	10,00	4,88

Source: own

Fig. 1: Box plots of importance (A1/A5) and effectiveness of elements E1 / E5.

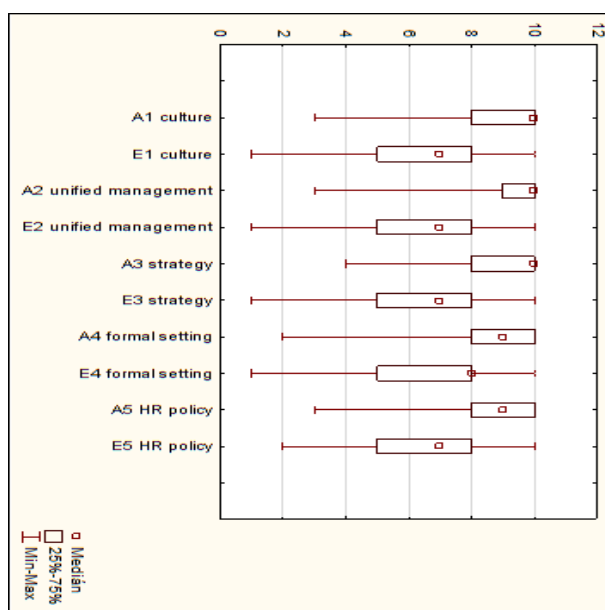
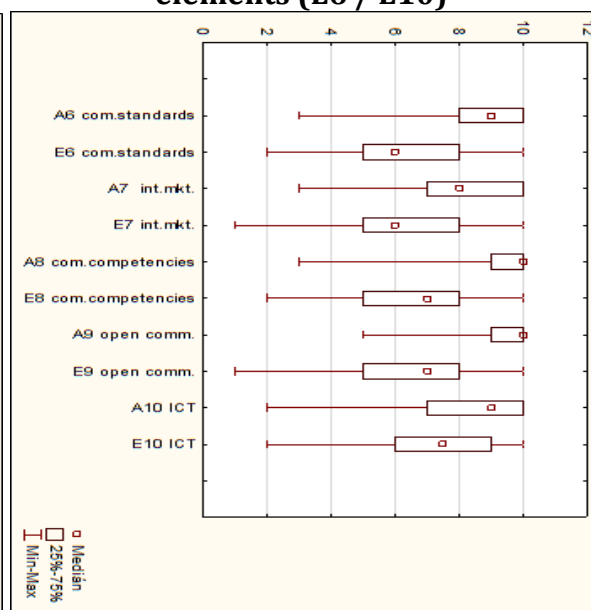


Fig.2: Box plots of importance (A6/A10) and effectiveness of elements (E6 / E10)



Source: own

As for the evaluation of internal communication elements the results of Table 1 mean that the theoretical assumptions reach greater significance than their effectiveness in practice. All variances for the evaluated assumptions (A) are lower than the variances of

evaluated effectiveness of elements (E) which means greater consistency in the assessment of the element effectiveness. Size differences in evaluation can be assessed by the medians which are best illustrated by box plots (see Fig. 1 and Fig.2).

The difference between relevance and effectiveness assessment is also shown in Table 2. This table shows the percentage of respondents who rated the importance of assumptions and elements as highly significant scored 9 to 10. The table shows that % of highly significant assumptions are always higher than the % of highly effective elements.

Tab. 2: Comparison assessing assumptions and elements in the categories of highly important / effective (9-10 rates)

assumptions/elements	highly significant importance (evaluated 9 – 10)		highly significant effective (evaluated 9 – 10)	
A1/E1 culture	52	74,29%	10	14,29%
A2/E2 unified management	53	75,71%	13	18,57%
A3/E3 strategy	49	70,00%	16	22,86%
A4/E4 formal setting	49	70,00%	15	21,43%
A5/E5 HR policy.	39	55,71%	13	18,57%
A6/E6 com. standard	38	54,29%	12	17,14%
A7/E7 int. mkt.	31	44,29%	14	20,00%
A8/E8 com. competencies	56	80,00%	9	12,86%
A9/E9 open comm.	57	81,43%	12	17,14%
A10/E10 ICT	37	52,86%	27	38,57%
IC importance/IC effectiveness	48	68,57%	19	27,14%

Source: own

A percentage (69%) of respondents who evaluate the internal communication (IC) as highly important is much higher than the % of respondents who evaluate the effectiveness of IC in their own company as highly effective, therefore, in the category of highly effective (9-10). According to the assessment of managers responses the most important assumptions of effective internal communication are: A9 - open communication, A3 strategy and A2 unity of management. The least importance by managers is given to A10 - ICT technologies. Conversely, the effectiveness of element E10 ICT technologies is evaluated in the first place next is an element E4 formal settings and E2 unity of management.

We can observe large and small differences between the importance and effectiveness of individual elements. The biggest differences are between the importance and effectiveness A9/E9 open communication, A8/E8 communication competence of managers, A1/E1 culture and A3/E3 strategy. The smallest difference in the evaluation of the importance and effectiveness is a difference between A10/A10 ICT technologies. This element was by the managers rated as the most highly effective see Table 2. A similar situation to the comparison of the importance and effectiveness of individual elements of internal communication is the evaluation of the importance and effectiveness of internal communication. Managers attribute higher score to the meaning than to the actual effectiveness of internal communication in practice. Table 4 shows the statistical indicators. Values of variances are almost the same. Homogeneity of opinions of the managers when evaluating the importance and effectiveness of executives is almost identical and can be seen in Table 4. Figure 3 shows the box plot of the difference between the importance and effectiveness of internal communication. Even if the managers

consider internal communication to be very important their evaluation proves lower internal communication effectiveness.

Tab. 3: Comparison of statistical indicators of the importance and effectiveness of internal communication

evaluation 1-10 (max)	N	mean	median	modus	sum	min	max	variance
IC effectiveness	70	7,41	8,00	8,00	519,00	2,00	10,00	3,17
IC importance	70	8,60	9,50	10,00	602,00	2,00	10,00	3,75

Source: own

A similar situation as the comparison of the importance and effectiveness of individual elements of internal communication is the evaluation of the importance and effectiveness of internal communication. Managers attribute the higher score to importance than to the actual effectiveness of internal communication in practice. Table 3 shows the statistical indicators. Values of variances are almost the same. Homogeneity of opinions of the managers when evaluating the importance and effectiveness of executives is almost identical. Even if the managers consider the internal communication to be very important their evaluation proves lower internal communication effectiveness.

Conclusion

Among the fulfillment of the importance and effectiveness of the desired settings can be found certain disproportion. However, 68% of managers rated the importance of internal communication in their work as very important (score 9-10) this result suggests that internal communication is considered to be an important part of the management. The managers recognise all the important elements and include them in the system of internal communication. The results also show that managers emphasize the importance of assumptions that primarily create communication environment for their own communication. These assumptions are: open communication, unity of the management, and sufficiently understandable and declared strategy of the organization must be set by the owner or the top management. As for evaluation of the effectiveness, the managers more likely emphasize elements of their effectiveness primarily based on the organizational settings, namely: ICT technologies, formal setting, and unity of the management. The discrepancies between theory and practice can be caused by the difference in manager's attitudes to internal communication. The principal differences between the importance and effectiveness include open communication, communication competencies of managers, culture and strategy. These differences can be based on dissatisfaction with the functioning of these elements within the organization. Although these elements are considered to be significant, they do not work as needed. This result confirms some formerly published results of audits of internal communication, in which most respondents perceived lack of open and transparent communication, lack of communication with superiors), inadequately stated strategy and non-existent culture of the organization. Above all, these elements create internal communication environment in which managers themselves then apply their own communication competence. A comparison of the importance and effectiveness of ICT technologies provides also interesting results. Managers find it the least significant assumption, but its effectiveness is evaluated as one of the highest. And among these evaluations there is not a considerable difference. Positive evaluation of ICT appears to be based primarily on the fact that for the

past 10 years has been accepted general standards in information and communications infrastructure companies that provide communications support to the whole organization. ICT resources are seen as instruments. Investments in technology can become counterproductive without management communication competencies, the evaluations of the technologies are now more sober [15]. Yet ICT technologies also show an important element of internal communication and its effectiveness will certainly have an impact [8]. System setting can clearly help internal communication to achieve the effectiveness of the company operations and its better results. Our study confirmed the importance of internal communication and relevance of its elements, then obviously the lack of effectiveness based on a lack of will and interest in internal communication. The bases for improving the quality of internal communication are sufficient knowledge of the internal communication discipline, which must go hand in hand with the main goals. This study on a sample of companies showed that internal communication has its place in the management and can be defined as a system whose individual elements of mutual synergies influence the resulting efficiency.

Acknowledgements

This paper was created with partial support of University Pardubice Grant SGSFZS_2015

References

- [1] AKKIRMAN, A. and D. HARRIS, D. Organisational communication satisfaction in the virtual work place. *Journal of Management Development*, 2005, **24**(5): 397–409. ISSN 0262-1711.
- [2] ARMSTRONG, M. and A. BARON. *Human capital management: achieving added value through people*. 1st ed. London: Kogan Page, 2008. ISBN 978-0749453848.
- [3] EASTERBY-SMITH, M. et al. *Management Research*. 3rd ed. London: SAGE, 2008. ISBN 18-478-7176-3.
- [4] EASH, W. *European Agency for Safety and Healthy at Work. European Survey of Enterprises on New and Emerging Risk* [online]. 2010. [cit. 2013-06-06]. Available at: http://osha.europa.eu/en/slc_cse_search_results
- [5] GALLUP. *Brochure: Employee Engagement: What's Your Engagement Ratio?* [online]. Washington, USA: Gallup, 2008. [cit. 2015-04-02]. Available at: http://www.mvonderland.nl/system/files/media/gallup_2008_pdf.pdf
- [6] HOLÁ, J. *Interní komunikace ve firmě*. 1st ed. Brno: Computer Press, 2006. ISBN 80-251-1250-0.
- [7] HOLÁ, J. *Jak zlepšit interní komunikaci*. 1st ed. Brno: Computer Press, 2011. ISBN 978-80-251-2636-3.
- [8] HOLÁ, J. and J. ČAPEK. Internal Communication as a Neglected Part of ICT Management. In DOUCEK, P., G. CHROUST, and V. OŠKRDAL. eds. *Proceedings from the 22nd Interdisciplinary Information Management Talks 2014*. Linz, Austria: Gerhard Chroust, 2014. pp. 249–258. ISBN 978-3-99033-340-2
- [9] JACKSON, P. C. *Corporate Communication for Managers*. 5th ed. London: Pitman, 1987. ISBN 0-273026-88-7.
- [10] LMC. *Průzkum interní komunikace 2012*. Praha: LMC, 2012.

- [11] MILLER, K. *Communication Theories: Approaches and processes*. 1st ed. Boston: Cengage Learning, 2008. ISBN 978-0495565512.
- [12] MLÁDKOVÁ, L. *Management znalostí v praxi*. 1st ed. Praha: Professional Publishing, 2004. ISBN 80-86419-51-7.
- [13] QUINN, D. and O. HARGIE. Internal communication audits: A case study. *Corporate Communication*, 2004, **9**(2): 146–158. ISSN 1356-3289.
- [14] ROBSON P. and D. TOURISH. Managing internal communication: An organizational case study. *Corporate Communications: An International Journal*, 2005, **10**(3): 213–222. ISSN 1356-3289
- [15] RUCK, K. and M. WELCH. Valuing internal communication; management and employee perspectives. *Public Relations Review*, 2012, **38**(2): 294–302. ISSN 0363-8111.
- [16] SMITH, L. *Effective internal communication*. 2nd ed. London: Kogan Page, 2008. ISBN 978-0-7494-5265-0.
- [17] STRAUSS, A. L. and J. CORBIN. *Základy kvalitativního výzkumu: postupy a techniky metody zakotvené teorie*. 1st ed. Brno: Sdružení Podané ruce, 1999. ISBN 80-85834-60-X.
- [18] VERČIČ, D. et al. Internal communication: definition, parameters, and the future. *Public Relations Review*, 2012, **38**(2): 223–230. ISSN 0363-8111.
- [19] YATES, K. Internal Communication Effectiveness Enhances Bottom-Line Results. *Journal of Organization Excellence*, 2006, **25**(3): 71–79. ISSN 1932-2054.

Ivan Jách¹, Josef Sedlář¹,
Andrey Zaytsev², Alexander Zaytsev³

¹ Technical University of Liberec, Faculty of Economics
Studentská 1402/2, 461 17 Liberec 1, The Czech Republic
email: ivan.jac@tul.cz, josef.sedlar@volny.cz

² Bauman Moscow State Technical University, Department of Engineering Business and
Management, 2nd Baumanskaya 5, 105 005 Moscow, Russian Federation
email: zayand12@yandex.ru

³ Moscow State University of Design and Technology, Textile Institute “A.N. Kosygin”,
Malaya Kaluzhskaya 1, 119 071 Moscow, Russian Federation
email: az-inform@mail.ru

Specificity of Forming the Incremental Value of a High-Technology Enterprise on the Basis of Implementing Innovative Managerial Techniques

Abstract

During innovative activities various innovative managerial techniques are applied in order to increase the market value of an enterprise. At the same time, companies can, for instance, create and implement the Lean Production concept, the kaizen philosophy, the kanban system, the Just-in-Time production strategy, Business Process Reengineering, Total Quality Management, etc. Therefore, creation, improvement, and implementation of such techniques lead to formation of fundamentally new elements of intellectual assets. They enrich the structure of the intellectual capital for strategic management of high-technology enterprises. The authors have designated the class of such intangible assets as “unidentifiable intangible assets”. The paper analyzes peculiarities of forming and implementing innovative managerial techniques at the high-technology enterprise, as well as problems of inexpedient use of resources during implementation of such techniques.

The authors have formalized the definition and demonstrated the significance of unidentifiable intangible assets in forming the increment to the value of the business. A mechanism of forming and enhancing use efficiency of such asset class is presented. Expediency of attributing investments, related to creation of unidentifiable intangible assets, to capital expenditures is substantiated and demonstrated. Novel methods of managing the value of the business and valuating the market value of such assets are proposed on the basis of the Lean Production concept. The analysis of the outcome of realizing the proposed valuation approach is produced on the example of the active of business of the Hartmann – Rico, a.s. (Brno, the Czech Republic) enterprise, a subsidiary of German transnational concern Paul Hartmann AG. The research was carried out for 6 years since 2008.

Key Words

capital expenditures, competitive strategy, high-technology enterprise, innovative managerial techniques, lean production concept, market value, operating expenses, unidentifiable intangible assets, valuation, value of business

JEL Classification: C13, D24, L10, L23, L25, M11, O31

Introduction

Modern innovation-oriented enterprises carry out their operations in the conditions of dynamic changes in external and internal environments. In this connexion, the corporate strategy of an enterprise is designed in times when the market is characterized by strengthening competition, increasing customer requirements to marketed products and goods, the presence turbulence, and a high degree of uncertainty. In such situation during development of the competitive strategy the management should orient towards those development factors that activate the innovative activity of the enterprise. This will enable the enterprise to create objects of the intellectual property, improve profitability and secure the growth of its market value.

Enterprises can increase the profit during the process of managing the business by either a traditional approach or an innovative approach. The traditional approach contemplates increasing the revenue via intensifying the commercial effort. Thus, in the conditions of the established competitive environment such approach to solving the task of dynamic formation of the profit growth and increasing the enterprise value is invariant for dominant and peripheral economic players. The reason behind it is that the market capacity for manufacturers is limited by the purchasing power and demand of customers for existing products and services. Taking into consideration the growing customer capability for accumulating money and the weakening capabilities for purchasing goods, this situation will result in market oversaturation and growing expenses on promotion and selling of products. Therefore, the probable consequence of applying this approach is a hypertrophied structure of costs and expenses of the enterprise.

Functioning in the conditions of tough competition, modern high-technology enterprises are in constant search for advantages that will enable them to realize their respective corporate strategies. Such advantages are formed depending on the industry of the enterprise, specifics of its operations, and availability of various resources. During the process of executing the strategy the advantages can take the following forms:

- creation of different results of innovative activities and comparable competitive prices with high quality of goods;
- achievement of efficient business processes management in combination with low costs, etc.

The arsenal of innovative managerial techniques that the management can apply plays a particular role in forming competitive advantages, as they enable the enterprise to fully utilize its production and technological potential.

1. Peculiarities of forming and implementing innovative managerial techniques at a high-technology enterprise.

Unlike traditional approaches to managing business, the innovative approach contemplates increasing the revenue and the market value growth on the basis of sustainable development efficiency factors, formed via application of modern business process management techniques – both in developing and producing innovative products

and their selling. However, it is vital not only to fully support the innovative process with the required resources, but also to balance all the functional strategies of the enterprise. The operations of production-technological subsystem should not result in creating redundant inventories. For instance, designing different functional strategies of an enterprise on the basis of implementing innovative managerial techniques to reduce costs will enable the management to:

- identify the wasting and its origin points;
- determine the influence of the wasting on business processes;
- classify the types of the wasting into eliminable and unavoidable;
- develop a set of measures to eliminate or compensate for the influence of the identified wasting.

Therefore, the management, implementing innovative techniques and novel management procedures, facilitates development and execution of the strategies. Among such managerial techniques a particular emphasis in realizing the competitive strategy is placed on the Balanced Scorecard and the Lean Production concept. These modern management tools synchronize the execution of the strategic goals with business processes [1, 4-7, 10, 14].

Application of managerial techniques must be of systemic nature in order to secure efficiency and effectiveness of the enterprise's operations. This means that the management must integrate them into the competitive strategy of the enterprise. For instance, the Lean Production concept may serve as the base for creating the focus strategy of reducing production costs and expenses at the enterprise.

Thereto, implementing such managerial technique as the Lean Production concept enables the management to solve the tasks of eliminating the identified wasting and reducing costs. In turn, this creates prerequisites for forming the positive value of the profit. Consequently, economic performance parameters will be higher than innovation-related operating expenses and investment expenditures. As a result, the financial resources, released due to cost reduction, can be used for investing into creation of the innovations system and formation of the enterprise value growth chain.

Nevertheless, it is necessary to point out that mistakes in selecting or developing the cost management strategy are an imminent cause of low efficiency of the enterprise performance, and in some cases may decrease its profit to the negative value and even diminish the equity. It is possible to prevent such mistakes by conducting a thorough analysis of the economic activity and using tools of innovative managerial techniques. Such analysis is carried out by means of the systems and process approaches to researching the operations of the enterprise [4, 5, 14].

In practice the transition to innovative managerial techniques is linked to challenges and peculiarities, predetermined by the industry and uniqueness of the economic player. For instance, during the application of the Balanced Scorecard, which was implemented for assessing the efficiency performance of concern Paul Hartmann AG (Heidenheim, the FRG) according to for elements (financial, client, internal business processes, learning and growth), the management has developed a long-term program of improving business process management in its regional subsidiaries in Europe, Asia, and America. Thus, the

management of the concern has reached the conclusion that it is necessary to simultaneously implement a new managerial technique – the Lean Production concept – in order to determine the areas of reducing production costs and expenses.

Thereupon, Hartmann – Rico, a.s. (Brno, the Czech Republic), one of the subsidiaries, has faced the necessity of solving simultaneously a number of tasks:

1. Analyzing problems in operations of the production-technological subsystem.
2. Determining on the basis of results of the analysis opportunities to improve the functional strategy of the reviewed subsystem.
3. Forming a corresponding focus strategy of reducing production costs and expenses.
4. Modernizing production and technological processes by investing in high-technology equipment.
5. Improving business process management on the basis of implementing the Lean Production concept.

During the organization and operations of the production-technological subsystem, based on the use of highly automated systems and the increasing role of intellectual resources, “hidden” wasting can also form there. As this wasting is largely dependent on the “human factor”, it becomes the key negative disturbance in the high-technology enterprise management system. Such influences lead to diminishing the enterprise performance efficiency and halting its market value growth dynamics. In some cases it is the hidden wasting that exerts a negative impact on efficiency of realizing the competitive strategy and suppresses it to a critical level.

Creating and implementing various innovative managerial techniques, which become a part of the intellectual asset structure of the enterprise as unidentifiable intangible assets, enable the management to quell the impact of such negative factors. For example, application of the Lean Production concept provides the best opportunities to reveal sources and origin points of the hidden wasting, as well as to identify and eliminate them [1, 6, 7, 10, 12, 14].

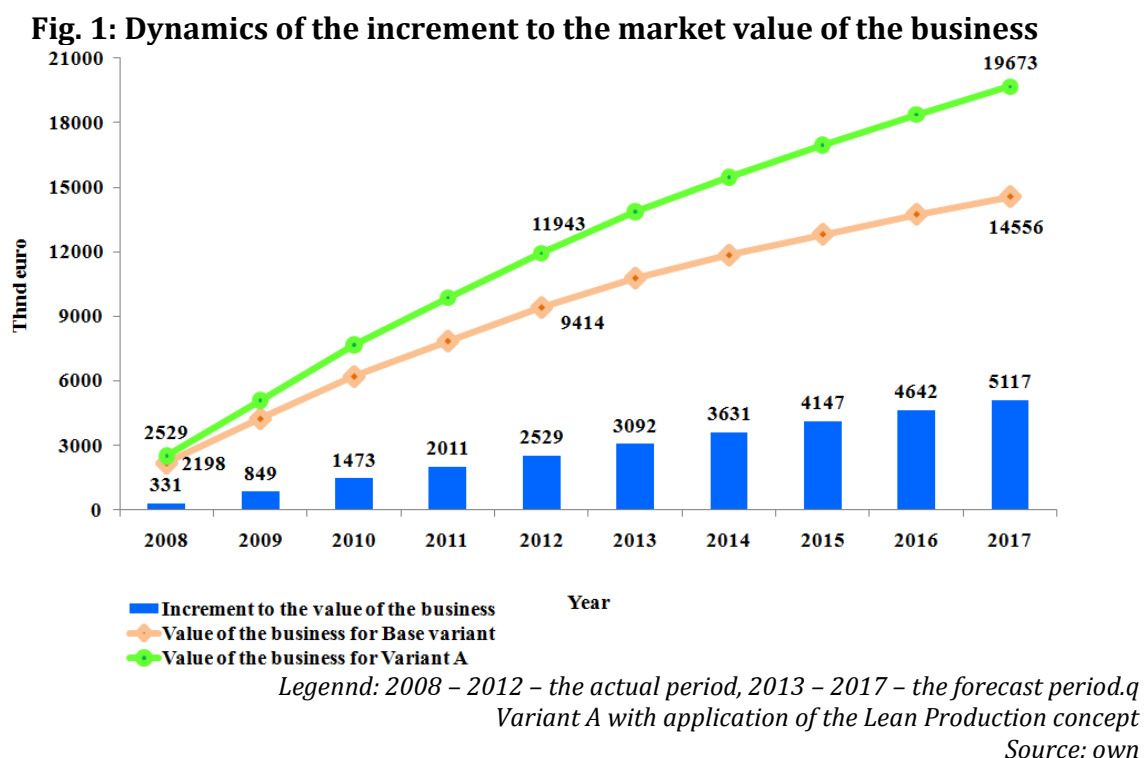
2. Unidentifiable intangible assets as a tool of innovative managerial techniques and their contribution to forming the value of a high-technology business.

Nowadays, the key feature of the modern economy is creation and use of various objects of the intellectual property in the entrepreneurial sector of the high-technology business. Thus, the most successful economic entities are those that attribute a significant share of their value to intangible assets. Such orientation of the business to the value growth in conjunction with production modernization and the transition of the economy towards the innovative development course has brought the management to developing and implementing technological innovations (new products and its production technologies). At the same time, such approach results in creating new areas in organizing the production process and improving business management, i.e. in forming a set of organizational and managerial innovations for the company.

Increasing the market value of many companies (both publicly traded and other forms of entrepreneurial structures) is based on intangible assets. In particular, firms that produce fast-moving consumer goods rely on their brand and trademark. Cutting-edge developments of pharmaceutical companies can be patent-protected, while high-technology enterprises protect trade secrets and codify knowledge of the personnel. In this connexion, on one hand, the market value is the economic parameter that demonstrates the significance of intangible assets; on the other hand, these assets are the key factor in forming the value of the company on the competitive market.

However, all these entities endeavor to apply different managerial techniques during the innovative activities in order to increase their market value. For example, they create and implement the Lean Production concept, the kaizen philosophy, the kanban system, the Just-in-Time production strategy, Business Process Reengineering, Total Quality Management, etc.

Therefore, as well as application of technological innovations, creation and implementation of various managerial techniques lead to forming fundamentally new elements of intangible assets. They improve the structure of the company's intellectual capital and are attributed to the class of so-called "unidentifiable intangible assets". It is this asset class that is the tool of the modern management by which a countermeasure to influence of different factors, lowering enterprise efficiency performance, is created [1, 12].



Let us analyze the results of calculations of the practical example on the basis of the previously proposed approach to valuating unidentifiable intangible assets by means of the discounted cash flows [1, 12, 15]. In Fig. 1 the lower graph ("Base variant") demonstrates changes in the market value of the business during 2008 – 2017, when activities of the company are carried out exclusively on the basis of the conducted

modernization of production-technological processes by means of investing 7.88 mln euros into high-technology equipment during 2002 – 2007. The upper graph (“Variant A”) depicts changes in the market value of the business during period 2008 – 2017. In this variant the activities are carried out not only on the basis of the conducted modernization of production-technological processes, but also by means of investing 1.402 mln euros into the Lean Production concept during 2008 – 2012. The comparison of the two charts demonstrates us that the Lean Production concept can secure the increment to the market value of the business during 2008 – 2017.

The reviewed practical example demonstrates the dynamics of the growth of the market value of the business of the Hartmann – Rico, a.s. enterprise. The forecast calculations for period 2008 – 2012 in comparison with actual parameters have the same trend and are close enough with the actual parameters, received as of 31.12.2012 [12]. On the basis of the received results it is possible to state that the actual increment to the value of the business is 2.529 mln euros as of 2012. The forecast increment to the value of the business reaches 5.117 mln euros in 2017 (vide Tab. 1 and 2).

It is obvious that implementing a new managerial technique during realization of the competitive strategy is the process of creating an element of the intellectual capital of the high-technology enterprise. Thereupon, the increment to the value of the business, formed owing to the implementation of the Lean Production concept, represents the market value of the newly-created unidentifiable intangible asset. The value of the asset reaches 5.117 mln euros in 2017.

Thus, the enterprise management should take into consideration during the creation of the value of the high-technology business the fact that a significant proportion of the value increment is formed owing to assets that do not reveal themselves in any physical form during innovative activities. We have designated the class of such intangible assets as “unidentifiable intangible assets”.

It is necessary to highlight an important issue in the process of formation of the increment to the value of the business by means of creating and implementing unidentifiable intangible assets (unidentifiable in terms of lacking their apparent role in forming the value). While for investors this proportion of the value can be regarded as eluding from the viewpoint of the estimated outcome, for the accounting it is a completely hidden constituent of the increment to the value of the business. For this reason, the management must not only navigate the accounting peculiarities with confidence, but also master approaches to valuating a high-technology business.

The accounting and valuation in the high-technology field differ remarkably from production enterprises. The main feature of the former is how high-technology companies would attribute investment (capital) expenditures and operating expenses in the conditions of innovative activities. Since the accounting is carried out in strict segregation of capital expenditures and operating expenses, companies that base their activities on using intangible assets face a discrepancy in attributing the expenses. Innovative activities require from high-technology enterprises, research and production enterprises and pharmaceutical companies not only substantial amount of time, but also significant investments into R&D, advertising for strengthening the brand and maintaining

trademark awareness, development of the client base, creation and implementation of various managerial techniques, etc.

From the point of view of the accounting such investments have unpredictable results and cannot be quantified, therefore, as a rule, in practice they are attributed to operating expenses – as well as production costs [2, 12]. However, despite the result uncertainty it is necessary to attribute them to capital expenditures. Otherwise, it is possible that the financial reports reflect underrated profits and capital expenditures. From the strategic management perspective the reduction of these parameters is linked to an increase in the target cost of goods sold; this, in turn, leads to suppressing the growth of the value of the business.

One of the possible criteria for attributing investments into creation of intangible assets to the capital expenditures category is a long-term resulting economic effect for the company. It means that the assets should be used for more than 1 year and, consequently, should have a set amortization period. Hence, in order to reallocate operating expenses and capital expenditures it is necessary to formulate documented expert acknowledgement of the long-term resulting economic effect of the newly-created intangible assets [2, 3, 8, 9, 12, 13].

We suggest analyzing 2 variants of calculation results of the approach to managing the value of the business on the basis of valuating unidentifiable intangible assets on the practical example [12]. The first variant (Variant A, vide Tab. 2) represents the method of realizing the technological process with application of the Lean Production concept and attributing expenses to operating expenses. Application of the Lean Production process and attributing expenses to capital expenditures is shown in the second variant (Variant B, vide Tab. 3).

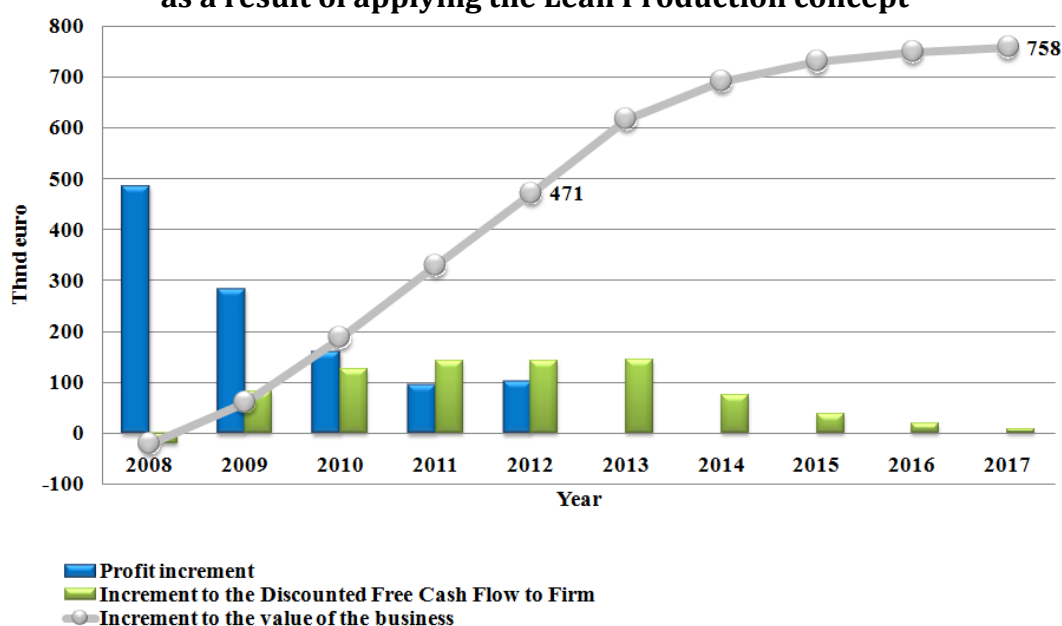
First, let us demonstrate the economic expediency of attributing investment expenditures on creating and using unidentifiable intangible assets (innovative managerial techniques) to capital expenditures. I.e., we shall provide an answer on how the business value-forming process reacts, depending on whether such expenses are attributed to capital expenditures or operating expenses.

Let us compare results of Variant A (Tab. 2, attributing expenses to operating expenses) with Variant 2 (Tab. 3., attributing expenses to capital expenditures). The data in Tables 2 and 3 demonstrate changes on the market value of the business during the actual period (2008 – 2012) and forecast period (2013 – 2017).

Using the table data, we can plot corresponding histograms and a graph. The results of the comparison of economic-mathematical calculations are presented in Fig. 2 in forms of:

- histogram “Changes in the profit increment”
- histogram “Changes in Discounted Free Cash Flow”;
- graph “Changes in the increment to the value of the business”.

Fig. 2: Comparison of changes in financial-economic parameters of the enterprise as a result of applying the Lean Production concept



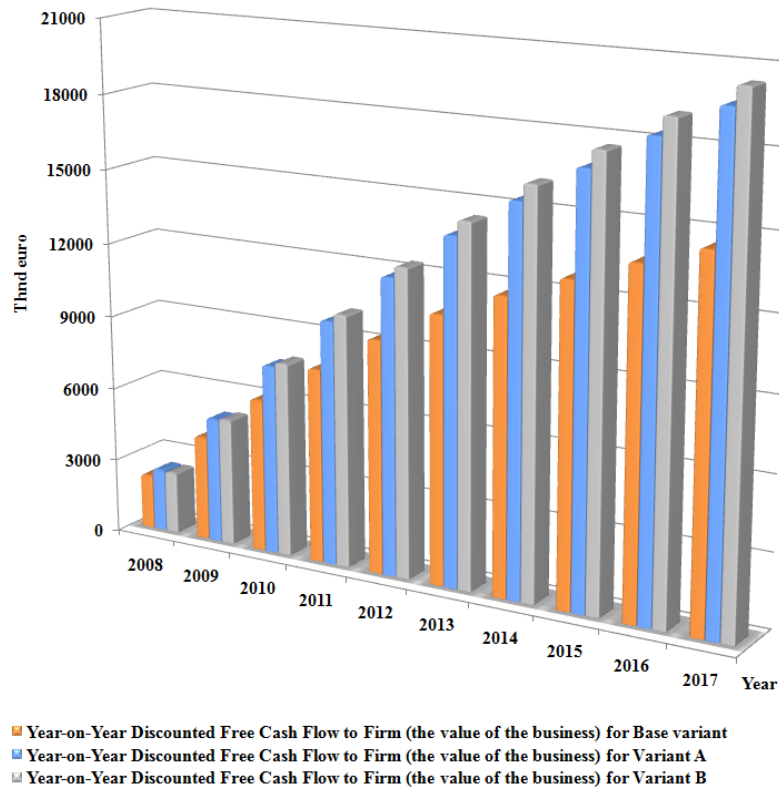
*Legend: 2008 – 2012 – actual data, 2013 – 2017 – forecast period.
 Variant A (investment expenses are attributed to operating expenses)
 Variant B (investment expenses are attributed to capital expenditures)
 Source: own*

As investments into the intangible asset were made from 2008 to 2012, the additional profit increment for the second variant was formed annually pro rata to absolute values of the investment expenditures excluded from the operating expenses with their subsequent attribution to capital expenditures. Since 2013 there is no additional profit increment exclusively due to the completion of investments into intangible assets and their attribution to capital expenses. However, the aggregate profit accretion for the company remains the same in both variants up to 2017; thus, the values of the increments are equal. Therefore, from 2013 there are no changes in the profit increment (vide Fig. 2 histogram “Changes in the profit increment”).

It is that “invisibility” of different outcomes of the value of the business, resulting from attributing such investments to different expense categories, both the management and the accounting face. The proof of this situation is graph “The increment to the value of the business” in Fig. 2. The graph demonstrates the positive dynamics of increasing the value of the business, owing to the exclusion of expenses on implementing the Lean Production concept from operating into capital expenditures. The proposed approach maintains the sustainable value growth since 2009 up to the forecast period (2013 – 2017). Comparing the variants, we witness that the transfer of investments into capital expenditures results in the increment of 471 thnd euros in 2012 and 758 thnd euros in 2017.

Having proved the economic expediency of attributing investments into creating and using unidentifiable intangible assets (innovative managerial techniques) to capital expenditures, we can analyze financial-economic parameters of all 3 variants. Let us compare results of Base variant (Tab. 1), Variant A (Tab. 2), and Variant B (Tab. 3). Figure 3 demonstrates the respective histograms of changes in the market value of the business, plotted according to the table data.

Fig. 3: The dynamics of the increment to the value of the business



Legend: 2008 – 2012 – the actual period, 2013 – 2017 – the forecast period
Base variant (without applying the Lean Production concept)
Variant A (investment expenditures are attributed to operating expenses)
Variant B (investment expenditures are attributed to capital expenditures)
Source: own

The calculations and histograms demonstrate that implementation of the Lean Production concept with attributing the investments to capital expenditures (i.e., creation of a new element of the intellectual capital) enables to secure the highest increment to the value of the business. The actual value of the business reached 12.414 mln euros by 2012. The forecast value of the business is 20.431 mln euros by 2017 (vide Tab. 3). The increment to the value of the business from implementing the new managerial technique is 3 mln euros by the end of the actual period (2008 – 2012) and 6.501 mln euros by the end of the forecast period (2013 – 2017). This means that the market value of the newly-created intangible asset (the Lean Production concept) is 3 mln euros by the end of 2012, and its forecast value is 6.501 mln euros by the end of 2017.

Tab. 1: Financial-economic parameters of calculating the value of the business of the Hartmann – Rico, a.s. enterprise.

№	Parameter	Actual period					Forecast period				
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
		year 0	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9
1.	VAT-free Revenue	39 902	41 828	44 827	39 729	42 167	44 445	46 846	49 377	52 044	54 856
2.	Variable costs	31 746	33 228	35 611	31 560	33 497	35 307	37 214	39 225	41 344	43 577
3.	Fixed costs	5 602	5 864	6 284	5 509	5 911	6 231	6 567	6 922	7 296	7 690
4.	COGS	37 348	39 091	41 895	37 130	39 408	41 537	43 781	46 147	48 640	51 267
5.	EBT	2 614	2 736	2 933	2 599	2 759	2 908	3 065	3 230	3 405	3 589
6.	Net Profit	2 091	2 189	2 346	2 079	2 207	2 326	2 452	2 584	2 724	2 871
7.	Depreciation	788	788	788	788	788	628	228	148	148	0
8.	Amortization	0	0	0	0	0	0	0	0	0	0
9.	Total Depreciation and Amortization	788	788	788	788	788	628	228	148	148	0
10.	Net Profit + Total Depreciation and Amortization	2 879	2 977	3 134	2 867	2 995	2 954	2 680	2 732	2 872	2 871
11.	Working Capital Requirements	-681	-713	-764	-677	-719	-758	-799	-842	-887	-935
12.	Cash Flow from operating activities	2 198	2 264	2 370	2 190	2 276	2 196	1 881	1 890	1 984	1 936
13.	Cash Flow from investing activities	0	0	0	0	0	0	0	0	0	0
14.	Free Cash Flow to Firm	2 198	2 264	2 370	2 190	2 276	2 196	1 881	1 890	1 984	1 936
15.	Discount factor	1	0,9091	0,8264	0,7513	0,6830	0,6209	0,5645	0,5132	0,4665	0,4241
16.	Discounted Free Cash Flow to Firm	2 198	2 058	1 958	1 645	1 554	1 364	1 062	970	926	821
17.	Discounted Free Cash Flow to Firm (Year-on-Year)	2 198	4 256	6 215	7 860	9 414	10 778	11 840	12 810	13 735	14 556

Legend: Base variant – without application of the Lean Production concept (thnd euro)
Source: own

Tab. 2: Financial-economic parameters of calculating the value of the business of the Hartmann – Rico, a.s. enterprise

№	Parameter	Actual period					Forecast period				
		2008 year 0	2009 year 1	2010 year 2	2011 year 3	2012 year 4	2013 year 5	2014 year 6	2015 year 7	2016 year 8	2017 year 9
1.	VAT-free Revenue	39 962	41 828	44 827	39 729	42 167	44 445	46 846	49 377	52 044	54 856
2.	Variable costs	30 880	32 321	34 639	30 700	32 583	34 344	36 199	38 155	40 216	42 389
3.	Fixed costs	5 449	5 704	6 113	5 418	5 750	6 061	6 388	6 733	7 097	7 480
4.	COGS 1	36 329	38 025	40 752	36 117	38 333	40 404	42 587	44 888	47 313	49 869
5.	Expenses on the Lean Production concept	605	353	199	118	127	0	0	0	0	0
6.	COGS 2 (including expenses on the Lean Production concept)	36 934	38 378	40 951	36 235	38 461	40 404	42 587	44 888	47 313	49 869
7.	EBT	3 028	3 450	3 876	3 494	3 706	4 040	4 259	4 489	4 731	4 987
8.	Net Profit	2 422	2 760	3 101	2 795	2 965	3 232	3 407	3 591	3 785	3 990
9.	Depreciation	788	788	788	788	788	628	228	148	148	0
10.	Amortization	0	0	0	0	0	0	0	0	0	0
11.	Total Depreciation and Amortization	788	788	788	788	788	628	228	148	148	0
12.	Net Profit + Total Depreciation and Amortization	3 210	3 548	3 889	3 583	3 753	3 860	3 635	3 739	3 933	3 990
13.	Working Capital Requirements	-681	-713	-764	-677	-719	-758	-799	-842	-887	-935
14.	Cash Flow from operating activities	2 529	2 834	3 125	2 905	3 034	3 102	2 836	2 897	3 046	3 054
15.	Cash Flow from investing activities	0	0	0	0	0	0	0	0	0	0
16.	Free Cash Flow to Firm	2 529	2 834	3 125	2 905	3 034	3 102	2 836	2 897	3 046	3 054
17.	Discount factor	1	0,9091	0,8264	0,7513	0,6830	0,6209	0,5645	0,5132	0,4665	0,4241
18.	Discounted Free Cash Flow to Firm	2 529	2 577	2 582	2 183	2 072	1 926	1 601	1 487	1 421	1 295
19.	Discounted Free Cash Flow to Firm (Year-on-Year)	2 529	5 106	7 688	9 871	11 943	13 869	15 470	16 957	18 378	19 673

Legend: Variant A – with application of the Lean Production concept and attribution of investment expenses to operating expenses (thnd euro)
Source: own

Tab. 3: Financial-economic parameters of calculating the value of the business of the Hartmann – Rico, a.s. enterprise

N°	Parameter	Actual period					Forecast period				
		2008 year 0	2009 year 1	2010 year 2	2011 year 3	2012 year 4	2013 year 5	2014 year 6	2015 year 7	2016 year 8	2017 year 9
1.	VAT-free Revenue	39 962	41 828	44 827	39 729	42 167	44 445	46 846	49 377	52 044	54 856
2.	Variable costs	30 880	32 321	34 639	30 700	32 583	34 344	36 199	38 155	40 216	42 389
3.	Fixed costs	5 449	5 704	6 113	5 418	5 750	6 061	6 388	6 733	7 097	7 480
4.	COGS	36 329	38 025	40 752	36 117	38 333	40 404	42 587	44 888	47 313	49 869
5.	EBT	3 633	3 803	4 075	3 612	3 833	4 040	4 259	4 489	4 731	4 987
6.	Net Profit	2 906	3 042	3 260	2 889	3 067	3 232	3 407	3 591	3 785	3 990
7.	Depreciation	788	788	788	788	788	628	228	148	148	0
8.	Amortization	101	160	193	213	234	234	133	74	41	21
9.	Total Depreciation and Amortization	889	948	981	1 001	1 022	862	361	222	189	21
10.	Net Profit + Total Depreciation and Amortization	3 795	3 990	4 241	3 890	4 088	4 094	3 768	3 813	3 974	4 011
11.	Working Capital Requirements	-681	-713	-764	-677	-719	-758	-799	-842	-887	-935
12.	Cash Flow from operating activities	3 114	3 276	3 477	3 212	3 369	3 336	2 969	2 971	3 087	3 075
13.	Cash Flow from investing activities	-605	-353	-199	-118	-127	0	0	0	0	0
14.	Free Cash Flow to Firm	2 509	2 923	3 278	3 094	3 242	3 336	2 969	2 971	3 087	3 075
15.	Discount factor	1	0,9091	0,8264	0,7513	0,6830	0,6209	0,5645	0,5132	0,4665	0,4241
16.	Discounted Free Cash Flow to Firm	2 509	2 658	2 709	2 325	2 214	2 072	1 676	1 525	1 440	1 304
17.	Discounted Free Cash Flow to Firm (Year-on-Year)	2 509	5 166	7 875	10 200	12 414	14 486	16 162	17 687	19 127	20 431

Legend: Variant B – with application of the Lean Production concept and attribution of investment expenses to capital expenses (thnd euro)
Source: own

Conclusion

We have prepared all calculations and analytical materials on the basis of the research effort that was performed for 6 years (from 2008 till 2013) at the Hartmann – Rico, a.s. enterprise (Brno, the Czech Republic) of German transnational concern Paul Hartmann AG. Our experience has demonstrated that it is considerably difficult to reveal the unique impact of unidentifiable intangible assets, directly affecting growth of the market value of the business, in routine practical activities. The reason is that their value and role in solving such task is implicit. Therefore, we have proposed novel approaches to identification of the impact of the newly-created intangible asset on the increment to the market value. The subsequent valuation of the intangible assets plays a significant role in forming the value of a high-technology business. It is demonstrated how to value the market value of unidentifiable intangible assets using our method on the example of implementing an innovative managerial technique (the Lean Production concept). The algorithm of its application is presented in this and other our papers. The procedure has been tested at the abovementioned enterprise [4, 12].

The formation of the enterprise value growth chain plays a particular role in realizing the competitive strategy. The main resource in solving this task is a highly-skilled human capital. The research findings at the Hartmann – Rico, a.s. enterprise, as well as case studies of implementing the Lean Production concept in large companies, indicate that managing innovative changes within the competitive strategy is often carried out in the project form. Therefore, managing such projects requires a team of experienced and creative specialists that possess the necessary professional qualities to solve the tasks of implementing innovative managerial techniques. However, while implementing such techniques as the Lean Production concept, Just-in-Time, Total Quality Management and other, there is a high probability of falling into the so-called “realization gap” [4].

A successful transition from the vision and strategy to realizing organizational and managerial innovations requires from the personnel high compliance, discipline and readiness. Lack of the necessary knowledge, abilities, skills and experience among the personnel, as well as missing innovative managerial tools, required for the strategy execution, lead to disruptions in algorithms of its realization. As a result, it would be impossible to achieve target parameters. It is necessary to forestall circumstances in which having a sterling resource base is an insufficient condition for executing strategic plans. This discrepancy is called “the realization gap”.

For example, the Harmann – Rico, a.s. enterprise has faced such “gap” in lacking a unified algorithm of improving logistic and production-technological processes. This situation has inhibited the transition to the principles of the Lean Production concept, increased project expenses, suppressed the production potential and lowered motivation of the personnel. Therefore, in order to determine other ways to increase the value of a high-technology enterprise on the basis of implementing innovative managerial techniques and to further improve their application it is necessary not only to realize the approaches, proposed in our paper, but also to develop mechanisms for modernizing production-technological and logistic processes on the basis of the principles and tools of the lean logistics.

References

- [1] BARANOV, V. V., A. A. ZAYTSEV, and A. V. ZAYTSEV. The Lean Production Concept and its Influence on the Market Value of a Company. In KOCOUREK, A. ed. *Proceedings of the 10th International Conference Liberec Economic Forum*. 2011. Liberec: Technical University of Liberec, 2011. pp. 43–52. ISBN 9788073727550.
- [2] EVANS, F. C. and D. M. BISHOP. *Valuation for M&A: Building Value in Private Companies*. New York: John Wiley & Sons, Inc., 2001. ISBN 0-471-41101-9.
- [3] DAMODARAN, A. *Investment Valuation: Tools and Techniques for Determining the Value of any Asset*. 8th ed. Moscow: Alpina Publisher, 2014. ISBN 9785961445053.
- [4] JÁČ, I., J. SEDLÁŘ, A. A. ZAYTSEV, and A. V. ZAYTSEV. Principles of Creating a Cost-Cutting Strategy at an Enterprise by Means of the Lean Production Concept. *E+M Ekonomie a Management*, 2013, **16**(3): 75–84. ISSN 1212-3609.
- [5] KEŘKOVSKÝ, M. *Moderní přístupy k řízení výroby*. 2nd ed. Praha: C.H. Beck, 2009. ISBN 978-80-7400-119-2.
- [6] LIKER, J. K. *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*. New York: McGraw-Hill, 2004. ISBN 0-07-139231-9.
- [7] LIKER, J. K. and D. MEIER. *The Toyota Way Fieldbook: A Practical Guide for Implementing Toyota's 4Ps*. New York: The McGraw-Hill Companies, Inc., 2006. ISBN 0-07-144893-4.
- [8] MARINIC, P. *Plánování a tvorba hodnoty firmy*. Praha: Grada Publishing, 2008. ISBN 978-80-247-2432-4.
- [9] NEUMAIROVÁ, I. et al. *Řízení hodnoty podniku aneb Nedělejme z podniku záhadu*. Praha: Profess Consulting, 2005. ISBN 80-7259-022-7.
- [10] ROTHER, M. and M. SHOOK. *Learning to see*. Cambridge, the USA: The Lean Enterprise Institute, 2003. ISBN 0-9667843-0-8.
- [11] SEDLÁČEK, J. *Cash Flow*. Brno: Computer Press, 2003. ISBN 80-7226-875-9.
- [12] SEDLÁŘ, J., A. A. ZAYTSEV, and A. V. ZAYTSEV. Methods for valuating unidentifiable intangible assets of a high-technology business. In *Proceedings of the 2nd Business System Laboratory International Symposium "Systems Thinking for a Sustainable Economy. Advancements in Economic and Managerial Theory and Practice"*. Rome, Italy: Universitas Mercatorum, 2014. ISBN 978-88-9082-420-3.
- [13] SCOTT, M. C. *Value drivers: The Manager's Framework for identifying the drivers of Corporate Value Creation*. New York: John Wiley & Sons, Inc., 1998. ISBN 0-471-97878-7.
- [14] WOMACK, J. P. and D. T. JONES. *Lean Thinking: Banish waste and create wealth in your corporation*. New York: Free Press, 2003. ISBN 0-7432-4927-5.
- [15] ZAYTSEV, A.V. *Managing innovative changes and evaluating efficiency of their realization at high-technology enterprises*. Moscow: Moscow State Textile University "A.N. Kosygin", 2012. ISBN 978-5-8196-0230-0.

Hendrik Jähn

Chemnitz University of Technology, Department of Economic Sciences
Professorship for Production and Industrial Management
Thüringer Weg 7, 09126 Chemnitz, Germany
email: hendrik.jaehn@wirtschaft.tu-chemnitz.de

A Methodology for the Integration of Soft Facts in a Performance Analysis

Abstract

A model for the consideration of soft facts in the enterprise-related performance analysis is presented in this conceptual paper. Soft facts are basic facts and features which are not available as figures or formulas. For the management of networked production structures and its participating enterprises both incentive and sanction mechanisms are useful and applicable. The operationalization of sanctions is primarily based on control and supervision management systems. This is founded on the assumptions of the New Institutional Economics, e.g. asymmetrically distributed information among the actors. In that context a comprehensive approach for the measurement, assessment and evaluation of the service performance of enterprises operating in networked organisation structures has been developed. That approach involves besides hard facts also soft facts into the analysis procedure and methodology. The description of possibilities for integration of soft facts in the approach of the performance analysis of enterprises involved in networked cooperation structures is focused. At first a number of relevant soft facts for the performance analysis must be identified. Then the basic procedure is described in a detailed manner in form of a meta-model. This procedure results in a fixed algorithm and allows a high degree of flexibility. The individual working steps of this algorithm and possibilities of quantifying soft facts, checking differential and preferential independence of the influence factors and the idea of the ideal positioning are explained. Furthermore the subsequent application of the cost-benefit analysis and the Analytic Hierarchy Process are described in detail.

Key Words

production network, soft facts, performance management, quantitative analysis

JEL Classification: M15

Introduction

The success of enterprise-spanning forms of cooperation such as networks or supply chains depends on both hard factors such as financial, quantitative or scheduling aspects as well as soft facts such as tradition, regional roots and values as trust. For a comprehensive performance management it is imperative to take into account these soft facts in the context of performance evaluation. In the present contribution, this qualitative (soft) dimension is considered primarily. The focus hereby is on the integration of the social braid on a network. When considering soft facts usually after the survey it is required to quantify the findings. Here, the selection of the appropriate method for quantification is of great significance. Then the soft and hard facts can be brought together in a comprehensive model for performance analysis. Here, however, some basic requirements need to be fulfilled always. This must be checked and guaranteed. Finally, it

seems expedient to develop a suitable algorithm, which describes the procedure and possible alternatives in an appropriate, flexible and comprehensive way.

1. Economic Framework

1.1 Organizational Background: Network Theory

Especially since the beginning of this century, more and more enterprise-spanning cooperations have been realized in practice. Likewise an increasing number of theoretical perspectives have focused the topic. Thereby, a kind of network theory has been developed within the scope of several works which, however, is marked often by a lacking harmonization of approaches and terms as well as numerous individual approaches, see for example [1],[2],[3],[4]. Nevertheless, there are also common ideas.

In general, it is assumed that the base of all the networks is represented by a so-called static enterprise network or pool of resources. This network consists of all enterprises which are ready and willing to cooperate. The enterprises, which offer their specific core competences, unite for a certain value adding process using several methods in order to manufacture the required product. This construct is typically called virtual enterprise or dynamic network. It is dissolved after a value adding process has been finished.

For the content of this paper it is necessary form an exact specification of the term cooperation. It is assumed that the cooperation includes legally and economically independent enterprises. This is commonly referred to as classical enterprise network. The companies involved are small and medium-sized enterprises in most cases. These enterprises will usually remain economically and legally independent

1.2 Economic Background: New Institutional Economy

The basis for all further considerations and model-forming procedures is represented by the New Institutional Economics (NIE) [5]. That approach is a micro-economic oriented approach which with several specific assumptions which include asymmetrically distributed information among the actors, individual maximization of utility, opportunistic behaviour and bounded rationality.

When focusing on information and its transfer, it seems obvious that usually not all actors dispose of the same kind of information or the same type. Thus, a contractor (principal) in most cases disposes of a better knowledge with regard to its efficiency and willingness to work than a client (agent). The reason for that situation of asymmetrically distributed information is that the corresponding actor will always be better able to describe itself than another actor. Because this situation represents a deficit, the question about the possibility of reducing or abandoning of these informational asymmetries arises. This will be explained later in a more detailed manner.

As opposed to neo-classicism, the NIE stresses the bounded rationality in the actions of the actors. The reason for that is the subjective (actor-related) existence of incomplete

knowledge. Therefore, the actors are not fully transparent for the market as it was propagated within the neo-classic theory. Thus, the actors usually are only able to act with regard to their subjective (but incomplete) level of information.

A further characteristic assumption of the NIE consists in the assumption that the actors are focused on the maximization of their own utility. Individual utility maximization means that every actor aims at fulfilling its own needs and interests. Under the given, subjectively perceived preferences, every actor will choose the action alternative that promises the highest efficiency for himself. Related to the network theory, this assumption allows important and wide-spanning conclusions. In a network, several partners compete for the selection for a value-adding process. Regularly every network participant attempts to maximize its utility, also at the costs of others. Consequently, the sum of the maximized utility rates of all the actors does not correspond to the possible maximum utility of the entire network. This means that the global (network-specific) maximum cannot be achieved under this condition, but only local (individual) maxima are achievable. This problem has to be solved using specific mechanisms. The assumption of the individual maximization of utility also gains importance within the scope of the utility theory and is relevant for the performance management of enterprises participating in the network.

The assumption of opportunistic behaviour is closely related to the assumption of the individual maximization of utility. Thus, economic actors are directed towards their own interest in their actions. Thereby, it is assumed that also negative consequences for other actors are taken into account if the individual efficiency of an actor can be maximized. It is also imaginable that moral limits are overshot. This causes the danger that networks might collapse sooner or later because the confidence culture among the actors which is necessary for the establishment and operation of networks is disturbed considerably.

1.3 Social Background: Soft facts

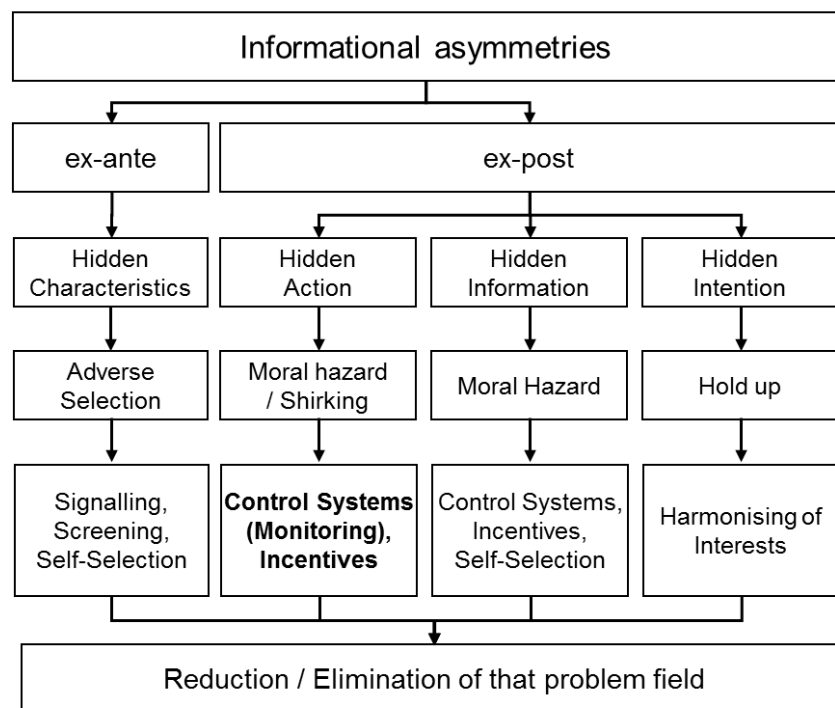
There are numerous different soft facts which play an important role in the success of cooperation. Therefore, it is necessary to focus these success factors. With the integration of soft facts in a comprehensive economic analysis always the question to what extent such factors should be taken into account arises. It should be clarified what number of different factors should be included. In this case, it makes sense to put the analysis on the broadest basis possible. However, the considered soft facts should not overlap. This will be examined in the context of independence tests later. The derivation of the relevant soft facts depends on the particular situation of cooperation. In the present case, it is assumed that a network of different enterprises which cooperate is formed in order to meet a required purpose. In this context numerous possibilities of the identification of soft facts are available. Various authors offer different approaches and methods and also are numerous charts or summaries can be found [3]. For reasons of space restrictions at this point a detailed summary of the existing possibilities in this regard omits.

1.4 Method of Resolution: Performance Management

One branch of the NIE is the Principal-Agent-Theory (PAT). The PAT deals with the economic analysis of client-contractor-relations under consideration of the marginal conditions and assumptions of the New Institutional Economics. Thereby, two kinds of actors are strictly classified: principal(s) and agent(s). Thus, according to ROSS, there is an agency relation among two or more actors if a party (called agent) completes a task of another party (principal) [6]. According to JENSEN and MECKLING, a principal agent relation is defined as contract by which one or more people engage another person for completing a certain task. Thereby, they hand over a certain permission of decision [7]. Furthermore, it is stressed here that in case both groups of actors are utility maximisers, there is a good reason to believe that the agent might not act in the interest of the principal in any case. In the context of the network, the participants are interpreted as agents.

Several different types of problems might occur in principal-agent-relations. That includes hidden characteristics, hidden action, hidden information and hidden intention [5]. The interdependencies of the terms are illustrated in figure 1.

Fig. 1: Interdependencies of the terms concerning informational asymmetries



Source: [5]

From the previously mentioned issues and the resulting problems it is necessary to implement appropriate management measures. This includes incentive and control mechanisms (see figure 1). Control mechanisms are part of the performance management and are represented by appropriate performance measurement approaches, for example the Balanced Scorecard or Performance Pyramid. However, there are also more specific approaches such as the Performance Analysis Approach (PAA) [8], which is the basis for further ideas. It is briefly described below. That approach represents an innovative proposal for the solution of the challenge.

1.5 Basic Idea: Performance Analysis Approach (PAA)

The PAA comprises of the performance measurement and evaluation including the derivation of possible consequences. The approach provides a comprehensive concept for the performance management of enterprises engaged in cooperations. Thereby that specific concept allows a high level of automation by the application of prepared algorithms.

For structuring the approach, a classification has been made into value-adding process neutral phases and value-adding process specific phases. The neutral phases include the processes of determining the performance parameters, the parameters, the evaluation functions and the weights. They need to be carried out from time to time - but not regularly before every value-adding process – by suitable instances. The value-adding process specific approaches include the processes of measuring and evaluating the performed tasks, the weighting of the single performances as well as the calculation of an aggregated measure that is based on the aforementioned parameters. Based on those figures, it can be derived whether sanctions need to be paid by specific enterprises and how much they need to pay. In order to achieve a high level of automation, all performance parameters are evaluated with regard to their degree of fulfilment and based on mathematical functions. Finally, they are aggregated as a complete value. Coherence between the degree of fulfilment and possible sanctions is also developed by applying a mathematical function. Those are processes which have to be carried out for every value-adding process based on pre-defined algorithms.

The approach was realized by applying the balanced scorecard-approach for deriving the relevant performance parameters (hard and soft facts) as well as an adapted value benefit analysis [9]. That procedure allows a high level of automation. The trade-off-procedure [10] is proposed for determining the weights of the single performance parameters. Because - in addition to hard facts - also soft facts should be considered for a comprehensive performance analysis, an approach had to be found for quantifying those soft facts. This will be explained in the following section. Within the scope of modelling the approach, suitable key figures are formulated for the relevant performance parameters. Based on that modelling, evaluation functions are constructed which thus represent the precondition for the PAA. Possible consequences can be formulated. Those consequences for example include sanction payments if the performance has been insufficient or a bonus if the performances of single enterprise are extraordinarily good.

2. Measurement of Soft facts

As already clarified the type and number of the relevant soft facts depends on the context. The claim of the approach of performance management described below is of a high degree of flexibility. Therefore, the procedure of the determination of soft facts is not described in a detailed manner.

For the measurement of soft facts numerous methods exist. A comprehensive, meaningful and understandable measurement and assessment requires the consideration of important features for the selected qualitative factors. It is also necessary to allow a

systematic processing and the possibility of a total numerical conclusion. In addition, the criteria according the selected methodology should be met. Significant attributes for the methodology to be selected are:

- consideration of differing levels of relative importance of individual criteria,
- the presence of partial dependencies between individual characteristics,
- the option of an aggregation to a comprehensive measure and
- quantification of the relative importance of the criteria.

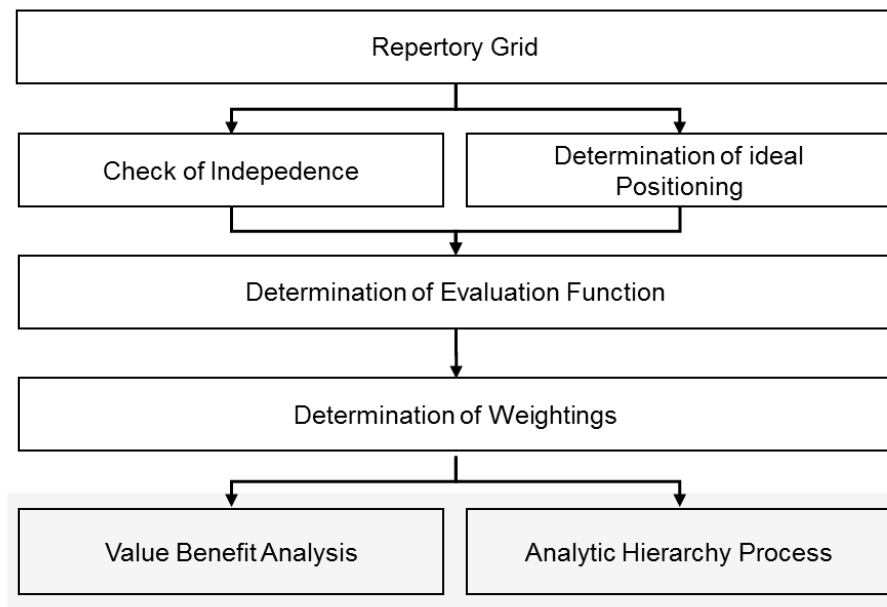
In the compilation of possible approaches to the assessment of intellectual capital or assets can be realized that they are transferable on the areas of organizational and divisional level as well as they allow the inclusion of a monetary and non-monetary valuation. In this context the Skandia Navigator, Balanced Scorecard, Intangible Assets Monitor and Human Capital Intelligence can be mentioned. These scorecard methods have in common that no monetary valuation of intellectual capital takes place. However, the search and measurement of possible influencing factors is based on the corporate strategy. These approaches mainly focus mainly the observation of the resource knowledge. Deficits exist in the comparison of different levels of aggregation and significance levels. Therefore, multi-criteria methods are favoured that allow an integration of soft facts especially well. The characteristic feature of multi-criteria methods is the reference to a variety of options, which are based on at least two criteria and analysed from a minimum of one decision maker. The main targets are a categorization, the formation of a ranking and the choice between different alternatives. After further investigation the most appropriate methods are the value-benefit analysis [9] and the Analytic Hierarchy Process [11]. Both methods are now well known and widely spread. Next the different steps in incorporating soft facts in the PAA are described in detail.

3. Integration Approach

3.1 Overview

Figure 2 shows the procedure for the integration of soft facts in the PAA in principle. That procedure is separated into value-added process related and value-added process-neutral phases.

Fig. 2: Procedure of soft facts integration



Source: own

The content of the phases will be described more detailed below. Here the three examples of soft facts trust, cooperation and communication serve as the background.

3.2 Repertory Grid

Approaches for the quantification of soft facts are available in different contexts in technical literature, but nevertheless, the quantitative analysis of soft factors always causes problems for scientists. Up to now, some approaches have been identified [12],[13], which, however, cannot be used primary, as their evaluation results are unusable in the present case. In that context the Repertory Grid methodology [14] counts thereby to the most promising approaches. That methodology is based on the Role Construct Theory which has been developed by KELLY [15]. There exists as a simple proceeding, linked with effective evaluation methods and a high level of acceptance.

The purpose is primarily to involve the subjective construction of reality with the help of the experiences of one or more persons. In the opinion of KELLY using the Repertory Grid-methodology allows the detection of the construct system of an individual. The essential terms of the approach include elements and constructs. A collection of valuations (repertory, repertoire) is described by elements. These represent uniquely assignable events for the respondents and are used to transfer the meanings as for example roles, groups or situations of people.

In this paper, the elements are characterized by the enterprises in which the company being valued is connected. Constructs are not directly observable characteristics or beliefs referred to the elements and are shown in a Repertory Grid as polarized opinions. The use of constructs enables the structuring of the environment of persons. A construct enables the realization of behaviour. The term grid defines the use of a data matrix in which the distinctive features of the properties are listed. In a subsequent step they are valued. The

content of the Repertory Grid-methodology is for example determined by the use of qualitative questionnaires and the inclusion of quantitative data by means of the review by the numbers in the matrix.

The most commonly used type of scale is the multi-level rating scale, where the rating scale here includes an assessment of -3 to +3. The individual occurrences are as follows:

Tab. 1 List of possible characteristics

3	very pronounced (Property Pole)
2	moderately pronounced (Property Pole)
1	less pronounced (Property Pole)
0	neutral
-1	less pronounced (Contrary Pole)
-2	moderately pronounced (Contrary Pole)
-3	very pronounced (Contrary Pole)

Source: own

The use of a scale without centre position (here 0 / neutral) would mean that the reference is not possible on a neutral position by the decision maker. The aim of this step in the Repertory Grid- methodology is filling the matrix with individual assessments as part of the value-added process specific tasks within the PAA.

The assessment of the resulting Repertory Grid can be done by cluster analysis or principal component analysis consecutively. The Repertory Grid methodology offers the benefits of a systematic detection of a set of constructs.

3.3 Check of Independence, Determination of ideal Positioning and Evaluation

To perform the procedure correctly it is necessary to perform both differential and preferential independence test among the parameters. The detailed background can be found in the literature on decision theory [10]. In essence, only the constructs may be included which are independent with regard to their meaning and content. This approach secures that there are no redundancies.

The representation of the ideal position of a performance parameter represents the desired performance. This makes it possible to construct a suitable criterion for comparison to actual performance. The ideal position for each construct of each performance parameter must be determined individually. To determine the percentage of the "ideal" +3 positions, the mean values were calculated using the number of possible answers of the grid questionnaire and transformed into a percentage. So the necessary comparative figures are available. This step is in principle performed once before the beginning of the analysis [14].

A rating of each criterion for each enterprise in the cooperation is carried out separately. The assessment is made by the enterprises themselves, but optionally also a neutral network coach is to be considered. Starting from the ideal ratings the reviews are carried out within the given spectrum, here from -3 to +3. Hereby each soft fact is evaluated based

on the criterion remaining after the check of independence. These ratings are aggregated subsequently and represented by a measure. It can then be incorporated as an enterprise-specific measure in the overall assessment. Therefore the value-benefit analysis and AHP-method are applied.

3.4 Value Benefit Analysis

By means of value-benefit analysis the various performance levels of the key figures of the performance parameters are aggregated to a total dimension. Here, it is necessary to establish a relationship between performance level and point score for each performance parameter. This is possible best by modelling an evaluation function. An evaluation function can be modelled using a sufficiently large number of nodes by means of Lagrange interpolation. The performance levels are determined by quantification methods, eg. the Repertory Grid-methodology. The appropriate evaluation function must be formed in advance. Subsequently, in the implementation of performance analysis easily the evaluation score can be determined. This procedure is performed for all (both qualitative and quantitative) performance parameters. As a result ratings of all performance parameters are available. It is important to specify a range of values (interval) for the scores. Common is a scale from 0 to 10 points in order to achieve a reasonable differentiation.

In the evaluation of soft facts, in many cases a soft fact consists of several sub-facts. In that case the performance levels of the sub-facts are determined according to the same pattern as described. Subsequently an aggregation of these values to a specific degree of fulfilment of the corresponding soft fact is required. In case of different meanings (in the sense of importance) weightings can be introduced. For determination of weightings a large number of methods is available [10]. By the multiplication of the weights with the scores and the subsequent summing the products the aggregated score can be determined.

The same procedure then is determined for the aggregation of the evaluation scores of the different performance parameters. Again, weightings must be determined for the different performance parameters according to their importance. Finally the aggregated total performance level of an enterprise as important evaluation result is available. Further consequences such as the application of incentives and sanctions becomes possible.

3.5 Analytic Hierarchy Process (AHP)

The AHP-method [11] can be used as an alternative to the value-benefit analysis. The AHP-method is based on a hierarchical structure. The alternatives at the lowest level are represented by the individual enterprises. Furthermore, the constructs are included in a separate level to allow a raw review. Single construct categories are set up. The AHP method, the overall objective is to derive a utility value which maps as a measure to assess the performance of individual enterprises. Here, the same performance parameters can be taken into consideration. The derived evaluation functions representing the score reviews for the calculation of the utility values are also applicable with the AHP-method.

The same output function serves as the basis. The need for further exploitation of the evaluation function is given by the less appropriate adjustment to the SAATY scale, which would result in a distorted comparability in an extension to the evaluation function. However, a different type of weighting of the criteria is applied. It is customary for the AHP-method.

In AHP the evaluation of the degree of fulfilment of a performance parameter is realized that every element is evaluated with the next higher element in the hierarchy. This circumstance not only plays a role of the paired review, but also in consideration of the weightings. The preparation of the weightings in the AHP-method requires the sake of consistency, so a check for consistency must be performed before modelling weightings. The aggregation of paired comparison judgments adjoins the consistency check. For the calculation of the weightings in the upper levels the checks of indifference of the value-benefit analysis are used again. They are adjusted according to the adapted approach according to the calculated weights of the SAATY scale. Then the partial utilities of the various performance parameters are calculated. These result from the combination of the weightings using the SAATY scale and the integration of the scoring levels that have already been applied in the value-benefit analysis. The determination of the partial utility values and the overall utility value is therefore carried out similarly to the value-benefit analysis. Thus, after completing the AHP method it is again possible to draw conclusions from the determined performance of enterprises.

3.6 Summary

An objective assessment of soft facts is virtually impossible despite a differentiated approach. The output data are based on a subjective basis. This affects not only the weightings, but already the selection of the research subject, the choice of evaluation criteria (constructs) and also the choice of the evaluation function. These subjective influences do not have to be interpreted automatically as a disadvantage in the use of value-benefit analysis and AHP-method. There are no objectively correct total scores for the performance parameters and enterprises. In addition, there is no method which can reproduce objective total scores. For this reason it is better to perform a conscious subjective choice e.g. with regard to the selection criteria. However, the subjective component also should be considered when assessing the results. Both methods represent a high degree of structuring, so a logical processing of the individual process steps is assumed. The use of the utility value as a measure of performance evaluation constitutes an adequate analysis instrument which allows a holistic judgment.

Conclusion

The approach was presented in the form of a meta-model. By the fundamental description of a solution approach a modelling of a comprehensive application becomes possible. Depending on the problem situation and the conditions appropriate performance parameters can be selected and included. By means of the introduced methodology the quantification of soft facts, the aggregation to an overall performance measure and the inclusion of possible consequences becomes possible in a structured manner.

A possible extension of the approach is the application of a sensitivity analysis in order to determine critical values. Additionally the fuzzy set theory is to be incorporated into the approach. This method involves the consideration of fuzzy relationships with mathematical methods. However further research work is necessary to allow a detailed modelling. Currently parts of the approach have been already concretized and modeled. It has been proven that this procedural method represents an appropriate approach for the consideration of soft factors in an economic context.

References

- [1] GRANOVETTER, M. The Strength of Weak Ties. *American Journal of Sociology*, 1973, **78**(6): 1360–1381. ISSN 0002-9602.
- [2] MILES, R. E. and C. C. SNOW. Organizations: New concepts for new forms. *California Management Review*, 1986, **28**(1): 62–73. ISSN 0008-1256.
- [3] DAVIDOW, W. H. and S. M. MALONE. *The Virtual Corporation: Structuring and Revitalizing the Corporation for the 21st Century*. New York: Harper Collins, 1992. ISBN 978-0-88730-657-0.
- [4] BYRNE, J.A. The virtual corporation. *International Business Week*, 1993, February 2nd, pp. 36–40.
- [5] FURUBOTN, E. G. and R. RICHTER. *Institutions and Economic Theory: The Contribution of the New Institutional Economics*. 2nd ed. Ann Arbor: University of Michigan Press, 2005. ISBN 978-0-47208-680-1.
- [6] JENSEN, M. C. and W. H. MECKLING. Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure. *Journal of Financial Economics*, 1976, **3**(4): 305–360. ISSN 0304-405X.
- [7] ROSS, S. A. The Economic Theory of Agency: The Principal's Problem. *American Economic Review*, 1973, **63**(2): 134–139. ISSN 0002-8282.
- [8] JÄHN, H., M. FISCHER, and T. BURGHARDT. Options for the Performance Analysis and Profit Distribution in networked Organizations based on industrial Enterprises. In HÁN, J. and P. HOLEJŠOVSKÁ. eds. *Proceedings of the 10th International Conference on the Modern Information Technology in the Innovation Processes of the Industrial Enterprises (MITIP 2008)*. Prague: University of West Bohemia, 2008. pp. 268–273. ISBN 978-80-7043-738-4.
- [9] ZANGEMEISTER, C. *Nutzwertanalyse in der Systemtechnik*. 4th ed. München: Wittemannsche Buchhandlung, 1976. ISBN 3-923264-00-3.
- [10] EISENFÜHR, F., M. WEBER, and T. LANGER. *Rational Decision Making*. Berlin, Germany: Springer, 2010. ISBN 978-36-4202-850-2.
- [11] SAATY, T. L. *The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation*. 2nd ed. Pittsburgh: RWS Publishing, 1990. ISBN 978-0-9620317-2-4.
- [12] SCOTT J. *Social Network Analysis*. 3rd ed. London: SAGE Publications, 2013. ISBN 978-1-4462-0904-2.
- [13] BURT R. S. *Structural Holes – The Social Structure of Competition*. New York: Cambridge University Press, 1992. ISBN 0-674-84371-1.
- [14] FRANSELLA, F., R. BELL, and D. BANNISTER. *A Manual for Repertory Grid Technique*. 2nd ed. Chichester, UK: Wiley & Sons, 2004. ISBN 0-470-85489-8.
- [15] KELLY, G. A. *The Psychology of Personal Constructs*. Vol. I, II. 2nd ed. London, New York: Routhledge, 1991.

Varvara Karpova

Moscow State Technological University "STANKIN", Faculty of Information Technology
and Control Systems

Vadkovskiy per., 3-A, 127 994 Moscow, Russian Federation

email: karpova.varvara.inf@yandex.ru

Managing the Competitive Strategy of a High-Technology Enterprise During the Instability of the External Environment

Abstract

The paper looks into the main factors that exert negative influence upon national economies during an economic crisis. Conditions in which the unstable state of the external environment may lead to the aggravation of recessions and entering the stagnation phase are examined. Such situation is demonstrated on the example of the Russian economy. The author has developed an approach and measures for surmounting negative factors of the external environment during the realization of the competitive strategy of a high-technology enterprise in order to ensure the economic adaptability of the enterprise management system to changes in the external environment. An array of unorthodox measures, embodied in managing adjustments of the competitive strategy of the enterprise, is proposed. Toward this end, the conditions for realizing adjustments of the competitive strategy are formulated, and stepwise adjustment, conducted by the high-technology enterprise in the crisis period, are substantiated.

The expediency of using a value-based mechanism of managing the competitive strategy of the high-technology enterprise via integrating different business units into a holding structure is demonstrated for the conditions of the high uncertainty and external environment instability. The creation of such innovative system of managing a high-technology enterprise facilitates a sustainable and efficient functioning of the newly-formed structure. This enables to secure saving or increasing the market value of the enterprise in the long term in the conditions of limited external financing resources.

Key Words

change management, competitive strategy, economic crisis, enterprise value increment, external environment instability, high-technology enterprise, holding structure, innovative organization adjustments

JEL Classification: G23, O12, O32, L10, L22, D24

Introduction

The continued consequences of the Great Recession, rekindled geopolitical wars, increasing prices for energy resources, and aggravating problems on the world financial market are dominating negative factors that affect national economies. Nowadays, entrepreneurial entities are forced to take and develop unconventional organizational and managerial measures in the conditions of the high uncertainty and instability of the external environment. High-technology enterprises and companies from various industries have faced similar conditions: sales issues, payment delays, trust crisis, etc.

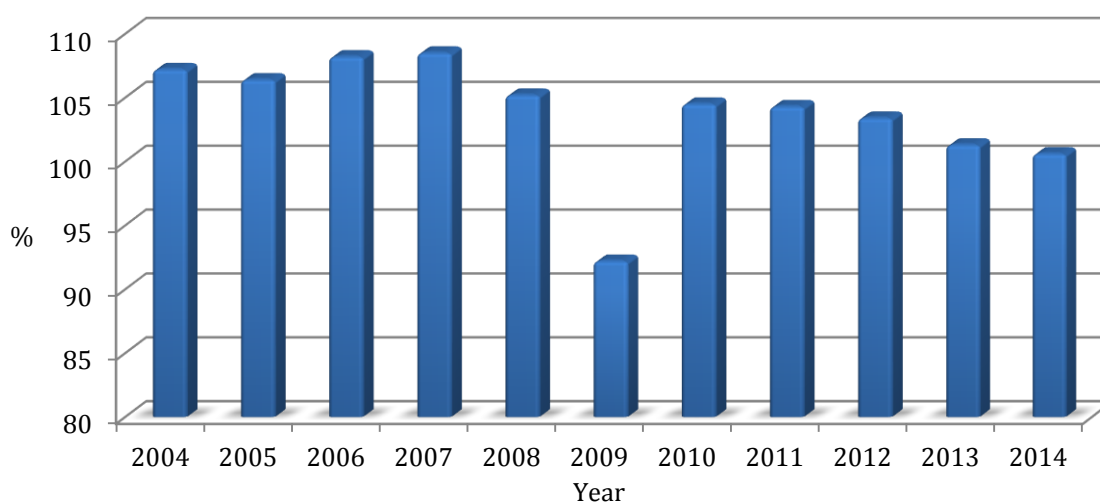
Therefore, developed investments projects, being realized within the strategy of the business value growth, can be at the moment subject to the unaccounted influence of external factors. Therefore, not only realization of the projects, but also the execution of the strategy, securing the growth of the market value of an enterprise in the long run, can be jeopardized.

1. The influence of the external environment instability and measures for suppressing negative factors during realization of the competitive strategy of a high-technology enterprise

Negative processes, arisen from changes in the global economy, affect not only competitiveness-enhancing factors and the stability of a national economy, but also operations of high-technology and science-intensive enterprises. Thus, a particular emphasis within the sustainable development of the macroeconomic system in a period of instability is placed on [4, 5, 11, 12]:

- agile methods of managing business;
- adaptability to changes in the external environment factors;
- creativity of the enterprise's personnel;
- endeavor to carry out innovative activities by developing various objects of intellectual property;
- application of the obtained results of intellectual activities into practice.

Fig. 1. The dynamics of the Gross Domestic Product of the Russian Federation during 2004 – 2014 (at the percentage of the previous period)



Source: author's plotting on the basis of the Russian Federal State Statistics Service data¹.

¹ *The National Accounts of the Russian Federation* [online]. The Russian Federal State Statistics Service database. [cit. 2015-04-05]. Available at: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/accounts/

However, it is necessary to consider the fact that in the conditions of instability, predetermined by the external environment turbulence, tools for achieving strategic goals should be adequate to the changes in the environment. The unstable state of the external environment may be a sign of entering a state of recession – which can in certain conditions transform into the stagnation phase. The recession is associated with a drop in the gross domestic product (GDP). In order to define the economic downturn as the recession phase of the economy the GDP downturn trend should be maintained for a prolonged period.

Tab. 1 Economic activity of the population (seasonally unadjusted).

	2015		February 2014	Comparison of February 2015 with	
	February	January		February	January
				2014	2015
Absolute value, thnds of people					
Economically active population aged 15 – 72 years (the total workforce)	75,82	75,919	75,228	-560	-99
Employed	71,41	71,752	70,999	-621	-342
Unemployed	4,41	4,167	4,229	61	243
Comparative ratio, %					
Economic activity rate	68.4	68.5	68,7	-0.2	-0.1
Employment rate	64.5	64.8	64,8	-0.2	-0.3
Unemployment rate	5.VIII	5.V	5,6	0.1	0.3

Source: The Russian Federal State Statistics Service¹

The influence of instability in the economy of the Russian Federation also manifests itself in the impending decline in the real income of the population; moreover, growing wage and salary arrears can be observed. For instance, according to companies' data (excluding small business), as of the 1st of March 2015, the effective wage and salary arrears amounted for 2,875 mln rubles (48 mln euros), which is the increase of 14.7% as compared to the 1st of February 2015.

Aggravation of the economic instability can lead to the stagnation, contemplating a prolonged negative condition of the economy. The transition of the economy into the persistent stagnation phase signifies that the macroeconomic system does not adapt to the changes in the external environment. Therefore, the macroeconomic system functions as a loop system. At the same time, inefficient functioning models of the system, having no development prospects, continue constantly recurring within it [3, 6, 8].

In such situation realization of the competitive strategy of a high-technology enterprise must be adjusted for the aggravating influence of the negative external environment factors on the macroeconomic system. Within the enterprise management system these factors represent disturbing influences, eroding the stability margin of the system. Thus, it is necessary to respond adequately by introducing control signals into the management system. Such controllers can contribute to processes of cost optimization, restructuring

¹ *Employment and Unemployment in the Russian Federation in February 2015.* The Russian Federal State Statistics Service database. [cit. 2015-04-05]. Available at: http://www.gks.ru/bgd/free/b04_03/IssWWW.exe/Stg/d05/54.htm

business and individual production systems, the transition to resource-saving innovative technologies, etc. [2, 5, 14, 15]

In order to surmount the instability in the national economy and shift the country to the innovative model it is necessary to strengthen the base of business development. The rapid growth of the financial and economic status of market structures can serve as such base. During the assessment of the external environment, exploring the array of disturbing influences, innovative processes, and proposing approaches to innovation management, strategy and program architects rarely examine innovative changes within market structures. Therefore, in the current conditions it is necessary to investigate the innovative development of market structures. It is many respects caused by the fact that the state should devise an appropriate response to the influence of the external environment negative factors in the particular present macroeconomic system [9, 10, 11].

In irregular and crisis situations a creative approach of the management can ensure the economic adaptability of the enterprise management system to sudden changes in the external environment factors and market conditions. Due to the changing external operating conditions of economic players a creative team of managers develops an array of unorthodox managerial decisions, embodied in the adjusted competitive strategy of an enterprise. The developed array can, for instance, include organizational changes of the company's structure or undergoing business processes, reallocation of material and financial flows, as well as various combinations of possible elements within the array of managerial decisions.

2. Forming a sustainable high-technology business via transformation of the organizational structure

We suggest the high-technology business counteracts the influence of the external environment instability on the basis of the value approach. It is expedient to conduct in this period, as managing the value encompasses not only an array of financial and economic measures, but also innovative organizational adjustments in the business management system [1, 6, 7, 11, 13].

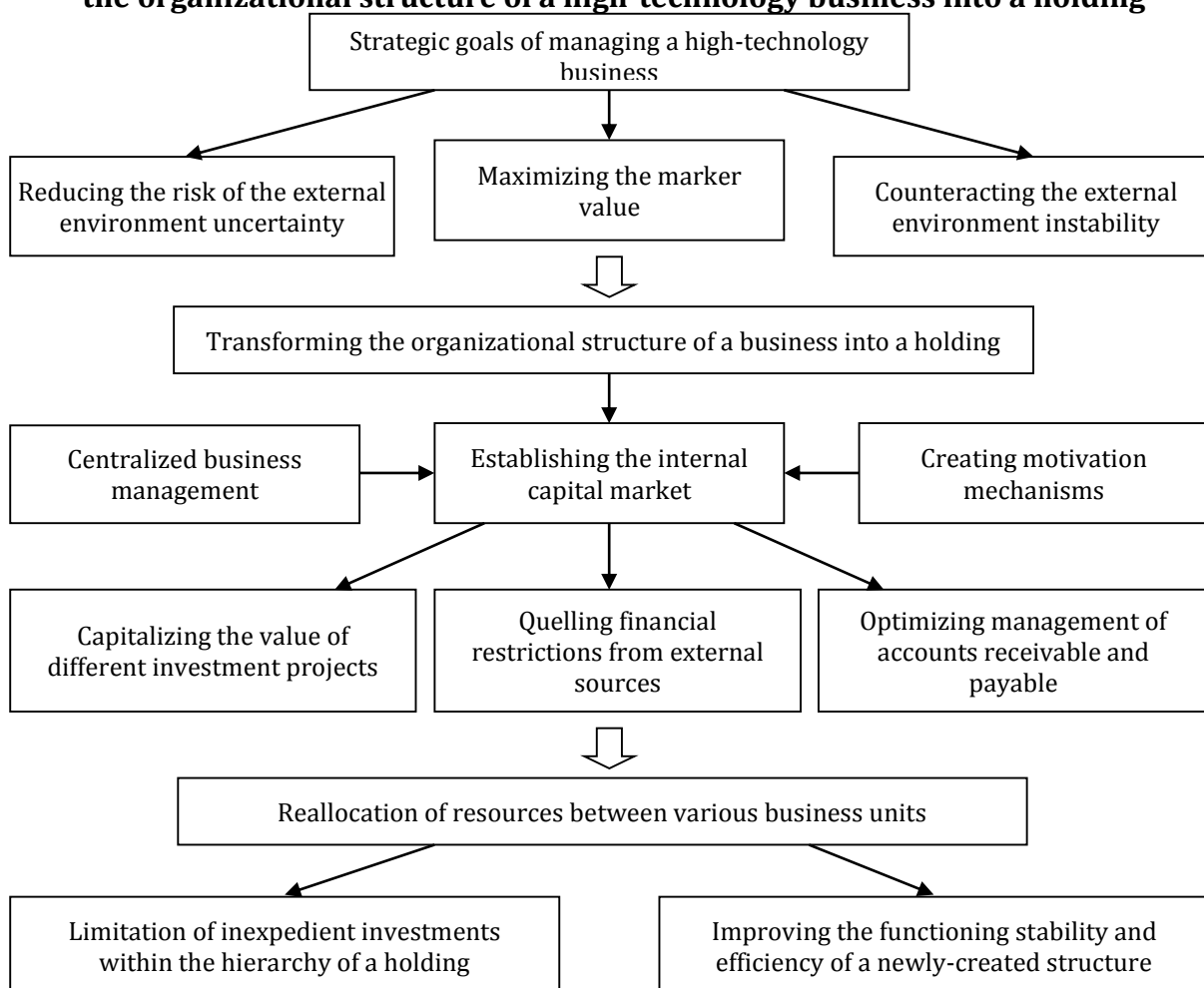
In practice, when shareholders and the management make decisions on developing and protecting the business from the severe competition and instability, it is often necessary to integrate its business units in a holding structure. Such integrated structure exerts a positive influence on realization of the investment policy and increases the market value of the business, owing to application of organizational innovations.

The strategic goal of such holding structures is to maximize the market value and diversify the high-technology business, aiming to reduce the impact of risks, associated with the uncertainty and instability of the external environment. During investment activities the efficiency of resource allocation correlates with an organizational mechanism of the holding company management system. As a result, the quality of the newly-designed hierarchic structure depends on centralized business process management, establishment of the internal capital market, and motivation mechanisms on all levels of the holding management [3, 11, 13].

The cash flow centralization process enables the management of the holding to capitalize the value added of different investment projects in the long term, while managing accounts receivable and payable in an optimal way creates the capital for short-term operations. As a part of the diversification processes, the internal capital market, established on the basis of accumulating cash flows, ensures resource reallocation to business units with low cash flows, yet with a higher investment potential and effectiveness.

Therefore, the undergoing organizational changes in the holding hierarchy would limit the inexpedient use of resources. Such approach to managing the business facilitates sustainable and efficient functioning of the newly-created structure in the conditions of insufficient conventional and unconventional financing sources. Fig. 2 demonstrates the proposed mechanism for managing the competitive strategy in the conditions of transforming the organizational structure of the business into the holding.

Fig. 2: Managing the competitive strategy in the conditions of transforming the organizational structure of a high-technology business into a holding



Source: own

Having a number of organizational and financial advantages, including efficient management, holding structures can enhance the mobility of their material and financial flows. Therefore, it is the adjustment of the financial strategy that becomes the key element of changes within the competitive strategy when facing problems in the national

financial system and the crisis of the partnership trust. It would ensure the financial stability of the holding and its capability to honor its priority financial obligations in the times of the instability.

It means that in the times of the instability the holding structure must possess the amount of the working capital sufficient for current operations of the holding. In addition, retaining the positive value of the working capital increases the market value of the holding. Thus, by optimizing financial flows and creating an efficient financial management system it is possible not only to ensure the survival of the company, but also to increase its market value growth.

Conclusion

Therefore, in practice during the adjustment of the competitive strategy of a high-technology enterprise in the times of the external environment instability we recommend realizing the following measures:

- to analyze and systematize the external environment factors and their degree of influence on the internal environment factors;
- to examine an enterprise management system and interactions between different business units;
- to analyze the financial system performance;
- to investigate and develop measures for required adjustments in the management system;
- to determine functional interrelationships within the business management team and to draw up regulations for operational and financial management.

The conducted analytical research is one of the most crucial parts of the executives' duty in the period of the external environment instability. It includes searching for novel and unorthodox decisions, selecting fundamental alternatives, concepts of navigating the company in the existing crisis conditions, and the general notion of its management system. Having conducted analytical procedures, in order to adjust the competitive strategy is necessary:

- to perform organizational adjustments in the business management system, create a coordination council for crisis management and ensure interaction between functional subsystems;
- to marshal mutual settlements and collaboration with partners, revise the client base, ensuring the balance between debtors and creditors, and, as a result, to improve trust and the reputation of the company;
- to optimize financial flow management within the holding on the basis of executing business transactions in accordance with intercompany terms and transfer prices;
- to plan financial flows in an optimal way;
- to enhance resource mobility;
- to eliminate the influence of financial flow lagging on the company's operations;
- to use intercompany agreements;

- to reallocate financial and material resources on the basis of the joint operating agreement;
- to organize a strategic partnership with large systemically important banks.

On the corporate level the conducted adjustments of the competitive strategy must secure the stability of operations and maintaining competitive advantages for the high-technology holding. This would enable to retain the value added or to form the incremental value during the period of the external environment instability.

References

- [1] BARANOV, V. V., A. A. ZAYTSEV, and A. V. ZAYTSEV. The Lean Production Concept and its Influence on the Market Value of a Company. In KOCOUREK, A. ed. *Proceedings of the 10th International Conference Liberec Economic Forum 2011*. Liberec: Technical University of Liberec, 2011. pp. 43–52. ISBN 9788073727550.
- [2] DRUCKER, P. F. *Řízení v turbulentní době*. 1st ed. Praha: Management Press, 1994. ISBN 80-85603-67-5.
- [3] FÁREK, J., J. KRAFT, and A. V. ZAYTSEV. *High-tech podniky v globalizované znalostní ekonomice*. Liberec: Technical University of Liberec, 2013. ISBN 9788074940163.
- [4] GUSOV, T., M. BATOVA, V. V. BARANOV, and A. V. ZAYTSEV. Creation and Development of the Knowledge Management System as a Tool of Growth of the Fundamental Value of a High-Technology Enterprise. In KOCOUREK, A. ed. *Proceedings of the 10th International Conference Liberec Economic Forum 2011*. Liberec: Technical University of Liberec, 2011. pp. 147–154. ISBN 9788073727550.
- [5] JÁČ, I., J. SEDLÁŘ, A. A. ZAYTSEV, and A. V. ZAYTSEV. Principles of Creating a Cost-Cutting Strategy at an Enterprise by Means of the Lean Production Concept. *E+M Ekonomie a Management*, 2013, **16**(3): 75–84. ISSN 1212-3609.
- [6] JOHNSON, M. W. *Seizing the White Space: Business Model Innovation for Growth and Renewal*. Boston: Harvard Business Press, 2010. ISBN 978-1-4221-2481-9.
- [7] KARPOVA, V. B., J. SEDLÁŘ, A. A. ZAYTSEV, and A. V. ZAYTSEV. Maximizing the market value of an enterprise on the basis of the cost-cutting strategy. In *Proceedings in Conference of Informatics and Management Sciences, the 3rd International Virtual Conference ICTIC*. Žilina, Slovak Republic: EDIS – Publishing Institution of the University of Žilina, 2014, vol. 3, pp. 74–77. ISBN 978-80-554-0865-1.
- [8] KARPOVA, V. B., L. SOJKOVÁ, and A. V. ZAYTSEV. Formation of conditions for development of enterprises in textile and light industries on the example of the Russian Federation and the Czech Republic. In *Proceedings of Higher Education Institutions. Textile Industry Technology*. (Special issue in English), 2011, no. 7, pp. 26–29. ISSN 0021-3497.
- [9] KRAFT, J. Market Structures and Macroeconomic Reality. In KOCOUREK, A. ed. *Proceedings of the 10th International Conference Liberec Economic Forum 2011*. Liberec: Technical University of Liberec, 2011. pp. 252–159. ISBN 9788073727550.
- [10] KRAFT, J., P. BEDNÁŘOVÁ, M. LUNGOVÁ, I. NEDOMLELOVÁ, and L. SOJKOVÁ. *Hospodářská krize. Vybrané makroekonomické a mikroekonomické souvislosti s projekcí na úrovni regionů*. 1st ed. Liberec: Technical University of Liberec, 2010. ISBN 978-80-7372-678-2.
- [11] IVASHCHENKO N.S. and A. V. ZAYTSEV. eds. *Peculiarities of developing an enterprise in the innovative economy*. Moscow: Creative economy, 2011. ISBN 9785912920769.

- [12] ZAYTSEV, A. V. Adaptive Control of an Investment Project Risks Based on the Prediction Approach. In KOCOUREK, A. ed. *Proceedings of the 11th International Conference Liberec Economic Forum 2013*. Liberec: Technical University of Liberec, 2013. pp. 627–633. ISBN 978-80-7372-953-0.
- [13] ZAYTSEV, A. V. and V. B. KARPOVA. Integrated structures as an instrument of organizational transformations in the innovative economy. *European Social Science Journal*, 2013, 4(7): 471–480. ISSN 2079-5513.
- [14] ZIMOVETS, O., V. V. BARANOV, and A. V. ZAYTSEV. The Economic-Organizing mechanism of Commercialization of Intellectual Assets of a High-Technology Enterprise. In KOCOUREK, A. ed. *Proceedings of the 10th International Conference Liberec Economic Forum 2011*. Liberec: Technical University of Liberec, 2011. pp. 599–603. ISBN 9788073727550.
- [15] ZUZÁK, R. *Strategické řízení podniku*. 1st. ed. Praha: Grada Publishing, 2011. ISBN 978-80-247-4008-9.

Anna Lemańska-Majdzik, Małgorzata Okręglicka

University of Technology, Faculty of Management
Ul. Dąbrowskiego 69, 42-201 Częstochowa, Poland
email: lemanska@zim.pcz.pl, m.okreglicka@wp.pl

Business Process Management in an Enterprise – Determinants of the Implementation and Expected Advantages

Abstract

Business Process Management in an enterprise is an approach to management that concentrates on optimising the ways business processes are performed in organisations. The aim of BPM is to increase the effectiveness and efficiency of organisational processes through their improvement and introduction of innovations. Identification of factors influencing an effective management of processes in an enterprise may make it easier for it to achieve success at different levels of management. The aim of the paper is to analyse and assess business processes taking place in small, medium-sized and large enterprises conducting business activity in Poland, and to identify advantages of the process approach to managing an enterprise. A questionnaire survey conducted in 2015 on a group of enterprises allowed for finding statistical relationships and verifying the research hypotheses formulated, which specified, among other things, advantages of the development or implementation of a process management system in an enterprise and determinants of process orientation in the management of an enterprise. Specification of factors determining the use of business process management in an enterprise increases the effectiveness and efficiency of organisational processes occurring in an enterprise. Identification of advantages of this type of management may show directions for the operation of an enterprise.

Key Words

business process management, determinants of process management, Polish enterprises

JEL Classification: L25, L53, M10, M21

Introduction

One of the most common approaches to management in an enterprise is business process management (BPM) which concentrates on optimising the ways business processes are performed in business entities. Its effect should be measurable benefits for an enterprise in the form of more effective operation, i.e. innovative solutions, better financial results or stronger growth. Processes, perceived as a sequence of tasks, should be performed within the whole enterprise and should definitely be in line with its strategy. Hence, an effective BPM is one of the elements that makes an enterprise come closer to achieving its strategic objectives. Focus on improving BPM methods, as well as identifying reasons for the implementation of this system and areas of the biggest advantages of its use will be translated into the competitive position of an enterprise operating in a turbulent environment.

There are a number of organisational, technological, strategic and operational factors that are important for an impact, according to Bai and Sarkis, the success of the process management in an organisation. Determinants of success or failure may belong to a number of areas of an organisation, such as: strategies, IT technologies, skills, knowledge, or organisational culture [1]. Identification of key factors impacting an effective management of processes in an enterprise may make it easier to achieve such success at very different levels of management. We should however remember that groups of determinants affecting the management of processes may vary across different groups of enterprises, industries or sectors, so the identification of determinants for BPM is often specific to a given case. Moreover, measuring and monitoring the impact of factors on BPM is difficult and requires efficient operation.

The aim of this paper is to analyse and assess the orientation of an enterprise towards process management and to identify benefits of the process approach to managing an enterprise. Inference is based on the results of questionnaire surveys conducted in 2015 on a group of 138 enterprises conducting their business activity in Poland.

1. Process management in enterprises and its determinants – selected aspects

Business process management is a comprehensive approach to the implementation of objectives of an organisation, and the aim of business process management is to increase the effectiveness of activities within an organisation. In order to be competitive, modern enterprises have to use their methodological potential, and identify, diagnose and project emerging business models [2, 3]. Generally speaking, process approach should be understood as identification of all the processes implemented in a specific organisation, establishment of mutual relationships between these processes and their management. As Singh stresses, business processes are necessary for enterprises to be able to be competitive on the market, as the awareness of identification of business processes makes them successful [4]. According to Schmiedel, Brocke and Recker business process management is a comprehensive approach to realizing efficient and effective business processes in an organization. The purpose of business process management is to increase the efficiency and effectiveness of organizational processes through improvement and innovation [5].

Business Process Management is integration of an organisation's skills which - through procedures and practices that support each other - are aimed at the use of existing processes and discovery of new ones. All these activities have an impact on improving the functioning of an organisation [6]. Process approach requires a different perception of an organisation, i.e. we need to cease to look at it from the angle of an organisation chart and its units, but instead we should perceive an organisation through the objectives actually implemented in it. Business processes in every enterprise, regardless of its specificity, are connected with a range of decisions, often strategic ones, which lead to the success of a process. Increased investment into BPM or plans assuming the development of an organisation towards process management allow an enterprise to implement its objectives, which means achieving success. However, BPM involves a detailed analysis of

an organisation and often determines changes in the organisational structure of the whole enterprise.

BPM can speed up organizational processes, reduce needed resources, improve productivity and efficiency, and improve competitiveness for organizations. Although BPM has been a business concept for decades, its strategic and operational roles within organizations is still an important issue requiring investigation from various perspectives such as operations and information technology management [7].

While there has been much research on process modelling techniques and corresponding tools, there has been little empirical research into the success factors and the post hoc evaluation of its success.

Before investigating CSF even further, the “success” of BPM must be properly defined; this often lacked in earlier studies. Since BPM can be initiated for a variety of different reasons and the definition of success may differ by unit of analysis (e.g. project, organization) a very general definition of success is proposed: BPM is successful if it continuously meets pre-determined goals, both within a single project scope and over a longer period of time [8].

There is, as confirmed by some empirical studies, a positive correlation between management processes and success in business [9]. In order to reduce the failure rate of BPM implementation, it's necessary to identify and analyze success factors for the successful implementation of BPM [10]. Moreover, in order to achieve a long term-success and better efficiency, BPM has to be linked with the strategy of action of an enterprise [8]. As Hung stresses, understanding the strategic context in the process of management is necessary and maximises value for the organisation [11].

It turns out that process management in an enterprise is affected by organisational culture, as it creates environment that facilitate BPM initiatives and can help BPM project progress by leading it to success [12]. Another important contingent variable is the trade-off between the use of specialist and generalist employees for conducting the activities in each process. Specialists build up routine more quickly and may have a more profound knowledge. As a result they work more quickly and delivers higher quality [13].

The use of IT technology is another factor that affects process management in an organisation. IT is usually an incentive to and coordinator of change for BPM projects, as process management should be started from using the capabilities of IT. We can thus say that the relationship between process management and modern technologies is reciprocally beneficial, and a successful IT implementation requires efficient management of processes occurring in an enterprise [14]. It is hard to perceive these two factors separately, as the relationship between them is strong and reciprocally beneficial.

A success factor for implementing and sustaining a business process management culture is the ability to understand change and its effect across all dimensions of the organization (the people, resources, processes and customers [15]. By defining the key factors, an organisation can focus on changing business processes to ensure, among other things, cost reduction and improvement of efficiency and customer satisfaction. It should be however remembered that the final specification of the determinants of BPM

development involves costs for an organisation connected, among other things, with the necessity of ensuring training courses to employees [8].

Nowadays, BPM isn't a new concept and analyzing the literature of the subject it can be seen that the impact of various factors on the scope and quality of BPM in the enterprise is widely discussed. In turn, the level of BPM in an organization depends on factors such as: the nature of leadership in the organization, the level of investment, quality of communication, the level of training in process management [16]. Among the reasons for the implementation of this concept, the researchers suggest: the need for continuous improvement of the management system, quality improvement, introduction of new products, cost reductions, etc. [17]. Also the main results of the process management application are identified, e.g. the improvement of company's competitive position or increase in its productivity and efficiency [18].

2. Research methodology

The aim of the authors' own research was to analyse and assess business processes occurring in small, medium-sized and large enterprises conducting business activity in Silesian Voivodeship (Poland) and to identify benefits of the process approach to managing an enterprise. It was conducted in I and II of 2015 on a group of 138 enterprises classified, according to the size of employment, as small, medium-sized and large enterprises¹. The survey used purposive sampling. A survey questionnaire was addressed both to production companies and services companies. The research sample was not fully representative, therefore the survey should be treated as a pilot study and the problem addressed in it should be further explored in the future by conducting representative studies. The size of the research sample certainly allows the authors to draw initial conclusions and identify regularities that can be verified during the proper studies. The results presented below represent only a fragment of the empirical studies conducted.

In view of the main aim of the paper, the following research hypotheses have been formulated:

- **H₁** – development of a system of process management in an enterprise impacts the economic situation of the company;
- **H₂** – development of a company, through increasing the area of its functioning and expanding its business profile, makes the company more focused on processes occurring during managing the company.

Statistical analysis of survey results allowed the above-formulated hypotheses to be fully or partially verified.

The dominating group among the enterprises surveyed comprised small companies employing from 10 to 49 people, which accounted for 69% of all the companies surveyed.

¹ The survey did not include micro-firms, employing up to 9 people, due to the fact that business processes rarely occurred in such companies and they had little knowledge of the phenomenon under analysis.

The second dominating group comprised medium-sized enterprises employing from 50 to 249 people, which accounted for 20% of all the enterprises surveyed, whereas 11% of those surveyed were large enterprises, employing over 250 people. The largest group of enterprises, representing 65.7%, has operated on the market for over 10 years; 18.6% of enterprises declared functioning on the market for 5 to 10 years, whereas the remaining companies have conducted their business activity for a year to 5 years. Among the enterprises surveyed, almost 55% declared good current financial condition, and over 23.5% assessed their financial condition as very good.

3. Factors influencing an enterprise's orientation to process management – selected results

Managing an organisation is a process that is affected by a number of factors, resulting both from the environment of an organisation and management of an organisation itself. An enterprise's orientation to process management, as shown in the literature on the subject, may contribute to management of an enterprise that is characterised by greater efficiency, including greater flexibility and fast reaction to changes in the environment of an enterprise. Specifying factors determining the use of business process management in an enterprise increases the effectiveness and efficiency of organisational processes occurring in an enterprise. Specification of benefits of this type of management may show directions for the activity of an enterprise.

After analysing of BMP in the enterprises, it could be possible to assess an orientation and supporting for BMP implementation. The survey shows that the average score in the assessment of knowledge on process management in an enterprise is 3.49 on a five-point scale, whereas the average score showing the orientation of an enterprise towards processes occurring during managing a company is 3.25 on a four-point scale. Support for process management was evaluated by entrepreneurs relatively low - the average was 2.66 on a five-point scale. In over half of all the enterprises surveyed, business processes resulting from managing an enterprise are set in both directions, both top-down and bottom-up. The most frequent problem in identification of business processes, according to the enterprises surveyed, was difficulty with defining such processes, both due to too general definition of process management and inappropriate definition of the issues discussed.

The relationships between the variables: number of employees, period of functioning of a company and evaluation of the current financial situation of an enterprise, and answers to the questions from the survey questionnaire provided by respondents on rank (gradable) scales, i.e. planned focus on management connected with defining, implementing and verifying processes within the nearest 3 years, were analysed by calculating tau-Kendall rank correlation coefficients. Test probability $p < 0.05$ was accepted as relevant, whereas test probability $p < 0.01$ was accepted as highly probable.

Own research shows that planning connected with an enterprise's orientation to process management in the near future is statistically highly relevant and positively correlated at a low level with the number of employees ($\tau = 0.1454$) and at a moderate level with the evaluation of the current financial situation of the company ($\tau = 0.2151$). Thus, the bigger

the number of employees in a company, i.e. the bigger the enterprise, the bigger focus on management connected with defining, implementing and verifying processes within the nearest 3 years. Similarly, the better the evaluation of the current financial situation of the company, the bigger the plans connected with process management in an enterprise in the nearest future. Such relationship was not observed for the variable: the period of functioning of the company on the market ($p=0.2723$), so it's hard to predict involvement in process management based on the length of operation or experience of an enterprise (Tab 1).

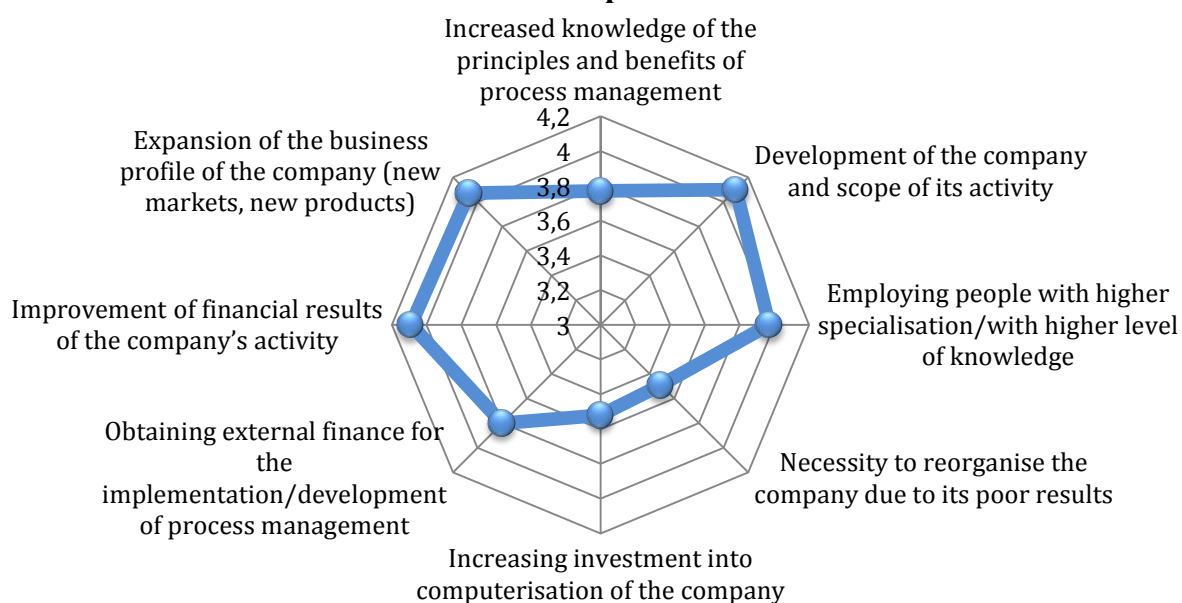
Tab. 1: Relationship between elements of process management in an enterprise and specific characteristics of enterprises

	Number of employees in the company		How long the company has been functioning on the market		Current evaluation of the financial situation of the company	
	tau	p	tau	p	tau	p
Planned focus on management connected with defining, implementing and verifying processes within the nearest 3 years	0.1454	0.0108	0.0626	0.2723	0.2151	0.0002

Source: own work based on a survey

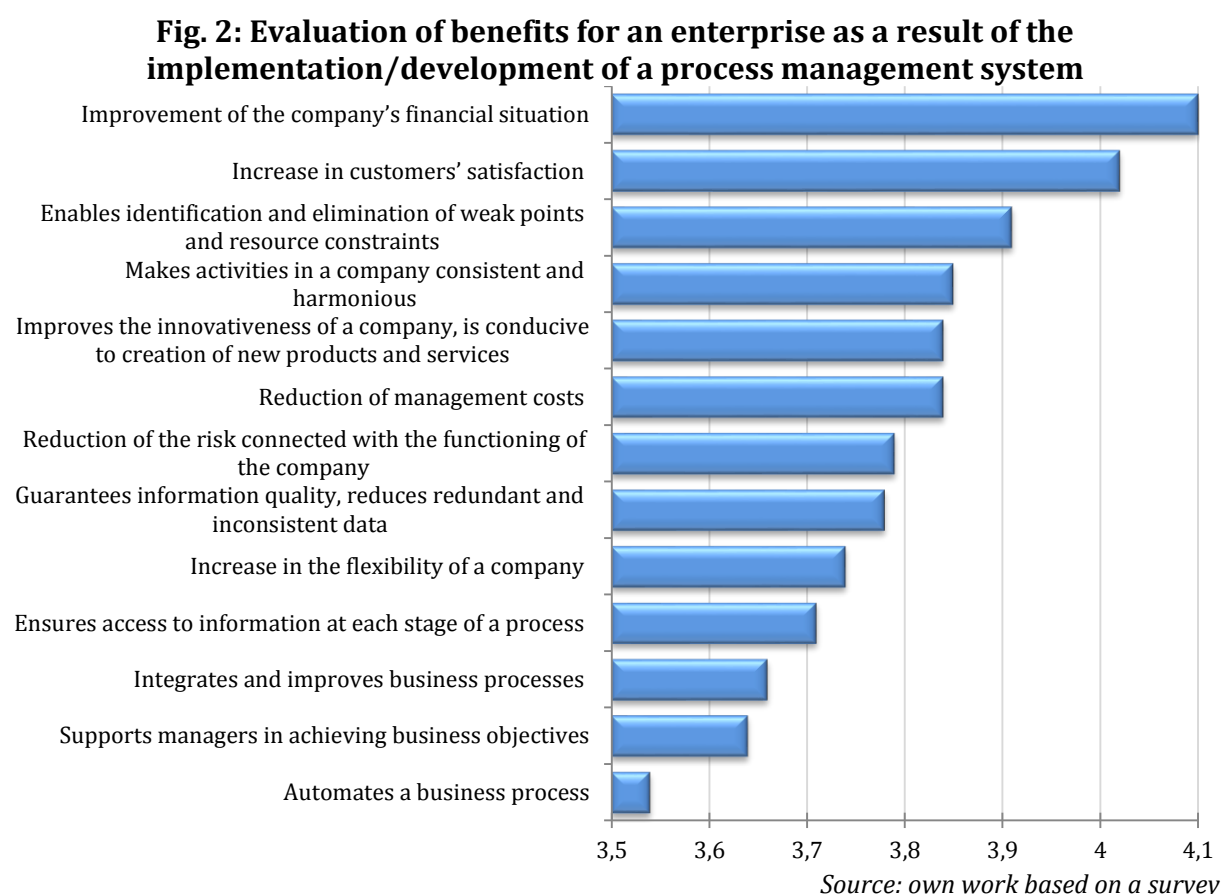
The survey shows that the factors determining large scale use of process management include, first and foremost, the development of the company and scope of its activity, which achieved the score of 4.1 on a five-point scale. Other determinants with high scores: improvement of financial results of the company's activity and expansion of the business profile of the company through entering new markets or an offer of new products, which achieved the scores of 4.09 and 4.07 respectively.

Fig. 1: Determinants of the introduction or large scale use of process management in enterprises



Source: own work based on a survey

This shows that the enterprises surveyed are aware of benefits of using process management on a larger scale, and this is connected with willingness, and at the same time, necessity to employ people with higher level of knowledge, i.e. with higher qualifications. At the same time, the use of process management in the enterprises surveyed on a larger scale than currently is not well evaluated with the increase of costs resulting from increased investment into computerisation of a company (the score is 3.52) and necessity to reorganise the company - the score is 3.49 on a five-point scale (Fig. 1).



The top factors connected with the implementation or further development of a process management system that are beneficial for the functioning of the enterprises surveyed, score of above 4 on a five-point scale, include improvement of the financial condition of the company and increase in customer satisfaction by supporting services for customers. All the other factors received a score of above 3.5, which may indicate large knowledge and full awareness of the existence of and support for business processes in managing an enterprise (Fig. 2).

Examination of the relationships between analysed categories shows that the number of employees in a company is correlated in a statistically relevant way with selected benefit factors for an enterprise (Tab. 2). The survey also revealed that such factors as: increase in the flexibility of a company, decrease in management costs, guarantee of information quality and possibility of identification and elimination of weak points and resource constraints showed a weak positive correlation with the number of employees in enterprises.

Tab. 2: Determinants of the implementation or further development of a process management system in an enterprise

Benefit factors for an enterprise	Number of employees in a company	
	tau	p
Increase in the flexibility of a company	0.1431	0.0121
Decrease in management costs	0.1309	0.0217
Guarantee of information quality, reduction of redundant and inconsistent data	0.1294	0.0233
Enables identification and elimination of weak points and resource constraints	0.1143	0.0452

Source: own work based on a survey

The analysis of the survey results reveals a weak relationship between some of the above-discussed benefits of BPM and the size of an enterprise. This shows that with the increase in the number of employees, i.e. with the increase in the size of an enterprise, there is also an increase in the benefits of the implementation or further development of process management both in the form of increased flexibility of a company, decreased costs of management and guarantee of information quality and elimination of "bad" resources (Tab. 2). This seems to be justified as larger companies pay more attention to the development of business processes occurring in an enterprise, and at the same time they have larger resources, both financial and human ones. Summing up, the survey shows that the size of an enterprise matters during the implementation and development in the area of process management, which is conducive to effective management.

Conclusion

The aim of the survey conducted on a group of small, medium-sized and large enterprises carrying out their business activity in Poland was to analyse and evaluate business processes, and to identify benefits of the process approach to managing an enterprise. The questionnaire survey shows that planning concerning an enterprise's orientation to process management in the near future is statistically highly significant and positively correlated at a low level with the number of employees, and also positively correlated at a moderate level with the evaluation of the current financial situation of a company.

The authors own researches confirmed the importance of some factors of the BPM implementation, development and results, identifying at the same time other factors, rarely discussed in the literature. The main factors determining the use of process management on a larger scale include the development of a company and scope of its activity, improvement of financial results of a company and expansion of the business profile of a company through entering new markets or an offer of new products. This shows that the enterprises surveyed are aware of benefits of using process management on a larger scale, which is connected with willingness and necessity to employ people with higher level of knowledge, i.e. with higher qualifications. The top factors connected with the implementation or further development of a process management system that are beneficial for the functioning of the enterprises surveyed include improvement of the financial condition of a company and increase in customer satisfaction by supporting services for customers, which may indicate large knowledge and full awareness of the existence of and support for business processes in managing an enterprise. Moreover, with the increase in the size of an enterprise there are also more benefits of the

implementation or further development of process management, both in the form of an increase in the flexibility of a company, decrease in management costs and guarantee of information quality and elimination of "bad" resources.

The survey enabled verification of the research hypotheses formulated, namely:

- hypothesis **H₁** has been generally confirmed, as the implementation/development of a process management system in enterprises is closely connected with the improvement of the economic situation of a company (six factors received the score above 3.8 on a 5-point scale), and the bigger an enterprise, the bigger benefits of the development or implementation of a process management system, e.g. in the form of increased flexibility of a company, lower management costs, and thus the economic situation of an enterprise may improve.
- hypothesis **H₂** has been confirmed, as the development of a company and scope of its activity comes first among factors determining the use of process management on a larger scale, followed by expansion of the business profile of a company through entering new markets or an offer of new products.

It's worth considering conducting similar studies on a bigger population to identify regularities and present recommendations to enterprises that identify business processes during managing their company.

References

- [1] BAI CH. and J. SARKIS. A grey-based DEMATEL model for evaluating business process management critical success factors. *International Journal of Production Economics*, 2013, **146**(1): 281–292. ISSN 0925-5273.
- [2] NOGALSKI, B. Modele biznesu jako narzędzia reorientacji strategicznej przedsiębiorstw. *Master of Business Administration*, 2009, **2**(17): 3–14. ISSN 1231-0328.
- [3] SIPA, M. Innovativeness and Competitiveness of Small Enterprises and Market Features. In LECHMAN, E. ed. *Enterprise in Modern Economy. Innovations*. Gdańsk: Gdańsk University of Technology, 2010, vol. I, pp. 5–25. ISBN 978-83-62197-52-1.
- [4] SINGH, P. K. Management of Business Processes Can Help an Organization Achieve Competitive Advantage. *International Management Review*, 2012, **8**(2): 19–26. ISSN 1551-6849.
- [5] SCHMIEDEL, T., J. BROCKE, and J. RECKER. Development and validation of an instrument to measure organizational cultures' support of Business Process Management. *Information & Management*, 2014, **51**(1): 43–56. ISSN 0378-7206.
- [6] NG S. C. H., J. M. RUNGTUSANATHAM, X. ZHAO, and T. S. LEE. Examining process management via the lens of exploitation and exploration: Reconceptualization and scale development. *International Journal of Production Economics*, 2015, **163**: 1–15. ISSN 0925-5273.
- [7] BITITCI, U., F. ACKERMANN, A. ATES, J. D. DAVIES, S. GIBB, and J. MACBRYDE. Managerial processes: an operations management perspective towards dynamic capabilities. *Production Planning & Control*, 2011, **22**(2): 157–173. ISSN 0953-7287.

- [8] TRKMAN, P. The critical success factors of business process management. *International Journal of Information Management*, 2010, **30**(2): 125–134. ISSN 0268-4012.
- [9] MCCORMACK, K. and W. JOHNSON. *Business process orientation: Gaining the E-business competitive advantage*. Delray Beach: St. Lucie Press, 2001. ISBN 1-57444-294-5.
- [10] ARIYACHANDRA, T. R. and M. N. FROLICK. Critical success factors in business performance management-striving for success. *Information Systems Management*, 2008, **25**(2): 113–120. ISSN 1058-0530.
- [11] HUNG, R. Y. Business process management as competitive advantage: A review and empirical study. *Total Quality Management & Business Excellence*, 2006, **17**(1): 21–40. ISSN 1478-3363.
- [12] BROCKE, J. V. and T. SINNL. Culture in business process management: a literature review. *Business Process Management Journal*, 2011, **17**(2): 357–378. ISSN 1463-7154.
- [13] REIJERS, H. A. and L. MANSAR. Best practices in business process redesign: An overview and qualitative evaluation of successful redesign heuristics. *Omega*, 2005, **33**(4): 283–306. ISSN 0305-0483.
- [14] ATTARAN, M. Exploring the relationship between information technology and business process reengineering. *Information & Management*, 2004, **41**(5): 585–596. ISSN 0378-7206.
- [15] VAN RENSBURG, A. A framework for business process management. *Computers & Industrial Engineering*, 1998, **35**(1–2): 217–220. ISSN 0360-8352.
- [16] LU, X.-H., L.-H. HUANG, and M. S. H. HENG. Critical success factors of inter-organizational information systems, A case study of Cisco and Xiao Tong in China. *Information & Management*, 2006, **43**(3): 395–408. ISSN 0378-7206.
- [17] SENKUS, P. *Zarządzanie i dowodzenie z wykorzystaniem orientacji procesowej. Sektor prywatny, sektor publiczny, sektor non-profit*. Warsaw: Difin, 2013. pp. 257–258. ISBN 978-83-7930-048-8.
- [18] BITKOWSKA, A. *Zarządzanie procesowe we współczesnych organizacjach*. Warsaw: Difin, 2013. pp. 129–135. ISBN 978-83-7641-913-8.

Kateřina Maršíková, Václav Urbánek

Technical University of Liberec, Faculty of Economics,
Department of Business Administration and Management
Studentská 2, 461 17 Liberec 1, Czech Republic

email: katerina.marsikova@tul.cz, vaclav.urbanek@tul.cz

Firms and Overeducation: Influence on Employee Satisfaction and Firm Productivity

Abstract

The aim of the paper is to evaluate effects of overeducation and undereducation from the employee's and firm's perspective. In case of workers, authors use data of the PIAAC (Programme for International Assessment of Adult, first round, 2008 - 2013) to show effects of overeducation, with focus on the Czech Republic. Methodological approach of the paper is based on regression using a classic ORU model including variables of education, earnings, age, gender, economic sector of the company and job satisfaction. In the case of workers we analyse their earnings and returns to their education, with aim to find economic losses caused by overeducation and undereducation for employees. Results of our research show that returns to years of overeducation are lower than returns to required education; it means that overeducated workers get higher wages than their co-workers but lower wages than workers with the same education working in jobs requiring this level of education. Similarly, workers with lower than required education (undereducated) have lower wages than their colleagues with required education but receive more than workers with the same level of education who work in jobs that require that level of education. Moreover, satisfaction of employees with their job is negatively influenced by their overeducation and we can conclude that overeducated workers have negative impact on firm productivity. Therefore on the firm level we include a factor of satisfaction into the ORU model to analyse its indirect impact on productivity of a firm. In the paper there is indicated satisfaction of overeducated workers from PIAAC data in the Czech Republic and thus showed some effects on the productivity of the firm.

Key Words

mismatch, overeducation, wage penalty, job satisfaction, firm, productivity

JEL Classification: I21, J62, J24

Introduction

There is a need of society to support a sustainable and innovative level of economic development by ensuring not only that the necessary skills and competences are available in the population, but also that these are fully used in an occupation to increase productivity of a firm. This necessity arises apart from other reasons from an international scheme which was introduced in i.e. the 'European strategic framework on education and training'. It aims to raise the share of people aged between 30 and 34 with tertiary education up to 40 percent on average in the European Union by 2020 as a factor used to increase productivity of firms. Nevertheless this step can have some limitations in case some of these employees end up in jobs for which they are overeducated for various reasons (see e.g. [3], [10]).

Kampelmann [10] emphasizes that educational mismatch (or simply over- and undereducation) refers to the difference between the worker's attained level of education and the education required in the job. An increasing amount of people getting a university degree but not matching to an appropriate job causes a significant level of job mismatch in many European countries. There is an abundant literature on overeducation in the last decades, both in theoretical and in empirical fields (see for example meta-analysis of 25 studies on overeducation in an article by [3], [6], [7], [8] and others). Belfield [2] demonstrates the consensus of worker-level relationships between overeducation and penalties to earnings and job satisfaction. Firms run the risk of lower profits as a result of poor deployment of workers [13]. These lower profits may primarily arise because of lower worker effort (higher absenteeism, higher fluctuation, less job satisfaction of workers) [2], [6], [7].

1. Aspects of Job Mismatch

It is necessary to understand, that the relationship between education, wages and productivity is likely to be much more complex than that put forward by standard human capital theory and its explanation of its effects on earnings and productivity. Reviews or relevant scientific literature concludes that all studies find overeducated workers earning less than comparably educated workers who have the appropriate qualification, with the estimated wage penalty averaging 15 per cent, other authors also alert that "human capital" approach as well as "job satisfaction" approach suffer from important methodological limitations [3], [10].

Tab. 1: Penalties and Merits of Overeducation in Business Environment

Penalties of Overeducation for Firms	Merits of Overeducation for Firms
Lower worker effort (i.e. absenteeism, lower efficiency)	Adjustment of pay to reflect any lower effort of overeducated employees
Need of additional training for such employees	Possible positive effect on productivity (different scientific explanations)
Higher fluctuation (higher hiring costs)	Value-added in upgrading the skills of the undereducated
Imposition of negative externalities on co-workers (i.e. undermining workplace morale or influencing workplace norms about effort)	
Absenteeism	
Penalties of Overeducation for Employees	Merits of Overeducation for Employees
Lower job satisfaction	'Surplus' educational credentials may still receive some wage premium comparing to those with adequate education on this occupation
Lower earnings (and also lower rate of return from investment to education)	
Penalties of Overeducation for Society	Merits of Overeducation for Society
Waste in tax revenues	Positive externalities generated by people with higher degree
Inefficient spending on public higher education	

Source: [2], [5], [6], [10] - own elaboration

In matching theories of job search, for example, overeducation is an indication of a poor job match, and overeducated workers will seek, and achieve, better matches over time through repeated job search activity [4]. Also results of analysis confirm that the

overskilled are much more job mobile than other workers who are in jobs that provide a better skills match. Overeducation can be harmful for individuals, enterprises and societies [3], [5]. Negative but also some relatively positive influences of job mismatch on a firm, an employee and a society illustrates Table 1.

Table 1 shows that a phenomenon of overeducation brings negative effects to all mentioned subjects. On the other hand other authors of overeducation surveys identify also merits of employment of overeducated people (see data from [2], [5] and others) in the Table 1 above.

Even though the process of hiring overeducated employees can entail a waste of potential and talent, it has been argued that their recruitment can be a deliberate hedging strategy to ensure a continuous and uninterrupted supply of high skills to a firm. Companies may also seek to exploit certain unobserved positive attributes that the overeducated are likely to possess [5].

1.1 Overeducation and Job Satisfaction

Certainly, for individual workers the evidence of overeducation reducing job satisfaction is very strong; correspondingly, the evidence of low job satisfaction reducing worker effort is strong (see the mass of evidence in [11]). But there are other reasons why overeducation may impair profits. If workers' skills do not match their jobs, they may need training which companies may have to subsidize. Also, overeducated workers may be more likely to quit: frequent hiring adds to firms' personnel recruitment costs. If pay is set according to a formula, such as a worker's credentials, then an overeducated worker may be overpaid relative to some of their job requirements. Finally, overeducated workers may impose negative externalities on co-workers, either undermining workplace morale or influencing workplace norms about effort. Potentially, overeducation may be associated with lower profits because it reflects poor labour management decisions by the firm's managers [2], [5].

The counter-argument is that a firm could hire overeducated workers and adjust their pay to reflect any lower effort. Moreover if firms have only a few workers who are overeducated they may not notice any adverse effects in terms of profit, norms of worker/workplace effort, or absenteeism. In some cases like this firms might not care if their workers are overeducated.

Nevertheless, it is claimed to a fact that firms would prefer lower rates of overeducation. A workplace test would focus on the availability of training: where training options are more likely, overeducated workers can acquire firm-specific skills that complement their formal education and so progress toward higher paid positions [2].

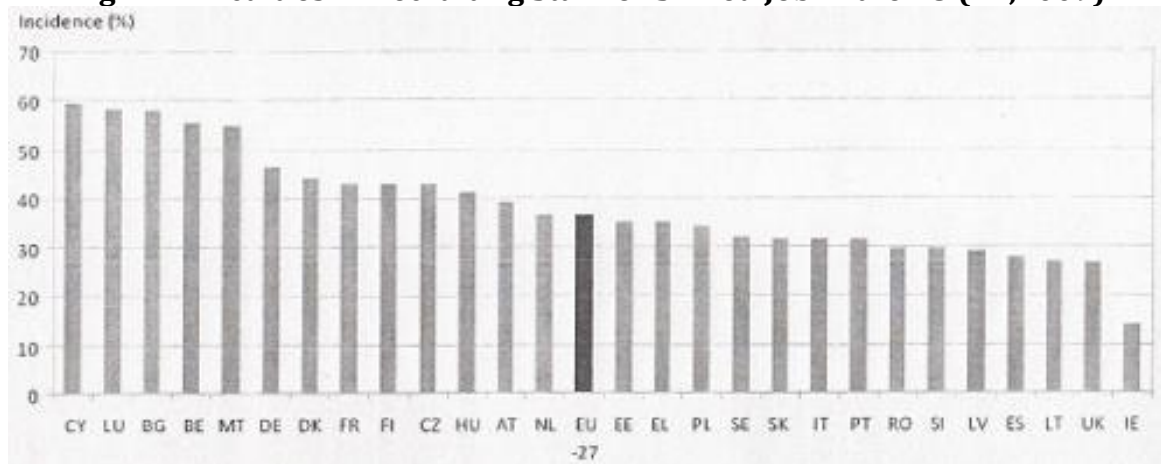
On the other hand, data from [11] indicate that even though the process of hiring overeducated employees can entail a waste of potential and talent, it has been argued that their recruitment can be a deliberate hedging strategy to ensure a continuous and uninterrupted supply of high skills to a firm [5].

2. Influence of Overeducation on Firm Productivity

Findings [10] confirmed that higher level of required education exerts a significantly positive influence on firm productivity. Moreover additional years of overeducation (both among young and older workers) are beneficial for firm productivity, and additional years of undereducation (among young workers) are harmful for firm productivity.

As data from [11] in Figure 1 show many firms in the EU-27 experienced recruitment difficulties. A sizeable 36% of enterprises in Europe declare that they experience problems in finding staff for skilled jobs, while a smaller percentage (10%) has difficulty in attracting people for unskilled or low-skilled positions [5].

Fig. 1: Difficulties in Recruiting Staff for Skilled Job in the EU (27;2009)



Source: [5]

Several factors can account for inadequate match between job-seekers and employers [14]. Firstly there can exist a lack of complementarity between the attributes of the two parties (particular skills for certain production technologies). Secondly high skill levels and digital literacy are necessary components for efficient execution of tasks related to information and communication technologies (ICT). Thirdly lack of proficiency in digital and computing skills in the workforce can, therefore, impair successful job match in high-technology companies. The fitness of the skills possessed by individuals in a modern knowledge-based economy hinges critically on the ability of vocational and higher education systems to be flexible and responsive to the technological needs of employers [2].

3. The methodology and data description

Data used for the data analysis in this paper originate from an international survey PIAAC. This survey was carried out by an Organisation for Economic Co-operation and Development (OECD) as a new international comparative survey of adults within a Programme for the International Assessment of Adult Competencies (PIAAC). First data from this survey were published at the end of year 2013.

For analysing of influence of overeducation, adequate education and undereducation on individuals (workers) and firms, the authors used a subjective (self-assessment) method described below. Data implemented in our model arise from questions of PIAAC questionnaire, aiming namely at:

- Adequate education (or over and undereducation): D_Q12a Still talking about your current job: If applying today, what would be the usual qualifications, if any, that someone would need to GET this type of job?
- Job satisfaction: D_Q12a Thinking about whether this qualification is necessary for doing your job satisfactorily, which of the following statements would be most true? And D_Q14 All things considered, how satisfied are you with your current job?
- Earnings: D_Q16b What is your usual gross pay?

From the PIAAC data our analysis further focuses and uses information about gender, type of a working position and a field of study. In the Czech Republic data from 6102 respondents were received in total. The sample used for our analysis contained 3274 respondents – employees and self-employed workers; respondents without any economic activity (students, pensioners etc.) were omitted. Descriptive statistic of the sample shows Table 2.

Tab. 2: Descriptive Statistics of the Sample

Gender		AGE	Years of education	Monthly Salary CZK
Male	N	1712	1708	1120
	% of Total N	52.3%	52.3%	50.5%
	Mean	39.46	13.6710	24983.-
Female	N	1562	1559	1097
	% of Total N	47.7%	47.7%	49.5%
	Mean	41.00	13.8037	18501.-

Source: [12], own calculation

3.1 Methods of Measurement of Overeducation

To measure an educational and skill mismatch scientists and specialist use different methods of measurement. First approach labels workers matched or mismatched according to their self-evaluation of their skills and skills needed for such a job to perform it. Secondly workers specific skills are compared with the frequency in which these skills are performed at work [1],

In the literature (see i.e. [1], [3], [7], [8] etc.) are classified three approaches to identify overeducation. The most common but a subjective approach is when one's education is compared to his/her self-assessed qualification required to perform one's job. However this is the most popular method used in the empirical research providing interesting internationally comparable data (including ESS and PIAAC data). Authors [1] call this method as a subjective (self-assessment) direct or indirect method.

Second possible way to find out mismatch is an “expert” definition of an educational requirement for a given occupation. Third, the distribution of education is calculated for

each occupation; employees who depart from the mean or median by more than some ad hoc value (generally one standard deviation) are classified as overeducated [9].

3.2 Returns to Education, Overeducation and Undereducation

The effects of overeducation and of undereducation on earnings (i.e. on returns to adequate schooling, over- and under-schooling) were estimated using a modified Mincer's earnings equation based on [9]. This equation is also referred to as the Duncan and Hoffman or the ORU model (ORU stands for Overqualification – Required qualification – Underqualification) [7].

$$\ln w_i = X_i \beta + \alpha_1 ADSCH_i + \alpha_2 OVERSCH_i + \alpha_3 UNDERSCH_i + \alpha_4 AGE + \alpha_5 GEN + \alpha_6 EXP + \alpha_7 EXP^2 + u_i \quad (1)$$

where: $\ln w_i$ is the natural logarithm of gross earnings, α_j are regression coefficients, $ADSCH_i$ is the number of years of adequate schooling, $OVERSCH_i$ and $UNDERSCH_i$ are numbers of years of over-schooling and under-schooling ($OVERSCH = SCHOOL - ADSCH$, where $SCHOOL$ is the number of years of actual education; similarly $UNDERSCH = ADSCH - SCHOOL$), EXP are years of experience, GEN is a dummy variable for the gender of the respondent, X_i is a set of other variables assumed to affect earnings (in the case of PIAAC, data is job satisfaction and economic sector) and u_i is a disturbance term (index i is for individual i).

4. Results and Discussion

Our sample was firstly analysed for overschooling and underschooling. As mentioned above, respondents answered question about required education for their job and results of these answers are in the following Table 2.

Tab. 3: Structure of Respondents with Adequate, Over and Under Education

	All	Male	Female
Undereducated	28.70	21.20	36.20
Adequately educated	30.58	32.56	28.60
Overeducated	40.72	46.24	35.20

Source: [12], own calculation

The sample from PIAAC data for the Czech Republic respondents was analysed using Ordinary Least Squares regression. Results are in the following tables 4, 5 and 6. Results of the regression in the Table 6 show that returns to required education for workers on adequate positions are standard and they are similar to returns reported in literature ([3], [10]) Similarly, lower returns for workers with overeducation (2.4%) and penalty for workers with undereducation (-3.8%) are not too different from reported results (for overview, see ([7], [11])). For our analysis of influence on a company, it can be seen that job satisfaction has not very strong negative coefficient for wages of workers (-1.9%) and this result is statistically significant; similarly, influence of economic sector (Private versus Public) is not strong and is also statistically significant.

Tab. 4: Descriptive Statistics of the Data Used for Regression

	Mean	Std. Deviation	N
lnWage	9.8495	.45729	3274
AGE	40.19	12.002	3274
Gender	1.48	.500	3274
Required years of education	13.1569	2.56885	3274
OVERSCH	2.9068	.95544	3274
UNDERSCH	2.2301	.43265	3274
Work Experience	19.0003	12.68923	3274
Work Experience Squared	524.0709	711.58975	3274
Job Satisfaction	2.2019	.92353	3274
Economic Sector	.2293	.41318	3274

Source: [12], own calculation

Tab. 5: Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.453 ^a	.205	.203	.40824

Source: [12], own calculation

Tab. 6: Regression Coefficients

Model		Unstandardized Coefficients		t	Sig.
		B	Std. Error		
1	(Constant)	9.318	.072	130.032	.000
	AGE	-.005	.002	-2.957	.003
	Gender	-.196	.015	-13.161	.000
	Required years of education	.072	.003	23.393	.000
	OVERSCH	.024	.008	3.111	.002
	UNDERSCH	-.038	.017	-2.268	.023
	Work Experience	.010	.003	3.945	.000
	Work Experience Squared	.000	.000	-4.257	.000
	Job Satisfaction	-.019	.008	-2.458	.014
	Economic Sector	-.045	.018	-2.454	.014

Source: [12], own calculation

Conclusions

Overqualification is a very important issue in all developed countries and it is a great challenge to the relevance of more investment in the education. If many workers have more than required education or qualifications then continuing the expansion of secondary and higher education is inefficient. In the methodological part, various possibilities how to measure overeducation and undereducation were discussed. The research carried out in this paper firstly addressed questions connected with education and earnings, or with returns on investment to education, based on human capital theory. The equation known as ORU specification of Mincer's original equation was used for the research presented in this paper. Final parts of the paper firstly analysed incidence of overqualification and underqualification in the Czech Republic. Several studies show that overeducation is not as serious as presented and its incidence is overestimated when the heterogeneity of workers is not taken into account. Similarly, negative effect of overeducation on earnings is not so big when endogeneity of overeducation is controlled. Overeducation can also be temporary situation when worker is beginning the career on labour market. However, statistical analysis carried out on the cross-section data from

PIAAC found that incidence of overschooling is high - around 40 % for the Czech Republic. Secondly, regression analysis of the data from PIAAC was carried out to find wage effects of overschooling and underschooling. As to the effects on returns to education, the results show that the rate of return to overschooling is positive and lower than the rate to adequate (required) schooling, while the rate to underschooling is negative. The authors are fully aware that the results are limited by many factors, e.g. omitted variables, model specifications etc. However, it can be concluded that education and job mismatch is not a minor problem and should be taken into account. All these questions deserve further research because efficient educational policy will be one of the main factors supporting economic growth in the future.

References

- [1] RAŠOVEC, T. and T. VAVŘINOVÁ. Skills and Educational Mismatch in the Czech Republic: Comparison of Different Approaches Applied on PIAAC Data. *Statistika: Statistics and Economy Journal*, 2014, **94**(3): 58–79. ISSN 1804-8765.
- [2] BELFIELD, C. Over-education: What influence does the workplace have? *Economics of Education Review*, 2010, **29**:236–245. ISSN 0272-7757.
- [3] MCGUINNESS and S. M. WOODEN. Overskilling, Job Insecurity and Career Mobility. *IZA Discussion Paper*, 2007, no. 2938.
- [4] JOVANOVIĆ and BOYAN. Job Matching and the Theory of Turnover. *Journal of Political Economy*, 1970, **87**(5): 972–990. ISSN 0022-3808.
- [5] LETTMAYR, C. F. ed. *Skill mismatch: The role of the enterprise*. Thessaloniki, Greece: European Centre for the Development of Vocational Training, 2012. ISBN 978-92-896-0918-0.
- [6] GROOT, W. and H. VAN DEN BRINK. Overeducation in the labour market: a meta-analysis. *Economics of Education Review*, 2000, **19**(2): 149–158. ISSN 0272-7757.
- [7] URBÁNEK, V. Overeducation and Earnings – Labour Market Mismatch. *ACC Journal*, 2012, **18**(C3): 209–217. ISSN 1803-9782.
- [8] HARTOG, J. Over-education and earnings: where are we, where should we go? *Economics of Education Review*, 2000, **19**(2): 131–147. ISSN 0272-7757.
- [9] CHEVALIER, A. and J. LINDLEY. Overeducation and the skills of UK graduates. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, 2009, **172**(2): 307–337. ISSN 1467-985X.
- [10] KAMPELMANN, S., F. RYCX. The Impact of Educational Mismatch on Firm Productivity: Evidence from Linked Panel Data. *IZA Discussion Paper*, 2012, no. 7093.
- [11] RUBB, S. Overeducation in the labour market: a comment and re-analysis of a meta-analysis. *Economics of Education Review*, 2003, **22**(6): 621–629. ISSN 0272-7757.
- [12] PIAAC. *Datasets and Tools* [online]. [cit. 2015-03-21]. Available at: <http://piaacgateway.com/datasets>
- [13] TSANG, M. C. and M. H. LEVIN. The economics of over- education. *Economics of Education Review*, 1985, **4**(2): 93–104. ISSN 0272-7757.
- [14] OYER, P. and S. SCHAEFER. Personnel economics: hiring and incentives. *Handbook of labor economics*, 2011, **4**(2): 1769-1823. ISSN 1573-4463.
- [15] COHN, E. and N. G. YING CHU. Incidence and wage effects of overschooling and underschooling in Hong Kong. *Economics of Education Review*, 2000, **19**(2): 159–168. ISSN 0272-7757.

Oleg Melnikov, Andrey Zaytsev

Bauman Moscow State Technical University,
Department of Engineering Business and Management
2nd Baumanskaya 5, 105 005 Moscow, Russian Federation
email: melnikov@creativeconomy.ru, zayand12@yandex.ru

Strategic Management of Innovative Activities of a Company According to the Market Capacity for Innovation

Abstract

In the current economic conditions innovative activities have become the core element of competitiveness for high-technology companies. However, in order to utilize fully their innovative potentials it is necessary to balance such activities with the market capacity for innovation. Thus, the aim of the paper is to develop a model for dynamic evaluation of innovative activities of a company according to the market capacity for innovation. The authors postulate that the expediency of a product launch is determined by a ratio of two parameters: the level of novelty ΔN ($N_{new} - N_{obsolete}$) and the time-to-market of the innovative product Δt (more precisely, from development of the product to its mass production and sustainable sales). At the same time, the ratio $\Delta N/\Delta t$ is an integral parameter that characterizes the creative ability level of both the producer and the consumer.

This model has enabled to develop recommendation on evaluating strategic actions of the company, depending on preparedness of its specialists to exhibit the required innovative activities, corresponding with the market capacity for innovation that had been identified by the marketing subsystem. The research demonstrates that innovative activities of every company is one of the strategic aspects of a company's development and has a cyclic nature, depending on both the growth of the market capacity for innovation and the organizational-technological level of the company itself. The authors have defined that the suggested model for evaluating the innovative activities of the company ensures maintaining and enhancing its competitiveness on the basis of the continuous comparison of the market capacity for innovation with the existing and strategic capabilities of the company.

Key Words

competitiveness, creativity, innovative activities, market capacity for innovation, product innovations, strategic management

JEL Classification: D21, D83, M31, O31, O32

Introduction

One of the features of the modern economy is the multidirectional competition of economic entities. The globalization processes have contributed to uniting national markets into a single economic space with relatively low entry barriers. Along with granting producers the access to foreign markets, thus expanding their opportunities to generate the additional profit via the international expansion, the globalization has also exacerbated competition. Increasing numbers of companies that supply customers with similar products has marked for most industries the transition from a "seller's market"

(customer follows the producers' supply) to a "buyer's market" (producers adapt and respond to customer requirements). As a result, the markets have become oversaturated, and companies have resorted to increasing marketing and commercial spending as part of the competitive struggle. Therefore, it is the focus on the marketing and price factors that turns out to be the key differentiator on the oversaturated buyer's market. This approach to generating the additional profit via increasing the revenue can be regarded as the extensive approach, because it contemplates the production capacity extension.

The multidirectedness of competition reveals itself not only in rivalry between companies for customers, but also in the struggle for limited resources: financial, human, intellectual, material, etc. Resorting to the extensive course of development means that companies would magnify resource consumption. The emergence of the global resource market has made resources more accessible; however, taking into consideration their scantiness, the resource consumption growth has led to the rise in their prices and, consequently, caused the rivalry for them in the long run. Limited resources, severe competition, and the geopolitical instability over the last decade have undermined the world economic system, forcing all companies to divert more attention to maintaining and enhancing their competitiveness.

Purposeful innovative activities are aimed at maintaining the competitiveness and developing the market stability of a company. However, in order to conduct the transition from a proclamation of such aim to its execution science-intensive companies require such level of innovative activities of the personnel that would correlate with the market capacity for innovation.

Therefore, to solve this task the authors of the paper propose and examine a dynamic model, describing development of innovative activities of the company in accordance with changes in the market capacity for innovation. The model defines improvement in competitiveness of the company, depending on its response to changes in the market conditions.

1. Defining innovative activities in terms of the creative energy of a company

The current macroeconomic changes have a particular significance for high-technology companies, because they create competitive advantages mainly via innovative activities. The activities manifest themselves in the form of developing and implementing novelties that generate a substantial impact on economic and social levels and present qualitatively new opportunities for the market. I.e., it is possible to define a novelty as a type of a strategic managerial decision that can considerably or even radically affect a particular process – economic, technical, political, social, etc. The results of innovative activities become elements of the intellectual capital of a company, which is included, in turn, into the integral value of the company [10].

For example, according to the annual analytical review by information technology research and firm Gartner Inc., the 4 leading companies in the field of Endpoint Protection Platforms are Symantec Corporation (the USA), McAfee/Intel Security Group

(the USA), Trend Micro Inc. (the USA), and Kaspersky Lab (the Russian Federation), evaluated according to their “Completeness of Vision” and “Ability to Execute” (vide Fig. 1) [7].

Fig. 1: The Gartner Magic Quadrant 2014 of companies in the field of Endpoint Protection Platform



Source: [7]

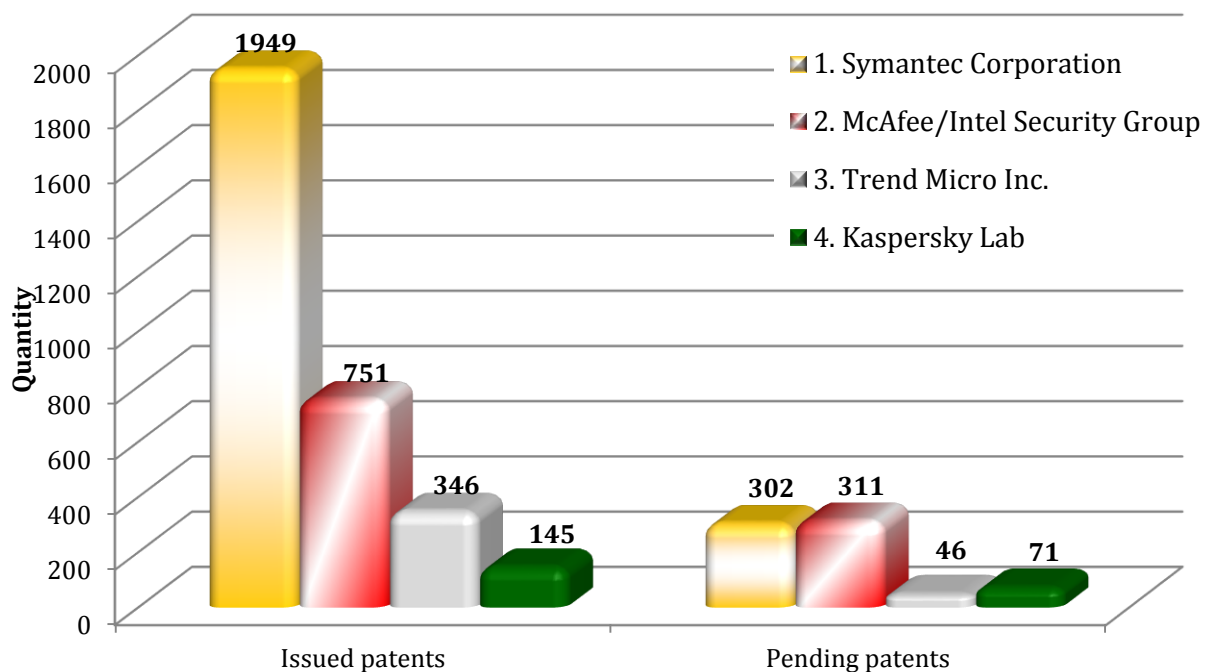
Our performance analysis of these companies has demonstrated that their competitiveness and leading positions on the market can be attributed to continuous creation of significant numbers of innovations, which take the form of patented technologies. Figure 2 demonstrates the quantity of issued and pending patents for leading companies in the sphere of Endpoint Protection Platforms by the United States Patent and Trademark Office up to the 11th of April 2015 [11, 12].

However, in the current conditions companies are forced to cut their innovative development programs, because these activities are characterized by high capital intensity, a significant innovation cycle duration (especially research and development phases), and an undetermined outcome. In this connexion, the priority tasks for high-technology companies include evaluating results of innovative activities and verifying the efficiency of strategic management of responses to the market capacity for innovation.

Creating innovations is a sophisticated creative process that demands from the company a great amount of time and intellectual work. Thus, an innovation can be defined as a product or technology with better or unique attributes, as compared to those existing on the market. We propose comparing the fusion of its new qualities and attributes N_{new} and selection of a basic variant N_{old} to be used as the first evaluation indicator – the

measure of novelty added ΔN ($N_{new} - N_{old}$). The constituent elements of the criterion depend largely on the industry and product. For instance, a viable approach to calculating the novelty is by identifying the core functions/attributes of the product and comparing the core attributes of the new product (product innovation) with either a benchmark (competitor's) product or with market requirements. The second indicator for evaluating innovative activities of a company is the time-to-market of the innovation (from development of the innovation to obtaining the first economic effect) – Δt . At the same time, ratio $\Delta N/\Delta t$ is an integral parameter of the creativity level of the producer and of the creativity level that the consumer should possess in order to acknowledge the innovation and, as a result, to deem the innovation a success [12, 13]. The ratio reflects the economic essence of creative activities (energy) of all market participants.

Fig. 2: Issued and pending patents for leading companies in the sphere of Endpoint Protection Platforms by the United States Patent and Trademark Office



Note: as of the 11th April 2015

Source: authors' plotting on the basis of [11, 12]

For example, when a third party renders consulting services or conducts research and development, the following aspects are always taken into account:

1. The list of services that a contractor renders, quantified in particular denominations, reflecting the entrusted assignments. In other words, the list states expected novelty added ΔN as a result of creative and intellectual energy, expended by the contractor.
2. Time Δt given for the contractor to render the services, i.e., duration of the interval in which the contractor must mobilize intellectual and creative abilities to generate expected novelty added ΔN .
3. The contractor's remuneration for generating the novelty added.

Thereby the actual value of the creative energy which specialists of the contractor must generate during the given time period is evaluated. As a rule, an integral parameter is

used. Then the contractor decomposes the parameter for each particular specialist, involved into the innovative project.

Indicator ΔN depends to a large extent on the current scientific and cultural level of the society, industry, and company. These aspects determine which products a consumer is prepared to purchase. In the first place, $\Delta N/\Delta t$ describes the receptiveness degree of a person to the offered novelty or, in other words, his or her creativity level. Ratio $\Delta N_{company}/\Delta t_{company}$ defines the creative activity level of a particular company and depends, first of all, on its organizational and technological capabilities. It is compared to the market capacity for innovation $\Delta N_{market}/\Delta t_{market}$, identified by the marketing subsystem of the company. In reality it is the market capacity for innovation that approves the required level of the novelty added by the company, which considerably depends on the level of creative activity (creative energy) of each specialist, engaged in the business project.

2. The model of dynamic evaluation of innovative activities of a company

On the basis of the proposed model of dynamic evaluation of innovative activities of a company we can demonstrate, firstly, how innovative activities of a high-technology company should be adjusted strategically for the market capacity for innovation. Secondly, how it can evaluate the innovative activities level, having received information on changes in the market capacity for innovation.

In order to secure a competitive edge for its products as one of the constituents, forming and maintaining the competitiveness of the company in toto, innovative activities of specialists must always correlate with the dynamics of changes in the market capacity for innovation (vide Fig. 3).

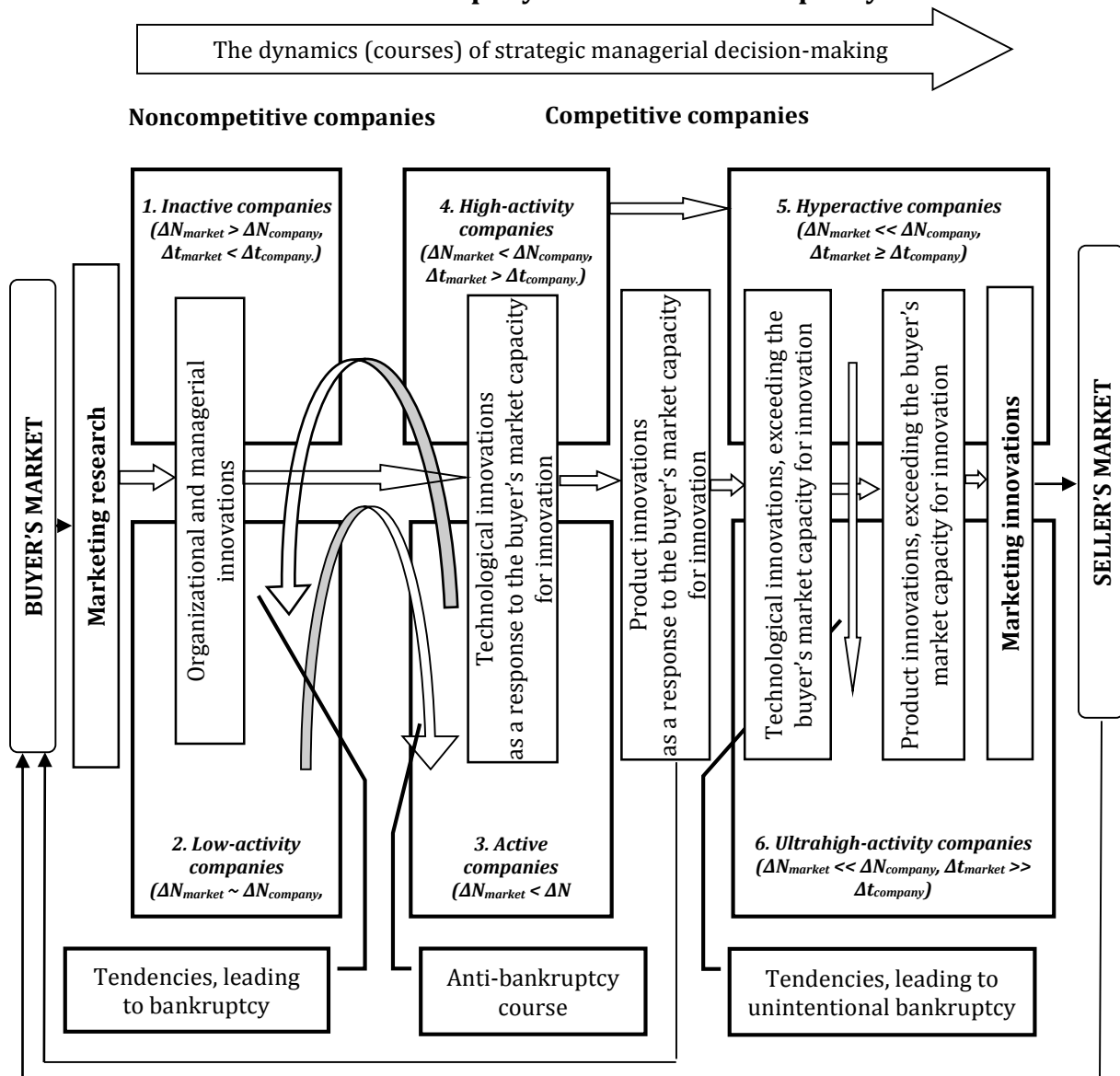
Traditional marketing research aims to identify the existing customer requirements and forecast the course of their development in the short term. As a rule, such research is conducted in the conditions of an established buyer's market. Having obtained the results of the marketing research, the company can evaluate its innovative potential according to the sequence, presented in the model in Fig. 3. Let us investigate in more detail a possible status range of the company in terms of its innovative activities.

1. **Inactive innovative status** of a company is characterized by the undeveloped potential of its intellectual and creative resources, i.e. it fails to:

- firstly, satisfy the market capacity for innovation ($\Delta N_{market} > \Delta N_{company}$);
- secondly, deliver within the competitive time period ($\Delta t_{market} > \Delta t_{company}$).

Such situation is typical for companies that have a creatively weakened team of specialists. As a rule, it is the stage of the economic stagnation, when creative processes are superseded by the routine ones. They are somewhat close to such company behavior as stabilization [12].

Fig. 3: The dynamic model of development and evaluation of the conformity of innovative activities of a company to the market capacity for innovation



Source: own

In order to enhance innovative activities of the company it is necessary to implement organizational and managerial innovations and the following measures should be considered:

- restructuring the innovative project management system;
 - boosting innovative activities of its specialists not only via the conversion training and obtaining the required skills and abilities, but also via improvement of the application of their creative abilities;
 - employ intellectual and creative resources of third-party companies (e.g., using outsourcing).
2. **Low-activity innovative status** manifests itself in the conditions when company's specialists are capable of satisfying the market demand for products with satisfactory innovative attributes ($\Delta N_{\text{market}} = \Delta N_{\text{company}}$, $\Delta t_{\text{market}} = \Delta t_{\text{company}}$). However, this position

is not sufficiently stable, because the market capacity for innovation is constantly growing. The essence of this situation is very similar to the inclination of the company towards implementing modifications.

The modification policy is realized in the conditions of the limited production capacity and lack of capabilities for their extension. Such company possesses minor capabilities for realizing product innovations, however, the innovative activities of the employees is insufficient for realization of innovative projects that can provide the company an edge over the rivals.

Even minor additional market demands can be fatal for inactive and low-activity companies, forcing them into bankruptcy. Thus, it is vital that they immediately implement organizational and managerial innovations that would restore (or create from scratch) conditions for developing and implementing technological innovations. Enterprises of the Soviet Union can serve as an example of the inactive innovative status. As many lacked experience of functioning in the market economy, they were not able to develop competitive products. Products they manufactured within the public contract demonstrated a low innovative level; thus, customers purchased them only because it was Hobson's choice. As soon as superior alternatives with a higher innovation level emerged, obsolete products became unneeded. Often, these enterprises possessed technological capabilities and employee potential, but collapsed due to the fact that they lacked marketing subsystems and, consequently, information of the market requirements.

The transition to new market conditions required implementing organizational and managerial innovations; those companies that managed to undergo such transformations avoided bankruptcy and continued their operations.

3. **Active innovative status** is characterized by the fact that companies can realize innovative projects that would be slightly ahead of the market capacity for innovation ($\Delta N_{company} > \Delta N_{market}$) within the competitive time period ($\Delta t_{market} \sim \Delta t_{company}$). It means that the company can develop pioneering technological (product and process) innovations and non-technological (marketing, organizational, managerial) innovations, required by the market [10].
4. **High-activity innovative status** is reached in the case if the company can exceed the market demands both in terms of innovative attributes of the product ($\Delta N_{company} > \Delta N_{market}$) and time-to-market ($\Delta t_{market} > \Delta t_{company}$). It is typical for companies pursuing diversification.

Such innovative status results in the growth of the scientific and/or production potential of the company on the basis of intensifying its innovative activities, creating qualitatively new products and entering new markets for their realization. It is possible provided the company puts a particular emphasis on innovative development of its organizational, managerial, and, above all, technological activities. Active and high-activity companies navigate confidently the buyer's market and position themselves as competitive, innovation-driven players.

Most successful companies maintain an active or a high-activity status. For example, major automotive groups, such as Volkswagen, Toyota, etc., continually improve their product range, launching different variations of popular models. In order to secure competitiveness new models are launched in synchronization with the market expectations (alternation of generations – the so-called “facelifting” – takes place every 3-5 years) and the latest technological advances are accounted for during their creation. Models that do not undergo upgrading become swiftly obsolete and the demand for them rapidly declines.

LED dipped and full beam headlights can serve as an example of a product innovation that has appeared in the automotive industry, owing to implementations of technological innovations. Originally, Lexus specialists installed LED headlights on the LS 600h flagship sedan to make it stand out against competitors. However, customers approached the novelty with caution, as there was some distrust towards the new technology (i.e., $\Delta N_{company} > \Delta N_{market}$). Later, installing such headlights on flagship cars has become a standard.

5. **Hyperactive innovative status** appears in the case, when a company introduces an innovation significantly exceeding the market capacity for innovation ($\Delta N_{company} \gg \Delta N_{market}$) and which customers can acknowledge on the limit of their creative abilities ($\Delta t_{market} \geq \Delta t_{company}$). For example, a product with highly advanced features enters the market (e.g., mobile phones, computers and other devices that are now common household appliances). Then the market would demonstrate a delayed reaction, yet confidently accept rather strong innovative offers.
6. **Ultrahigh innovative status** is characterized by the fact that specialists not only supply innovative solutions, significantly exceeding the market capacity (receptiveness capabilities) for innovation ($\Delta N_{company} \gg \Delta N_{market}$), but also considerably surpass in time the consumer readiness to acknowledge them ($\Delta t_{market} \gg \Delta t_{company}$). As a rule, it results in the product innovation being in demand for the time being and its development and production expenses would not be covered by sales. On the other hand, this situation may create the so-called “Blue Ocean” [9]. The Blue Ocean is the concept and strategy which postulate that companies can tremendously outclass the competition by focusing their intellectual resources not on minor product modification and cost reduction (i.e., “the Red Ocean”), rather than on creating a completely unique product, service or business model, satisfying existing customer needs in a new way or even generating a new need. That breakthrough innovation would bring forth a brand new market – “the Blue Ocean”.

In this case hyperactive and especially ultra-high innovative companies must swiftly implement marketing innovations in order to prepare the market for high-technology products and services. The reason behind it is that although such innovators enjoy a head start over rivals, because they possess unique expertise, knowledge, and trade secrets, as soon as the competition notices a new lucrative business model, it would divert its resources to catch up with the innovator. Thus, the seller’s market would naturally transform into the buyer’s market. The cycle loops with high-technology companies starting a new stage of developing next-generation products.

For example, by creating iPhone with a unique user-friendly control system Apple has outpaced the market and reinvented the phone, implementing a number of novel solutions that went beyond simple “making calls” and “sending messages”. Owing to the exceptional marketing innovations, iPhone has become the picture of the smartphone, while Apple is the largest publicly traded corporation in the world by market capitalization.

Therefore, strategic innovative activities of all companies have a cyclic nature, depending on both the growth of the market capacity for innovations and organizational and technological development of the company itself; it can be used as one of the tools of the strategic enterprise management.

Conclusion

Our research has demonstrated that maintaining and enhancing the competitiveness of a company depends on the efficiency of strategic management of its innovative activities. It is further substantiated by the fact that, according to consulting company Chubby Brain, specializing in providing funding recommendations to entrepreneurs, the key reason for failures of 32 analyzed startup companies was ignoring customer requirements – i.e., the market capacity for innovation [1]. Among the top 20 identified reasons [2] 7 are directly linked to inadequacy of the products and marketing strategies to the market demands.

Therefore, we believe the proposed dynamic model of evaluating innovative activities of a company presents a certain interest for innovation-oriented companies, especially for high-technology enterprise. Although the model itself is universal and can be applied in virtually all industries, the specific set of factors and values for determining the novelty added should be chosen with consideration for the uniqueness of the business and the specifics of the industry and products.

References

- [1] *25 Best Startup Failure Post-Mortems of All Time* [online]. Chubby Brain database, 2010. [cit. 2015-05-11]. Available at: <http://www.chubbybrain.com/blog/startup-failure-post-mortem>
- [2] *Analyzing 32 Startup Failure Post-Mortems to Find the 20 Top Reasons that Startups Fail* [online]. Chubby Brain database, 2010. [cit. 2015-05-11]. Available at: <http://www.chubbybrain.com/blog/top-reasons-startups-fail-analyzing-startup-failure-post-mortem>
- [3] ANTHONY, S. D., M. W. JOHNSON, J. V. SINFIELD, and E. J. ALTMAN. *The Innovator's Guide to Growth: Putting Disruptive Innovation to Work*. Boston: Harvard Business Press, 2008. ISBN 978-1-59139-846-2.
- [4] COKINS, G. *Performance Management: Finding the Missing Pieces (to Close the Intelligence Gap)*. 2nd ed. Moscow: Alpina Publisher, 2008. ISBN 978-5961408805.
- [5] DAVYDOV, S. V. *Fundamentals of Forming the Service Concept of Managing Investment Processes*. [Основы формирования сервисной концепции управления инвестиционными процессами.] *Russian Journal of Entrepreneurship*, 2003, **11**(47): 77–80. ISSN 1994-6937.
- [6] ESTRIN, J. *Closing the Innovation Gap: Reigniting the Spark of Creativity in a Global Economy*. New York: The McGraw-Hill, 2009. ISBN 978-0-07-149987-3.
- [7] FIRSTBROOK, P., J. GIRARD, and N. MACDONALD. *The Gartner Magic Quadrant for Endpoint Protection Platforms 2014* [online]. Gartner database, 2014. [cit. 2015-04-11]. Available at: <https://www.gartner.com/doc/2949726>
- [8] JOHNSON, M. W. *Seizing the White Space: Business Model Innovation for Growth and Renewal*. Boston: Harvard Business Press, 2010. ISBN 978-1-4221-2481-9.
- [9] KIM, W. CH. and R. MAUBORGNE. *Blue Ocean Strategy, Expanded Edition: How to Create Uncontested Market Space and Make the Competition Irrelevant*. Boston: Harvard Business Review Press, 2015. ISBN 978-1-62527-449-6.
- [10] KRAFTOVÁ, I., J. KRAFT, and A. V. ZAYTSEV. *The Philosophy of Innovative Changes Development in the National Economic System*. [Философия развития

- инновационных изменений в национальной экономической системе.] *Journal of Creative Economy*, 2013, 7(3): 56–53. ISSN 1994-6929.
- [11] USPTO. *List of patents issued to Symantec Corporation, McAfee/Intel Security Group, Trend Micro Inc., and Kaspersky Lab as of 2015, April 11th* [online]. The United States Patent and Trademark Office database. [cit. 2015-04-11]. Available at: <http://patft.uspto.gov/netahtml/PTO/search-adv.htm>
- [12] MELNIKOV, O. N. Is an Advent of a Creative Economy Accidental? [Случайно ли наступление эпохи креативной экономики?] *Journal of Creative Economy*, 2013, 74(2): 118–126. ISSN 1994-6929.
- [13] MELNIKOV, O.N. Technological Approaches to the Management of Creative Activities in Business. [Технологические подходы к управлению созидательными действиями в бизнесе.] *Russian Journal of Entrepreneurship*, 2013, 22(244): 28–35. ISSN 1994-6937.
- [14] MELNIKOV, O.N., ALABUZHEV, D.S. Ensuring the Unity of Innovation-Oriented Enterprise Strategy and Tactics. [Обеспечение единства стратегии и тактики инновационно-ориентированного предприятия.] *Journal of Creative Economy*, 2015, 97(1): 77–86. ISSN 1994-6929.

Žaneta Rylková

Silesian University in Opava, School of Business Administration in Karvina
Univerzitní nám. 1934/3, 733 40 Karviná, Czech Republic
email: rylkova@opf.slu.cz

Strategic Drivers of Family Business

Abstract

Family business can be considered as a very important part of national economies. Family businesses contribute significantly to GDP and employment. The family business produces almost 80% of gross domestic product in Europe. The family businesses make up the worldwide solid backbone of the economy, the paper is focused on issues in the environment of Czech companies. In comparison with other European countries, the family business remains still underrated in the Czech Republic. Family business has in the recent history of the Czech Republic relatively short tradition, which is of course determined by political developments in the country. In the Czech Republic there was the development of private enterprise and family business after Velvet Revolution which marked the fall of the former totalitarian regime in general. But if we continue questing in history, particularly in the era of the First Republic, we would find that at this time was family business relatively well developed especially in small businesses, which had been handed down from father to son; this procedure in the transmission of family craft was completely normal. The paper is focused on strategic drivers of family business and on advantages and disadvantages of this type of business. The approach combines a literature review that highlights family business and key strategic drivers with primary data from questionnaire survey in family businesses. The key strategic drivers related to family business issues that are required to build and strengthen the adaptive capacity of Czech family business are the objective of the paper.

Key Words

family business, strategic drivers, Czech Republic

JEL Classification: L20, L25, L29

Introduction

The vast majority of enterprises in the world is owned or controlled by families. Family business is the most common form of business in the world and more than 80% of businesses in the United States is owned or under the control of families. In Latin America, it is approximately 70% of the enterprises, absolutely dominant position occupies Asia, particularly China, for which the family business and the family togetherness is like a pillar of national morals and customs. [2]

This type of business makes a world increasingly useful and valuable impression. The largest and most successful brands of family business in the world are: IKEA, Bosch, Porsche, Swarovski, Ford Motor Company, Dr.Oetker, Michelin, Renault, etc. The Czech Republic is not different. There is a number of important family businesses with fame and glory, such as Synot Holding, Kofola, Pear, Madeta, Koh-i-noor, Petrof, Ravak, Pivovar Svijany, Siko, etc.

The importance of family businesses can be expressed not only quantitatively but also qualitatively. Family businesses are more than short-term on profit rather long-term on success oriented. Far more than non-family businesses are able to sacrifice profits to ensure the further management of the company, in order to make them a resistance to critical situations. Family businesses are becoming relatively reliable business partners, too. In countries such as Japan, Finland, Germany, USA it is quite common that entrepreneurs have already set up a business as a family business. [8]

The key drivers related to organizational and management issues that are required to build and strengthen the adaptive capacity within long-term planning are: leadership, clear responsibilities and flexible organizational framework, effective integration of knowledge and insights, learning approach to natural resources management, and human capacity and coordinated participation in decision-making. [5] Factors such as planning ability, coordinating ability, information, innovativeness, risk orientation, decision making, opportunity seeking behaviour, achievement motivation, self-confidence and cosmopolitanisms have impact on entrepreneurial behaviour. [1] The aim of the paper is to find out strategic drivers of family business on the basis of secondary and primary research.

1. Theoretical Framework Regarding Family Business

Direct definition of a family business in the professional community began to discuss in the 90s of last century. A unified interpretation was required mainly for comparing the results of the family business in the European or global scale.

On the basis of the research it was recommended to use three types of definitions of family businesses: [6]

- Family business - family has a major impact on management and business development and the strategic goal is to submit the company to the next generation.
- Family business - defined on the basis of ownership control (e.g. the shares), the founder and the descendants.
- Family business - is the business of several generations. Family directly manages the company, the assets of the company are owned by the family, more than one family member is in top management.

The family business is distinguished from non-family business. In family business one or more family members have a decisive influence on the company policy. Family members can present this influence that they participate in the guidance. The term management means all activities that control target-open, productive and social system of the family business. Many members of the family are raved among family matters based on an emotional basis among business and matters that are purely on rational basis. Family members in stressful situations hold emotional patterns when analyzing the problem and this process significantly reduces the scope for constructive solutions to problems in the family business. Overlapping of different roles in the family business are far more marked than in other businesses.

One person on the top of the hierarchy of family business has to play four different roles: the main supervisory authority, the manager, the owner or the shareholder of the company and the head of the family. Each of these roles requires a different approach, which contradicts other roles. Legitimate demand of the owner or companion after high dividends or share of profits does not correspond with the requirement on the manager to increase the company's capital. In an emotional level this problem arises: How has householder explain to the son that the role of a manager does not fit him, although several times before he said "one day it all will be yours"? Emotional reactions of the son will be influenced by some model of family behavior. He will feel left out and it may cool down family relationships. [7]

The existing family business literature informs us of the career intentions of adolescents with a family business background [4, 9, 14]. The reasons why next-generation family members may or may not enter the family business have been addressed [10], and prior family business involvement has been shown to be an important influence on entrepreneurial intent [4].

Succession in family business is widely seen as the process that transfers ownership and leadership from an incumbent to a next-generation successor, who may or may not be a family member [11, 13]. Researchers agree that succession is one of the most important processes of a family business's life cycle due to its substantive effect on the firm's strategy, culture, and also its survivability. The succession-planning process, which is the focus of this paper, is the first and one of the most important parts of the overall succession process and has two main goals: first, the selection of the successor, which includes setting criteria or defining a pool of possible candidates [13]; and, second, preparation for the transfer of management control as well as ownership shares from an older to a younger generation [12].

2. Family Business in the Czech Republic on the Basis of the Secondary Research

The Association of Family Business is engaged in the area of family business in the Czech Republic. The association mediates the owners of family businesses to share the values, experiences and information. The basic principles of the Association of family businesses include formulating positive status of the family business and its contribution to the economy and society, support of the long lasting, sustainability and the importance of family business. The association emphasizes support for a succession of next generation family members, advocates the creation of equal opportunities for family business and non-family business.

Although exact figures do not exist, as estimated by the Association of Small and Medium-Sized Enterprises of the Czech Republic (AMSP ČR) the share of family business is about 20 to 25 percent from all the companies in the Czech Republic, the family business is involved in 15 percent of gross domestic product. Czech Republic is seeking to catch up with Europe, where family clans dominate nearly 80% of business! [3]

The most popular form of family business is company with limited liability in the Czech Republic, which accounts for 85% of family business [7]. The lowest proportion has public limited liability company and public company. It is evident that the companions of family business trying to minimize the potential business failure with suitable legal form of business. In this case it is the limited liability company.

The Czech Republic lacks any legislative framework that would give order to the family business. Under the new Civil Code, which came into legal force on January 2014, the family business is in the legal text a special type of commercial establishment. It is not a legal entity but from the perspective of legal theory rather a matter of public. This is a commercial establishment where spouses are working together, their relatives up to the third degree, or persons in kinship, i. e. persons whose relationships are formulated with marriage, relationship to blood relatives partner until the second stage. But it can also include a person who is constantly working for the family, especially those who regularly takes care of running the family household.

The paper presents the results of the survey on Czech family business from the June 2013. The research was conducted under the auspices of the Association of Small and Medium-Sized Enterprises Czech Republic. Implementation of the survey was conducted by IPSOS Ltd. The research was aimed at small and medium-sized family business and companies that have 5 – 249 employees were involved in the investigation. The total sample size was 64 respondents and as a research tool was used a structured questionnaire sent by e-mail. The same survey was carried out the following year, in May 2014, when it was used the same survey, however, the telephone conversation was used, which lasted approximately 15 minutes. Second survey was attended by 100 representatives of family business. The main objective of both surveys was to find out the attitudes of executives and business owners to a family business. Investigations also answered the following questions:

- Is the family status an advantage of the company?
- Which expectations do the family businesses have?
- What visions do the family businesses have for the future?

The first question of the survey 2013 was the prognosis regarding future revenues over the next three years. The same question was asked in the year 2014 and also there were positive results. Compared to the results of the year 2013 there is growth of sales, the significant growth in value remained the same. It confirmed the overall positive mood in the business environment of family businesses. The family business is in optimistic expectations than non-family business. A part of this issue was also the weights of individual priorities regarding questions on other activities of enterprises. The most important criterion was determined by increasing the efficiency of the family business, the retention and recruitment of quality staff, which is a good sign for reducing unemployment in the vicinity of these enterprises, the most important criterion was followed by optimization of financing, procurement processes and by improvement of supplier selection.

It is surprising that among the less important priorities is involved the priority of next-generation family members change in the management of family business. It is important to know that each family business must approach this issue individually. Conversely, there may be included businesses that have already gone through this next-generation

family members change and facing the horizon, for example, twenty years relative calm. However, the businesses should develop effort for managing the family business into the future.

Another question was about the idea of whether the leader of the family business considers the fact that family business is an advantage. Here is a surprising fact that compared to the 2013 year findings, these results are somewhat negative. In the year 2013, nearly 61 % of respondents consider that the status of the family business is their advantage. In the year 2014 the result dropped to 38 %. It's a big drop, and it is not possible to determine the cause. One possible explanation should be that it is an expression of opinion of next-generation family members who can see the situation differently than the founders. This may be related to the influence of the business of parents to their offspring. They may have ingrained feeling that such a way of doing business does not have a positive impact on family relationships. The overall result is acceptable, there is to know that the majority of respondents still consider a family business as benefit, but decreasing number of positive responses is disturbing.

The respondents indicated the flexibility and stability, as well as the atmosphere of companies and business ethics as the biggest advantages of family business. The following findings were that 43 % of representatives responded that the family business had no disadvantage. Others included on the imaginary first place management system and poorer access to financing as disadvantage. The particular fact is that a very small portion, approximately 4 % of respondents reported a negative impact on family relationships and time consuming as the disadvantage.

The final question, which was described, was a vision of the future in the context of succession. 66 % representatives of family business considered to refer the management of the family business to other family member in the year 2014. In the year 2013 the result was 4 % higher. The interesting fact is that the approach „it's not important to solve the succession“ decreased from 22 % to 13 % in the year 2014 compared to the year 2013. It is possible to say that more and more family business are realizing that the succession is one of the basic building blocks for building the family business vision for the future.

But there is warning: Within the presented survey of AMSP ČR half of the Czech family businesses do not deal with the question of succession. Just 30 % family businesses in the world survive the second generation change. In case of transfer of the family business to the third generation even nine out of ten businesses do not survive. [3]

3. Methodology and Results

In order to know which factors influence strategic management of family business the Department of Management and Business Administration of the Silesian University in Opava, School of Business Administration in Karvina carried out research entitled “Strategic Management of Family Business”.

The primary objective of the research was to examine the impact of different factors in period 2011 – 2014 on the strategic management and competitiveness of family

businesses in the Czech Republic on the basis of the potential correlation among questions. The questionnaire survey was done in the winter term of 2014 by students of the Silesian University in Opava, the School of Business Administration in Karvina. About 200 family businesses were approached; and filtering them produced 162 questionnaires duly filled and usable for the purpose of this survey. Polling took place throughout the Czech Republic, in family businesses. Respondents' selection was random.

The questionnaire form relied largely on closed-ended questions with an option to specify the answer in more details. The questionnaire was split into these topic sections:

- Strategic management and culture
- Production, services and innovative activity
- Business performance measurement
- Advantages and disadvantages of family business
- Company priorities in terms of sustainable economy

The data of questionnaire were subsequently entered into Microsoft Office 2007 Excel application for assessment. In order to evaluate the survey there was used the SPSS program. Outputs were achieved with using several methods, for the purposes of this study there were selected three methods: the Rotated Component Matrix (factor loadings after rotation, arranged by size), the Communalities (part of variability explained by variables common factors) and the Correlation Matrix (mutual dependence of two questions).

One of the objectives of the research carried out by the Department of Management and Business Administration was to analyze and evaluate which factors had an impact on the strategic management of family businesses in the years 2011 – 2014. From the questionnaire survey conducted by the Department of Management and Business Administration it was possible to point out the areas that can have a high impact on the strategic management of family businesses. Using the SPSS program there was found the structure of questions which join the links with other questions and are most responsible for the results that came out after the evaluation of the specified number (sample) of questionnaires. Questions correlation coefficient higher than 0.5 was found 16 times in the research of years 2011 – 2014, but in order to keep the contribution clear and concise, the table number 1 involved just 4 of the most important issues with a correlation coefficient higher than 0.8. In the primary research of the period 2011 - 2014 there was determined the following hypothesis: H₁: Succession is one of the factors affecting strategic management of family business. Out of the primary research the most important issues with a correlation coefficient higher than 0,8 are customer focused innovation, culture of the company, succession and performance measurement. Recognition of the potential importance of competitiveness drivers is in the table 1.

Tab. 1: The most important questions – TOP 4 (Communalities), years 2011 – 2014

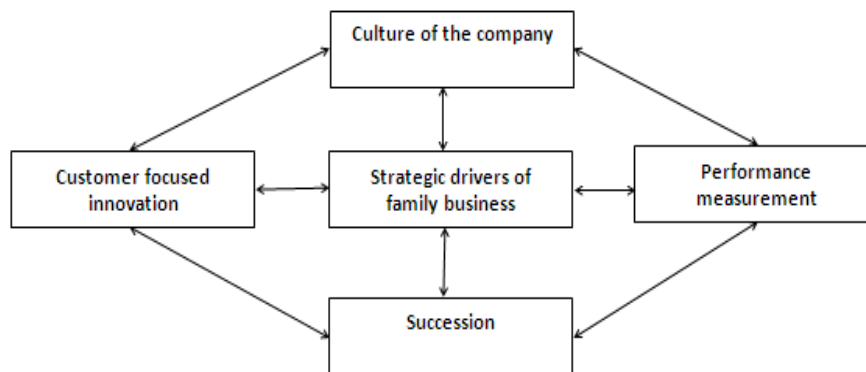
	Initial	Extraction
Customer focused innovation (E2)	1,000	0,873
Culture of the company (C6)	1,000	0,869
Succession(C7)	1,000	0,803
Performance measurement (E3)	1,000	0,801

Source: own

Table 1 shows that customer focused innovation, culture of the company, succession, performance measurement are the categories which have a significant impact on strategic management (there was used an own evaluation by the SPSS). From the above, it is possible to confirm the hypothesis H₁: Succession is one of the factors affecting strategic management of family business.

Based on the results of primary research from the years 2011 - 2014 it was possible to create a model of strategic drivers of family business (see Figure 1).

Fig. 1: Strategic drivers of family business



Source: own

In successful product innovations, customers are significantly more deeply involved in the innovation process compared to less successful product innovation. 71 % of asked companies have customer focused innovation. On the one hand, customers are – besides management and sales – the most important source for new innovative ideas. Collaboration with customers in the innovation process usually improves the competitive situation of the company. Additionally, it reduces the risk that the new service will not find market acceptance. This approach may also avoid image loss, which would present a danger by a lack of market and customer orientation. In the early phases of the innovation process considerable time savings may be achieved by integrating customers, because potential research areas for finding new ideas will be identified better from the very beginning. Later on in the innovation process in the phases of conceptualization and implementation, collaboration with customers may positively affect development speed.

Regarding the characteristics of the performance measurement system in the family business, from the sample of 162 businesses 44 % of companies stated that they had established the performance measurement system and they use it. 7 % of companies stated that they had assembled the performance measurement system, but they do not use it, 10 % of businesses reported that a performance measurement system was in the phase of making or implementation and the remaining 39 % reported that they did not measure performance.

It is necessary to highlight the positivity of generation values and traditions which are the most important factor of organizational culture of the family business. Problems of family business in the sphere of organizational culture are in teamwork and empowerment, the categories are part of the dimension of engagement in the company. Furthermore, it is the area of organizational learning and the area of goals and tasks. The outputs obtained from

the primary research showed that problems in these areas arise from poor communication within the company.

On the basis of the primary research 27 % representatives of 162 family businesses considered to refer the management of the family business to other family member in the period 2011 - 2014 and 12 % family businesses passed the second generation change in the period 2011 - 2014. Owners have to motivate and build potential of family members properly to be able to take over greater or high responsibility of the company in the future. Therefore it is necessary for owners and managers to provide family members more opportunities for further personal development and the owners and the managers have to learn to be able trust and delegate competences to the family members.

Conclusion

A set of key organizational drivers affecting adaptive capacity and strategic management were drawn from the literature. These were explored through primary research within the Czech Republic. Through the application of methodology it was possible to deduce the following general strategic drivers that support adaptive capacity and strategic management of family business: culture of the company, customer focused innovation, succession and performance management. Based on the results of primary research of the period 2011 - 2014 it was possible to create a model of factors affecting strategic management of family business. This model „Strategic drivers of family business“ should not be the final goal itself for these organisations. This model should be understood as the effective tool for strategic management. According to the Association of Family Business, the representatives from the family businesses do not deal with the factor succession. The number of enterprises which expect to refer the organisation to next-generation family members fell from 70% to 66%. The causes can be difficult conditions for the realization of succession in the enterprise, such as insufficient experience and knowledge of the next-generation members, unwillingness to continue the family tradition, lack of interest or lack of person who can lead the company. Primary research found that the factor succession is considered to be a strategic factor of family business. The developed approach is useful for family business and for the Association of Family Business because it can help identify areas that require further improvements. The strategic drivers that are identified emphasize the need to effectively create and maintain strategic interactions. In the research it was not possible to directly contrast the particularities of strategic drivers with other international examples because to do so it would need to apply the same methodological framework in other case studies. This is a direction of further research that will be tackled through an international collaboration project.

Acknowledgment

This paper was supported by the Ministry of Education, Youth and Sports Czech Republic within the Institutional Support for Long-term Development of a Research Organization in 2015.

References

- [1] ABEYRATHNE, H. R. M. P. and L. N. A. C. JAYAWARDENA. Impact of group interactions on farmers' entrepreneurial behaviour. *E+M Ekonomie a Management*, 2014, **17**(4): 46-57. ISSN 1212-3609.
- [2] ALDERSON, K. *Understanding the family business*. New York, USA: Business Expert Press, 2011. ISBN 978-160-6491-690.
- [3] ASMP ČR. *Výsledky průzkumu č. 26 Asociace malých a středních podniků a živnostníků ČR, Situace rodinných firem, 2014* [online]. Prague: Asociace malých a středních podniků a živnostníků ČR, 2014. [cit. 2015-04-25]. Available at: http://www.amsmp.cz/uploads/Pruzkumy/Vysledky_26._pruzkumu_AMSP_CR.pdf
- [4] CARR, J. C. and J. M. SEQUEIRA. Prior family business exposure as intergenerational influence and entrepreneurial intent: A theory of planned behavior approach. *Journal of Business Research*, 2007, **60**(10): 1090-1098. ISSN 0148-2963.
- [5] DUTRA, L., H. BUSTAMANTE, I. SPORNE, I. PUTTEN, C. M. DICHMONT, E. LIGTERMOET, M. SHEAVES and R. A. DENG. Organizational drivers that strengthen adaptive capacity in the coastal zone of Australia. *Ocean and Coastal Management*, 2015, **109**: 64-76. ISSN 0964-5691.
- [6] HESKOVÁ, M. and V. VOJTKO. *Rodinné firmy: zdroj regionálního rozvoje*. 1st ed. Zeleneč: Profess Consulting, 2008. ISBN 978-80-7259-062-9.
- [7] KORÁB, V., A. HANZELKOVÁ, and M. MIHALSKO. *Rodinné podnikání*. 7th ed. Brno: Computer Press, 2008. ISBN 978-80-251-1843-6.
- [8] ODEHNALOVÁ, P. *Přednosti a meze rodinného podnikání*. 1st ed. Brno: Masarykova univerzita, 2011. ISBN 978-802-1056-039.
- [9] SCHRÖDER, E., E. SCHMITT-RODERMUND, and N. ARNAUD. Career choice intentions of adolescents with a family business background. *Family Business Review*, 2011, **24**(4): 205-321. ISSN 1741-6248.
- [10] STAVROU, E. T. and P. M. SWIERCZ. Securing the future of the family enterprise: A model of offspring intention to join the business. *Entrepreneurship: Theory and Practice*, 1998, **23**(2): 19-39. ISSN 1540-6520.
- [11] SHARMA, P. An overview of the field of family business studies: Current status and directions for the future. *Family Business Review*, 2004, **17**(1): 1-36. ISSN 1741-6248.
- [12] SHARMA, P., J. J. CHRISMAN, and J. H. CHUA. Succession planning as planned behavior: Some empirical results. *Family Business Review*, 2003, **16**(1): 1-15. ISSN 1741-6248.
- [13] STEIER, L. P. and D. MILLER. Pre-and post-succession governance philosophies in entrepreneurial family firms. *Journal of Family Business Strategy*, 2010, **1**(3): 145-154. ISSN 1877-8585.
- [14] ZELLWEGER, T., P. SIEGER, and F. HALTER. Should I stay or should I go? Career choice intentions of students with family business backgrounds. *Journal of Business Venturing*, 2011, **26**(5): 521-536. ISSN 0883-9026.

Monika Sipa, Andrzej Skibiński

Czestochowa University of Technology, Faculty of Management,
Department Economics, Investment and Real Estate
ul. Dabrowskiego 69, 42-201 Czestochowa, Poland
email: monikasipa@gmail.com, skibinskia@tlen.pl

Innovative Strategies of Small Enterprises in Poland

Abstract

The modern market is characterized by rapid changes. There has been an increasing trend of shortening product life cycles, the emergence of new technologies, including IT, boosting the dynamics of introduction of new products to the market, etc. In order to find their place and survive on the dynamic and global market, today's enterprises must change their management style from conservative to innovative one. However, introduction of innovations brings many dangers because the characteristic of the innovative processes is a high degree of risk, which is influenced by a.o.: substantial costs and a high failure rate in their implementation. All of this contributes to the fact that only a few processes of creating innovations end with the introduction of a new product to the market that creates a certain economic value. Lack of planning may affect the nature and scope of new innovations. The main aim of the article is the identification of changes in the planning and implementation of innovations by small businesses operating in the southern region of Poland. The inference was based on the results of two studies concerning the innovativeness and competitiveness of small businesses, carried out in 2006, 2007 and 2013. In the first part, the specification of innovative strategies of small businesses was shown. The second part presents the results of research on the issues discussed. The analysis of data indicates, among other things, that when it comes to creation and implementation of innovations, owners of small businesses of the southern region of Poland still rely mainly on their own intuition and they do not plan them. The percentage of companies that have and execute the innovation strategy has decreased, and most of the implemented innovations were weaker in quality because they were new only to the companies themselves or at most to the local market.

Key Words

small firms, innovation strategy, planning innovation

JEL Classification: M20, O30

Introduction

Unpredictability or, in fact, the impression of chaos, is the attribute of the contemporary economy. Global competition with economies without boundaries, which is discussed in reference to the future, deepens this impression. The 'openness' of the economy has caused the removal of barriers in the worldwide flow of information, commodities, technologies, capital and people, bringing both new opportunities and new threats such as increasing competition.

Dynamic changes in the world's economy force the companies to improve the ways of their functioning and production, to re-design processes. A shorter cycle of the product

life, a quicker pace of the introduction of technological changes, a wider availability of productive factors with comparable quality and price, on the level of both the entire economy, regions and particular entities within the economy. In the Polish economy, similarly to other countries in the world, one can observe a visible participation of the private sector, which to a large extent, is created by micro-, small and medium enterprises (MSME). One should pay particular attention to small enterprises which dominate in this sector – they amount for approximately 99% of all entities functioning in the European Union. One can also observe constant changes in the number of those companies on the market, which, inter alia, results from the process of creation of new ones and termination of the already existing companies (for example, as a result of bankruptcy). Hence, a contemporary enterprise, regardless of its size and the subject of activity, depends on a multidisciplinary influence of its surroundings and the clients' constantly rising requirements.

One of the most significant challenges which the societies of the twenty-first century face is innovativeness. There are many authors who indicate that innovations are the determining factor for the international competitiveness of enterprises. They define the competitive position of both countries and countries' unions (EU) as well as the smallest regions which create them. The essential condition for the growth of the competitiveness of the Polish industry is, therefore, the development of innovative activity, that is the change in the management style, from the preservative to the innovative one. Every company, which responds effectively to the changes during the introduction of innovations, is forced to search for necessary knowledge, financial and technical resources as well as those created in its environment due to its limited competences and, above all, resources.

1. Innovation strategies in small companies

Small companies often do not have clearly defined missions or plans; that is why the strategic aspect of innovation is often considered to be an element of intuitive strategies, which do not always have their external dimension [1]. Such an approach, however, does not have a negative impact on their innovativeness, as long as the companies are able to carry out those strategies properly.

An innovation strategy is aimed to carry out innovation. It is a part of a development strategy and is strictly related with it. Innovation strategies are usually complex functional strategies that should be determined on every level of the companies' strategy, independent of its scale and the range of the companies' activity [4]. Both formulating a strategy of innovation and its implementation should include: an analysis of the strategy of innovation in the aspect of its compatibility with the environment and goals of the company, an analysis of realization of the innovation and an analysis of acceptability of this strategy. However, just a formulation of the strategy has no real significance if the strategy has low chances of implementation. The success of this process depends mainly on the level of preparation of the company for its implementation, and in particular, on a proper level of engagement of the management team. According to [7] a successful growth of small firms appears to be a result of entrepreneurs' dedication and commitment and their ability to identify a niche in the market especially with regard to creating added value by applying process and product innovation. This fact becomes especially

significant in case of small companies, in which the main managing person is the owner-manager [9]. In order to manage innovations, a classic management of activities requires a transformation of the manager into a leader who should: create a vision and present it to the employees, establish a strategy and a proper mentality for the company, take care of the company's best image and choose people for managerial positions on his/her own.

In case of small companies, taking up individual research as well as designing and implementing a new production requires appropriate technical and managerial skills, which are significantly limited in companies of this scale [10]. In such companies, an innovation strategy, which is more frequently applied, is a strategy of defense which means avoiding a direct confrontation with competitors. This happens because it is a low-risk strategy that does not require an own R&D facility, as in case of an offensive strategy. One of the defensive strategies of small companies is the strategy of imitation which is a quick copying of a new product before its manufacturer makes sure that they have succeeded (this is common in such industries as clothing, furniture and small home appliances). Another frequently applied defensive strategy of companies of this scale is the strategy "second but better". It can be used to determine (create an own) niche on the market, onto which a product or service with a unique characteristic is introduced – the one that the new product of a competitor does not have [8]. A proper strategy for both small and big companies is the license purchase strategy. It enables small companies to offer innovative products or services on the market without the necessity to take additional risks connected with conducting their own research. This is pointed out for example by I.Gorzeń-Mitka, who analyses the ways of risk management among this group of companies [3]. A large number of small companies operating on big growing markets apply the strategy of avoiding competition by finding a niche, in which their company can find its place, knowing that market leaders will not compete with them. As it is emphasized by B.Twiss, a dependency strategy is also applied in innovative companies of this scale. Those companies cooperate with another, bigger company, which offers them their skills and technologies. Small innovative companies that do not have enough resources to finance their research and development can be taken over by other, bigger companies that follow the strategy of obtaining other companies [11].

Small and medium-sized enterprises were particularly affected by the changes in the economic milieu which stemmed from the financial crunch of 2008. In the authors' opinion, the crisis might have transformed their attitudes towards innovation and ways to build their market competitiveness, which also [6] drew attention to. Hence, the research objective is to identify the factors that shape the planning and implementation of innovation of such companies in the context of two studies (study I – 2006-2007 – before the crisis, and study II – 2013). Details of the studies and their results are presented further in this article.

2. Characteristics of study area

The Małopolska and Silesia provinces constitute one of the six regions in Poland, i.e. the South Region, whose area constitutes 8.79% of the entire area of Poland. This region is characterized by the highest index of population in Poland, whereas the population density is higher in the Silesia province by as much as 154 people per 1 km squared (for the entire country, this index amounts to 123 people per 1 km squared). It is also

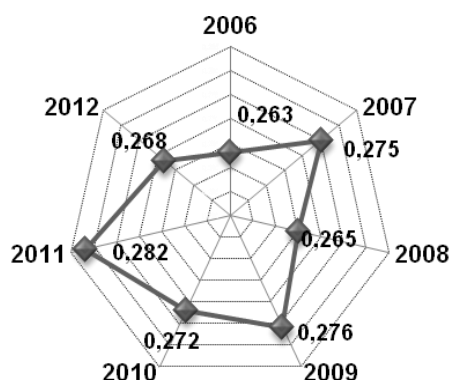
characterized by the country's highest GDP per capita. Only the Łódź and Mazovia provinces present higher indexes. In the Silesia province, the GDP per capital is higher than in the Małopolska province by 20.1%. Many businesses operate in this area, and when referring to the potential of Poland, it can be noticed as follows:

- the Silesia province is on the second place in terms of the number of small enterprises (surpassed only by the Mazovia province),
- the Małopolska province is the fourth province in Poland in terms of the number of small enterprises and it is surpassed only by the Wielkopolska province.

In the South Region, there are almost 20% of small Polish enterprises. In the Silesia province, more than 456 thousand entities conduct a business activity, while in the Małopolska province, it equals to more than 348 thousand.

When referring to the level of innovativeness of Poland, it should be pointed out that it still falls below expectations. Taking Summary Innovation Index (SII) - into consideration, it should be commented on that the value of this index for Polish economy diverges greatly from the average value for European Union. Considering the period of time, which the authors refer to in their own study, namely 2006-2012, it can be noticed that the value of index SII in 2012 is a little higher in relation to 2006 (by 0,005 points) and in relation to 2007 there is a drop of its value by 0,007. (fig. 1)

Fig.1: European Innovation Scoreboard 2004–2012 – SII time series



Source: own study based on [2]

What is more, in 2013 Poland was qualified to the group characterized by the lowest innovativeness, which was defined as 'modest innovators.' In the light of these considerations, selected aspects characterizing the potential of the environment which is advantageous to the innovativeness of the enterprises were considered. The South Region may compete with a few regions in Poland in terms of the number of companies, universities and R&D institutions. There are 73 universities in this region, of which 41 are located in the Silesia province. 334154 students study here - 189609 in the Małopolska province and 144545 in the Silesia province. In these provinces 662 active research institutions operated here in 2013 whereas more than 81% operated in the sector of enterprises. When referring to the researched periods, the number of such institutions increased nearly two times while in the sector of enterprises - nearly three times. A slightly larger increase was recorded in the Silesia province. The situation does not seem so positive when we consider the average share of innovative enterprises in the general

number of enterprises, or the share of expenditures on innovative activity at enterprises in national expenditures.

When reviewing 2013 in comparison to 2006, the average share of innovative enterprises in the South Region decreased by 19.1%. In 2013, in the Małopolska province, innovative enterprises constituted 11.6% of all enterprises while in the Silesia province this amounted to 10.9%. What is interesting, this tendency was opposite in an earlier period. When considering the expenditures on innovation at enterprises in this region, there is a visible decrease of over 5%. Despite the difficult economic situation, in the analyzed period in the Małopolska province, the share of expenditures for this type of activities in the national expenditures increased by 0.6% as compared to 2006. The details are presented in Table 1.

Tab. 1: Selected information on the innovative potential of the investigated provinces (2013)

	Number of enterprises				outlays on innovative activities in enterprises in comparison with total domestic expenditures (%)		the average share of innovative enterprises in the total number of enterprises (%)	
	small enterprises			total				
	0-9	10-49	in all		2006	2013	2006	2013
Provinces of Małopolska	335314	12989	348303	351074	6.2	6.8	18.4	11.6
Provinces of Silesia	436932	19142	456074	460350	16.7	10.6	23.2	10.9
Southern Region	772246	32131	804377	811424	22.9	17.4	41.6	22.5

Source: own study based on: www.stat.gov.pl

3. Implementing innovations at small enterprises – an analysis of changes

3.1 Method

The conclusions were based on results of two own research procedures relating to innovation and competitiveness of small enterprises. The research had a survey character and it was conducted between 2006 and 2007 among the Silesia-based small enterprises (study 1) and in the first quarter of 2013 among small Małopolska-based enterprises (study 2). Both study 1 and 2 were conducted with the use of the correspondence method. In order to provide a better return of the surveys sent, phone calls were carried out during which the aim of the research was explained and participants were asked to send completed surveys back. The categorization adopted by the EU, based on the number of employees was used as the criteria of classifying the enterprises to the given survey group, i.e. small enterprises. The results presented below constitute only a fragment of broader research.

In order to diagnose the changes in portraying this issue, similar survey questionnaires were used in both research procedures, consisting of open questions, semi-open

questions or closed dichotomous questions, as well as the cafeteria-style checklist. The questions featured nominal, relational and significance scales. The questions were classified according to the category, into three parts relating to the following issues: market and competition; innovative activities; cooperation with the environment. The questionnaire also contained demographics. 216 complete and properly filled out questionnaires were adopted for the analysis in the case of research 1 and 105 surveys in the case of research 2. In the surveyed groups, small innovative and non-innovative enterprises were separated, while considering those enterprises which have implemented innovations in the last five years, as the innovative ones. In the survey managers were asked to indicate what kind of changes there were and what the level of innovation was (0 – no changes, 1 – innovative to the enterprise, 2- innovative to the local market, 3 – innovative to the domestic market, 4 – innovative to the foreign market), which allowed further, deepened analysis.

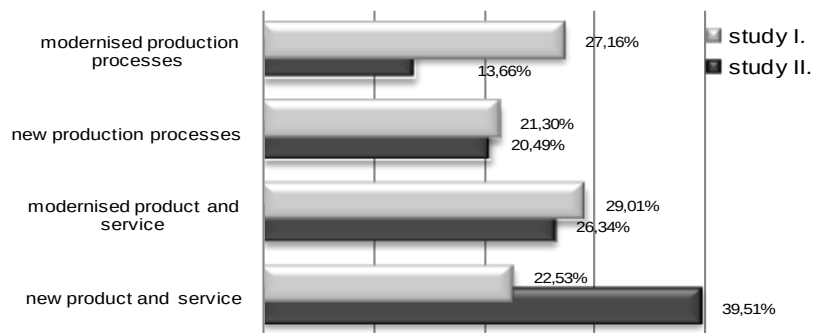
Heterogeneity of small enterprises impedes largely harmonization of classification criteria executed by business entities of this scale of innovation strategies, which often result from their innovative behaviours. Therefore, in the presented analysis, the level of innovation introduced in the innovative business entities of interest was referred to. It was adopted that enterprises implementing innovations to local market at most, executed defensive strategy whereas those which introduced innovations to domestic as well as foreign market, executed offensive strategy.

3.2 Results

Changes in the economic environment caused by the recession in 2008 had a specific impact on the functioning of the researched group of enterprises. In the opinion of the authors, this could have had an impact on changing their approach to innovation. Hence, the aim of the research is to identify changes within the scope of planning and implementing innovation in the context of two research procedures (research 1 - 2006/2007 - before recession, and research 2 - 2013). The details of the research and its results are presented in the further part of this article. Based on the analysis of data relating to the research conducted between 2006 and 2007, more than a half of the surveyed small enterprises (65.74%) was included in the group of innovative companies, whereas in the case of 2013, this percentage increased to 92.38%. This is a positive tendency, considering the time of conducting research 2, where the effects of the international recession were still experienced in the background. Positive changes are also visible in relation to the approach to innovations and the will to implement them in the future. The percentage of companies planning to implement innovation in the future increased from 56.9% to 59.0% in the second research.

Positive changes can be observed in relation to the character of all introduced innovations. In the case of study 1, the implemented innovations were mainly based on modernizing the existing products/services and production processes (56.2% of changes) whereas in study 2, 60.0% of innovations were new products and services as well as production processes. The scope of changes relating to new products/services mainly concerned the domestic market (54.9%) and the company itself (48.4%). (fig. 2.)

Fig.2: Changes within the scope of the introduced innovations

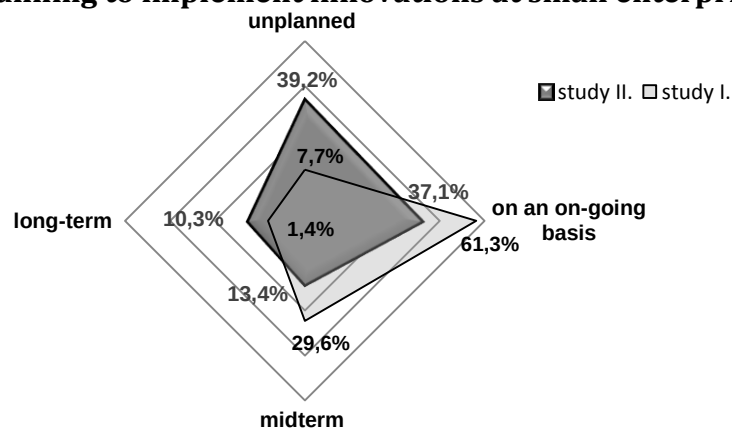


Source: own work based on survey

Implementing innovation is a complex and risk-bearing process so it is recommended to plan this procedure properly. Pursuant to the obtained results, between 2006 and 2007, a clear dominance of an on-going planning of implemented innovations was visible (61.3%), midterm planning was second, while long-term planning related merely to 1.4% of companies. In the case of research conducted in 2013, there is no single dominant answer. The largest changes relate to ad-hoc implementation of implementing innovations. Lack of planning recorded 31.5% more indications than in the case of study 1. This means that according to the research conducted in 2013, four out of ten companies implemented innovations without any planning activities whatsoever. The largest “deficiencies” are observed in a short-term planning, which obtained 24.2% less indications in the analyzed period. Lower percentage indication also related to midterm planning which decreased its share in all indications by 16.2%. A positive change in planning implement innovations is nearly a 9% increase in the indications relating to a long-term planning. The detailed data on the changes are specified in Figure no. 3.

Very limited planning in the scope of implementing innovations translates into infrequent application of innovation strategies in the researched entities. Developing and implementing an innovation strategy, which will be a part of a development strategy, will minimize the negative effects which may occur while implementing innovations. The research shows that there are still few small entities which indicate that they have such a strategy implemented while, when compared to the previous research procedures, the percentage of these companies increased from 15.74% to 30.48%. This constitutes a twofold increase but it still does not equal to even 1/3 of this scale of enterprises.

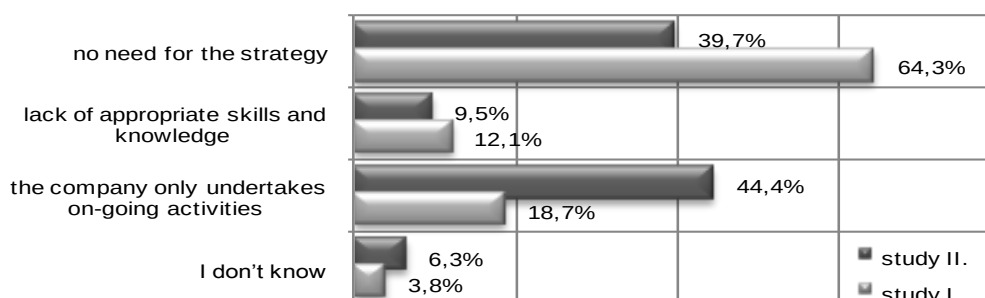
Fig.3: Planning to implement innovations at small enterprises



Source: own work based on survey

The key causes of the lack of an implemented innovation strategy have also changed (fig. 4). A visible transition of the centre of balance relates to the lack of the requirement to have such a strategy implemented. In the research conducted between 2006 and 2007, more than 60% of the most important indications focused on this cause whereas in the case of the other research, it turned out that the above amounted to just less than 40% of the most important indications. This change may mean that entrepreneurs, despite the fact of not using an innovation strategy, no longer focus on the lack of necessity of having such a strategy implemented. Throughout the years, the fact of undertaking actions only on an on-going basis in the scope of innovativeness became the key cause of companies not implementing the strategy.

Fig. 4: The causes of lack of innovation strategy



Source: own work based on survey

The small share of indications, even lower than in the previous research, relates to the lack of skills and knowledge within the scope of developing and implementing such a strategy. Among the most important indications, this barrier constitutes 9.5% as compared to 12.1% from the research conducted in 2006-2007. This is a very positive phenomenon since it may mean that there is an increase in the skills and competence of entrepreneurs with regard to company management. However, it must not be forgotten that this is the research carried out among enterprise owners so in fact the results may be a little better than in reality as admitting one's weakness is not so common. [7] and [12] point out that not only appropriate skills (financial or marketing ones), but also ability of strategic thinking, innovativeness, interpersonal skills as well as development and care for strong team of managers, directors and outside specialists, decide on development of small and medium-sized enterprise sector.

The classification of innovative strategies in the case of small enterprises, is a lot more difficult due to their high level of heterogeneity relating to innovativeness. Often, companies implement a number of strategies which are modified as particular needs arise. There are also many criteria of dividing the innovation strategy whereas in the case of small enterprises, these often result from innovation-related behaviours. When referring to the level of new activities, it was adopted that companies implementing innovations, which constituted a new activity for themselves and the local market, execute a defensive strategy whereas those companies, which have implemented innovation constituting a new activity in the domestic and foreign market, execute an offensive strategy.

Considering the level of new activities within the implemented innovations by small enterprises, in the case of the research conducted in 2013, it can be observed that a

definite majority of companies (78.1%) which confirmed the fact of having an implemented innovation strategy, also executed a defensive strategy. The innovations implemented by such companies constituted a new activity for the local market at the most. 44.0% of entities executing a defensive strategy focused on implementing one type of innovation, i.e. applicable to new or modernized products (services and technologies). The remaining enterprises offered both new and modernized products, services or production technologies. Among the companies which execute this type of strategy, new products, new services and new technological processes were in majority (61.5%). Only 21.9% of enterprises which execute an offensive innovative strategy, implement innovations which are a new activity for the national market (no new activities were recorded for the foreign markets). In the case of the above enterprises, there are no particular differences whether they are new activities (53.3%) or changes in the form of modernization (46.7%). However, there is a visible quantitative advantage of innovations relating to products and services vs. process-related innovations. New and modernized products and services constituted 60.0% of the implemented changes, which were a new activity in the domestic market.

The situation is different in the case of the earlier research conducted in 2006-2007. Most of the enterprises with implemented innovation strategies executed an offensive strategy. Among the innovations implemented by the above companies, new products, new services and new technological processes were in majority. They constituted 72.9% of all implemented changes in total. More than 40% of entities executing an offensive strategy have also introduced new products (services and technological processes) as well as modernized products. Nearly 1/3 of companies which confirmed the fact of an implemented innovation strategy have executed a defensive strategy. The innovations implemented by such companies constituted a new activity for the local market at the most, whereas 70% of these changes constituted a new activity only internally. More than 50% of entities executing a defensive strategy focused on implementing one type of innovation, i.e. applicable to new or modernized products (services and technologies). The remaining enterprises offered both new, and modernized products, services or production technologies. It should be also noted that when facilitating the opinions of entrepreneurs in relation to extent of new activities of the implemented changes to determine the type of the strategy, it should be remembered that these evaluations are subjective and thus may be slightly overestimated.

Conclusion

To summarize, it needs to be stressed that just having a formulated innovation strategy is not a guarantee of success. Successful implementation is greatly dependent on the degree of business preparedness, and in particular, on the appropriate engagement of the management team. In the case of small enterprises, the optimal amount of the human resources contributes to the lower focus on formalising the activities in this area. In small companies, an informal plan often acquires a character of a strategy.

The comparative analysis that has been carried out indicates that the percentage of small businesses which do not plan implementing any innovation has definitely increased. There has also been an increase in long-term planning. Unfortunately, it can be also observed that, although the number of innovative small businesses has increased, in most

cases these innovations were not implemented as a result of an innovation strategy. The changes that have been observed indicate that the percentage of companies which have an innovation strategy has decreased and that the strategies [- if they exist at all -] are mostly defensive, which is the opposite result to the earlier studies. The lack of a prepared and implemented innovation strategy is mostly a result of innovation occurring on the basis of current activities.

The character of innovations which are implemented has also changed as the studied businesses focused on introducing new products or services, limiting to the greatest extent activities that aim to optimise and improve the production process. It needs to be stressed that these are activities with a low degree of uniqueness [and genuine novelty], limited to the company itself or possibly the local market. These results might suggest that the owners of small business undertake current activities relying mostly on their intuition, which, with increased competition and in a changing environment, might not be enough, and this way of operating makes small enterprises vulnerable to risk and limits their development.

The authors of this article are aware of the fact that a small extent of the research sample will not allow to form far-reaching generalizations, but the compared results show the direction of changes in the operations of small Polish enterprises and may be the basis for further analyses. Furthermore, the frequency of research showed the direction of changing the focus within the scope of the strategic planning of introduced innovations at companies operating in this scale, resulting to some extent from the changes which took place in the business environment and in connection to the recession in 2008.

References

- [1] ENNIS, S. Marketing planning in the smaller evolving firm, empirical evidence and reflections. *Irish Marketing Review*, 1998, **11**(2): 49–61. ISSN 0790-7362.
- [2] EC. European innovation scoreboard 2008: Comparative analysis of innovation performance. *PRO INNO Europe paper*, 2009, no. 10. Brussels: European Communities, 2009. ISBN 978-92-79-09675-4.
- [3] GORZEŃ-MITKA I. Risk Identification Tools – Polish MSMEs Companies Practices. *Problems of Management in the 21st Century*, 2013, **3**(7): 6–11. ISSN 2029-6932.
- [4] IGARTUA, J. I., J. A. GARRIGÓS, and J. L. HERVAS-OLIVER. How innovation management techniques support an open innovation strategy. *Research-Technology Management*, 2010, **53**(3): 41-52. ISSN 0895-6308.
- [5] *Kierunki inwestowania w nowoczesne technologie w przedsiębiorstwach MSP: Raport z badania ankietowego*. Warszawa: PARP, 2007. ISBN 978-83-60009-57-4.
- [6] MADRID-GUIJARRO A., D. GARCÍA-PÉREZ-DE-LEMA, and H. VAN AUKEN. An Investigation of Spanish SME Innovation during Different Economic Conditions. *Journal of Small Business Management*, 2013, **51**(4): 578–601. ISSN 1540-627X.
- [7] MAZZAROL T., D. N. CLARK, and S. REBOUD. Strategy in action: Case studies of strategy, planning and innovation in Australian SMEs. *Small Enterprise Research*, 2014, **21**(1): 54–71. ISSN 1321-5906.
- [8] ONCIOIU, I. and D. CANTEMIR. Innovation of Romanian SMEs – a developing strategy of the economical activity perspective. *Global Conference on Business and Finance Proceedings*, 2013, **8**(1): 242–246. ISSN 1941-9589.

- [9] OKRĘGLICKA, M. Adoption and Use of ICT as a Factor of Development of Small and Medium-sized Enterprises in Poland. *Przedsiębiorczość i Zarządzanie*, 2014, **15**(7.1): 393–405. ISSN 1733-2482.
- [10] STAWASZ, E. Potrzeby innowacyjne firm z sektora małych i średnich przedsiębiorstw z województwa łódzkiego. In STAWASZ E. and J. MERTL. eds. *Instrumenty transferu technologii i pobudzania innowacyjności małych i średnich przedsiębiorstw*. Łódź: Wydawnictwo Uniwersytetu Łódzkiego, 2005. ISBN 9788390163673.
- [11] TWISS, B. *Managing Technological Innovation*. London, UK: Pitman Publishing, 1993. ISBN 978-0470547823.
- [12] WOODS, A. and P. JOYCE. Owner-managers and the practice of strategic management. *International Small Business Journal*, 2003, **21**(2): 181–195. ISSN 0266-2426.

Alice Reissová, Tomáš Siviček, Josef Jílek

Jan Evangelista Purkyně University in Ústí nad Labem, Faculty of Social and Economic Studies, Department of Management, Department of Economics

Moskevská 54, 400 96 Ústí nad Labem, Czech Republic

email: alice.reissova@ujep.cz, tomas.sivicek@ujep.cz,
josef.jilek87@gmail.com

Spatial Aspects of Employee Engagement

Abstract

This article deals with a systemic bias of strategic company management related to perceived employee engagement from the perspective of a manager. As shown by a number of studies, employee engagement can significantly influence company performance. Employee engagement, its appraisal and measurement have become quite topical recently. The objective of this research was to provide empirical validation in the region of whether there is a relationship between the positive perception of the region and perceived employee engagement. The research was conducted in all districts of the Ústí Region. The sample comprised 151 respondents - businesses as well as state and public administration organisations. The conclusions explicitly show that respondents who positively perceive their region also show a higher engagement rate of their employees at the same time. The research also focused on finding out whether there are differences in the appraisal of the employee engagement rate by their employers. The conclusions of this research study surprisingly showed that respondents from state and public administration organisations appraise their employees as more engaged than those from companies. It was also established that there were differences in employee engagement with respect to the size of the business. A lower engagement rate was established in large businesses (above 250 employees) as opposed to smaller companies. In terms of human resource management, our businesses pay more attention to all standard personnel activities. Companies quite recently have started making inquiries into employee satisfaction, for example. However, companies show big differences in establishing the engagement rate in practice. Organisations looking for a way to increase their performance should focus exactly on this issue.

Key Words

performance management, employee engagement, workplace engagement, human resources, competitiveness, Czech Republic

JEL Classification: E24, J24, O15, M12, M14

Introduction

Irrespective of the recent pace and intensity of innovations, the key to the success of a business will always be people. People are a source of ideas and innovations but this also depends on the people implementing them in order to help customers to resolve their problems or needs. Consequently, to manage a company, not only should the outputs be checked but it is necessary to focus on managing human resource performance as well.

As early as in 1968, Peter F. Drucker envisaged in his book "The Age of Discontinuity" that the most important change we can expect in the future will be that: „...knowledge will

become the fundamental and decisive asset that will change the character of the labour force and work, training and learning, and, at the same time, there is a question of responsibilities of people who have the knowledge." [17; p. 19]

Resources, including human resources, influence the formulation of a strategy and the strategy is based on them. [17; p. 102] As to the context of strategic human resources management, there are several different approaches to how to manage performance. M. Armstrong [1], representing the so-called integrative approach, says that the performance management process offers the opportunity to integrate all HR strategies, i.e., linking personnel procedures so that they complement and strengthen each other. On the contrary, Lengnick-Hall et al. [7] have developed a rather chronological view of the development of strategic human resources management (SHRM).

1. Employee Engagement Management and Measuring

The issue of engagement has emerged recently in connection with the development and management of human resources. The general topic of performance management is relatively broad and very frequented. As of 4th April 2015, Google Scholar offers¹ 3.61 million references to "Performance Management", EBCOhost 11,011²; the collocation "Employee Engagement" shows 476,000 references in Google Scholar and 689 in EBCO (under the same conditions). If you combine "Employee Engagement" with "Measuring", EBSCOhost offers only 15 sources.

In any case, studies dealing with engagement and the spatial aspect focus, for example, on the impacts of globalization on human resources management, how to adjust HR strategies, programmes and questions of Performance Management, how to balance global functioning and standardization with local aspects and autonomy [12, 6], or tailored to employee engagement in remote and off-site locations depending on institutional factors such as communication with the headquarters and training options [16]. The most important study taking regional aspects into consideration is the "State of the Global Workplace", which suggests the alarming fact that only 13 % of employees are engaged, with 11 % in Central and Eastern Europe and 8 % in the Czech Republic.[2] Basically, there are relatively few similar academic studies. However, it is not possible to compare the results of conducted studies due to different methodologies used for measuring the engagement.

Employee Engagement development represents a way to deliver greater performance of a business enterprise, which is appreciated as the key to the success and competitiveness of an organisation. [3, 4, 9, 13] At the same time, however, employee satisfaction should be differentiated from their engagement. Satisfaction with work is believed to be a prerequisite to engagement. [9, 15]

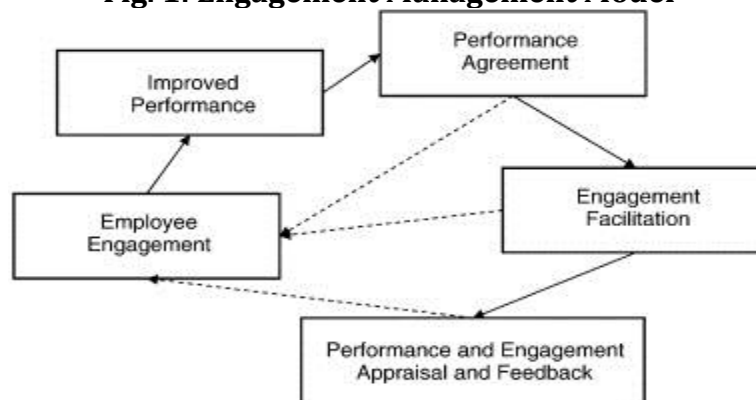
¹ Without quotations and patents; without filtering it is 3.97 million references.

² Filtering parameters: Full Text; academic and reviewed periodicals. The number of entries without filtering is: 47545.

To achieve a higher level of performance, many companies put greater emphasis on performance management systems. The best way to improve performance is to focus on the performance management system in order to support the involvement of employees. The authors specified a new approach to the performance management process for this purpose, which includes personnel involvement, and they describe the main factors important for employee involvement at each stage. They represent a management model that suggests a new view of support and management personnel involvement so that a high level of performance can be achieved. [3] One of the latest studies looks into the influence and impact on performance as long as the main principles of management and management process are based on personnel involvement [10].

Models of the performance management process typically comprise a sequence of phases or activities, such as: Performance Agreement, Engagement Facilitation, Performance and Engagement Appraisal and Feedback, Employee Engagement, and Improved Performance (e.g., [1, 3, 11]).

Fig. 1: Engagement Management Model



Source: Gruman, 2011

SurveyMonkey¹ [15] took up the theoretical concept of Macey et al. [9] on Work Engagement. According to this concept, urgency, focus, intensity and enthusiasm represent the four basic components of Work Engagement. Macey et al [9] recommend in measurement to establish employees' opinion as well as their perception of how their colleagues behave, both in links to engagement, they showed that in a sample of 65 companies in different industrial branches, the top 25% of companies showed a greater return on assets (ROA), higher profitability and more than double the value for shareholders (as opposed to those ranked in the bottom 25% companies). However, there are more organisations that compile and implement Employee Engagement Surveys in practice on a commercial basis.²

¹ It links to the previous product "People Insight Survey" generated by the Society for Human Resource Management.[15]

² For example, Qualtrics, etc.

Since 1990¹, Gallup – the world acclaimed organisation - has been conducting regular research² in the USA focusing on Employee Engagement. The geographical focus was increased in their next study – "State of the Global Workplace" - which provides an analysis of more than 140 countries in the period between 2011 and 2012. However, it covers data from 2009-2010, which is rather limiting. [2] At the same time, it draws attention to the fact that 24% of employees are actively disengaged worldwide, i.e., "those who are negative and potentially hostile to their organisations" [2; p. 6]. In Germany, for example, the costs associated with this issue reach up to €138 bill. per annum. Disengaged employees in the Czech Republic make up to 30%. The next significant contribution from Gallup is their Q12 Meta-Analyses, which measure the relationship between Workplace Engagement and Organisational Outcomes at the levels of Business/Work units, such as customer loyalty, profitability, productivity, etc.³

Our study is based on the presumption that if there are any differences in motivation at the Business unit level and between countries [2], there are also differences in space at the regional level⁴. Objectively, there are obstacles that prevent full utilisation of a company's potential both on the part of external, objective causes as well as internal, subjective ones which are reflected in different financial performance in different regions. Those external ones can be given by overall socio-economic factors (including, e.g., quality of workforce, willingness to commute to work, willingness to do business), institutional environment [5, 8] and geographic zone; those subjective ones can be given by organisational structure, manner and effectiveness of management (including aspects such as motivation, leadership, etc.). These obstacles can lead to dissatisfaction with the place of business, which can be reflected in, for example, weaker leadership of the management. It is, however, one of the factors directly influencing the links and engagement of employees that relate to company performance.

2. Methodology

In terms of methodology, we conceptionally link to Macey et al. (2009). The questions in the questionnaire come from the methodology applied by SurveyMonkey [14, 15]. We modified it in the effort to find out how satisfaction/dissatisfaction with the place of business can influence perceived employee engagement. Its objective is to provide empirical validation within the regional scope, i.e., at a lower level than nationwide, to see if there is a link between the perception of a region and perceived employee engagement, and if so, whether it is statistically significant.

Our sample involved businesses as well as state administration organisations and local governments. The sample of companies was created upon the quota sampling principle. The quota features were legal form, number of employees and place of business. The

¹ It also develops previous studies on satisfaction of employees.

² See more: Gallup's State of the American Workplace: Employee Engagement Insights for US Business Leaders.

³ See more: Gallup Q12® Meta-Analysis.

⁴ According to Gallup - region is a group of countries, e.g., Western Europe, East Asia, etc. In this article, we mean a lower level, e.g., NUTS 2 or NUTS 3.

sample of state and public administration was created according to the place/seat. (Respondents from all districts of the Ústí Region were contacted). The sample comprised 151 respondents in total, of which 41 of those enquired worked in state and public administration organisations and 110 in businesses.

An enquiry was selected as the main research method. An electronic questionnaire was developed and sent¹ to personnel managers, or managers (in smaller companies not having a position of personnel manager). Data were collected in March 2015. If the questionnaire was not filled in upon the e-mail request, the respondent was contacted by telephone (CATI support). Data were processed in the MS Excel programme, and Pearson's Chi-square test with Yates' continuity correction and McNemar's Chi-square test with continuity correction were used to provide a statistical analysis.

Apart from the main objective stated above, we also established the proportion of involvement (engagement) of employees in the sample selected by us and compared whether there is a difference between the engagement proportion in businesses compared to state and public administration.

3. Regional Analysis of Employee Engagement

The main objective of our research was to establish the employee engagement proportion and empirically validate in the regional scope, i.e., at lower than the national level, whether this link between the region's perception and perceived engagement exists and if it is statistically significant. We also wanted to know whether individual samples of employers (i.e., state and public administration as opposed to businesses) will show differences in employee engagement. To measure engagement we used the SurveyMonkey methodology [14, 15]. It is based on ten questions that were modified with respect to the goal of our survey. The questions are shown in Tab.1.

Tab. 1: Group of questions focused on establishing employee engagement

Question number	Question text
1.1	employees are willing to accept changes
1.2	employees are willing to accept new tasks if need be
1.3	employees are willing to take over initiative and, if need be, help other employees
1.4	employees proactively identify future challenges and opportunities
1.5	employees continue in their efforts despite any current failures
1.6	employees respond quickly to difficult situations and accommodate to them
1.7	employees come up with creative ideas for improving work/the environment
1.8	employees endorse the values of the company/organisation
1.9	employees are interested in what is happening in the company/organisation and they are willing to participate in different events
1.10	employees go to work not only to earn money but because they enjoy their work

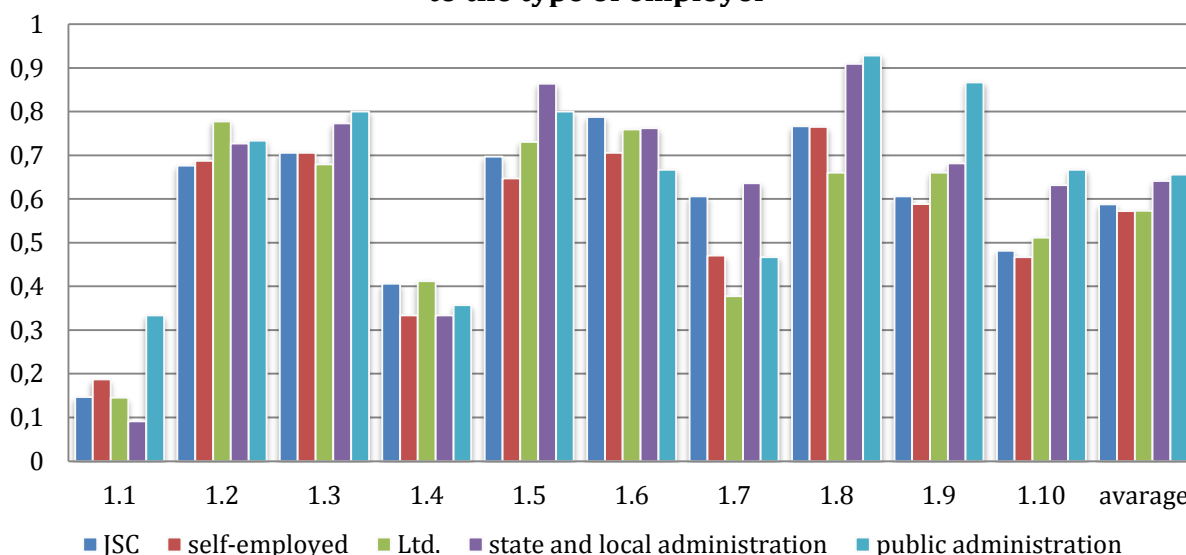
Source: own processing, according to [14].

¹ This approach is different from that of Gallup or SurveyMonkey, where questions are answered by employees.

At first we tried to find out whether there were differences in the perceived engagement rate between employees of state and public administration organisations and company employees.

Fig. 2 shows that in question No. 1.8 (i.e., whether employees endorse the company/organisation values)¹ there is a considerable difference between the monitored samples. We applied here Pearson's Chi-square test with Yates' continuity correction with null hypothesis, that both companies and state and public administration organisations endorse the values of their organisation to the same degree. The alternative hypothesis was that between these two samples there is a statistically important difference. X-squared = 5.0969, df = 1, p-value = 0.0239 values were obtained. $p1 = 0.7113$ is an estimate of the likelihood that employees of state companies will endorse the values of their organisation and $p2 = 0.9167$ is the analogical estimate for employees of state and public administration. Consequently, at the achieved 5% level of significance, the null hypothesis was denied in favour of the alternative that employees of state and public administration show higher endorsement of the values of the organisation in which they work. Such finding is relatively surprising and it would be interesting to find out what factors influence it.

Fig. 2: Relative frequency of positive responses to individual questions according to the type of employer



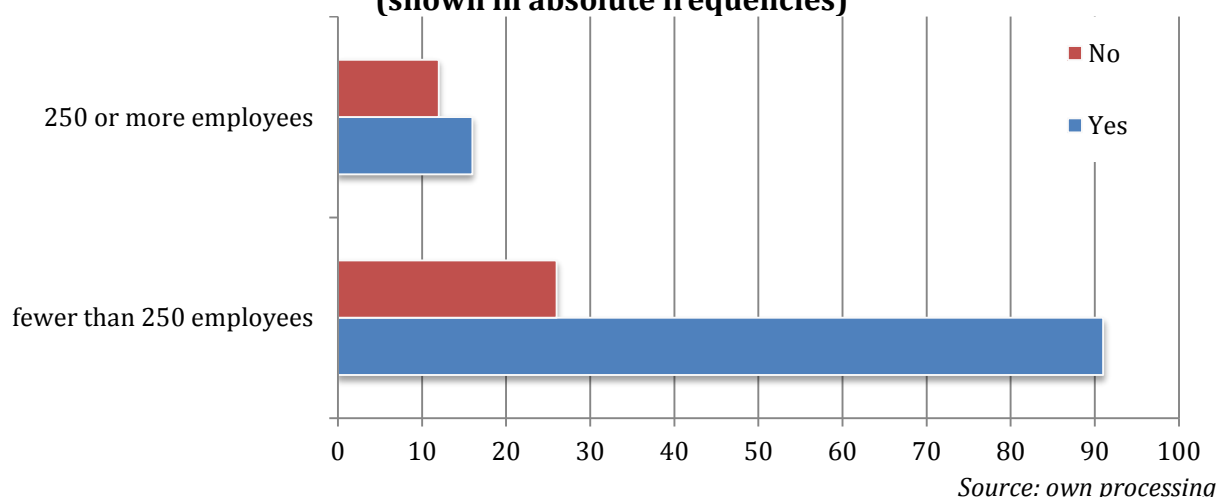
Source: own processing

In the further data analysis we divided the sample according to the number of employees. We created two samples: "smaller-sized organisations" (up to 250 employees) and "large-scale organisations" (over 250 employees). In this case, a statistically significant difference was shown in responses to question No. 2 (employees are willing to accept new tasks if need be). We used Pearson's Chi-square test with Yates' continuity correction with null hypothesis that the positive response rate is the same in both companies and with the alternative hypothesis that the positive response rate differs between individual samples. X-squared = 3.9647, df = 1, p-value = 0.0467 values were established. $p1 = 0.7777$ is an

¹ Positive responses for Figures 2-4 are aggregates from the five point response form.

estimate of the likelihood that employees of a smaller company will be willing to accept new tasks if need be, and $p2 = 0.5714$ is an estimate of this likelihood for employees of large companies. At the 5% level of significance, we reject the null hypothesis in favour of the alternative hypothesis that employees of smaller-sized companies are more willing to accept new tasks as needed by the employer.

Fig. 3: Willingness of employees to accept new tasks as needed by their employer (shown in absolute frequencies)



As to the findings in terms of region perception, we also asked respondents if they think that the place/city where they do business somehow influences the total financial results of the company¹.

Tab. 2: Group of questions focused on establishing the perception of the place/region

Question number	Do you think that the place (city) where you have your registered office / place of business influences your total financial performance? Do you think that:
2.1	If you did business in a different region, your performance would be significantly better?
2.2	If you did business in a different district in the region, would your performance be significantly better?
2.3	If you did business in a different town in the same district, would your performance be considerably better?

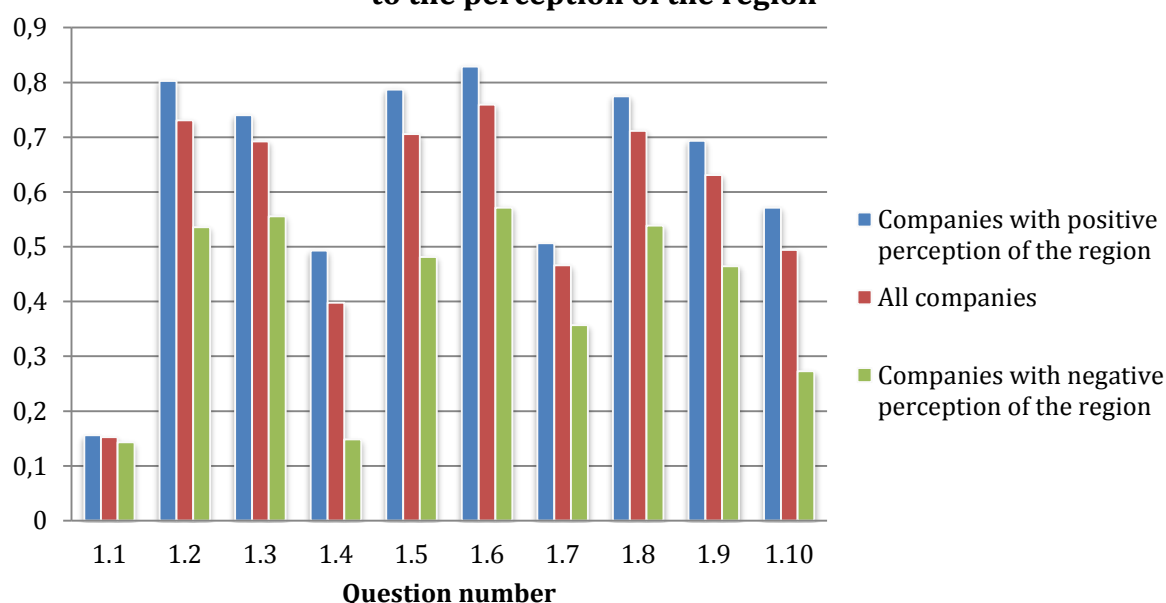
Source: own processing

Respondents should appraise whether their financial performance would be better if they conducted business in a different region, in a different district in the same region or a different town in the same district. Out of 110 respondents from companies, 30 responded that their performance would be better if they were based in a different region, 12 respondents thought they would perform better if they were based in a different district in the same region and 8 business units responded that their performance would be better if they were based in a different town in the same district. We conducted the McNemar's Chi-square test with continuity correction for paired observations with null hypothesis - if the region was changed, the company performance would improve in the same percentage rate of organisations, as well as in case the district were changed. An

¹ This question was not targeted at respondents from state and public administration organisations.

alternative would be the hypothesis that the change in region and/or district would bring different expected improvements in the company performance. The McNemar's chi-squared = 16.0556, df = 1 values and p-value = 6.151e-05 clearly deny the null hypothesis at both the 5% and 1% level of significance. An even lower p-value was achieved when we compared anticipated improved performance of the company when the region and the town in the district were changed. So we can clearly see that the businesses in the region think that if a change in seat was to bring positive changes, it would have to be a change in region, and a change in district in the same region or change in town in the district would not be enough to improve. Out of 30 companies that would expect a positive change if the region were changed, 16 think that their performance would be better in the Central Bohemian Region or in Prague and 8 did not specify any region. Hence, the results show that the financial environment is relatively less beneficial for companies in the whole Ústí Region as well as a big contrast with the financial environment of the Central Bohemian Region.

Fig. 4: Relative frequency of positive responses to questions 1.1 – 1.10 according to the perception of the region



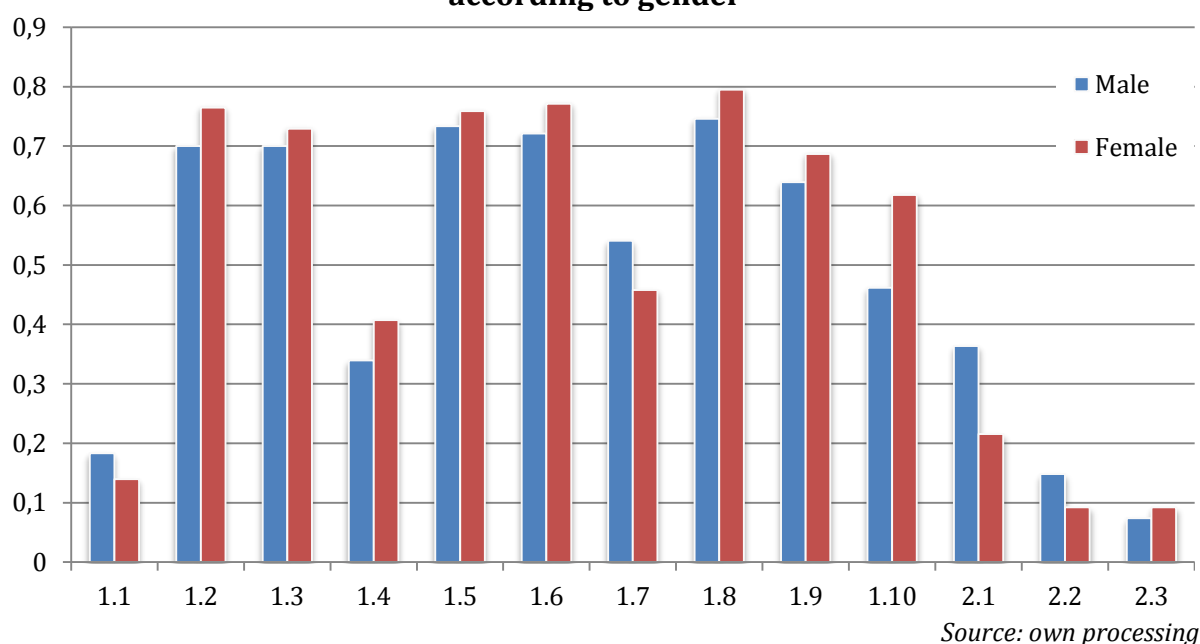
Source: own processing

Based on the above-stated findings, the companies were divided into two samples. The first sample involves businesses that positively perceive their region (i.e., they do not think that moving the company to another region would improve their financial results). The second sample comprises companies that perceive their region negatively (i.e., they think that a change in seat would improve their financial performance). The analysis of the first question was carried out based on this division, i.e., questions 1.1 – 1.10. The results are shown in Fig. 4.

Fig. 4 shows that the business units that perceive their region positively achieved a larger relative frequency of positive responses in all questions 1.1 - 1.10. Those business units negatively perceiving their region also show considerably worse appraisal of the total engagement of employees. The greatest drop in relative frequency of positive responses was seen in question No. 1.4 (employees proactively identify future challenges and opportunities).

To provide statistical validation of the significance of the established difference, we compared the results established for the second question (region perception) with the results established in the first question (where the employee engagement was measured). In the ten sub-questions (i.e., 1.1 – 1.10) the relative frequency of positive responses (“completely agree” or “more or less agree”) was calculated for each business. This value shows the level of employee engagement. All companies were then divided into two samples: the first sample contained companies that achieved an above-average value of employee engagement, whereas the second sample contained businesses with below-average employee engagement. The second division of the sample was carried out based on question 2.1., i.e., according to whether the respondent thinks that the company's performance would be better in a different region. Based on the methodology selected, Pearson's Chi-square test with Yates' continuity correction with null hypothesis was conducted that the perceived employee engagement is the same independently of the fact whether the company would expect better performance in a different region or not. The alternative hypothesis was that businesses showing a better perception of the current region will achieve a different rate of the perceived engagement. Due to the obtained values $X^2 = 9.6036$, $df = 1$ and $p\text{-value} = 0.001942$, the null hypothesis was clearly denied at the 1% level of significance. The average measured perceived employee engagement (i.e., the average relative frequency of positive responses to questions 1.1 - 1.10) is 0.6345 in companies that perceive their region positively and 0.4194 in companies that think that a change in region would benefit their performance. Hence, the data we collected clearly show the fact that respondents who perceive their region more positively achieve statistically significantly higher engagement of employees than employees in companies with a negative perception of their region.

Fig. 5: Relative frequencies of positive responses to individual questions according to gender



Finally, we wanted to validate whether the responses were not skewed as a result of the respondent's gender. Surprisingly, responses to all questions in both females and males were very similar. The results are shown in Fig. 5.

No statistically significant difference was established in any question. The only question where some difference was observed was question number 2.1. In this question we looked at the respondent's opinion of whether the performance of the organisation would be better if the company was based in a different region. We divided the sample according to gender and then studied the null hypothesis using Pearson's Chi-square test with Yates' continuity correction stating that both males and females responded in a similar way. We calculated the X-squared = 2.5358, df = 1, p-value = 0.1113 values. The null hypothesis was therefore not denied at the 5% level of significance. We can say that the responses were not skewed in this question or any other question by the respondent's gender.

Conclusions

The survey conducted by Gallup, the world-acclaimed institution, shows that only 13 % of employees are engaged [2] worldwide. As numerous previous studies suggest, there is a strong positive link between employee engagement and company performance. From this viewpoint, companies have a great internal potential which is not utilised.

In our research, we dealt with the question of whether there is a link between region perception (satisfaction with the place of business) and the perceived rate of employee engagement. We obtained definite statistically significant conclusions that such a link exists. Companies showing positive region perception appraise their employees as more engaged.

Dissatisfaction with the place of business can lead to less authentic leadership of the company management, which negatively influences the engagement of employees and can lead to generally lower company performance. It can further have a retroactive impact on employee satisfaction and the loss of key talents, which risks the long-term operation and development of a company.

If strategic management should also provide the right feedback about the company and employees performance for decision making processes, then from this perspective, the manager's perception of the region is a source of a systematic bias in decision making, which might lead to a wrong selection of tools and to unsatisfactory results. Using more objective or standardised methods might be a way to the elimination of this bias.

As the studies show, increased engagement brings positive results at the company level as well as at the regional and national level. It can be considered one of the instruments to increase the competitiveness of both companies and regions. Together with the satisfaction of employees and customers it contributes to a higher quality of their life. Improved image and perception will preclude loss of talent but it can be a reason to obtain and keep them, even if they commute from remote areas. Moreover, positive perception of the region in engaged employees encourages the entrepreneurial spirit.[2]

The issue of the employee engagement rate is not only the domain of companies. Both the state and public administration have placed great emphasis on quality appraisal of the outcomes from such organisations recently. Our research showed a surprising finding that state and public administration employers appraise their employees as more engaged than company employers.

Acknowledgements

This article was written as part of the SGS project of the Jan Evangelista Purkyně University "Perception of restructuring regions in the context of various forms of commodification".

References

- [1] ARMSTRONG, M. *Performance management: Key strategies and practical guidelines*. London, UK: Kogan Page Limited, 2000. ISBN 0-7494-4537-8.
- [2] GALLUP. *State of the Global Workplace: Employee Engagement Insights for Business Leaders Worldwide* [online]. Washington, USA: Gallup, 2014. [cit. 2015-02-25]. Available at: <http://www.gallup.com/services/176735/state-global-workplace.aspx>
- [3] GRUMAN, J. A. and A. M. SAKS. Performance management and employee engagement. *Human Resource Management Review*, 2011, **21**(2): 123–136. ISSN 1053-4822.
- [4] HARTER, J. K., F. SCHMIDT, and T. L. HAYES. Business-unit-level relationship between employee satisfaction, employee engagement, and business outcomes: a meta-analysis. *Journal of applied psychology*, 2002, **87**(2): 268–279. ISSN 0021-9010.
- [5] HLAVÁČEK, P., M. ŽAMBOCHOVÁ, and T. SIVIČEK. The Influence of the Institutions on Entrepreneurship Development: Public Support and Perception of Entrepreneurship Development in the Czech Republic. *Amfiteatru Economic*, 2015, **17**(38): 408–421. ISSN 1582-9146.
- [6] HUBBELL Jr., P. Optimizing employee engagement across the globe. *Plant Engineering*, 2014, **68**(6): 18–22. ISSN 0032-082X.
- [7] LENGNICK-HALL, M. L., C. A. LENGNICK-HALL, L. S. ANDRADE, and B. DRAKE. Strategic human resource management: The evolution of the field. *Human Resource Management Review*, 2009, **19**(2): 64–85. ISSN 1053-4822.
- [8] RUMPEL, P., O. SLACH, and J. KOUTSKÝ. Shrinking cities and governance of economic regeneration: The case of Ostrava. *E+M Ekonomie a Management*, 2013, **16**(2): 113–128. ISSN 1212-3609.
- [9] MACEY, W. H., B. SCHNEIDER, K. M. BARBERA, and S. A. YOUNG. *Employee engagement: Tools for analysis, practice, and competitive advantage*. Hoboken, NJ, USA: Wiley-Blackwell, 2009. ISBN 978-1-4051-7902-7.
- [10] MEDLIN, B. and K. W. GREEN Jr. Impact of management basics on employee engagement. *Academy of Strategic Management Journal*, 2014, **13**(2): 21–35. ISSN 1939-6104.

- [11] PULAKOS, E. D. *Performance management: A new approach for driving business results*. Malden, MA: Wiley-Blackwell, 2009. ISBN 978-1-4051-7761-0.
- [12] RAZI, N. Employing O.D. Strategies in the Globalization of HR. *Organisation Development Journal*, 2006, **24**(4): 62–68. ISSN 0889-6402.
- [13] RICHMAN, A. Everyone wants an engaged workforce how can you create it? *Workspan*, 2006, **49**(1): 36–39. ISSN 1529-9465.
- [14] SURVEYMONKEY. *Work Engagement Survey Template* [online]. Palo Alto, CA, USA: SurveyMonkey, 2015. [cit. 2015-02-25]. Available at: <https://www.surveymonkey.com/blog/en/work-engagement-survey-template-shrmf>
- [15] SURVEYMONKEY. *Overview of the Development of the SurveyMonkey Employee Engagement Survey* [online]. [cit. 2015-02-25]. Available at: <https://secure.surveymonkey.com/smassets/anonweb/2015.03.10.633-anonweb-0144/assets/emp-engage-dev-overview.pdf>
- [16] VAIJAYANTHI, P., K. A. SHREENIVASAN, and S. PRABHAKARAN. Employee Engagement predictors: A study at GE Power & Water. *International Journal of Global Business*, 2011, **4**(2): 60–72. ISSN 2151-7541.
- [17] ZUZÁK, R. *Strategické řízení podniku*. Praha: Grada Publishing, 2011. ISBN 978-80-247-4008-9.

Miroslav Žižka, Lukáš Turčok

Technical University of Liberec, Faculty of Economics,
Department of Business Administration and Management
Studentská 1402/2, 461 17 Liberec, Czech Republic
email: miroslav.zizka@tul.cz, lukas.turcok@tul.cz

Data Envelopment Analysis as a Tool for Evaluating Company Performance

Abstract

The article deals with multi-criteria performance measurement of innovative companies. As a tool for evaluating the performance of companies, a two-stage Data Envelopment Analysis (further DEA) is used. In the first stage of the analysis, effectiveness in terms of the protection of industrial property rights is quantified. In the second stage, efficiency, that means whether companies can commercialize industrial rights, is measured. The overall performance score, then, integrates both dimensions; efficiency and effectiveness. The article is divided into three consecutive parts. In the first part, the definition and measurement of performance of companies is discussed. Further, the DEA method is presented in more detail. The history of this method and its application in practice is briefly introduced. In the second part, the methodology used in the research and the data used are presented. The third part shows the results. The proposed methodology for evaluating the performance of innovative companies was tested on a sample of 36 innovative companies in the textile industry. To quantify individual performance components, the BCC input-oriented model was used because decreasing returns to scale in the industry were identified. A long-term capital and the period of a company's existence as a measure of intellectual capital were used as inputs of the first model. The outputs of the first model are numbers of registered results of technical creative activity and industrial design. These outputs are also inputs to the second model. The output of the second model is the value added indicating whether the companies are able to commercialize protected industrial rights. At the end of the analysis, the companies are divided into four quadrants according to scores of effectiveness, efficiency and performance.

Key Words

data envelopment analysis, business performance, industrial property rights, effectiveness, efficiency, BCC model

JEL Classification: C61, L67

Introduction

The performance of companies is a current and frequent topic in professional literature. At the same time, however, the topic can be understood in different ways, and, thus, allows considerable research potential. This article aims to propose a methodology for evaluating the performance of innovative companies using Data Envelopment Analysis (further DEA). An innovative company is the company that systematically implements projects for new products up to commercial maturity stage and launches the product to the market [19]. The article is divided into three main parts. The first part presents the history of the DEA method and its applications with the emphasis on the performance of companies. In the second part of the article, a methodology for evaluating the

performance of the companies and sources of data used are presented. In the next section, the methodology is tested on the example of companies from the textile industry. The results are then evaluated and other possible directions of research are discussed.

1. Literary overview

In the following part, different approaches to the performance of companies are first introduced. Furthermore, the DEA method that was used in the article as the main tool of multi-criteria evaluation of the performance of companies is characterized in more detail.

1.1 Company performance

In literature, there are many different definitions of performance. As stated by Lebas, to define the term performance is even more frustrating than to measure it [17]. The performance of the company includes two major dimensions - "do the right things" and "do the things right" [20]. The first dimension is referred to as effectiveness and the second dimension as efficiency. Apart from these two components, the performance is also linked to the economy and ethics. It can thus be concluded that the performance integrates all elements of the 4E concept [2].

Performance is making assumptions and management of all areas of company activities within the limits specific for the given company which leads to achieving the set objectives at the right time. In particular, it leads to the creation of value for shareholders, which will ensure long-term viability of the company. This definition includes prevailing views on performance (see e.g. [3], [14], [17], [20]), and in particular, underlines the link of performance on company existence sustainability [15].

Creating a system for measuring performance is obviously also important supposing we are to manage company performance [8]. New demands require a change in the competitive environment and in performance measurement and management, especially towards the wider use of non-financial indicators and multidimensional concepts [13]. There are several concepts of company performance measurement: using simple indicators, a set of pyramid indicators, composite indicators and multivariate and multi-criteria methods. Each of these concepts can use various financial and non-financial performance measures. The disadvantage of simple indicators is the fact that according to every measure, we obtain different, difficult-to-compare results. Conversely, the advantage of multi-criteria methods is a possibility to take into account a number of inputs and outputs that affect company performance. One of these methods is the DEA method presented below.

1.2 Characteristics of Data Envelopment Analysis

Data Envelopment Analysis is one of the methods of multi-criteria linear programming. This method enables to evaluate the companies using multiple inputs and outputs. The authors of the method are Charnes, Cooper and Rhodes who published it in 1978 in the

European Journal of Operations Research. The first model, denoted by authors' last names as CCR, was based on the assumption of constant returns to scale [5]. The method is used to evaluate the efficiency or performance of homogeneous decision-making units (further DMUs) that work with the same inputs and outputs. DEA divides a set of DMUs into two parts (efficient, performing or inefficient, non-performing units) where efficient (performing) units are located at the frontier representing "best practice" [5]. For each unit, the coefficient of technical efficiency is calculated as a ratio of the weighted sum of outputs and a weighted sum of inputs. The inputs and outputs are yet assigned different weights so as to maximize the efficiency or performance of each DMU [12]. Coefficient of technical efficiency of the units on the efficient frontier equals one. For inefficient units the coefficient is greater or smaller than one, depending on whether the model is focused on inputs or outputs.

In 1984, Banker, Charnes and Cooper suggested a model which considers the variable returns to scale. This model is referred to as BCC and may also be focused on inputs or outputs. In addition to basic CCR and BCC models, other DEA model variants were later developed. However, their characteristics exceed the intent of the article and are described, for example, in the book [12].

The application of DEA models is relatively broad. Historically, they typically include public services (hospitals, schools, public transport), see e.g. [5], [18]. In recent years, however, the application of DEA models can also be encountered in evaluating the performance of business entities. For example, Jablonský and Dlouhý used DEA models to evaluate the efficiency and performance of companies in the Czech Republic, Poland, Hungary and Germany. They also tried to identify differences in the performance of companies in the former Eastern and Western blocs [12]. Chen, Xu and Feng examined innovative processes in Chinese high-tech companies using a two-stage DEA method. The production process in this study was divided into a stage of technological development and the commercialization stage, while the outputs of the first stage were used as inputs to the second stage of evaluation [4]. A banking sector is a common area of application too [11], [16] since its branch network well meets the requirements for the homogeneity of units. In the above mentioned bank studies, the two-stage DEA was also used. In the first stage, efficiency was evaluated and in the second stage, the effectiveness was evaluated. Product of efficiency and effectiveness, then, determined the performance score. In financial institutions, inputs and outputs are often defined under conditions of uncertainty. These are, for example, outputs such as customer satisfaction and social responsibility. For such cases, DEA models are recommended using fuzzy data sets [10].

2. Data and methodology

The research was aimed at a two-stage performance evaluation of the innovative companies in the textile industry in the Czech Republic (industrial branch by CZ-NACE 13). This sector was chosen because it represents a traditional industry in the Czech Republic. In the past 20 years, it has undergone major restructuring and a decline in both the number of enterprises and employment. Therefore, mostly strong innovation-focused companies that make products with high added value remained in the industry.

The basic set consists of 55 companies that are listed in the database called the Technological Profile of the Czech Republic. This database is a joint Czech-German project with the official support of the Federal Ministry for Education and Research and the Czech Ministry of Education. The database contains research organizations and innovative companies [7]. Financial statements (balance sheet, profit and loss statement) were obtained from the company Magnus Web CZ database [1]. The statements for the year 2012 were used because they contained maximum information available. Data on the protected industrial property rights come from a database of the Industrial Property Office [6].

Research process can be divided into the following steps:

1. **Create a list of innovative companies in the industry** – the source of information was the Technological Profile of the CR database [7] containing information on 55 innovative companies in the textile industry in the Czech Republic. From this database, there was obtained an identification number, contact information including a link to a web page, the founding year and an interval number of employees.
2. **Definition of inputs and outputs** – corporate performance was evaluated from two aspects: effectiveness of invested resources to achieve the protection of industrial property rights and efficiency, which means how companies were able to evaluate the registered rights in the form of sales or value added. The two-stage DEA was used in which the first stage outputs are also inputs to the second stage of the analysis. The following inputs to the first stage were considered: the number of employees, long-term capital and time of existence of the company. Considered outputs of the first stage and inputs to the second stage: the number of patents, utility models, the number of industrial designs and the number of trade marks. Considered outputs of the second stage: sales of goods and services and value added. Determination of inputs and outputs will be specified after the correlation analysis, see step No. 7.
3. **Obtaining financial statements** – the data source was the Magnus Web CZ database [1]. The data from the year 2012 were available from the balance sheets and profit and loss statements for 50 companies. Five companies, however, showed zero revenues, and four of them with negative value added. These are companies that can be considered inactive. Adjusted basic set represents 45 companies.
4. **More accurate data on the number of employees** – as in the Technological profile database were available only interval data on the number of employees with a relatively wide range, the particular number of employees of companies in 2012 was traced in the Magnus Web database.
5. **Finding information about the history of companies** – the history of a company was seen as a form of accumulated intellectual capital including know-how, skills and experience of the staff and shareholders of the company. Overall company history, including any possible legal predecessors, was examined. The data came from the collection of documents in the Commercial Register and website of the companies.
6. **A search in the Industrial Property Office database** – numbers of valid patents, utility models, industrial designs and trademarks, whose owner was one of the 45 companies, were surveyed. It was found that 36 companies that joined the DEA analysis registered at least one form of protection of industrial property rights.
7. **Analysis of dependence between inputs and outputs** – for the DEA analysis, it is desirable that the inputs (outputs) were independent; otherwise some phenomena can be assigned a higher weight in the evaluation. Therefore, Pearson correlation

coefficients among indicators on the input side as well as on the output side were calculated. At the same time, there was also detected a character of returns to scale for the selection of an appropriate DEA model. Using regression analysis, there were estimated parameters of Cobb-Douglas production function in a logarithmic form (2.4), where Q is output (sales or value added), I_1 and I_2 are inputs (e.g. labor and capital). It is true that if $\alpha + \beta = 1$, the production function represents the constant returns to scale, if the sum of the parameters is greater than 1, these are growing returns to scale and in the event that the sum of the parameters is smaller than 1, these are decreasing returns to scale [9].

$$\log Q = \log A + \alpha \log I_1 + \beta \log I_2 \quad (1)$$

8. **Assessment of a file size in terms of sufficient discrimination** – model should define a limited number of performing units. It is true that among the extent of the N set and a number of inputs m and outputs r , the relation (2) should be fulfilled, see [5]. In the first stage, there are considered 3 inputs and 4 outputs, thus, there should be available at least 21 units, in the second stage, there are considered 4 inputs and 2 outputs, so 18 units would be sufficient. In fact, complete data from 36 companies were available. The model should discriminate well.

$$N \geq \max \{m, r; 3(m+r)\} \quad (2)$$

9. **The two-stage DEA** – a mathematical model was built for every company. In total, 36 models were compiled that were resolved by using the add-in Solver software in MS Excel. There were established scores of effectiveness and efficiency, their product was the performance score for each company. In the end, there was assessed dependence among effectiveness, efficiency and performance using correlation analysis.

3. Research results

First, there were calculated Pearson product-moment correlation coefficients to identify strongly interrelated variables that could influence the results. On the side of the considered input, there was found statistically significant (at significance level $\alpha = 5\%$) and a very strong correlation between the number of employees and long-term capital ($r = 0.90$, p -value < 0.01), and a weaker correlation between the number of employees and the time of existence of the company ($r = 0.29$, p -value $= 0.04$). Conversely, there is no statistically significant correlation between the time of existence of the company and long-term capital ($r = 0.17$, p -value $= 0.24$). On the basis of these results, long-term capital and the time of existence of the company were retained as inputs to the first model of DEA.

On the output side, it was found that the numbers of patents significantly correlated with the number of utility models ($r = 0.78$, p -value < 0.01), furthermore, there is a moderately strong dependence between utility models and industrial design ($r = 0.51$, p -value $= 0.0002$), between utility models and trademarks ($r = 0.62$, p -value < 0.01) and between industrial designs and trademarks ($r = 0.48$, p -value $= 0.0004$). It was also necessary to carry out aggregation of outputs to ensure non-zero number of outputs in all categories.

Therefore, categories of patents and industrial designs, as well as categories of industrial designs and trademarks were merged, each into one group.

On the side of the considered outputs of the second model, there was proved a strong correlation between value added and sales of goods and services ($r = 0.95$, p -value < 0.01). Value added was, therefore, left as the output.

In the next stage, parameters of production function in a logarithmic form were estimated. Several variants of production function were considered, see equations (3) to (6) with outputs Q_1 value added and Q_2 the total number of registered industrial property rights and with the inputs I_1 number of employees, I_2 long-term capital and I_3 the time of existence of the company. The p -value in the analysis of variance was lower in all variants than the significance level (0.05), which means that there is a statistically significant correlation between the output and the two inputs. The sum of the parameters α and β in all production functions points to decreasing returns to scale.

$$Q_1 = 118.33I_1^{0.75}I_2^{0.20}, R^2 = 0.52, F\text{-Ratio} = 22.61, p\text{-value} < 0.0001 \quad (3)$$

$$Q_1 = 10.63I_2^{0.64}I_3^{0.22}, R^2 = 0.40, F\text{-Ratio} = 14.03, p\text{-value} < 0.0001 \quad (4)$$

$$Q_2 = 0.45I_1^{0.30}I_2^{0.08}, R^2 = 0.23, F\text{-Ratio} = 5.38, p\text{-value} = 0.0089 \quad (5)$$

$$Q_2 = 0.11I_2^{0.21}I_3^{0.36}, R^2 = 0.25, F\text{-Ratio} = 6.27, p\text{-value} = 0.0045 \quad (6)$$

With regard to the assumption of diminishing returns to scale, the BCC model oriented at inputs was used. The aim is to maximize the objective function z (7) under constraints (8). Symbol x_j are inputs to the model, symbol y_i outputs, u_i denotes the weight of outputs and v_j the weight of inputs. The variable q represents the difference from the constant returns to scale and can be of any value.

$$z = \sum_i^m u_i y_{iq} + q \quad (7)$$

$$\begin{aligned} \sum_i^r u_i y_{ik} - \sum_j^m v_j x_{jk} + q &\leq 0, k = 1, 2, \dots, n \\ \sum_j^m v_j x_{jq} &= 1 \\ u_i &\geq \varepsilon, i = 1, 2, \dots, r; \varepsilon - \text{very small non-Archimedean number } (> 0) \\ v_j &\geq \varepsilon, j = 1, 2, \dots, m, \\ q &\in R \end{aligned} \quad (8)$$

The score of effectiveness, efficiency and performance was determined for each company (see Table 1). The scores indicate the ratio between the weighted outputs and weighted

inputs. With the use of cofactor, it can be easily found by how many percent the company should reduce its inputs (while maintaining a given level of outputs) to become efficient in the appropriate stage.

Tab. 1: Total performance and its components

DMU	Effectiveness		Efficiency		Performance	
	Score	Rank	Score	Rank	Score	Rank
1	1.00	1	0.09	33	0.09	22
2	0.36	26	0.33	16	0.12	17
3	1.00	1	1.00	1	1.00	1
4	0.35	27	1.00	1	0.35	11
5	1.00	1	0.10	31	0.10	19
6	0.61	14	0.09	33	0.06	26
7	0.55	18	1.00	1	0.55	7
8	0.56	16	1.00	1	0.56	6
9	0.49	19	0.20	24	0.10	19
10	0.69	13	0.33	16	0.23	13
11	0.47	20	0.20	24	0.09	22
12	1.00	1	1.00	1	1.00	1
13	0.85	11	1.00	1	0.85	5
14	1.00	1	1.00	1	1.00	1
15	0.69	12	0.06	35	0.04	29
16	1.00	1	0.17	26	0.17	14
17	0.41	24	1.00	1	0.41	10
18	0.17	28	0.25	20	0.04	29
19	1.00	1	0.25	20	0.25	12
20	1.00	1	1.00	1	1.00	1
21	0.13	31	0.33	16	0.04	29
22	0.09	33	1.00	1	0.09	22
23	0.14	30	1.00	1	0.14	16
24	0.16	29	0.11	30	0.02	35
25	1.00	1	0.06	36	0.06	26
26	0.44	21	1.00	1	0.44	8
27	0.43	23	1.00	1	0.43	9
28	0.56	17	0.14	29	0.08	25
29	0.43	22	0.25	20	0.11	18
30	0.09	34	0.50	14	0.04	29
31	1.00	1	0.15	28	0.15	15
32	0.09	32	0.33	16	0.03	33
33	0.07	35	0.17	26	0.01	36
34	0.06	36	0.43	15	0.03	33
35	0.39	25	0.25	20	0.10	19
36	0.59	15	0.10	31	0.06	26
AVERAGE	0.55		0.50		0.27	
SD	0.34		0.39		0.32	
MAX	1.00		1.00		1.00	
MIN	0.06		0.06		0.01	

Source: author's own source

It is clear from Table 1 that 10 companies behaved effectively in terms of protection of the results of technical and creative activity and industrial rights. A total of 13 companies managed to commercialize results in an efficient way. Finally, only 4 companies acted both effectively and efficiently. These are companies whose performance scores in Table 1 reach one. From this perspective, the models define the performance of the units very well. The average rate of effectiveness of all companies amounted to 0.55 and the level of

efficiency reached 0.50. It follows that the average rate of performance is 0.27. Variability of the data expressed by a standard deviation is quite high.

The results of the first stage of the analysis can be interpreted so that the level of registered industrial property rights corresponds to companies which have lower inputs by 45%. The results of the second model imply that the given economic output corresponds, on average, to the companies with half extent of registered industrial rights. In other words, it can be said that the commercialization of registered industrial rights is not very satisfactory.

Spearman's rank correlations among the effectiveness, efficiency and performance demonstrated that at a significance level of $\alpha = 5\%$, there are positive medium links between both effectiveness and performance ($r = 0.56$, $p\text{-value} < 0.01$) and between efficiency and performance ($r = 0.64$, $p\text{-value} < 0.01$). Conversely, between the effectiveness and efficiency, there was found only weak indirect and statistically insignificant dependence ($r = -0.20$, $p\text{-value} = 0.24$). Based on these results, the assumption can be confirmed that the effectiveness and efficiency are two fundamental pillars of performance. Thus, companies can improve their performance by increasing the effectiveness in terms of better protection of industrial property rights or increasing efficiency by better commercialization of these rights.

Conclusions

The two-stage DEA is a relatively strong and yet not too complicated tool for evaluating the performance of companies. Its advantages include the fact that the final performance indicator can be decomposed into a product of partial indicators, which will allow a better understanding of the factors influencing overall company performance. In this case, the main factors affecting the performance of innovative companies were considered the effectiveness and efficiency of business processes related to the protection of industrial property rights. DEA allows not only quantify business performance, but also compare, e.g. within the sector of the industry, with competitors. Therefore, it serves benchmarking purposes. With the help of the dual model, there can be detected the peer units for those companies whose performance score in this case is less than one. The issue of duality of the DEA models is beyond the scope of this article.

Based on the score of effectiveness and efficiency, the evaluated companies can be divided into four quadrants. In the best category with high scores of effectiveness and efficiency (both greater than 0.5), there are located 7 companies. These are companies which fully protect their results of technical creative activity and are sufficiently able to commercialize efficiently. Conversely, in the quadrant with low effectiveness and efficiency (both score of less than 0.5), there are 13 companies. These are companies whose long-term success in the market may be jeopardized. A total of 6 companies in the quadrant with high scores of efficiency but low scores of effectiveness can well transform the inputs into value added, however does not sufficiently protect the results of their creative work. For these companies, there is a danger that competitors will imitate technical solutions and the design. The last quadrant contains 10 companies with a high score of effectiveness, but low efficiency. These companies spend quite a lot of effort

protecting their industrial property rights but fail to sufficiently evaluate them in terms of value added.

The article can be understood as a contribution to the issue of multidimensional performance of companies. The proposed procedure was tested on the example of one industry. Other research opens the door to validate the proposed methodology on a larger number of sectors and examining differences affecting the performance of companies across sectors.

Acknowledgements

This work was supported by ESF operational programme “Education for Competitiveness” in the Czech Republic in the framework of project “Support of Engineering of Excellent Research and Development Teams at the Technical University of Liberec” No. CZ.1.07/2.3.00/30.0065.

References

- [1] BISNODE. *Databáze MagnusWeb CZ – kompletní informace o firmách v ČR a SR* [online]. Praha: Bisnode ČR, 2014. [cit. 2015-01-12]. Available at: <http://www.bisnode.cz/>
- [2] BUDAJ, P. et al. *Operations Management: Dimensions for Increasing Process Performance*. Fribourg: S.É.C.T., 2013. ISBN 978-2-9700892-3-0.
- [3] CARTON, R. B. and C. W. HOFER. *Measuring Organizational Performance*. Cheltenham: Edward Elgar Publishing, 2006. ISBN 978-1-84542-620-0.
- [4] CHEN, H., R. XU, and Z. FENG. Evaluation of Technological Innovation Efficiency in Chinese High-tech Industry: Two-stage Relational DEA. *Information Technology Journal*, 2013, **12**(15): 3169–3173. ISSN 1812-5638.
- [5] COOPER, W. W., L. M. SEIFORD, and J. ZHU. eds. *Handbook on Data Envelopment Analysis*. 2nd ed. New York: Springer Science and Business Media, 2011. ISBN 978-1-84542-620-0.
- [6] *Databáze Souhrnná rešerše průmyslových práv* [online]. Prague: Industrial Property Office, 2014. [cit. 2015-01-15]. Available at: <http://www.upv.cz/cs/sluzby-uradu/databaze-on-line.html>
- [7] *Databáze Technologický profil ČR* [online]. Prague: Association of Innovative Entrepreneurship CR, 2015. [cit. 2015-02-02]. Available at: <http://www.techprofil.cz/databaze.asp>
- [8] DEDOUCHOVÁ, M. *Strategie podniku*. Prague: C. H. Beck, 2001. ISBN 80-7179-603-4.
- [9] DUCHOŇ, B. *Inženýrská ekonomika*. Prague: C. H. Beck, 2007. ISBN 978-80-7179-763-0.
- [10] HAJIAGHA RAZAVI, S. H., H. AKRAMI, E. K. ZAVADSKAS, and S. S. HASHEMI. An Intuitionistic Fuzzy Data Envelopment Analysis for Efficiency Evaluation under Uncertainty: Case of a Finance and Credit Institution. *E+M Ekonomie a Management*, 2013, **16**(1): 128–137. ISSN 1212-3609.

- [11] HO, CH. T. and D. S. ZHU. Performance measurement of Taiwan's commercial banks. *International Journal of Productivity and Performance Management*, 2004, **53**(5–6): 425–434. ISSN 1741-0401.
- [12] JABLONSKÝ, J. and M. DLOUHÝ. *Metody hodnocení efektivnosti produkčních jednotek*. Prague: Professional Publishing, 2004. ISBN 80-86419-49-5.
- [13] KNÁPKOVÁ, A., L. HOMOLKA. and D. PAVELKOVÁ. Utilization of Balanced Scorecard and the Effect of Its Use on the Financial Performance of Companies in the Czech Republic. *E+M Ekonomie a Management*, 2014, **17**(2): 146–160. ISSN 1212-3609.
- [14] KNÁPKOVÁ, A., D. PAVELKOVÁ, and K. ŠTEKER. *Finanční analýza: Komplexní průvodce s příklady*. 2nd ed. Prague: Grada, 2013. ISBN 978-80-247-4456-8.
- [15] KOČMANOVÁ, A., J. HŘEBÍČEK, et al. *Měření podnikové výkonnosti*. Brno: Littera, 2013. ISBN 978-80-85763-77-5.
- [16] KUMAR, S. and R. GULATI. Measuring Efficiency, Effectiveness and Performance of Indian Public Sector Banks. *International Journal of Productivity and Performance Management*, 2010, **59**(1), 51–74. ISSN 1741-0401.
- [17] LEBAS, M. J. Performance Measurement and Performance Management. *International Journal of Production Economics*, 1995, **41**(1–3): 23–35. ISSN 0925-5273.
- [18] NAZARKO, J. and J. ŠAPARAUSKAS. Application of DEA Method in Efficiency Evaluation of Public Higher Education Institutions. *Technological and Economic Development of Economy*, 2014, **20**(1): 25–44. ISSN 2029-4921.
- [19] *Národní inovační strategie ČR* [online]. Prague: The Office of the Government of the Czech Republic, 2004. [cit. 2015-02-22]. Available at: <http://www.techprofil.cz/pdf/NIS.doc>
- [20] WAGNER, J. *Měření výkonnosti: Jak měřit, vyhodnocovat a využívat informace o podnikové výkonnosti*. Prague: Grada, 2009. ISBN 978-80-247-2924-4.

Section III

Opportunity of Modern Tools in Information and Communication Technologies

Václav Janoščík¹, Zdeněk Smutný², Radim Čermák²

¹ Newton College, a.s., Václavské nám. 837/11, 110 00 Prague, Czech Republic
email: vaclav.janoscik@newtoncollege.cz

² University of Economics, Prague, Faculty of Informatics and Statistics,
W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic
email: zdenek.smutny@vse.cz, radim.cermak@vse.cz

Integrated Online Marketing Communication of Companies: Survey in Central and Eastern Europe

Abstract

The main goal of this paper is to present an explorative research which focused on the approach companies from a sample set to integrated online marketing communication. The paper follows various aspects of the application (instrumental approach) of selected tools – Facebook, Twitter, company website – as well as the linking and sharing of information content across these instruments (synergistic approach). The practical benefit of this paper for companies lies in the possibility to compare their online marketing activities with the typical company from our sample. The typical company publishes annually ten items of news on its website, links the website with profiles on social media and shares approximately a third of communication content across communication tools. This paper partially builds on previous published surveys, which focused only on the Czech Republic. The contribution extends the view by adding other countries from the same region and also compares the results with those from the Czech Republic.

Key Words

online marketing communication, Facebook, Twitter, Central and Eastern Europe

JEL Classification: M31, L86

Introduction

The article aims at presenting an explorative research of company website, Facebook and Twitter usage for (integrated) online marketing communication of commercial subjects. The research focused on companies listed in a study by Deloitte, Top 500 Companies from Central Europe 2014 (Deloitte Top 500) [3]. In spite of the fact that the sample is significantly inhomogeneous, it still represents – in relation to online marketing communication – successful companies from various fields. The article unfolds how these subjects use, link and communicate their messages through selected social media and websites. Besides the descriptive part of the inquiry, the article offers also a basic comparison between the behaviour of B2B and B2C oriented companies, in order to assess the difference in their modes of communication.

Online marketing or the marketing activities in internet-mediated environment are along with the development of ICT and the acceptance of new technologies still more broadly considered to be a necessary part of marketing activities. Companies want to present themselves as well as their products and services within the framework of relevant internet-based services. Effective utilization of online instruments for these activities may

increase their competitiveness [12]. Internet-based technologies can be also used for better optimization of marketing activities – e.g. distribution or availability problems [4, 5]. In the field of marketing communication, the activities and the tools used by companies should be linked [11]. The interlinking creates synergic dynamic and the effect can be multiplied. This may have a positive impact on the public opinion (Word of Mouth) or raise discussion concerning the need for relevant products or services (Voice of Customers) [10]. Another positive result can be the creative engagement of customers and the sharing of their own creations through their profiles on social media and other internet-based services [14].

The perspective presented here, which highlights synergic aspects of online marketing activities, is also reflected in designing the models and attitudes toward communication activities in such environment – e.g. [1, 9, 13]. Within the Czech Republic, there have been surveys focused on interlinking social media with the websites of specific companies. On such basis, instrumental and synergic usage has been analysed, including further comparison with the situation in United States. The findings of the surveys include the following [11, 12]:

- There are significant gaps in the use of social media (the creation and administration of a profile) and its active interlinking in the framework of integrated marketing communication towards synergic effects on the level of interaction among the users of the environment.
- In comparison with companies in the United States, the competitiveness in using social media among companies active in the Czech Republic is relatively small.
- 62% of companies operating online do not interlink any social media with their websites, or they do not use them at all.

The presented article strives to extend the scope on the region of Central and Eastern Europe and compare the findings with other relevant surveys. While studies such as [8] focus – in relation to the effectivity of marketing – on the human element and aim to identify possible limits, this explorative study focuses on instruments and their (synergic) usage by relevant companies. Such approach brings with it a practical contribution for companies: they can compare their activities with competition, identify prospective trends and generally have a basis for further comparison with surveys from other countries or regions. In this respect, references are made to analogous surveys concerning the use of online instruments. They come from the context of NGOs [2], green electricity providers [6], media and publishing companies [7], and subjects operating on the Internet [12].

After reviewing the methodological perspective and material used here, the main findings will be presented concerning the intensity of online marketing communication as distributed between companies with B2B or B2C type of business relations. Furthermore, this comparative perspective will be extended on B2B and B2C companies by stratifying their ability to make marketing synergies across different online tools (social media, discussion forum, blogs and other). Finally, these data will be concluded with a set of deductive results.

1. Data Collection and Methods

Deloitte Top 500 was chosen as the sample set for the research. Although this list is labelled as addressing Central Europe, it actually covers not only Central but also Eastern European countries (Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Hungary, Ukraine, Slovenia, Croatia, Serbia, Bosnia and Herzegovina, Macedonia, Bulgaria, Romania, Ukraine). Only companies from this set were analysed. In the process of evaluation, only those companies were selected which focused on B2B (147) and B2C (183). Students from Newton College collected data manually as part of their project during October and November 2014. Data were gathered into MS Excel sheets and then aggregated and processed by the authors for the purposes of this contribution.

Working with this sample set addresses relatively unprecedented material for established online communication analysis. This research can thus form a basis for further study of online marketing within this dynamic region with its specifics. The values which were observed and analysed cover a basic range of data concerning company websites, Facebook and Twitter. Such basis provides elementary information for explorative research. The purpose of that is to address relatively new material and point towards its basic empirical patterns. Due to the explorative nature of this research, the range of the data and even their values, a relatively rudimentary comparison is made.

2. Research focus

The evaluation of social media focused on the main Facebook and Twitter profiles of relevant companies, which were used for online marketing communication. Other profiles, such as those used for technical support, were neglected. 23 values were observed, ranging from the properties of the companies themselves (business relation, type of industry) to quantitative data concerning their social network profiles (number of posts, likes or comments in a period of time). The scope of the original values was limited to problems concerning the research focus of this paper. The initial research questions include the following:

- How often do the relevant companies publish news on their websites?
- What proportion of companies from the sample set link their social media profiles with their website?
- How much does the content published in the news feed coincide with that of Facebook or Twitter profiles?

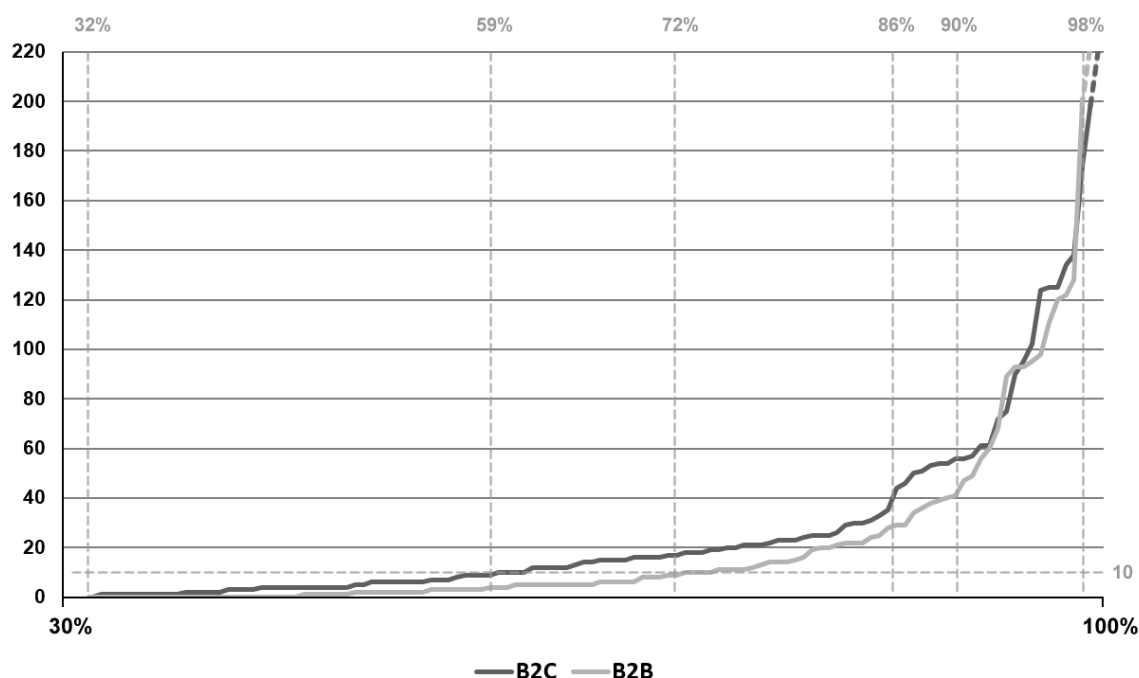
For the purposes of a wider discussion and the inclusion of results from other surveys, two secondary research questions were added:

- Which companies actually use online marketing more effectively?
- What is the typical practice in using the selected online marketing tools?

3. Results and Discussion

This section presents results concerning publishing news on websites. These have a specific informational position. They represent not only a default overview of the company itself or its products and services (default information channel), but primarily they form a certain core to which other online marketing activities are attached. In relation to websites, the survey focused on the number of news items published on a company website in a year, and on the distribution of this factor across companies. Around 32% of companies do not use news feeds at all. The other extreme is more than 100 items of news a year, published by 5% companies. 27% (B2C) and 40% (B2B) companies produce up to 10 items of news a year. 27% (B2C) and 18% (B2B) companies publish between 10 and 40 items of news per year. It can be concluded that one third of the companies do not use news feeds and that the majority of all of them creates less than 10 items of news per year. The hypothesis concerning the B2C and B2B division was that the former should have more motivation to use news feeds. This must be rethought, since – according to our findings – there is no significant difference between those two groups (Figure 1). It can be added that at least one item of news per year was observed in a very similar percentage of companies from both groups.

Fig. 1: Standardized graph of distribution of the number of news items on the websites of selected companies (9/2013 – 9/2014) as divided by their orientation between B2C and B2B (axis X represents percentage of companies while axis Y the number of news items per year).

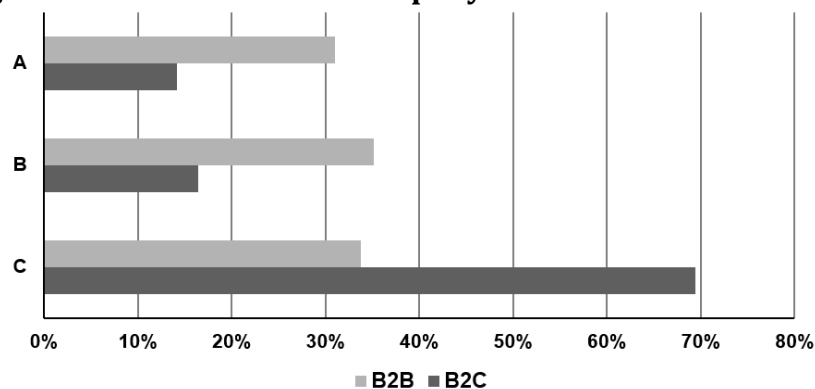


Source: own

The sample includes predominantly large companies with immense financial possibilities. Thus it can be presumed that with smaller subjects there would be more significant differences between B2B and B2C companies. In spite of that, the hypothesis is confirmed. The next section focuses on linking company websites and selected social media. The aim is to compare the results with other surveys in the Czech Republic.

The basic assumption was that B2C companies interlink their websites with relevant social media more often. As can be seen in the Figure 2, this hypothesis was confirmed. Approximately twice as many B2C than B2B companies did so. Compared to Czech companies, this is indeed a high percentage. In the Czech Republic, 39% of companies [12] (sample of 4584 subjects) link their Facebook or Twitter profiles, while in the present research it is 69%. This trend follows the development of the United States, where 74% companies (without any distinction between B2B and B2C) link their social media with websites [11]. This similarity between results from the United States and Central and Eastern Europe may be caused by globalization (on factual or virtual level), since the majority of companies listed in Deloitte Top 500 are international companies following world trends in online marketing communication.

Fig. 2: A – organizations that don't use the social media in question (Facebook, Twitter); B – organizations that don't link their websites with the social media; C – organizations that link the company website with the social media



Source: Authors

Figure 2 provides a general idea about synergies in online marketing communication. In B2B sector the values are extraordinarily similar. One third of companies in the sample do not use social networks. A slightly larger number of companies use them but without integration with their website and the remaining third integrate them with their website. On the other hand, B2C companies are more effective in such integration.

The research also focused on the way in which the companies link communication activities across different marketing tools to achieve integrated marketing communication. The selected time period was one month, during which individual profiles and websites were examined. On the basis of individual assessment of published information, the companies were divided into four groups according to the similarity of published content. The assumption was that B2C companies would actively share content across the selected tools. Results are shown in Table 1.

The initial assumption was not confirmed by the results. The results are similar for both groups of companies, with a few differences. The first difference (8%) is the percentage of companies that have different information contents on Twitter and Facebook. More B2C companies have different contents on Facebook and Twitter profiles, compared to B2B companies. The second difference concerns the similarity of communication content on Twitter and Facebook profiles, which is more than two thirds. Very similar content is presented by 10% more B2B companies than B2C companies. In this case, it may also result from an attempt to simplify work, rather than a strict compliance with the

principles of integrated online marketing communication. Because in this case a part of communication content should be specific to a particular tool.

Tab. 1: Percentage of companies that do not share or to some extent share communication according to the principles of integrated online marketing communication (communicated messages should be used across the communication tools used by a company)

Sharing content between:	No similarity		Less than 1/3		1/3 to 2/3		More than 2/3	
	B2B	B2C	B2B	B2C	B2B	B2C	B2B	B2C
website and Facebook profile	50%	47%	26%	30%	15%	14%	9%	9%
website and Twitter profile	61%	60%	21%	17%	12%	13%	6%	11%
profiles on Facebook and Twitter	42%	50%	23%	24%	19%	21%	16%	6%

Source: Authors

Based on the results, it can be concluded that about a half of the organizations (B2C or B2B) publish the same content on their websites and profiles on Facebook or Twitter. Only in the case of similarity of content between Twitter profile and company website, the same content is published by 40% of companies. This may be due to the specificity of Twitter – e.g. higher frequency of tweet publication in contrast with news on the website. Despite the above results, the approach may be considered satisfactory in the sample of companies. Approximately a half of the companies meet the principles of integrated online marketing communication. In conclusion, it is important to stress the limitations of the presented results not only with regard to the sample (as mentioned above), but also in terms of the number of monitored tools used for online marketing activities (profiles on Facebook, Twitter and the website of the organization).

Conclusion

From the perspective of this survey, it can be generally concluded that the use and linking of online marketing communication tools of companies in the region of Central and Eastern Europe is relatively good. Although the entire survey cannot be compared with similar research (concerning methodological perspective or data sample) realized in respect to different regions, the values themselves seem to support such conclusions. In spite of all this, selected results were at least partially compared with some studies in the Czech Republic and the USA.

Even within this sample, which consists predominantly of medium and large successful companies, there is still room for improvement. Although there is linking of profiles on social media with websites in companies from the USA, what can be improved is mainly spreading the same content through different tools. In this case the situation is about fifty-fifty and this state can be identified as a potential competitive advantage for companies that are better able to apply the principles of integrated online marketing communication. The research questions are answered below.

1. The first research question: **How often do the relevant companies publish news on their websites?**

Approximately a third of the surveyed organizations did not have or did not publish any news on their website in the selected time period of one year. Most companies had up to ten news items per year, which seems as a reasonable number.

2. The second research question: **What proportion of companies from the sample set link their social media profiles with their website?**

69% of the companies from sample set link their websites and profiles on Facebook and Twitter. This result is close to the results for top companies in the USA.

3. The third research question: **How much does the content published in the news feed coincide with that of Facebook or Twitter profiles?**

Approximately a half of the companies in varying degrees share the information content of the communication across studied tools. From the presented point of view it is appropriate to adapt to the specifics of each tool. For example, in the case of Twitter, there is expected a higher frequency of tweets than in the case of posts on Facebook. It is therefore not appropriate to have the same contents of communication, but at least one third of information should correspond.

Additional research questions concerned the differences between B2C and B2B organizations and related to the above mentioned assumptions. It can be concluded that B2C companies are more motivated to communicate their messages. Therefore, these companies had better results in the number of news items published on their websites. Furthermore, these companies also more often link their website with the monitored social media than B2B companies. But the results are comparable in content sharing across selected tools. Based on the answers to the three main research questions, the typical use of selected online marketing tools can be defined. The typical company from the sample annually publishes ten news items on its website, the website is linked with profiles on social media and approximately a third of the communication content is shared across communication tools.

Our findings entitle us to close our paper with stating that the companies within the region of Central and Eastern Europe are following the general trends of integrated online marketing. The results are comparable to other regions of the developed world, although it still leaves enough space for further intensification. Moreover we may assume that there might be evolving new paradigm for online marketing since the integrated marketing trend (using more platforms and interlinking their content) is still on rise, nonetheless we are lacking unequivocal outcomes. Moreover we see that the concept is not pursued universally, not even among bigger companies that definitely do have the resources and can evaluate the possible benefits of integrated online marketing. From methodological point of view we suggest to open the field of inquiry beyond first-hand data (quantitative analyses of social network usage) and take into account qualitative perspective that can extend our assessment considering online marketing strategies.

Acknowledgements

This paper was prepared thanks to the grant VSE IGS F4/18/2014. The paper was also processed with contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague.

References

- [1] BACH JENSEN, M. Online marketing communication potential. *European Journal of Marketing*, 2008, **42**(3–4): 502–525. ISSN 0309-0566.
- [2] BACHMANN, P. On-line marketing v neziskové organizaci: Analýza webových stránek organizací Královéhradeckého kraje. *Sociální studia*, 2011, **8**(3): 97–110. ISSN 1214-813X.
- [3] *Deloitte Top 500 Central Europe 2014* [online]. London: Deloitte, 2014. [cit. 2015-03-14]. Available at: <http://www2.deloitte.com/global/en/pages/about-deloitte/articles/central-europe-top500-2014.html>
- [4] DYNSTAR, J. Application of Agent-Based Supply Chain Modelling in Intralogistics System Design and Optimisation. In LÖSTER, T. and T. PAVELKA. eds. *The 8th International Days of Statistics and Economics*. Praha: Melandrium, 2014, pp. 374–384. ISBN 978-80-87990-02-5.
- [5] GROSOVÁ, S., GROS, I. and J. DYNSTAR. Food Products Distribution Systems Redesign in the Food Corporation Acquisition and Fusion Conditions. *Czech Journal of Food Sciences*, 2009, **27**(4): 223–227. ISSN 1212-1800.
- [6] HERBES, C. and I. RAMME. Online marketing of green electricity in Germany – A content analysis of providers' websites. *Energy Policy*, 2014, **66**:257–266. ISSN 0301-4215.
- [7] ISCHIA, M. and A. PAVLÍČEK. Tištěná média v prostředí sociálních sítí. *ProInflow*, 2012, **4**(1): 1–9. ISSN 1804-2406.
- [8] KARLÍČEK, M., Z. CHYTKOVÁ, L. TYLL, and H. MOHELSKÁ. Barriers of marketing effectiveness and efficiency within companies: a qualitative study. *E+M Ekonomie a Management*, 2014, **17**(4): 111–124.
- [9] NAIK, P. A. and K. PETERS. A Hierarchical Marketing Communications Model of Online and Offline Media Synergies. *Journal of Interactive Marketing*, 2009, **23**(4): 288–299. ISSN 1094-9968.
- [10] RUSNÁK, J. Kreovanie, šírenie a recepcia komunikačných stereotypov v on-line médiách. *Acta Informatica Pragensia*, 2014, **3**(2): 181–191. ISSN 1805-4951.
- [11] SMUTÝ, Z., V. ŘEZNÍČEK, J. KALINA, and A. GALBA. Interaction of Social Media and Its Use in Marketing Management. In DOUCEK, P., G. CHROUST, and V. OŠKRDAL. eds. *Proceeding of the 21st Interdisciplinary Information Management Talks*. Linz: Trauner, 2013, pp. 167–174. ISBN 978-3-99033-083-8.
- [12] SMUTNÝ, Z. The use of social media for marketing purposes by Czech companies doing business in the environment of services on the internet: A national survey. In DOUCEK, P., G. CHROUST, and V. OŠKRDAL. eds. *Proceeding of the 18th Interdisciplinary Information Management Talks*. Linz: Trauner, 2010, pp. 145–151. ISBN 978-3-99033-340-2.
- [13] WONG, H.-Y. Using Robustness Analysis to structure online marketing and communication problems. *Journal of the Operational Research Society*, 2006, **58**(5): 633–644. ISSN 0160-5682.
- [14] WU, J., N. WEN, W. DOU, and J. CHEN. Exploring the effectiveness of consumer creativity in online marketing communications. *European Journal of Marketing*, 2015, **49**(1–2): 262–276. ISSN 0309-0566.

Daria E. Jaremen, Elżbieta Nawrocka, Andrzej Rapacz

Wroclaw University of Economics, Economics, Management and Tourism Faculty
Tourism Marketing and Management Department

Nowowiejska 3, 58-500 Jelenia Góra, Poland

email: daria.jaremen@ue.wroc.pl, elzbieta.nawrocka@ue.wroc.pl,
andrzej.rapacz@ue.wroc.pl

ICT and the Travel and Tourism Intermediaries Sector

Abstract

The objective of the paper is to present the role of information and communication technology (ICT) in the transformations occurring in the sector of travel and tourism intermediaries. The sector operating in Germany was selected for the purposes of empirical illustration, with particular emphasis on TUI (the largest touroperator). The objective of the article was achieved as the result of critical analysis method application, SALSA method application and modelling of the transformations taking place in the sector of travel and tourism intermediaries. The deduction and research results synthesis methods were also applied. The obtained research results indicate that ICT contributes to disintermediation and re-intermediation and also to tourism business model change into the Internet-centric one.

Key Words

ICT, travel and tourism intermediaries sector

JEL Classification: L83

Introduction

Tourism remains one of the so-called information intensive industry sectors [8] (economic sectors based on information or rather the information-absorptive ones). The significant role of information decides about tourism sensitivity to transformations related to ICT application. Nonmaterial nature of tourist services results in the fact that the physical shift of a product towards its addressees does not occur. Distribution in tourism refers mainly to sending information, since by means of the distribution channels tourist services providers supply clients with information and knowledge where and when they can take advantage of their services or their various combinations. These clients, while purchasing a particular tourist service, actually just book an adequately prepared place at which they are supposed to arrive in a particular time to meet their tourist needs.

1. The objective and research methodology of the paper

The objective of the paper is to present the role of information and communication technology (ICT) in the travel and tourism intermediaries sector. The article presents the authors' model of tourism and travel intermediaries sector after ICT application. The model proposal was preceded by a three-stage research procedure covering as follows:

1. The characteristic of tourism and travel intermediaries sector before Internet application.
2. The characteristic of tourism and travel intermediaries sector after Internet application – the authors' model.
3. The changes in the travel and tourism intermediaries sector in case German market and TUI Group.

The research focused on German market as the largest tourism market in Europe and the third worldwide, at which travel and tourism intermediaries play an important role. It is confirmed by the fact that about 40% of tourist trips are organized by tour operators and the network of travel agencies remains the densest in the world. TUI Group represents the largest tour operator at both German and European market, which serves 30 mln customers a year. This tour operator can thus serve as a case study describing ICT impact on the sector of travel and tourism intermediaries.

The purpose of the article was achieved as the result of review and critical analysis method application (especially in the course of the first and second stage of the study), SALSA method application (at all stages) and the modelling of transformation of the travel and tourism intermediaries sector (second stage). The deduction and research results synthesis methods were also applied.

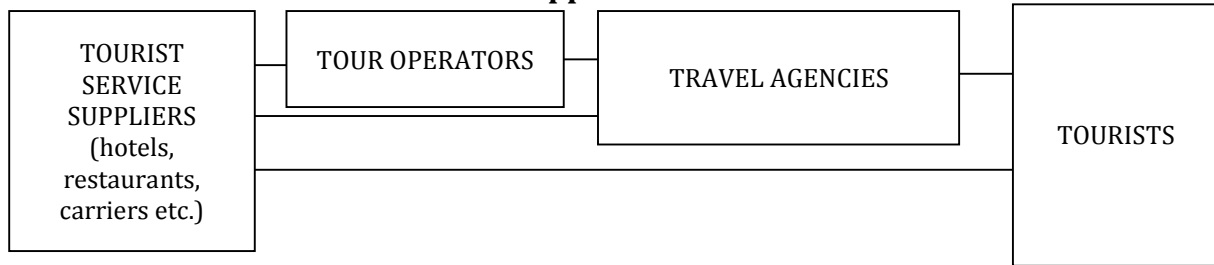
Their selection was based on applying the above-mentioned SALSA analytical framework (Search, Appraisal, Synthesis and Analysis). Search – the analysis of terminology used in published literature, which resulted in determining such terminology, i.e. the key words, and next specifying the selection criteria for research publications analysis. The following key words were distinguished: ICT, tourism, intermediaries. The following criteria were adopted as fundamental for the selection of the underlying research works: the recognized scientific publishers (e.g. Springer, IGI GLOBAL), the availability of publications (physical or virtual), the positioning in search engines and the number of quotations. Within the next stage of SALSA (Appraisal) procedure the assessment of publications was conducted, in terms of the above-mentioned key words, based on their abstracts analysis. The performed synthesis allowed for choosing these literature references which met all the selection criteria and thus the analysis has taken into account 9 compact publications and research articles. Among the key ones the most important were D. Buhalis's, H. Werthner and S. Klein's papers.

2. The characteristic of tourism and travel intermediaries sector before the Internet application

The development of the sector of travel and tourism intermediaries before the Internet application (later referred to as traditional intermediary services) can be divided into two phases: the phase before the computer and the computer one. In the first phase the sector covered two groups of entities, i.e. touroperators and tourist agents (fig. 1). As the model presents – the first group of entities function as tourism organisers by means of combining services provided by different tourist service suppliers into one cohesive item offered for one price and sold as a service package. Therefore, they establish a new tourist product which is offered to clients directly or through the third parties. i.e. tourist agents.

Agents deal in retail sales. A tourist willing to purchase a service arrives personally in a tourist agent's office or contacts him by phone in order to perform the purchase. A direct purchase with the service supplier can also be concluded (e.g. personally in a hotel or by phone). All entities participating in the distribution channels are actually present in reality, whereas the information is neither collected nor processes or sent in the virtual environment.

Fig. 1: The travel and tourism intermediaries sector before the Internet application



Source: Authors' compilation.

Each entity listed in the figure was responsible for particular functions:

- tourist service suppliers – typical production oriented functions, specializing in the provision of various services,
- tour operators – organization functions, specializing in such service package composition which meets the complex tourists' needs,
- travel agencies – information and sales function, consisting in transferring information about the available packages and offering the booking possibility,
- tourist function – purchased directly with tourist service suppliers or indirectly with travel agencies.

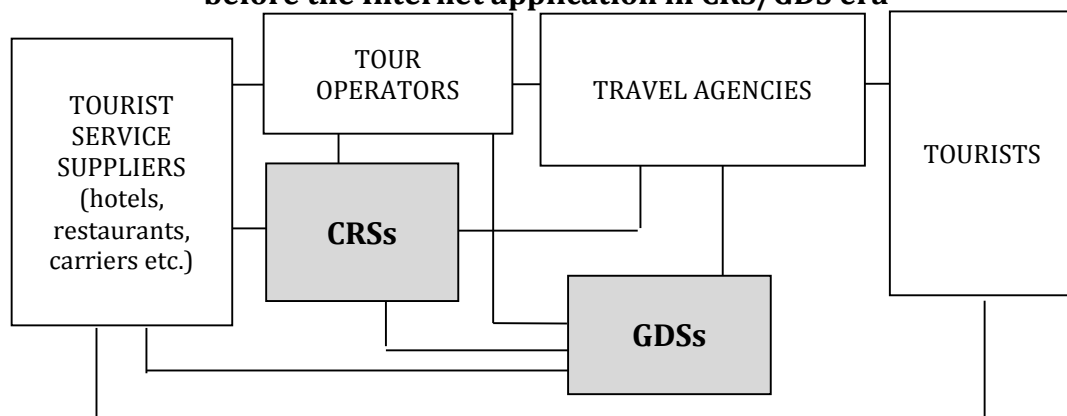
The special role of travel agencies, owing to which a tourist can purchase tourist services as a result of demand and supply synchronization in time and space, should be emphasized. The advantages of travel agencies functioning are manifested by higher effectiveness, speed and efficiency of the activities performed by tourist service suppliers and tour operators.

The sector of travel and tourism intermediaries was affected by transformations along with the advancing progress in information technology and the application of computers in tourism. CRS and GDS (phase II of development) were established.

In the 1960's Computer Reservation Systems (CRS) were implemented. They were primarily used by airlines and later by large hotel chains and other entities offering tourist services. The booking was made by employees of a travel agency with access to the system, who represented a special, internal organization unit called the booking centre. The staff of travel agencies who booked services ordered by tourists contacted such booking centre by phone, telewriter or later by fax. CRS represented an internal computer systems. In the 1980's development of information transfer facilities resulted in the transformation of the largest CRS into the so-called Global Distribution Systems (GDS). The establishment of GDS consisted in providing travel agencies with direct access to reservation systems by means of terminals installed in these agencies (consisting of a

computer, special software and technological solutions allowing for data transfer by means of telephone lines), whereas their transformation in global systems allowed travel agencies to make more efficient reservations of services supplied by many providers using one GDS and not, as before, by means of many CRS (when each supplier had an individual CRS) – figure 2. GDS represented external computer systems. Booking services using both CRS and GDS required specialized knowledge and facilities, which strengthened the position of travel agencies in the intermediary sector [13]. Tourist service suppliers had to pay relatively high transaction fees on each reservation. It should be emphasized that an extensive role of travel agents also resulted from the absence of direct access to CRS and GDS.

Fig. 2: The travel and tourism intermediaries sector before the Internet application in CRS/GDS era



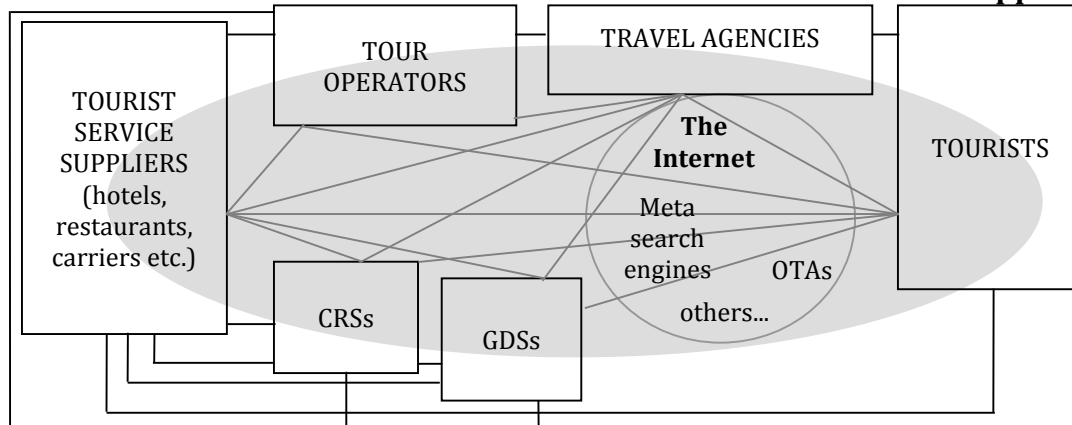
Source: Authors' compilation.

3. The characteristic of the sector of tourism and travel intermediaries after the Internet application – the authors' model

Another breakthrough, which revolutionized the sector, was the implementation of the Internet technology. Its basic consequence was direct information transfer from tourist service suppliers to clients at large distances and also to an extensive number of tourists. This direct interaction between a supplier and a client resulted in significant changes in an economic structure of the intermediary sector. They mainly refer to tourist agents, the number of which was significantly decreasing each year. It also brought about changes in the functioning of its particular entities consisting in the visualization, i.e. moving certain activities to the Internet. One of its effects is manifested by an increasing share of online sales in the general turnover of touroperators and travel agencies. An option of a particular service direct booking by a tourist reduces the importance of travel agencies in the sector of travel and tourism intermediaries. New mediaries appear which cover a wide range of organizations including suppliers selling directly on the Internet by allowing users to access their reservation systems directly; web-based travel agents; the Internet portals and vortals, as well as auction sites [4] (fig. 3). The authors' model was constructed based on the models by: Werthner and Klein [15], Pease and Rowe [9], Buhalis and Licata [4]. Following the authors' proposal, as opposed to the above listed ones, the Internet does not remain just the essential communication tool for the sector, but also constitutes space

for new concepts in business (e.g. online travel agencies – OTAs), as well as offers the tool for introducing changes in the functioning of tourism market entities. Nonetheless, it is noticeable that the most extensive transformations cover the intermediary sector. Major GDSs (e.g. Sabre – Travelocity.com, Galileo – TRIP.com) developed interfaces for consumers. By taking advantage of online technologies touroperators keep extending their operations by the functions so far performed by tourist agents and introduce an option of direct online booking. Therefore, the Internet allows for the broadly understood cooperation in a global scale.

Fig. 3: The travel and tourism intermediaries sector after the Internet application



Source: Authors' compilation

Moreover, the subject literature emphasizes that the Internet usage results in the following changes affecting the discussed sector:

- intensive implementation of multimedia techniques replacing the “classical” catalogues [10],
- from traditional packaging based on the concept of the “average tourist” to dynamic packaging based on the concept of the individual tourist (from “made by tour operators” to “made by tourism”) [6,12],
- maximizing organizational competitiveness, because Internet develops the ‘infostructure’ for organizations to manage their internal functions and their relationships with partners [5],
- the Internet facilitates combining the functions of touroperators and travel agents [4].

4. The selected economic effects of ITC application in the travel and tourism intermediaries sector – Germany and TUI Group case study

Tourism industry represents one of the growth sectors in German economy. According to the study „Wirtschaftsfaktor Tourismus“ the gross value added of tourism industry reaches the level of about 97 billion Euro. The indirect and induced impacts of tourism amounts to 214.1 billion euros. Tourism represents 9.7% of the total gross value added in German economy. Thus, the contribution of tourism to value creation in Germany is higher than that of vehicle industry. In the year 2010 total consumption expenditure of

tourists in Germany amounted 278.3 billion euros, of which only domestic tourists spent 241.7 billion euros [7].

According to Fürschungsgemeinschaft Urlaub und Reisen (FUR) the number of trips made in 2014 amounted to 70.3 million, of which more than 40% represented package/module travel organized using tour operators/travel agencies. About 85% the Germans continue to book the holiday packages in travel agency. With over 9,800 travel agencies Germany has the densest travel agency network worldwide in terms of residents' number. There are over 2,500 touroperators in Germany. This structure, made up mainly of medium-sized suppliers and some large corporations, remains unique in the world [11]. About 85% of travel agency and tour operator market sales is generated by Deutscher ReiseVerband (DRV) member companies [7]. According to DRV the number of travel agencies in Germany was continuously decreasing in the period 2004-2014 (fig. 4). At that time their number was reduced by almost 29% and the main reason given for such situation was the increasing popularity of online solutions applied in tourism.

TUI Group is the biggest tour operator on German travel market. In 2014 the company turnover amounted to 4,4 billion Euro in Germany and was higher than its largest competitors, such as Thomas Cook (by 22%) and DER Touristik (by 27%) [7]. The company is listed at London Stock Exchange. Its origins go back to an industrial and transportation company Preussaq AG established in 1923. Numerous mergers and take overs resulted in the fact that currently TUI Group represents the largest European touroperator, serving about 30 mln clients annually from 31 countries and also outside Europe. The company offers travelling to diverse tourist destinations located in 180 countries worldwide. It is estimated that TUI Group share on the touroperator market amounts to about 30%.



Source: Authors' compilation on based [7]

The analysis of annual TUI Group reports indicates that the share of online channels in total sales of the company mainstream business, i.e. sales of tourist events, hospitality services and cruises keeps increasing systematically (in 2010 it presented the level of

27%, whereas in 2014 about 38%), although the differences in particular countries, in which the company operates, are noticeable. The Internet channel role is definitely higher on Scandinavian (Sweden, Norway, Finland, Denmark) and British market, but much lower on German and French ones. Nevertheless, its fast increasing significance on the discussed German market (tab. 1) is worth emphasizing (almost threefold in the period 2012-2014).

Tab. 1: The share of online sales in TUI Travel PLC mainstream offers sales on the key markets in the period 2012-2014 (%)

Specification	2012	2013	2014
Nordic countries	65	67	70
German	4	8	11
France	21	18	24
UK	44	47	51

Source: Authors' compilation based on: [1, 2, 3].

Conclusions

Presented in the article research results allow to identify changes. On the one hand, they consist in eliminating the unnecessary supply chain components (disintermediation) and, on the other, in introducing new elements based on e-technologies (reintermediation). The phenomenon of disintermediation affects predominantly traditionally functioning travel agents, whose number has been continuously decreasing. ICT development, on the one hand, stimulates competition in the sector of tourism intermediation and, on the other, extends the possibilities of sales intensification by opening new markets and also facilitates reaching an individual consumer with an offer. Each year the significant increase of online sales is observed. ITC provides tourists with an extensive and direct access to tourist service suppliers' offer, which results in the decreasing importance of intermediaries and mainly travel agencies on the market.

According to the majority of reports presenting new trends on the travel and tourism market, it can be concluded that the transformation process will be continued due to the advancing ICT progress, especially in terms of mobile devices (m-commerce). 50% of the European travellers are forecast to be using smartphones while searching for travel information and/or making reservations by 2015. An important development takes the form of more travel and tourism reservations made through social network applications, such as Facebook for iPhone. The evolution of m-commerce is expected to be extremely fast, along with the drop in high international roaming costs [14].

References

- [1] *Annual Report & Accounts 2012* [online]. Crawley, UK: TUI Travel, 2013 [cit. 2015-01-14]. Available at: <http://tuitravelplc.com/investors-media/reports-results-presentations>
- [2] *Annual Report & Accounts 2013* [online]. Crawley, UK: TUI Travel, 2014 [cit. 2015-01-14]. Available at: <http://tuitravelplc.com/investors-media/reports-results-presentations>

- [3] *Annual Report & Accounts 2014* [online]. Crawley, UK: TUI Travel, 2015 [cit. 2015-01-14]. Available at: <http://tuitravelplc.com/investors-media/reports-results-presentations>
- [4] BUHALIS, D. and M. C. LICATA. The future eTourism intermediaries. *Tourism management*, 2002, **23**(3): 207–220. ISSN 0261-5177.
- [5] BUHALIS, D. and P. O'CONNOR. Information Communication Technology Revolutionizing Tourism. *Tourism Recreation Research*, 2005, **30**(3): 7–16. ISSN 0250-8281.
- [6] ČAVLEK, N. Tour operator marketing strategies: from “made by tour operators” to “made by tourism”. *Tourism Tribune*, 2013, **28**(2): 12–15. ISSN 1002-5006.
- [7] *Fakten und Zahlen 2014 zum deutschen Reisemarkt* [online]. Berlin: DRV Deutscher ReiseVerband e.V., 2015. [cit. 2015-02-07]. Available at: http://www.driv.de/fileadmin/user_upload/Fachbereiche/Statistik_und_Marktforschung/Fakten_und_Zahlen/15-03-03_Fakten_und_Zahlen_2014.pdf
- [8] GARKAVENKO, V. and S. MILNE. ICT and the Travel Industry. Opportunities and Challenges for New Zealand Travel Agents. In PEASE, W., M. ROWE, AND M. COOPER eds. *Information and Communication Technologies in Support of the Tourism Industry*. Hershey: IGI GLOBAL, 2007. pp. 50–63. ISBN 978-15-99041-59-9.
- [9] PEASE, W. and M. ROWE, M. *An overview of Information Technology in the Tourism Industry* [online]. Darling Height, Queensland, Australia: University of Southern Queensland, 2015 [cit. 2015-02-18]. Available at: <http://eprints.usq.edu.au/245/1/Pease.pdf>
- [10] POON, A. The Future of Travel Agents. *Travel & Tourism Analyst*, 2001, **3**: 57–80. ISSN 0269-3755.
- [11] *Reiseanalyse 2015* [online]. Kiel: Forschungsgemeinschaft Urlaub und Reisen, 2015. [cit. 2015-03-15]. Available at: <http://www.fur.de/ra/startseite>
- [12] SCHMEING, T., J. CARDOSO, and J. D. FERNANDES. Knowledge-based Dynamic Packaging Model. In *International Conference on Management of Innovation and Technology*. Singapore: IEEE, 2006. vol. 2, pp. 1085–1089. ISBN 9781424401475.
- [13] THAKRAN, K. and R. VERMA. The Emergence of Hybrid Online Distribution Channels in Travel, Tourism and Hospitality. *Cornell Hospitality Quarterly*, 2013, **54**(3): 240–247. ISSN 1938-9655.
- [14] *The European Tourism Market, its structure and the role of ICTs* [online]. Brussels: TOURISMLink Consortium, 2012. [cit. 2015-03-15]. Available at: http://www.tourismlink.eu/wp-content/uploads/2012/07/TOURISMLink_MktReport.pdf
- [15] WERTHNER, H. and S. KLEIN. *Information, technology and tourism: A challenging relationship*. Vienna: Springer Computer Science, 1999. ISBN 3-211-83274-2.

David Kubát, Marián Lamr, Jan Skrbek

Technical University of Liberec, Faculty of Economics, Department of Informatics
Studentská 1402/2, 461 17 Liberec 1, Czech Republic

email: david.kubat@tul.cz, marian.lamr@tul.cz, jan.skrbek@tul.cz

New Approaches to Smart Solutions for Eliminating Car Accidents

Abstract

Car accidents have become a common event and can be encountered every day. Together with their consequences they are a cause of property loss and can also cause severe or even fatal injuries. This article deals with up-to-date approaches and possibilities of prevention of car accidents and their consequences. In the first three chapters you can find descriptions of ways of dealing with traffic accidents and methods for their elimination and elimination of their consequences with the use of information technologies. Commonly used methods of eliminating traffic accidents are described in the aforementioned chapters, such as variable-message signs and RDS-TMC. Other telematic methods that are elaborated upon are the eCall and WAZE methods which are expected to be used on a much larger scale in the nearest time period, although mostly the eCall procedure since starting this year, all newly made cars should be equipped with it. More attention is directed upon the System for Automated Forewarning of Vehicle Crashes, the concept of which assures fully automated transfer of warning messages into vehicles approaching the location of a traffic accident. Automated transfer of warning messages is facilitated by forced broadcasting. The main idea behind this article is to design a real time early warning system using data mining models. The main advantage of this concept is that it tries to prevent accidents as opposed to dealing with the results of accidents which other models do. For predicting dangerous situations and forewarning the driver early enough and in real time, models which are created using data mining methods, are employed. The prerequisite of this concept is the usage of a traffic accident database.

Key Words

eCall, crashes, warning, information, Radio-Help, data mining, models

JEL Classification: L91, L96, O31

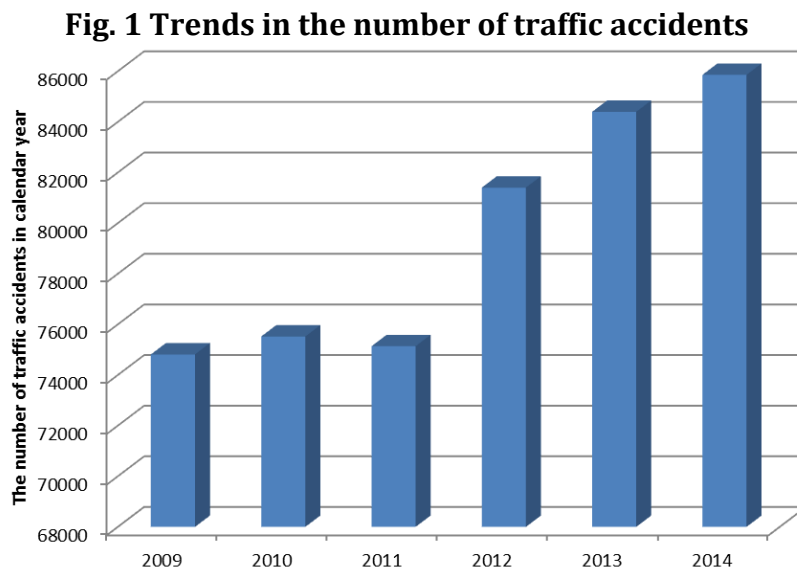
Introduction

According to the current traffic accident statistics the amount of traffic accidents keeps rising since the year 2011. In the year 2009 the bottom limit for having to report an accident was raised to 100 000 CZK. When the data from 2008 and 2009 are compared, it would seem that in the year 2009 the amount of accidents dropped dramatically, alas in this context the comparison doesn't have enough explicitness. In Figure 1 the progress of the amount of traffic accidents from the year 2009 to year 2014 is displayed to enable a relevant comparison[1].

Due to the rising number of traffic accidents, the police keeps trying to find methods which would increase the safety of traffic. To list some of those methods, the increase of the amount of road checkpoints, raising the fines for traffic violations, the introduction of the

point system and several regional or state-wide traffic safety campaigns, are of particular note.

Despite all precautionary measures, which should eliminate the amount of traffic accidents and number of injuries, the death toll in the traffic keeps rising. This fact can be directly demonstrated on this year's Easter holidays - despite the increased amount of police patrols on the roads the amount of fatal accidents was higher than last year's Easter holidays. The reason behind the amount of accidents during Easter holidays is a subject of many debates. The police has stated that the cause for most accidents was speeding and drivers not adjusting their driving to the nature and state of the roadway [2]. Current measures for increasing the safety of the traffic and lowering the amount of accidents do not seem very effective.



Source: Authors, data [1]

Because of that it is necessary to search for new ways of preventing traffic accidents - one of them possibly being the usage of state of the art technologies to better inform the drivers of the potential dangers on the roadway.

The aim of this article is to list and describe the current methods for eliminating traffic accidents and to design a concept of a system enabling a real time and real location prediction of traffic accident risks.

1. Description of telematics systems currently used

Currently the information about an accident is reported by a driver or a witness of the accident. This requests a phone call to the emergency line. The report is then transferred to the NTIC. From NTIC the information is spread via special information channels: RDS-TMC, variable information boards and voice relations on radio stations. Properties and drawbacks of those methods were in described in previous paper [3].

It can be briefly stated that the most important negative characteristics include the maintenance of variable information boards, the incapability to work in bad weather conditions (heavy rain, foggy weather) and eventually the delay which always manifests. RDS-TMC and voice relations on radio stations can be missed by drivers and not all drivers use radio broadcast.

On the input, there are some problems as well. The information is reported verbally and this is associated with problems when attempting to better understand the given situation and determining adequate reaction. Promptness of the intervention is a key factor for its success, whereby any possible delays influence negatively the outcome of the entire rescue operation.

1.1 Variable information boards

At the moment there are about one hundred of these variable information boards installed on Czech highways and motorways. This means approximately one board per 20 kilometers of the highway. In extreme traffic conditions during a normal working day an average number of cars per hour passing the 96 kilometers of the D1 highway is 1,400. Delayed distribution of information in matter of minutes, which is caused by time required for the processing and publishing of this information, brings danger for many motorists who can never receive information about the event in front of them via the variable information boards.

1.2 RDS-TMC

RDS-TMC (Radio Data System - Traffic Message Channel) is a service that provides the drivers with traffic and travel information via radio broadcast. This service integrates all relevant information and gives the driver a possibility to optimise the journey. The aim of the RDS-TMC is to provide traffic information within the FM broadcast band using RDS technology [3]. The disadvantage of this system is that a warning symbol appears in case a traffic problem occurs anywhere on the preselected route. For more information, the driver has to manipulate the navigation device, which requires his attention. In addition, if there are further problems on the same route, the warning icon remains unchanged despite the possibility that this newer traffic incident may have occurred in a location which is even closer in route than the originally reported traffic problem.

1.3 eCall (Emergency Call System)

Project co-funded by the European Union aims to the creation of a system that enables automated reporting on accidents to the European-wide emergency line 112, including accurate information about its location [4]. When the eCall device installed in a car detects an accident by means of sensors, it automatically sends a message to the nearest emergency centre, indicating the exact geographical location of the accident as well as other data. This system can be activated either manually by pressing a button on the dashboard by the vehicle passengers or automatically by the vehicle sensors triggered

during an accident. After the system is activated, a connection with the nearest emergency call centre (PSAP) is established transmitting both sound and data flow. The sound connection enables vehicle passengers to speak to professionally trained call operators while at the same time data channels are used to transmit data messages to these operators. Each message contains details about the accident, such as time, exact location, car identification, type of activation (manual or automatic) and information about possible service providers. Based on this information, the operator will liaise with the integrated emergency services to direct them to the exact accident location as well as provide them with an exact description of the accident's severity and the number of injured.

Although this system brings a clear improvement of the current situation in terms of saving lives and providing quick health care during accidents, it does not provide a solution for distributing information about the accident to the drivers approaching the place of accident, i.e. who are potentially at danger. When using existing information channels, the acquired accident data could be made available in about 5-10 minutes via motorway information boards, RDS-TMC messaging and radio travel news [3].

1.4 WAZE application

WAZE is a free social GPS application featuring turn-by-turn navigation. WAZE is supported by almost every mobile platform. WAZE differs from traditional GPS navigation software as it is a community-driven application and learns from users' driving times to provide routing and real-time traffic updates. It gathers map data and other information from users who use the service. Additionally, people can report accidents, traffic jams, speed traps, police patrols. It can also update roads, landmarks, house numbers, etc.

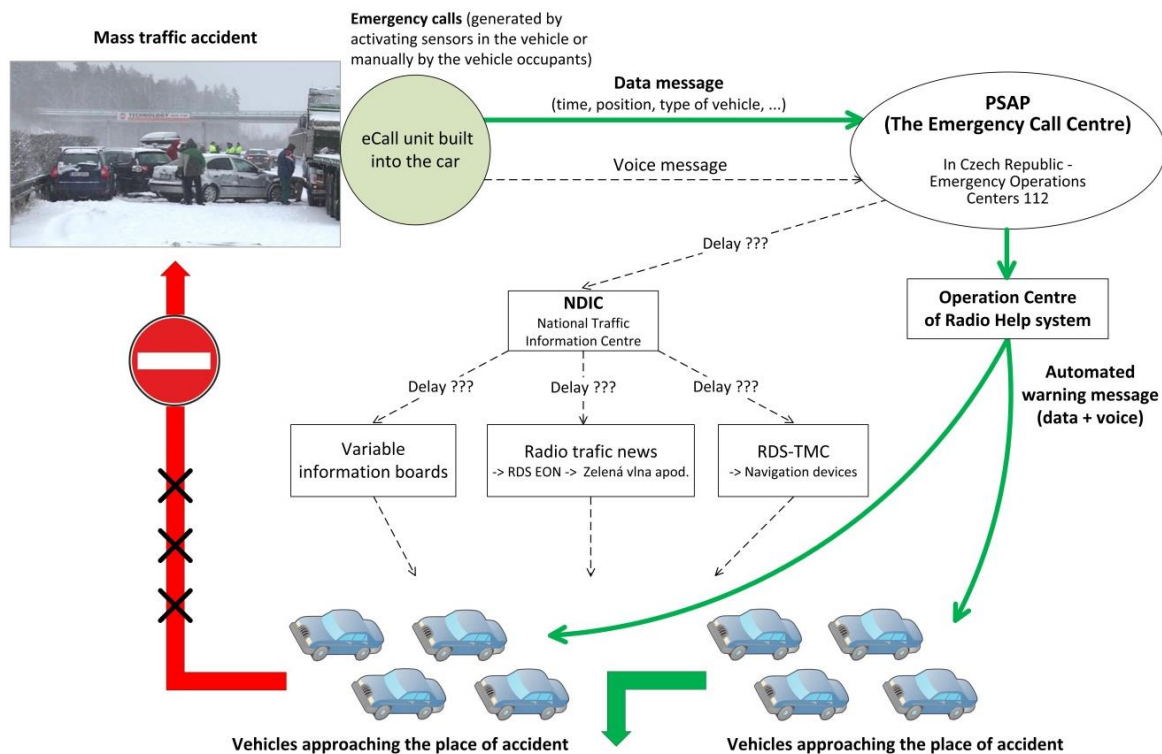
Recently there occurred some legal problems with WAZE (monitoring police units position) but these are minor and did not influence overall WAZE using. The real drawbacks of this application is a need for a data plan, smart phone and mobile operator signal accessibility.

1.5 System for Automated Forewarning of Vehicle Crashes

System for Automated Forewarning of Vehicle Crashes (the System) was designed for better distribution of warning information [3]. This concept implements eCall. The principle consists of full automation of generation and transmission of all relevant information about the accident to vehicles moving in its vicinity. The process of warning is initiated by the crashed vehicle, which will send information about the accident using eCall immediately after the collision happens together with the exact location of the accident. Information is received by the central office of the System which immediately generates data and / or voice information about the incident, including the positional code of the accident. Data will be sent via radio session and to car receivers as well [5].

Fig. 2: Transmission and acquisition of information in the event of an accident with the use of System for Automated Forewarning of Vehicle Crashes

Transmission and acquisition of information in the event of an accident using eCall and RadioHelp systems



Source: [3]

The transmitted relation of Radio-Help [6, p. 138] uses positional codes for identifying areas of compulsory income, i.e. where the broadcast is directed. The receiver in the area is maintained in standby mode and capture broadcast on fixed rate compares its position according to GPS coordinates with areas included in the broadcast. If there is an agreement it activates forced broadcast reception session. After the broadcasting code ends receiver goes into standby mode again.

2. Real Time Early Warning System Based on Data Mining Models

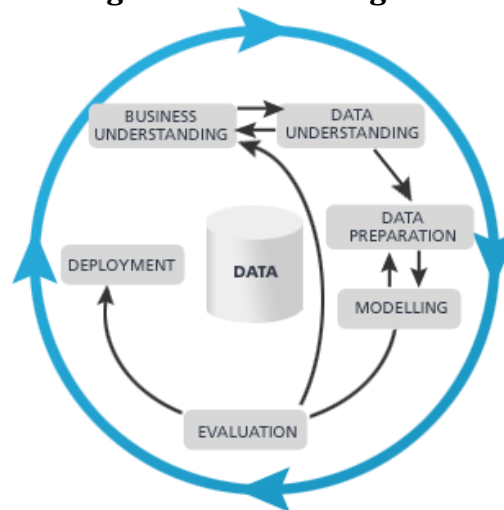
All the above mentioned solutions of elimination of car accidents and their consequences work with the event that the accident had already happened and they try to eliminate its consequences. Real time early warning system aims to prevent accidents from happening by using models based on location and other variables in real time. These predictive models can be built on the usage of of data-mining techniques.

Given the fact that LEF is a conference destined mainly for economy specialists it is necessary to define the term „Data mining“. The development drivers of data mining were commercial companies trying to maximize their profit. These organizations gather large amount of data every day which of course costs quite a lot of time and money and data mining gives the owners of this data the ability to take advantage of these resources.

Data mining can be understood as a targeted data research with a large amount of data as an input. By gradual targeting a specific characteristic the amount of data is greatly reduced and in the end it involves a small data set. Gartner group defines data mining as a process of discovery of significant non-trivial dependencies, patterns and trends by examining large amounts of data using algorithms for pattern discovery and also mathematical and statistical algorithms [7].

Many data mining methods were already developed. Real time early warning system is based on CRISP DM methodology. CRISP DM (Cross-Industry Standard Process for Data Mining) is a freely available, unified and versatile methodology which was funded by the European commission and its first version was published in 1999. [8]CRISP DM schema is seen in Figure 3.

Fig. 3: CRISP DM diagram



Source: [9]

2.1 System principle - user part

The operating principle of the Real time early warning system using data mining models can be explained on a model situation. It is Wednesday, 7. January 2015 15:45. A driver of a car is traveling on highway R35 from Turnov to Liberec at 90 km/h. The vehicle is found around the 40th kilometer – a place where car accidents happen quite often. The road is made of asphalt and it is generally in a good shape – there are no bumps/holes etc. It is, however, slightly covered with ice and the weather conditions are quite volatile. The temperature is 0°C and visibility is limited because it is getting dark.

The vehicle is equipped with the Real time warning system and everything is quite common for the driver, because he travels this road every day on his way to work and back. Therefore, the driver is not paying much attention and is looking forward to being home in Liberec. At this time, the driver gets a warning signal on his dashboard saying „Caution – High risk of car accident for this situation“ together with an audible warning. At this time the driver starts to drive more cautiously and pays more attention to the road as this does not happen every day he drives there. The increased focus of the driver makes

it possible to efficiently lower the risk of an accident, e.g. to eliminate the danger of skidding on a frozen roadway and to prevent any possibly collisions with other vehicles.

The described system is although more useful in situations where the driver is driving on a route for the first time. The driver is then informed ahead of time of a risky locations which would not seem so on the first guess and the driver would not be expecting any dangers there. These situations are illustrated in Figure 4.

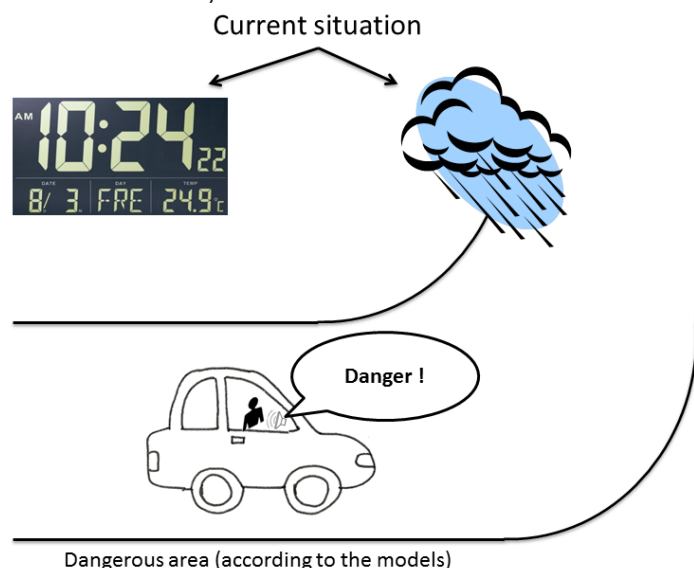
The device in the driver's vehicle compares a real time situation with a prediction result and in case of similarities between prediction and real time situation it warns the driver. The driver was warned because multiple car accidents occurred at that specific location, time of the day and year and under similar weather conditions.

The user part of the system assumes the availability of information necessary for the prediction model which is evaluated in real time. Information about time, location, vehicle condition, weather and many more is already available in modern vehicles.

The data of the vehicle prediction device is updated using wireless technology on a regular basis. Wi-fi networks or LTE can be utilized.

Fig. 4: Warning the driver in real time and place

The on-board device in the vehicle evaluates the situation as potentially dangerous (it is very similar to conditions in the past when an accident happened) and warns the driver immediately



Source: Authors

2.2 System principle - control center

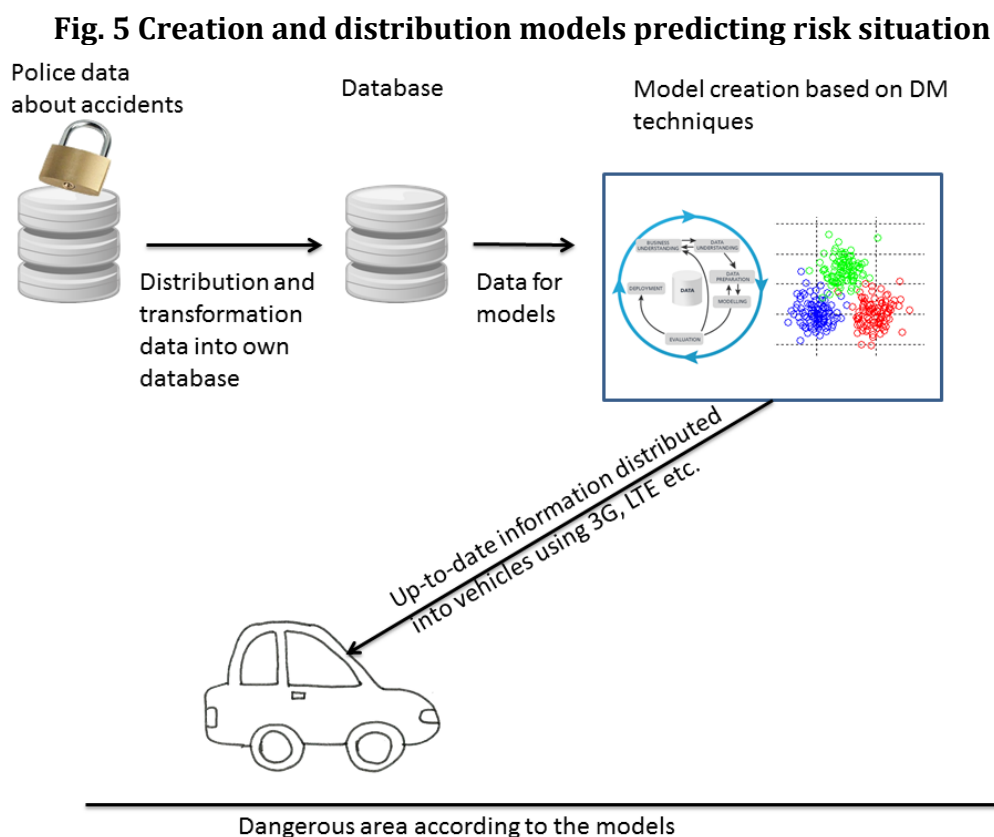
Smart devices in the vehicle regularly contact the control center and check for updates of the system and whether the prediction models are up-to-date like it is depicted in the figure 5. The control center of the system is used to gather and process heterogeneous data about car accidents from the police of the Czech Republic or the ministry of transport.

Database of traffic accidents is a part of the control system and it is used for data mining and also stores transformed data.

Each data mining project needs a date base in order to make predictive models. The data used to model various aspects of car accidents and predict the risk of danger in real time can be used from the “Uniform traffic map” project. Data from car accidents that occurred in the Czech Republic since 2006 are stored in this project by the ministry of transportation. The project is available online at <http://www.jdvm.cz> however the data for single car accidents is only available in a PDF file and it is thus necessary to transform it accordingly for data mining purposes [10].

One of the most important parts of the control center is the part where the prediction model is created. Prediction models are made from historical data about accidents stored in an internal database of car accidents. Data mining algorithms work with a so called model matrix. Only a properly prepared data matrix is used to create prediction models, which are made for example using cluster analysis or decision Trees.

Commercial as well as open-source software implementing common modeling techniques can be used to create prediction models. The perfect solution is to implement the most suitable algorithm for given needs. Models created this way can be used to create a map of dangerous areas on roads or predict the risk of accidents in real time.



Source: Authors

Conclusion

Real time early warning system using data mining, which is described in this article, is the first conceptual design of a new extensive project and the development of this design should take a few more years. The project is expected to provide on a long term solution based on obtaining, distributing and transforming data into a form which would enable the creation of models predicting the risk of an accident in real time and place. Not only will the ways of transforming and distribution of data be becoming more and more accurate over time, but so will be the selection of suitable algorithms for prediction be becoming more accurate as well. The main advantage of this new approach is the fact that it tries to prevent accident, i.e. it doesn't try to solve the situation in the moment of the accident happening, but it aims to prevent the accident from happening altogether. Some modern GPS applications provide "live traffic information"(they mostly detect traffic jams). Unlike the method described here, these hotspots are created by monitoring the movement of cell phones in real time and they solve potentially dangerous situations which are ongoing at the time. It's a completely different approach because the one described in this article predicts the risky locations using historical data from traffic accidents. This fact is both an advantage and a disadvantage of our approach. One problematic area of this project could be the quality and availability of data needed for predictions.

Acknowledgments

The current work is supported by the SGS project with the Number 21079, from Technical University of Liberec.

References

- [1] SAU. *Vývoj nehodovosti na českých silnicích. Sdružení automobilového průmyslu* [online]. 2015. [cit. 2015-04-13]. Available at: <http://www.autosap.cz/dalsi-informace/nehodovost-na-ceskych-silnicich/>
- [2] ČT24. *Velikonoční prázdniny si vzaly čtrnáct životů, nepomohla policie ani počasí.* [online]. Praha: Česká televize, 2015. [cit. 2015-04-13]. Available at: <http://www.ceskatelevize.cz/ct24/domaci/307070-velikonocni-prazdniny-si-vzal-y-ctrnact-zivotu-nepomohla-policie-ani-pocasi/>
- [3] KUBÁT, D., J. KVÍZ, J. SKRBK, and T. ŽIŽKA, T. Distributing Emergency Traffic Information. In In DOUCEK, P., G. CHROUST, and V. OŠKRDAL. eds. *Proceedings from the 20th Interdisciplinary Information Management Talks 2012*. Linz, Austria: Gerhard Chroust, 2012. pp. 33–39. ISBN 978-3-99033-022-7.
- [4] EC. *eCall – saving lives through in-vehicle communication technology* [online]. Brussels: European Commision, 2010. [cit. 2015-04-17]. Available at: http://ec.europa.eu/information_society/doc/factsheets/049-ecall_july10_en.pdf
- [5] BRUNCLÍK, M. and J. SKRBK. *Systém automatizovaného kritického varování před místem dopravní nehody* [online]. 2015. [cit. 2015-04-17]. Available at: http://spisy.upv.cz/Applications/2010/PPVCZ2010_0415A3.pdf

- [6] SKRBK, J. Informační služby ve specifických situacích. In DOUCEK, P. ed. *Informační management*. Praha: Professional Publishing, 2010. pp. 129–146. ISBN 987-80-7431-010-2.
- [7] *Gartner IT glossary* [online]. Gartner, 2013. [cit. 2015-04-17]. Available at: <http://www.gartner.com/it-glossary/data-mining>
- [8] AZEVEDO, A. and M. SANTOS. KDD, SEMMA and CRISP-DM: A parallel overview. In *Proceedings of the IADIS European Conference on Data Mining*. Amsterdam, The Netherlands: IADIS, 2008. pp. 182–185. ISBN 978-972-8924-63-8.
- [9] STATSOFT. *CRISP: Data Mining Session 2* [online]. [cit. 2015-04-17]. Available at: <http://www.statsoft.com/support/blog/entryid/540/crisp-data-mining-session-2>
- [10] MD ČR. *Jednotná dopravní vektorová mapa* [online]. Praha: Ministerstvo dopravy ČR, 2015. [cit. 2015-04-17]. Available at: <http://www.jdvm.cz/>

Lukáš Turčok, Athanasios Podaras

Technical University of Liberec, Faculty of Economics,
Department of Business Economics and Management, Department of Informatics
Studentská 1402/2, 461 17 Liberec 1, Czech Republic
email: lukas.turcok@gmail.com, athanasios.podaras@tul.cz

A VBA Application for Dynamic Model with Movement of Stocks Absolutely Determined

Abstract

Operations management is a significant scientific discipline. In general, it helps to find out the optimal result in many areas. The article presents the development of a software application that focuses on calculating the optimum amount of delivery of some goods, the duration of the delivery cycle and the number of deliveries so that the total costs per year will be minimal. The dynamic model with movement of stocks absolutely determined is part of the theory of stocks. This software is developed by using Microsoft Excel 2013 and the programming language Visual Basic for Application (VBA). The main goal is to create a simple, user-friendly interface designed to calculate the optimum amount of delivery of some goods, the duration of the delivery cycle and the number of deliveries and total costs per year. The contribution of this article is based on the assumption that small and medium sized enterprises do not use complicated IT systems, but mainly use Microsoft Excel to cater for their needs. The result of the article is the developed application. The main contribution is the application which allows for the calculation of the aforementioned variables in a short-term period. The created application is also designed for educational purposes (e.g. aimed to assist university students in absorbing the practical implementation of the dynamic model with movement of stocks absolutely determined). The results are presented via images in the chapter Dynamic model with movement of stocks absolutely determined in a VBA application. Images present the print screens of the developed application. In the conclusion, the authors express possible future research in this area.

Key Words

dynamic model, movement of stocks, stock keeping theory, visual basic for applications

JEL Classification: M29, C44, C61

Introduction

The dynamic model with movement of stocks absolutely determined that is part of operations management, namely the theory of stocks, can be a useful tool for decision-making in companies in order to determine the optimum amount of delivery of some goods, the duration of the delivery cycle, the number of deliveries and the total costs per year. Simultaneously, this issue is part of education at universities. Therefore, it is appropriate to create various teaching aids that enable students to better understand the topic. Whereas this dynamic model with movement of stocks is quite simple, there is a question of how to calculate the total costs when the optimum amount of delivery is changed. The paper aims to develop a simple application using the Visual Basic for Applications (VBA) programming language, which allows to calculate the mentioned variables. In the article, we present print screens of the application calculating values in

both situations. First, comes the calculation of the optimum amount of delivery, the duration of the delivery cycle, the number of deliveries and the total costs per year. The second situation shows the calculation of total costs for a changed value of the optimum amount of delivery. Finally, we develop the comparison between the initial calculation of total costs per year and the new one for another value of the optimum amount of delivery of goods.

1. Methodology of the research

In this article we present an example of using the VBA programming language in order to develop a simple software tool that practically presents the application of the dynamic model with movement of stocks absolutely determined. VBA is the acronym for Visual Basic for Applications. It is an integration of Microsoft's programming language Visual Basic with Microsoft Office applications. By running Visual Basic IDE within the Microsoft Office applications, customized solutions and programs that enhance MS Office capabilities, can be developed. Among the Visual Basic for applications, Microsoft Excel VBA is the most popular. Although MS Excel includes various formulas and functions, they are not enough for certain complex calculations and applications. In such cases, it would be relatively easier to write VBA code. In the first part, we summarize the literature framework focused on the theoretical explanation of the dynamic model with movement of stocks absolutely determined. In this section we use basic methods, such as analysis, synthesis, comparison, deduction and generalization. In the next section of the article, we introduce the proposal of the interface that is based on modelling methods and VBA coding. For the interface development we used Microsoft Excel 2013, its specific tab Developer and the programming language Visual Basic for Applications. The object is the dynamic model and the subject is the interface development using VBA.

2. Literature framework

In many cases the management of optimal level of stocks is still determined by a subjective approach. But nowadays several models of operations management already exist. These, so called models of stocks, are used to solve the optimization problems with the movement and management of stocks in the company (how much of stocks we need, when should we make an order of some material, what would be the amount of one delivery etc.). In general "the operation management field encompasses the following decision areas: design of goods and services, managing quality, process and capacity design, location strategy, layout strategy, human resources and job design, supply chain management, inventory and material requirements planning, intermediate and short-term scheduling, and maintenance." [2] Operations management allows to solve many areas. That is why "the role of operations research and operations management is yet to be studied in depth." [5]

Models of stocks are classified according to several aspects. For example, depending on whether we consider the progress of consumption over time, random effects on a model or the movement of stocks and so on. Models of stocks determined by the above aspects are then further divided into other "submodels" and strategies. An example could be the

dynamic model with the stocks movement absolutely determined. This model represents the basic calculation of the optimum amount of one delivery, the duration of the delivery cycle, the number of deliveries and the total minimum costs per period (e.g. per year). The substance of this model is to find out this optimal values.

“Time and spatial separation of production and consumption leads to the need to solve the questions associated with stocks movement management. The inventory we will understand any incomplete use of resource intended to meet future demand, respectively future consumption.” [8] Also, the size of this resource is determined in order to effectively meet the demand. By resource we mean finances, human resource, material assets, etc. There is still the question, “How much should we order?” With surplus of stocks there is a risk of their economic or even physical impairment. On the other hand, the lack of supplies poses the risk of not meeting the requirements of customers.

„The stocks and supplying are important areas of management and production because the amount of capital held in stocks is on average about 16 % of total liabilities at manufacturing enterprises and about 20 % at commercial enterprises.“ [9] „The costs of stocks keeping representing then from 20 % to 35 % of their nominal value.“ [6]

In managing the stocks we use mathematical modelling. “With the questions of determining the amount of stocks, the method of their recharge and compiling the methods for this purpose deals the theory of stocks.” [8] The essence is to optimize the stocks, in other words, it is an effort to minimize the total costs of inventory management.

One of the possibilities of how to manage the stocks effectively, is the dynamic model with movement of stocks absolutely determined. This model is included in the dynamic models of stocks and belongs to the most common models of stocks. The point is that these items should be regularly supplemented. We are looking for two basic answers: how much to order and when. Important is the fact that the total amount of the demand has to be known. Also, it is necessary to identify the costs for one delivery and the costs of storage per some period. The main goal is to calculate the optimal amount of one delivery, in order to achieve a minimum amount of total costs for this delivery.

Currently, many mathematical models are transformed into computer programs in order to automate various operations via macros. One of the tools is Visual Basic in Microsoft Excel. “Computer-aided technologies like Visual Basic Software have played a significant role in various science and engineering areas.” [7] This technology allows to solve for example “performing efficient and robust parameter estimation on nonlinear models; providing quantitative diagnostics of model fitting (including summary statistics that can be used for model comparison); optimizing the experimental design in the aim of maximizing the statistical power of model-based data analysis; assessing the results reproducibility at the group level (e.g., between-groups and between-conditions model comparisons).” [3] Also, the authors [4] add that “Visual basic is a standalone tool for creating separate software components, such as executable programs, COM components and ActiveX controls which are useful to build a specialized solution of particular task.”

Microsoft Excel is highly significant for small and medium enterprises. It is more often used in comparison with sophisticated IT systems, such as SAP. The author [1] indicates

the barriers to the adoption of specific information systems in small and medium enterprises. "They are:

1. Technological barriers (problems of security, insufficient infrastructure).
2. Organisational barriers (management style, shortage of financial sources).
3. Barriers arising from the surrounding environment (insufficient knowledge of the market).
4. Individual barriers (insufficient knowledge, personal relations in organisation)."

3. Dynamic model with movement of stocks absolutely determined in vba application

Nowadays there are specific software tools in order to facilitate the work of determining the optimal level of delivery, costs, etc. But, in many cases, these software applications include many functions and modules that are not used by the company. Despite this fact, the entrepreneur has to invest in the purchase of this software. Therefore, our goal is to simplify the determination of the optimum amount of a delivery in order to achieve the minimum value of total costs per delivery, without using some specific program. We have created a simple application by using Microsoft Excel and VBA programming language.

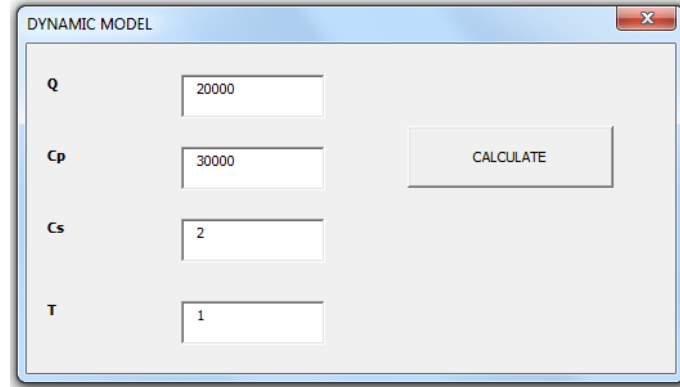
The current VBA Excel Software tool, is developed in order to support the calculation of the following Optimum Values of a specific product:

1. Optimum Amount/Quantity for one delivery (X_{opt}),
2. Total Cost with regard to this delivery ($NC(X_{opt})$),
3. Length of the delivery cycle (t_{Copt}),
4. Number of deliveries which are required (v_{opt}).

The above values are included in the second Form (Fig.2) of the Application. The specific Form appears after inserting the necessary input values in the Initial Form (Fig.1). The demanded input values are the following:

1. Total Yearly Quantity of the product/material (Q),
2. Cost for one delivery of the product/material (C_p),
3. Cost of daily storage of the product/material for one year (C_s),
4. Time (T) which can be either 1 year or 365 days.

Fig. 1: Initial Form of the Application

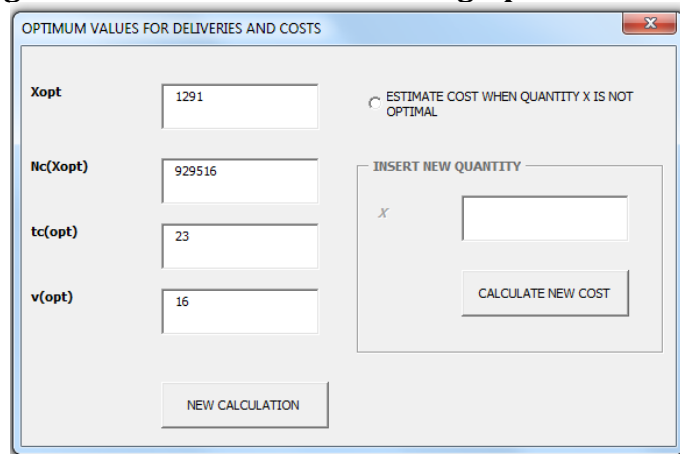


Source: own

After loading the application in Microsoft Excel, the Initial Form is available to the user in order to insert the above input values. By pressing the “CALCULATE” button (Fig.1) the second Form is loaded and the requested Optimum Values are calculated. The specific Form, also provides the user with the possibility to estimate Cost (NC) in the case when Quantity (X) is not Optimal.

In order to estimate the new cost, the user should activate the Frame “INSERT NEW QUANTITY” by pressing the option “ESTIMATE COST WHEN QUANTITY X IS NOT OPTIMAL” (Fig.2). The Frame is then activated and the user can insert a new input value with regard to the new quantity (X). The estimation is performed by pressing the command button “CALCULATE NEW COST” (Fig.2).

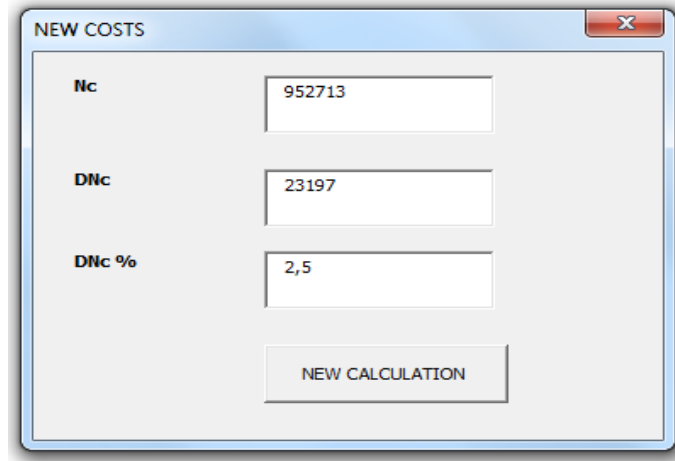
Fig. 2: Second Form that including Optimum Values



Source: own

The Form that includes the new cost, which is different than the Optimal, is then loaded and depicts the estimated results (Fig.3). The Form also includes information about the difference between the new cost and the Optimum Cost (DNC) as well as the corresponding percentage (DNC %) (Fig.3).

Fig. 3: Non Optimal Costs

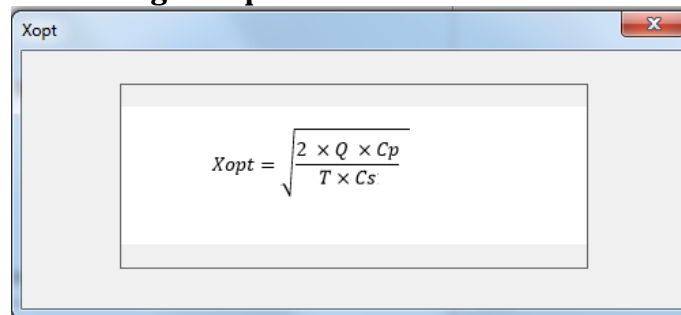
A screenshot of a software window titled "NEW COSTS". It contains three input fields: "Nc" with the value "952713", "DNc" with the value "23197", and "DNc %" with the value "2,5". Below these fields is a button labeled "NEW CALCULATION".

Nc	952713
DNc	23197
DNc %	2,5
NEW CALCULATION	

Source: own

Finally, since the current VBA Software tool is also aimed for educational purposes, a fourth Form is designed in order to depict the equations that estimate the desired values. This Form (Fig.4) emerges when the user moves the mouse on the desired field. For instance, if the user needs to see the equation that provides the Optimum Quantity for one delivery of a specific product, he has to move the mouse on the X OPT field (Fig.2).

Fig. 4: Equations Window Form

A screenshot of a software window titled "Xopt". It displays a mathematical equation for the optimum quantity:
$$X_{opt} = \sqrt{\frac{2 \times Q \times Cp}{T \times Cs}}$$

$X_{opt} = \sqrt{\frac{2 \times Q \times Cp}{T \times Cs}}$

Source: own

Conclusions

In the present article a simple application that can be used for the calculation of the optimum amount of delivery of some goods, the duration of the delivery cycle, the number of deliveries and the total costs per year is illustrated. Research shows that small and medium enterprises currently do not use complex software tools, but only spreadsheet programs, like Microsoft Excel. The current application developed by using the VBA programming language, can help small and medium enterprises in determining these values in order to achieve the optimal result.

Possible directions for future research could follow two ways. The first one, is to find out how small and medium enterprises deal with the problem of determining the optimal amount of a delivery or other problems connected to stock management and whether they would be interested in applications like this one. The next possible way to follow, based on the research, would be to create applications for other models of the theory of

stocks. For example, for dynamic models with the movement of stocks determined probability completely, etc.

Acknowledgement

This work was supported by ESF operational programme “Education for Competitiveness” in the Czech Republic in the Framework of project “Support of engineering of excellent research and development teams at the Technical University of Liberec” No. CZ.1.07/2.3.00/30.0065.

References

- [1] ANTLOVÁ, K. Motivation and barriers of ict adoption in small and medium-sized enterprises. *E+M Ekonomie a Management*, 2009, **12**(2): 140–155. ISSN 1212-3609.
- [2] AVELLA, L. and J. A. ALFARO. Spanish University Business Chairs used to increase the deployment of Action Research in Operations Management: A case study and analysis. *Action Research*, 2014, **12**(2): 194–208. ISSN 1476-7503.
- [3] DAUNIZEAU, J., V. ADAM, and L. RIGOUX. VBA: A Probabilistic Treatment of Nonlinear Models for Neurobiological and Behavioural Data. *PLoS Computational Biology*, 2014, **10**(1): 1–16. ISSN 1553-734X.
- [4] DINESH, A. C., V. J. MARKOSE, and K. S. JAYAPPA. Linfo – a visual basic program for lineament density, frequency and intersection density analysis. *Earth Science Informatics*, 2014, **7**(7): 197–203. ISSN 1865-0473.
- [5] GUNASEKARAN, A., Z. IRANI, and T. PAPADOPOULOS. Modelling and analysis of sustainable operations management: certain investigations for research and applications. *Journal of the Operational Research Society*, 2014, **65**(6): 806–823. ISSN 0160-5682.
- [6] CHASE, R. B. and N. J. AQUILANO. *Production and Operations Management*. Chicago: Irwin, 1995. ISBN 0-256-14023-5.
- [7] PAL, P., R. KUMAR, N. SRIVASTAVA, and J. CHOWDHURY. A Visual Basic simulation software tool for performance analysis of a membrane-based advanced water treatment plant. *Environmental Science and Pollution Research*, 2013, **20**(8): 1833–1849. ISSN 0944-1344.
- [8] SAKÁL, P. and V. JERZ. *Operačná analýza v praxi manažéra II*. Trnava: SP SYNERGIA, 2006. ISBN 80-969390-5-X.
- [9] SIXTA, J. and M. ŽIŽKA. *Logistika: Metody používané pro řešení logistických projektů*. Brno: Computer Press, 2009. ISBN 978-80-251-2563-2.

Otakar Ungerman

Technical University of Liberec, Faculty of Economics, Department of Marketing
Studentská 1402/2, 46117 Liberec, Czech Republic
email: otakar.ungerman@tul.cz

Use of Social Networks in Personnel Marketing

Abstract

Social networks in combination with personnel marketing are the focus of this work. These two currently relevant topics have been subjected to literary research and surveys in scientific databases. Based on the discovered information, a scenario has been set up for primary qualitative research, to which companies in the Liberec Region have been subjected. The sorting parameter for selection of companies that were subjected to thorough interviews business culture based on the parent companies' geographic origin. The qualitative research focused on internal and external company communication on social networks. The results of the thorough interviews were subjected to a group evaluation, which yielded important information related to the use of social networks for HR purposes. The final phases of the research involved uncovering latent information presented in the concluding synthesis. The aim of this contribution is to present the results of this qualitative research regarding the use of social networks in personnel marketing and based on the obtained information to predict the future of use of social networks in HR. In the Czech Republic, social networks are very popular across all age groups. Social networks used in the Czech Republic can be divided into two groups. The first consists of global networks, such as Facebook, LinkedIn and Google+. Twitter can also be included in this list of social networks, even though its use method is ranked among micro blogs. The second group consists of Czech platforms with a local presence, such as Libimseti.cz, Lidé.cz and Spolužáci.cz. There is not enough current information about the use of social networks for HR purposes in the Czech environment. The missing information was the main reason for conducting the survey presented in this Article. The survey was conducted in March 2015.

Key Words

social networks, HR, thorough interviews, qualitative research, analysis, synthesis

JEL Classification: M31, M50

Introduction

This work focuses on two areas, which are mutually connected. On one hand, there are social networks as a modern communication tool, and on the other hand, there is HR management. These areas have been overlapping to an increasing extent, and social media tools have gained in importance. The new era will bring new trends to the world of HR staff, who as a result will gain better options and tools for personnel marketing. The transition to the online world has given the green light to e-recruitment, involving finding suitable staff via online resources. This approach has a series of benefits, the most noticeable of which is cost savings. It also increases the effectiveness and speed of searches for suitable candidates. For today's young generation, who are extensively connected to the internet, this approach seems much more natural, and the young generation can be addressed much more effectively using these tools than using traditional media. This communication method is increasing demands on employees of

HR divisions, mainly in relation to controlling online tools. This is another reason why several paths exist, which can be taken in applying personnel marketing. Companies can apply this new communication method on their own and can either assign a specialist in social media for it or train an HR team completely. There are even specialised companies on the market, HR companies that consist of a large number of offered jobs and that can better work with applicants via all kinds of internet tools. Online tools include the social networks within which community environments are formed. Thanks to this community aspect, users can be addressed with specific content, but it is also possible to communicate with them interactively, quickly and with feedback. Social networks are currently playing a significant role in HR, which involves searching for middle management and key specialists, "headhunters". A representative of the HR agency CHC Partners, which focuses on social networks, specified the use in a press release: "For headhunters, social networks are an excellent aid, which effectively helps them to identify the right candidate and enables them to establish contact quickly. For collection of information, we use LinkedIn, Google+ and Facebook, and the level of security and presentation of private profiles are important evaluation criteria." The country, which has long defined the trends in using social networks in HR, is the United States. The situation overseas is reflected by a study by Jobvite, which in 2010 worked for more than 800 HR specialists. Social networks as a tool for recruitment of employees were according to a survey used or will be used soon by nearly 92% of companies. In the ladder of individual services, the career network LinkedIn leads (86%), followed by the social network Facebook (60%), Twitter (50%) and blogs (19%) [1].

1. Literature Overview

The literary view is focused on two areas: social media and personnel marketing. Social media are online media based on uninterrupted mutual communication. Consumers are using them increasingly more often and replacing them with traditional off-line searches [2]. Social media in general are considered a powerful tool for companies to keep in touch with customers and acquire feedback from them. They can also maintain contact with their customers through the fan groups or promote their events. Not only companies, but even products can be promoted or have their fan groups there. On the other hand, the bad reputation of a company spreads through Social media even faster [3]. A key element during the use of social media is feedback from the public, either in the form of comments, editing of original text or content creation. Social networks provide a simple way of using collaborative work spaces involving the use of all tools of the marketing mix [4]. Something interesting and of significance is the following definition: a social medium is any internet medium, which can gather a group of like-minded people together to discuss specific topics [5]. If the definitions of social media are summarised, they can be defined as online media, where content is created as well as shared by users. Social networks have already become an important source of information about job applicants and for searching for suitable candidates for key positions. Already today, many companies are realising their importance, and verification of candidates in various internet databases are among routine procedures before new staff are hired. From these sources, it is possible to obtain otherwise unavailable personal information, to check contact persons and to avoid the risk of a leak of important information to the competition as well as to analyse a party's regular social behaviour in society [6]. The social network LinkedIn was created directly for professional networking purposes. The Czech version has

approximately 200,000 users. This network serves for publishing personal professional CVs. Users can search for contact information for persons or groups of interest [7].

Communication for HR purposes, conducted via social media, is included in a new field named "Personnel marketing". Personnel marketing is aimed at creating a constant ability of the employee to behave in such a way towards customers that would keep the competitiveness on a high level. Personnel marketing is also a sign of an alternative attitude to human resources management and traditional marketing. Sometimes it is possible to find a term called "internal relationship marketing" [8]. This concept is linked with an adaptation of techniques used usually in the external surroundings of a company, but in personnel marketing it is used in an internal environment. According to Natalia Szozda internal marketing is based on attracting, training and motivating staff in contact with customers to create a team capable of meeting the needs of buyers. Usage of a personnel marketing makes employees satisfied with their jobs and their employer and also makes their workplace and working conditions comfortable and meeting their expectations. It should result in higher satisfaction of customers, building and keeping strong business relationships with them and improving the company's effectiveness. In fact, personnel marketing means that high standard of the internal client (employee) and external customer service should be promoted. A company which uses personnel marketing is open to the needs and expectations of the employees, because fulfilling those needs creates the ability to transfer this satisfaction to customers and as the final effect, the positive external image of company. Based on theory, personnel marketing is divided into external and internal types. The main purpose of external personnel marketing is to address and acquire new staff. The purpose of internal personnel marketing is to create quality conditions for work performed by already hired staff. Internal communication contributes significantly to the creation and sustaining of business culture. In a well-functioning business, even an employee at the lowest position benefits the employer. It is apparent from this that there is an endless process involved, which is participated in by all employees. In the past, unidirectional communication were more frequent, but in the modern period bidirectional communication across the entire structure of the business is essential [9]. Internal company communication focuses on employees and build the loyalty of employees to the company. The internal communication doesn't aim at satisfied employee but at satisfied customer [10]. The ways of internal communication are the following:

1. Work performance oriented communication
 - a) Written form (circular letters, forms)
 - b) Verbal form (meeting, consultation, presentation)
 - c) Electronic form (e-mail)
2. Teambuilding oriented communication: social and sport events, company meetings

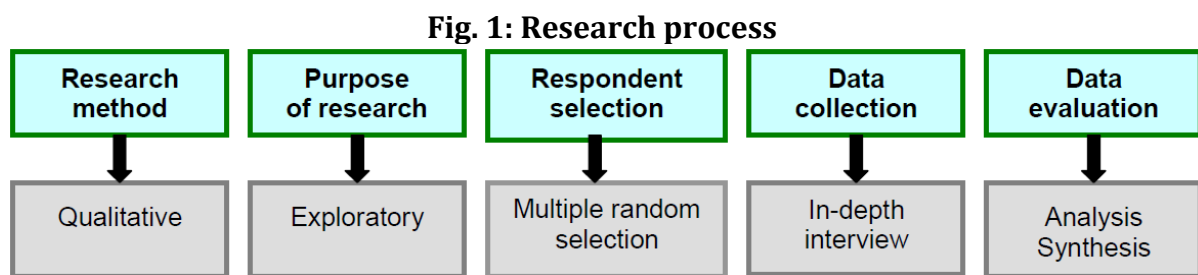
Internal communication strategy is a part of the communication plan which includes the activities, targets and strategies. When drawing up the plan the manager shall take into account the attitudes and opinions of his employees and official information sources such as notice boards, meetings and intranet [11].

External communication from the HR point of view involves an analysis of the labour market as well as identification of the needs and wishes of potential staff. The purpose of external communication is to ensure that an available job offer attracts many suitable

candidates in a timely manner and with reasonable costs. A no less important task is obtaining reasonable information about individual applicants, so that based on that information it will be possible later to select the most suitable of them relatively reliably. External communication focused on HR takes place in verbal form (telemarketing, face-to-face meeting), written form (letters, CVs), electronic form (e-mail, social networks) [12].

2. Methodology

The subject of the research consisted of businesses, which due to their size are categorised as medium-sized and large enterprises. The contact person was a human resource manager in each company, who is responsible for the company's HR agenda. The methodology is divided into five parts and is presented in Figure 1.



Source: Own calculation

1. **Research Method** – from a methodological approach, qualitative research was applied in the study for the purpose of forming new hypotheses, new understanding or new theory. The logic of the qualitative research is inductive. Through the research, a comprehensive image was created, which conveys the opinions of study participants and carries out an examination in natural conditions. The purpose of the qualitative method was to clarify the reasons why people act in a certain way and determine how they organise their activities and interactions.
2. **Purpose of research** – in view of the aim of the project, the purpose can be described as an exploratory one, which is usually used in a situation when there is not enough preliminary knowledge about the problem that will be examined. The aim of the exploratory research is to determine whether the information that led to recognition of the problem correctly conveyed the situation [13].
3. **Respondent selection methods** – the selection of respondents was carried out via a method of multiple random selection, when a basic file was divided into four groups based on the applied business culture. From each category, a representative was selected, who was subjected to a subsequent in-depth interview [14]. The basic file consisted of 84 most important employers from Liberec region that were generated from the Liberec region employment office database. This group was divided into four parts using the applied business culture as a sorting factor. Internally homogenous and externally heterogeneous groups of companies were created this way and one representative from each group was selected for the in-depth interview.
4. **Data collection method** – during the conducting of the in-depth interview, it is necessary to consider in advance the contents of the questions, their formulation, their sequence and the interview length. These matters were resolved in the

preparatory part, when detailed planning was carried out, along with testing and final setting of the scene. The basic aim during specification of the questions was to reduce coercion of answers as much as possible through question formulation, and therefore the questions were open, neutral and clear [15]. A smaller number of respondents are usually addressed for this type of research. When questioning a larger number of respondents, the responses are often repeated, and as a result the research loses effectiveness. The sampling was selected carefully, so that it would correspond to the target group as much as possible [16]. A recording is usually made of the interviews for better subsequent evaluation. During the research, a combination of written text and audio recordings were used.

5. **Data evaluation methods** – the in-depth interview captures respondents' answers in their natural form, which is a basic principle for qualitative research [17]. The evaluation from the in-depth interview was the main part of the research, which led to identification of the current uses of social media for HR purposes. Table 1 presents the approach for evaluating obtained data:

Tab. 1: Course of evaluation of an in-depth interview

Separation of obtained records based on sorting parameters.
Slowed down multiple replaying and analysis of recordings.
Comparison of written records obtained together with audio recordings.
Defining of five independent groups of variables and their recording in the table.
Synthesis of variables in the final model of the most important factors that influence communication in social media.

Source: Own calculation

The outputs from group interviews were subjected to expert group content analysis, participated in by HR and marketing communication experts. The definition of content analysis is connected with objective, systematic, manifest, reliable, valid and reductive information analysis. The subject of content analysis is the content of communication passed by as text or picture. The content analysis relates to both quantitative and qualitative form of information, the reference of text component prevails and practically coincides with the thematization of content analysis. Whether the content analysis is purely descriptive or brings more complex research, it's possible to identify in five points the basic work layout: research design, research organization, verification phase, obtaining and evaluating of data [18]. Following the overall analysis of the examined issues, concluding synthesis was performed, which culminated for fulfilment of the objective.

3. Use of social networks for personnel marketing

The personnel marketing approach involving the use of social networks is so far still a relatively new approach, and therefore there is a different approach among companies in its understanding and implementation. Most organisations imagine under the term social networks and personnel marketing mainly activities that are connected with acquisition of employees, meaning external HR tasks. However, the conducted research also focused on another area, which is the use of social networks within a company's environment, defined as internal HR tasks. It is apparent from the discovered research findings that personnel marketing in combination with social networks is mainly a matter for large companies with a larger number of employees. However, most small businesses do not

carry out personnel marketing at all. The main reason is an effort to minimise costs. This discovered information led to a decision to address companies with more than 200 employees. According to the needs of structured qualitative research only companies over 200 employees were selected into the basic file so that the thorough information base was secured which would be not possible with small companies.

3.1 Division of respondents

The basic sorting parameter for selection of the company was the type of business culture and used corporate identity. Identity can be taken as a set of ideas or thoughts that provide a picture of the essence of a company's existence. This is also taken from the location, design, individual types of communication in operation at the company, the traditions and rituals in place and the overall ability to innovate and adapt to changes [19]. A condition for selection was the application of personnel marketing already during the in-depth interviews. The aim of the division was to obtain the same overview of events and their conducting among members of the particular group. The in-depth interview captured the respondents' answers in their natural form, which is a basic principle of qualitative research. Table 2 presents the division and specification of respondents in greater detail.

Tab. 2: Sorting parameters of respondents

Respondent	Number of employees	Area of activity	Origin of business culture
Company A	200	Services - Automotive	Czech
Company B	250	Automotive	German
Company C	1,000	Automotive	American
Company D	2,100	Automotive	Japanese

Source: Own calculation

For the in-depth interviews, cooperation was agreed upon with four major employers in the Liberec Region. The aim was to achieve maximum differentiation of individual companies from the point of view of applied business culture. Company A is a provider of services, and although it was the smallest of the examined companies, it already had a lot of experience with application of personnel marketing. This company has been led by Czech management since its founding and is a typical example of application of Czech business culture. The other three companies are typical representatives of manufacturers, whose products are intended for the automotive industry. Companies from this field are the most important employers in the Liberec Region. The differences among these companies are in their sizes and business culture, which depend on the origin of the owner, meaning the origin of the foreign parent company. The business culture in companies involved in the automotive industry originates from Germany, the USA and Japan. Overall in all four companies, during preliminary interviews, the application of personnel marketing with the help of social networks was clearly confirmed, which was a basic condition for the in-depth interview. Also in the preliminary contacts, a time schedule was planned for in-depth interviews with an HR employee, who is aware of and responsible for handling issues that the research addresses. In order to protect the information from the competition, a step which was promised to the cooperating companies, the names of the companies have been changed.

3.2 Data collection

Before the information began being collected, extensive preparation was carried out, which consisted on detailed setting of the scene for the in-depth interview. The scenario was prepared both in paper and in electronic form, and all of the participants in the research were familiarised with it. The scenario was subjected to a feedback process, which was followed by testing, which included practice evaluations. The research in the terrain was participated in by two questioners from the marketing and personnel management fields, and for testing of the scenario an experienced expert was invited, who was part of the subsequent evaluation. The scenario was set up based on thorough questions at the beginning, which related to communication applied in HR to the specifics of social media. The scenario was also focused on differentiating applied communication for the needs of internal and external HR. Brief form of scenario:

- Communication in internal HR
 - How do you use "verbal" communication with your own employees?
 - How do you use communication "via media" with your own employees"?
 - For what types of content are the individual methods of communication beneficial?
- Communication in external HR
 - How do you use "verbal" communication with potential employees?
 - How do you use communication "via media" with potential employees"?
 - For what types of content are the individual methods of communication beneficial?
- Social networks for HR needs
 - Do you use social networks for HR activities?
 - No - Do you plan to use them? What do you expect from them?
 - Yes - What kinds of social networks do you use for HR activities?
 - Do social networks help you with providing of information? What kind?
 - Do social networks help you with obtaining of information? What kind?
 - Do you envision a future for the use of social media in HR work? For what types of uses?

The conducted qualitative research was not based directly on a fixed scenario, but despite this the in-depth interview was divided into three separate parts. Each part was comprised of basic questions, to which the questioner had prepared potential answers with helping topics for potential prompting of discussion. The questioners' aim was to carry out the in-depth interview within one hour, in order to prevent the respondent's attention from becoming blurred.

3.3 Research evaluation

The records from the in-depth interviews were obtained in written and audio form, from which the final analysis of the current situation in internal and external communication focused on HR activities. These results served as the base for the main aim of the research, i. e. the use of social networks in HR. Using the content analysis the verbal expression of content in natural words is transformed to the factual selective data in the process of

factual organization or to the sentences in the process of semantic text reduction of text in a document.

3.3.1 Company A

- Communication in internal HR
 - Currently in the company, there is a lot of overlapping of external and internal HR.
 - The HR department is centralised in one place and communicates to a very limited extent with existing staff.
 - The approach to each employee is individual based on the employee's work duties.
 - Application of internal communication with existing employees is done via a regional manager.
 - Verbal communication means applied in the company:
 - Presentation of the vision of the company's policy in an annual meeting.
 - Annual support of internal motivation via motivational interviews.
 - Provision of informal information aimed at influencing processes in the company.
 - Personal advisory sessions and personal support of the department.
 - Written communication means applied in the company: e-mail, Skype.
- Communication in external HR
 - There is no plan to address potential employees over the long term.
 - Communication occurs as needed prior to a tender.
 - Communication tools – social networks, e-mail, phone.
 - Conducted via a central HR department.
 - Communication focused on graduates with an offer of options for increasing qualifications.
 - A focus on external communication:
 - Presentation of tariffs specifically adjusted for a specific position and region.
 - Offering of Central Benefits with a structure choice.
- Social networks for HR needs
 - Social networks are used in the company to an increasing extent. The company sees the future of social networks in searches for special positions in external HR. In internal HR mainly in unofficial communication. In the future, social networks will not only be used for verifying information, but also for active internal as well as external communication. Division of social networks and tools of communication is presented in tables 3.

Tab. 3: Use of social networks in Company A

Facebook	Internal communication	Is used by the company for sharing operative disclosures, such as offers for language courses.
	External communication	Familiarisation of employees with unofficial information in the company
LinkedIn	External communication	Search for key employees and verification of information for selection of management positions

Source: Own calculation

3.3.2 Company B

- Communication in internal HR
 - Verbal communication methods:
 - a personal visit to a facility, which is very effective
 - via company-wide meetings in smaller intervals
 - via partial meetings led by supervisors in weekly intervals
 - Other forms of communication: company PA system, social networks, signs.
 - The contents of internal disclosures in the area of HR are filled mainly with financial details: payment deadlines, methods of setting payments, vacation schedules, the company's results for the previous year.
- Communication in external HR
 - Communication tools for external HR policy are used mainly via media: internet job-search platforms (jobs.cz), social networks, e-mail, phone.
 - Verbal communication with potential employees is used in pre-selections ensured by personnel agencies. The subsequent personal interview is applied only for middle and upper management.
 - The contents of external communication are focused on presentation of the offer of work, not on building the employer's brand.
- Social networks for HR needs
 - The use of social networks has been applied in the company for six years already. Facebook was first implemented in the communication process, followed by LinkedIn, and now the use of Twitter is being proposed. Division of social networks and tools of communication is presented in tables 4.

Tab. 4: Use of social networks in Company B

Facebook	Internal communication	Checking on employees' content and how much time they spend on Facebook (during the work period) and resolution of dissatisfaction.
		Obtaining information on dissatisfaction of employees
	External communication	For providing information for graduates of the engineering faculty, who are potential employees
LinkedIn	External communication	Searching for key employees
		Verifying of obtained information
Twitter	External communication	Providing of information to increase the employer's brand value.

Source: Own calculation

3.3.3 Company C

- Communication in internal HR
 - Verbal communication methods:
 - Recruitment of new employees via current employees.
 - A company-wide meeting twice per year for evaluating economic fundamentals, at which the company's president and employees responsible for quality and production speak.
 - Meetings of individual departments, which are connected with a section meeting of top management.
 - Other forms of communication:
 - Signs in public places intended for long-term information.

- Illuminated boards in halls and vestibules for current information.
- Publication of an internal magazine at monthly intervals.
- For THP management, e-mail management is used as an official media tool.
- The contents of internal HR communication are focused on the current offering of benefits, complaint resolution and evaluation of individual employees' successes.
- Communication in external HR
 - External communication in the company is mainly a matter for the personnel agency, which communicates with potential employees and collects and provides feedback. Social networks play a fundamental role in agencies' communication.
 - The company views communication as a tool for applying PR, involving activities such as sponsoring children's Olympics, holding of sport tournaments, open doors day at the training centre, presentations at the Technical University and participation in trade fairs.
- Social networks for HR needs
 - The company uses LinkedIn and Facebook for current HR needs. For the purposes of these two social networks, one employee has been assigned to devote all of his work to social networks. Social networks have a big future, and there are plans to expand the portfolio of platforms used for communication. Division of social networks and tools of communication is presented in tables 5.

Tab. 5: Use of social networks in Company C

Facebook	Internal communication	Informal communication with existing employees.
		Employees' comments are subsequently evaluated.
	External communication	Providing information to potential employees.
		Checking of future and potential employees
LinkedIn	External communication	Formal communication with potential employees
		Checking of obtained information
		Headhunting people for understaffed positions

Source: Own calculation

3.3.4 Company D

- Communication in internal HR
 - Verbal communication methods:
 - There is a rule in the company that requires direct personal communication regarding work suggestions, 24 hours per day. An employee can come to see his superior or HR staff at any time to discuss a problem or may call the parent company's employee hotline.
 - Management staff personally visit the production areas and talk with employees. Meetings are held with the director, to which team meetings of individual parts of the organisational structure correspond, and in the company an open doors policy applies, with support for communication face to face.
 - An Intranet is also used for sharing information in the company, where the HR department is represented directly on the home page. The following tools are also used for sharing information: information panels, signs, newsletters and e-mail.

- The company connects internal communication with PR activities: it publishes its own company magazine. Team-building events are conducted for middle and upper management. A Family Day event was organised focused on the topic of safety, when top management served beer and refreshments to employees.
- Communication in external HR
 - In external communication, the company focuses on PR activities, via which it makes an effort to strengthen the employer's good reputation. These activities include establishment of a charitable fund, holding a company ball, annual open-doors days, charity work for the Jedlička Institute and cooperation with the Red Cross.
 - In communication with potential employees, the company cooperates with the online HR platform Jobs.cz, which presents offers for management positions. An agency that communicates on the company's behalf is used for recruitment of candidates for manual labour positions.
- Social networks for HR needs
 - LinkedIn is the only social network used. The company would like to include other platforms in its communication portfolio, mainly Facebook, but this is being presented by the concern's strategy to which the company is subject. Division of social networks and tools of communication is presented in tables 6.

Tab. 6: Use of social networks in Company D

LinkedIn	Internal communication	Source of information about potential employees, before the first round of interviews for positions in middle and top management
		Active obtaining of information from other clients who are in the group with the applicant
		Work groups creation across all companies belonging to the concern
		Presentation of the company management
		Standardised company profile
	External communication	Offering of available jobs
		Presentation of company successes
		Presentation of PR events

Source: Own calculation

Conclusions

The final evaluation concerns only with the activities of companies on social networks. Internal communication which was also a part of the qualitative research and is the part of this paper shall only show how active in the field of HR communication the individual companies are. Generally we can say that the intensity of internal communication corresponds to the intensity of activities on social networks. From the results of the in-depth interviews, a large number of common characteristics in the use of social networks in HR have been identified via synthesis. Although the companies were intentionally selected based on the differences in their implemented company culture, their main common denominator is the use of Facebook and LinkedIn. The reason for the use of Facebook is its popularity and massive use across different age groups. The reason for the use of LinkedIn is its professional focus, where groups are formed based on professional skills and experience. The difference was identified in companies with Japanese

management style where HR department was not allowed to make independent decisions on use of social networks. For external use, HR staff have agreed on the use of social networks for checking the information that the applicant presents in the CV or in hiring interviews. Companies see a major opportunity in the use of social networks for finding crucial staff as well as unsuitable candidates. They agree on the option of using such tools to offer available jobs, mainly for management positions. Companies use social networks for presentation of PR activities and for increasing employer branding. In internal use of social networks, companies have agreed on a certain informality of the messages conveyed by HR staff. Such messages relate to the benefits that the company offers at the given time, the events that the company holds for employees and photos and comments from such events. A common characteristic has been an effort to present managers on LinkedIn in standardised profiles. However, the view of monitoring of existing employees via social networks has been different. The monitoring is related both to shared contents and the amount of time employees spend on social networks, even when they are at work. All of the companies have agreed that there is a huge future for the use of social networks in HR. In the future, social networks will become one of the main battlegrounds of HR departments seeking the best staff. Each of the questioned HR managers had an account on Facebook and LinkedIn used for work activities.

Although the examined companies have a different company culture, the communication methods and contents have mostly been identical. The research has confirmed that in current HR, the predominant opinion is that the method of communicating with employees is more important than the contents of messages. The description of options for using social networks in HR management neither is nor can be exhausting as provided herein. This is only a very brief introduction to the issue, which in the soonest period to come will certainly change the approach to searching for and checking of employees. This research may serve as an exploratory form of research of the topic and as a basis for quantitative research. The aim of the work was to present the results of qualitative research in the use of social networks for HR purposes. It can be stated objectively that this aim has been fulfilled and that the results clearly speak in favour of the use of social networks in HR. The results have been confirmed via researching of foreign sources about the huge future for this field. All in-depth interviews led to the conclusion that social networks help HR staff better communicate with existing employees and more easily and quickly obtain or verify information about potential employees.

Acknowledgement

This document was created with financial support from TUL, as part of the grant scheme supporting specific university research projects.

References

- [1] JOBVITE. *Social Recruiting Survey Results* [online]. Jobvite, Inc. [cit. 2014-12-11]. Available at: http://web.jobvite.com/rs/jobvite/images/Jobvite%202010%20Social%20Recruiting%20Report_2.pdf

- [2] KLEIN, L. R. and G. T. FORD. Consumer search for information in the digital age: An empirical study of prepurchase search for automobiles. *Journal of Interactive Marketing*, 2003, **17**(3): 29-49. ISSN 1094-9968.
- [3] VEJÁČKA, M. Facebook advertising and its efficiency on the slovak market. *E+M Ekonomie a Management*, 2012, **15**(1): 116–127. ISSN 1212-3609.
- [4] BUSH, V., A. J. BUSH, and R. P. BUSH. Girl Power and Word-of-Mouth Behavior in the Flourishing Sports Market. *Journal of Consumer Marketing*, 2006, **22**(5): 122–130. ISSN 0736-3761.
- [5] NOBLA, CH. *Media 2.0 Workgroup - Social, Democratic* [online]. Distributed, 2009. [cit. 2015-01-11]. Available at: <http://media2.0workgroup.org>
- [6] JANČA, J. *Sociálních sítě a lidské zdroje* [online]. Cognito, 2008. [cit. 2015-01-29]. Available at: <http://www.cognito.cz/internet/socialni-site-lidske-zdroje/>
- [7] BEDNÁŘ, V. *Sociální síť jako nástroj pro nábor zaměstnanců* [online]. 2015. [cit. 2015-03-21]. Available at: <http://www.personalni-marketing.cz/detail-clanku/socialni-site-jako-nastroj-pro-nabor-zamestnancu>
- [8] SZOZDA, N. Instrumenty marketingu wewnętrznego w firmach usługowych branży IT. *Zeszyty Naukowe Wyższej Szkoły Zarządzania Ochroną Pracy w Katowicach*, 2011, **1**(7): 173–185. ISSN 2300-0376.
- [9] DVOŘÁKOVÁ, Z. *Řízení lidských zdrojů*. Praha: C. H. Beck, 2012. ISBN 978-80-7400-347-9.
- [10] JANDA, P. *Vnitrofiremní komunikace: nástroje pro úspěšné fungování firmy*. Praha: Grada, 2004. ISBN 80-247-0781-0.
- [11] HOLÁ, J. *Interní komunikace ve firmě*. Brno: Computer Press, 2006. ISBN 80-251-1250-0.
- [12] KOUBEK, J. *Personální práce v malých podnicích*. Praha: Grada Publishing, 2003. ISBN 80-2470-602-4.
- [13] SAUNDERS, M. N., K. LEWIS, and A. THORNHILL. *Research Methods for Business Students*. 3rd ed. New Jersey: Prentice Hall, 2002. ISBN 978-0-273-65804-7.
- [14] KOZEL, R., L. MYNÁŘOVÁ, and H. SVOBODOVÁ. *Moderní metody a techniky marketingového výzkumu*. Grada Publishing, 2011. ISBN 978-80-247-3527-6.
- [15] HENDL, J. *Kvalitativní výzkum: základní teorie, metody a aplikace*. 2nd ed. Praha: Portál, 2008. ISBN 978-80-7367-485-4.
- [16] KARLÍČEK, M. *Základy marketingu*. Praha: Grada, 2013. ISBN 978-80-247-4208-3.
- [17] ŠVAŘÍČEK, R. and K. ŠEĐOVÁ. *Kvalitativní výzkum v pedagogických vědách*. Praha: Portál, 2007. ISBN 978-80-7367-313-0.
- [18] SCHERER, H. *Úvod do metody obsahové analýzy. Analýza obsahu mediálních sdělení*. UK Praha: Karolinum, 2004, pp. 29-50. ISBN 80-246-0827-8.
- [19] DĚDKOVÁ, J. and D. SKRBKOVÁ. Significant Competitiveness Factors of Companies in the Czech Part of the Euroregion Neisse-Nisa-Nysa. In *Proceedings for the 8th European Conference on Innovation and Entrepreneurship: ECIE 2013*. Academic Conferences Limited, 2013, pp. 212–220. ISBN 978-1-909507-59-3.

Section IV

Papers by Doctoral Students

Zuzana Palová

Silesian University in Opava, School of Business Administration in Karviná,
Department of Economics and Public Administration
Univerzitní nám. 1934/3, 733 40 Karviná, Czech Republic
email: zuzana.palova@centrum.cz

Measuring of Social Disparities in Selected Regions in the Czech Republic

Abstract

The European Union under the objective Cohesion emphasizes balanced development that reduces differences (disparities) between the regions. The European Union funds are used for the decreasing of the regional disparities in the regions of the European Union. The European Social Fund and the European Regional Development Fund are the most frequently used funds for decreasing of regional disparities. Despite of the European Union efforts to reduce disparities continuously between regions, there are still significant differences between them. This paper is devoted to the issue of above mentioned regional disparities in the social sphere. The social sphere was chosen because it is often neglected area. Most of the researches are devoted to the economic sphere (used descriptors as GDP, foreign direct investment, unemployment rate etc.) For the measuring there will be used four integrated indicators living standards, health condition, social facilities and social pathology. Subsequent evaluation of integrated indicators will be performed by using point method. The measuring will be done in four regions in the Czech Republic – the Hradec Kralove Region, the Plzen Region, the Usti Region and the Moravian-Silesian Region. These regions have been chosen because Hradec Kralove Region and Plzen Region are known as the regions “good for life” and the Moravian-Silesian Region and Usti Region are contrast to them. The Moravian-Silesian Region and Usti Region belong to the “worst” regions in the Czech Republic. There is high unemployment rate, damaged environment, high migration, high criminality etc. The measuring of the disparities was done in 2011 because more recent data was not available for the all descriptors.

Key Words

integrated indicators, point method, social disparities, regions

JEL Classification: I14, O1, P2, R11

Introduction

The European Union (EU) under the objective Cohesion emphasizes balanced development that reduces differences (disparities) between the regions. Despite of the EU efforts to continuously reduce disparities between regions, there are still significant differences between them. This paper is devoted to the issue of above mentioned regional disparities in the social sphere. The social sphere was chosen because it is often neglected area. Most of the researches are devoted to the economic sphere.

Regional disparities primarily help the citizens to raise awareness of the region and their position relative to other regions. Due to them it is possible to determine the differences between entities of the regions, their performance, structure, activities, etc. The focus

here is primarily on what the total level of regions is and what the region offers for the living conditions of its inhabitants namely from the social, economic and environmental point of view [3], [6], [9], [10].

Fachinelli and Tománek in their research defined integrated indicators for measuring of regional disparities [2]. In the social sphere they created five integrated indicators (see Tab. 1).

Tab. 1: Integrated indicators in social sphere

Integrated indicator	Indicators
Living standards	Net disposable income per capita
	Household equipment car
	Household equipment PC
Health condition	Life expectancy at birth (male)
	Life expectancy at birth (women)
	The average percentage of incapacity
	The incidence of neoplasms per 100 thousand inhabitants
Social facilities	Number of doctors per 10 thousands inhabitants
	Number of hospital beds per 10 thousand inhabitants
	Number of places in social care organizations per 10 thousand inhabitants
	Number of leisure centres for children and youth per 10 thousand inhabitants
Living	Number of census households per permanently occupied dwelling
	Number of persons in permanently occupied dwellings in the living room
	Living space per person in m ²
Social pathology	Crimes per 1000 inhabitants
	Number of car accident per 1 inhabitant
	Households with income below subsistence minimum

Source: [2]

1. Methodology

In this paper will be used the point method, whose method of calculation for integrated indicators Tuleja elaborated in his paper [7]. Melecký and Staníčková used this method in their research, where they used it for measuring of the competitiveness of the NUTS 2 regions [5].

The point method is one way of measuring of regional disparities. Tuleja in his paper states that the author of the point method is M. K. Bennet [7]. One advantage of the point method is its ability to summarize characteristics captured in different units of measurement in one synthetic characteristic. The result is a dimensionless number that does not possess a real sense, but it can be used either to determine the rank of the regions or to determine the regional differences that are associated with different categories of indicators. Specific form for using the point method is to determine the value of the index of regional disparities using weighted average of points (1) that each region will receive for the relevant indicators.

$$EI_{RD} = \frac{1}{p} \sum_{i=1}^p \frac{x_{ij}}{x_{i\max}}, \text{ resp. } \frac{x_{i\min}}{x_{ij}}, \quad (1)$$

where, x_{ij} represents the i -th variable for the j -th region, x_{max} represents the maximum value of the i -th indicator, x_{min} represents the minimum value of the i -th indicator (Tuleja, 2011).

2. Measuring of regional disparities

The measuring was performed in four regions in the Czech Republic (CR) – the Hradec Kralove Region (HKR), the Plzen Region (PR), the Usti Region (UR) and the Moravian-Silesian Region (MSR). These regions have been chosen because Hradec Kralove and Plzen Regions are known as the regions “good for life” and the Moravian-Silesian Region and Usti Region are contrast to them. The Moravian-Silesian Region and Usti Region belong to the “worst” regions in the Czech Republic. There is high unemployment; the environment damaged by industry, high migration, high criminality etc. The measuring of the disparities was performed in 2011. More recent data was not available for the descriptors.

For the measuring there was used four integrated above mentioned indicators: living standards, health condition, social facilities and social pathology. These integrated indicators were a little modified for this study. At first there were added two descriptors which included descriptors from education. It was the share of people with higher education in % in “living standards”. The second was the number of students at universities per 1 000 citizens in “social facilities”. This descriptor should show the possibilities of studying at universities in the regions. This number shows the number of students but also the number of places for students. It is better indicator than only number of universities or number of faculties, because every university or faculty has different capacity. The last change was that for the measuring of the regional disparities there was not used the descriptor number of leisure centres for children and youth per 10 thousand inhabitants because the data of these descriptors was not available.

2.1 Data of regional disparities

Table 2 shows the values of descriptors of living standards. The Hradec Kralove Regions is the best in two of the descriptors. The worst situation was in the Usti Region in three descriptors. Large difference was in the share of people with higher education in %, were in UR was 7.7 % and in HKR was 11.4%.

Tab. 2: Living standards

	MSR	HKR	UR	PR
Per capita annual income (net money income)	127 195	141 371	127 071	149 816
Household equipment: car*	58.1	72.7	59.9	70.4
Household equipment: PC*	63.4	67.7	59.2	65.3
The share of people with higher education in %	11.4	10.4	7.5	10.5

*Legend: *Housing characteristics, equipment and durables (%) It means % of households equipped with a car and a PC out of total number of households*

Source: own processing according to data by [1]

Table 3 represents values of indicator the health condition. The best situation was in this case in the Hradec Kralove Region in two descriptors – life expectancy at birth male and female and in Usti Region – the average percentage of incapacity and the incidence of neoplasm per 100 thousand inhabitants. In this indicator the worst social situation was in the Moravian-Silesian Region and Plzen Region.

Tab. 3: Health condition

	MSR	HKR	UR	PR
Life expectancy at birth (male)	72.7	75.5	72.8	75.1
Life expectancy at birth (female)	79.9	81.3	78.7	80.4
The average percentage of incapacity	4.3	3.6	3.6	3.8
The incidence of neoplasms per 100,000 inhabitants	771.8	853.2	757.1	967.1

Source: own processing according to data by [1]

Table 4 shows the values of descriptors of social facilities. The Hradec Kralove Region is again on the first place but only in one of the descriptors. The worst situation is in the Usti Region. But in Usti Region was surprising findings in the number of places in social care organization per 10 thousand inhabitants. Where the number was about 38% higher than in the Plzen Region where the least places in social care organization per 10 thousand inhabitants was.

Tab. 4: Social facilities

	MSR	HKR	UR	PR
Number of doctors per 10,000 inhabitants	39.94	44.93	34.68	45.94
Number of hospital beds per 10,000 inhabitants	51.05	62.56	61.69	62.01
Number of places in social care organizations per 10,000 inhabitants	82.22	75.25	100.53	72.68
Number of students at universities per 1,000 citizens	36.89	33.10	26.21	28.48

Source: own processing according to data by [1]

Table 5 represents values of indicator the social pathology. The best situation in this case was in the Hradec Kralove Region in one descriptor – crimes per 1000 inhabitants and on the second place in households with income below subsistence minimum and number of car accident per 1 inhabitant. In this indicator the worst social situation was in the Usti Region and Moravian-Silesian Region which there was expected especially for this indicator. Crimes and households with income below subsistence minimum related with high unemployment which is in these regions.

Tab. 5: Social pathology

	MSR	HKR	ÚR	PR
Crimes per 1000 inhabitants	34.5	19.9	36.6	24.1
Number of car accident per 1 inhabitant	152	144	116	184
Households with income below subsistence minimum	6.9	2.9	7.7	0.9

Source: own processing according to data by [1]

2.2 Point method

For measuring of regional disparities there was used the point method. In the first step it was necessary to divide those indicators for which the optimal value is called value of the maximum and for which the optimal value is called the minimum value. Furthermore, there was calculated the maximum (for number of doctors, number of hospital beds, number of places in social care organization, life expectancy) and minimum (the average of percentage of incapacity, the incidence of neoplasm) value in all regions. Finally there was formed converted table, where in the case of the minimum values there was divided the criterial value by the actual value, and this proportion was multiplied by the 1000. In the case of the maximum values there was divided the actual value by the criterial value and the percentage multiplied by the 1000 (see Tab. 6, 7, 8 and 9).

Tab. 6: Index of integrated indicator living standards

	MSR	HKR	UR	PR
Per capita annual income (net money income)	849	944	848	1 000
Household equipment: car in %	799	1 000	823	968
Household equipment: PC in %	937	1 000	874	964
The share of people with higher education in %	1 000	913	658	918

Source: own processing according to data by [1]

Tab. 7: Index of integrated indicator health condition

	MSR	HKR	UR	PR
Life expectancy at birth (male)	963	1000	964	995
Life expectancy at birth (female)	982	1000	968	988
The average percentage of incapacity	845	994	1000	945
The incidence of neoplasms per 100,000 inhabitants	981	887	1000	783

Source: own processing according to data by [1]

Tab. 8: Index of integrated indicator social facilities

	MSR	HKR	UR	PR
Number of doctors per 10,000 inhabitants	869	978	755	1000
Number of hospital beds per 10,000 inhabitants	816	1000	986	991
Number of places in social care organizations per 10,000 inhabitants	818	749	1000	723
Number of students at universities per 1,000 citizens	1000	897	710	772

Source: own processing according to data by [1]

Tab. 9: Index of integrated indicator social pathology

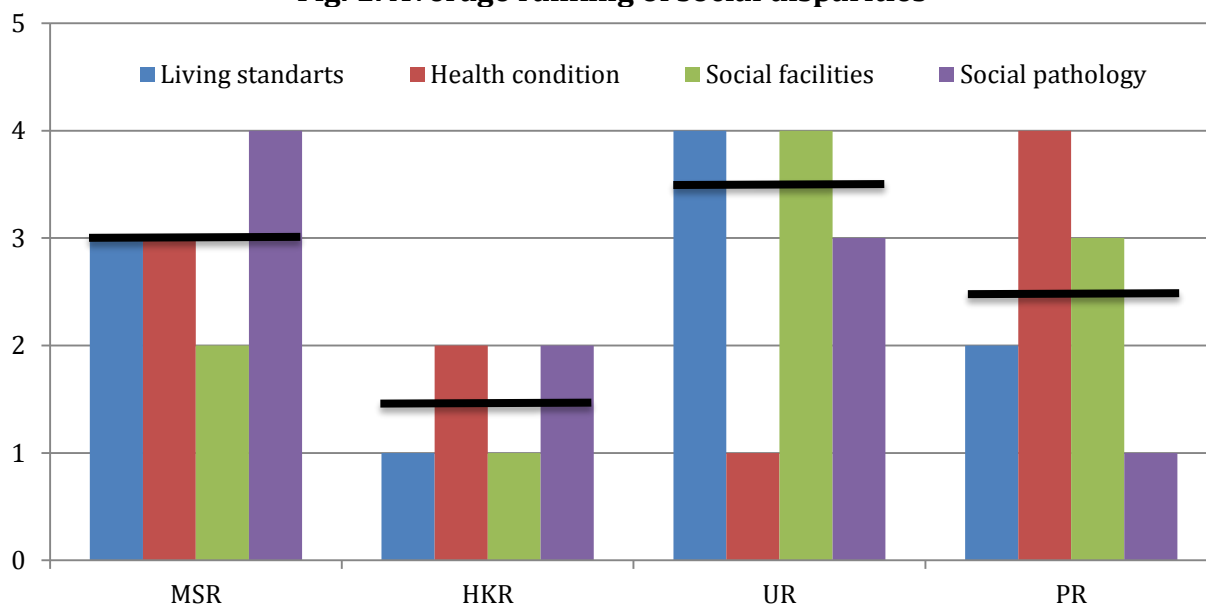
	MSR	HKR	UR	PR
Crimes per 1000 inhabitants	698	1000	544	827
Number of car accident per 1 inhabitant	762	806	1000	631
Households with income below subsistence minimum	130	310	117	1000

Source: own processing according to data by [1]

Fig. 1 shows the average values which could be described as an index of regional disparities. These values were calculated by averaging the values mentioned in the tables from 6 to 9. On the basis of the average values there were established ranks of the regions. The black line in each region is the average values of all four integrated indicators.

According to the Fig. 1 we can see that the Hradec Kralove Region is the best region in social sphere its average ranking is 1.5. On the second place the Plzen Region is with average ranking 2.5. The Moravian-Silesian Region placed on the third position with the average ranking 3. The Usti Region placed on the last position with average ranking 3.5. In this analysis was confirmed the problematic situation in the structurally affected regions as Usti and Moravian-Silesian Region.

Fig. 1: Average ranking of social disparities



Source: own calculation according to data by [1]

Conclusion

The EU under the objective Cohesion emphasizes the balanced development that reduces differences between the regions. This paper dealt with the differences in social sphere by using integrated indicators namely living standards, health condition, social facilities and social pathology.

The aim of this paper was measuring the regional disparities in social sphere in the four regions in the Czech Republic namely Hradec Kralove Region, Plzen Region, Usti Region and Moravian-Silesian Region. The measuring was performed using the point method and the integrated indicators living standards, health condition, social facilities and social pathology. On the base of the point method we could determine the order of the regions. The Hradec Kralove Region is the best region in social sphere its average ranking is 1.5. On the second place the Plzen Region is with average ranking 2.5. The Moravian-Silesian Region placed on the third position with the average ranking 3. The Usti Region placed on the last position with average ranking 3.5. Results of this analysis were not surprising because it could be expected on the base of the economic characteristic of the regions where the Usti and the Moravian-Silesian Regions are problematic regions which were structurally affected especially after the decline of heavy industry in the 90s. Since then, these regions are confronted with problems of high unemployment, migration, and with poor environment.

Acknowledgment

This paper originated from the project SGS 16/2015 “The support social innovation from funds of European Union”.

References

- [1] CZSO. *Regional time series*. [online]. Praha: Czech Statistical Office, 2014. [cit. 2014-10-10]. Available at: http://www.czso.cz/csu/redakce.nsf/i/regionalni_casove_razy
- [2] FACHINELLI, H. and P. TOMÁNEK. Hodnocení regionálních disparit prostřednictvím integrovaných indikátorů. *Regionální disparity*, 2011, 5(10): 31–44. ISSN 1802-9450.
- [3] HUČKA, M. and A. KUTSCHERAURER. Teoreticko-metodické otázky regionálních disparit. *Regionální disparity*, 2011, 5(10): 20–30. ISSN 1802-9450.
- [4] KUTSCHERAURER, A., D. FACHINELLI, J. SUCHÁČEK, K. SKOKAN, M. HUČKA, P. TULEJA, and P. TOMÁNEK. Regionální disparity. Disparity v regionálním rozvoji země – pojetí, teorie, identifikace a hodnocení. *Series on Advanced Economic Issues*, 2010, 2(3): 175–177. ISBN 978-80-248-2354-6.
- [5] MELECKÝ, L. and M. STANÍČKOVÁ. Hodnocení konkurenceschopnosti regionů České republiky v kontextu Lisabonské strategie. *Ekonomická revue – Central European Review of Economics Issues*, 2011, 14(3): 183–200. ISSN 1212-3951.
- [6] TVRDOŇ, M. and K. SKOKAN. Regional disparities and the ways of their measurement: The case of the Visegrad Four countries. *Technological and Economic Development of Economy*, 2011, 17(3): 501–518. ISSN 1392-8619.
- [7] TULEJA, P. Možnosti měření regionálních disparit – nový pohled. *Regionální disparity Working Papers*, 2009, no. 5, pp. 62–70.
- [8] TULEJA, P. Měření regionálních disparit – pohled zpět. *Regionální disparity Working Papers*, 2011, no. 8, pp. 55–67.
- [9] VITURKA, M. Disparity v regionálním rozvoji. In BLAŽEK, L. and M. VITURKA. eds. *Analýza regionálních a mikroekonomických aspektů konkurenceschopnosti*. Brno: CVKS ESF MU, 2008. pp. 4–15.
- [10] VITURKA, M. Regionální disparity a jejich hodnocení v kontextu regionální politiky. *Geografie*, 2010, 115(2): 131–143. ISSN 1210-3004.

Tereza Semerádová, Jan Mrázek

Technical University of Liberec, Faculty of Economics

Studentská 1402/2, 461 17 Liberec 1, Czech Republic

email: tereza.semeradova@tul.cz, jan.mrazek@tul.cz

The Influence of Experience and Education of Project Managers on Project Success

Abstract

Identification of Critical Success Factors (CSF) of Project Management belongs among the most explored topics in the area of project methodology. Although the research related to project CSF is quite comprehensive, there is so far no integrating paradigm that would be accepted by both academics and practitioners. Despite the lack of uniformity in conducted studies, the authors usually agree on some basic factors that are common for all types of projects. Apart from the iron triangle (times, costs, quality), people and organizational support represent the two other most frequently mentioned variables. In this respect, the authors often stress the need for good leadership from the part of the project managers and emphasize the importance of having managers with a high level of hard and soft skills. However, a frequently discussed issue is whether these skills must be acquired through specialized education programs or whether it is possible to replace this education by experience. In this paper we examine the relationships between the following variables - project oriented education, experience and project success. The main objective of our analysis lies in determining the approximated ratio of influence of each of these elements on the whole project performance. As a test sample we use the data collected during national survey including all regions of the Czech Republic that was carried out in the period from January to June 2015. Presented results are obtained by data processing via ANOVA and correlation analysis.

Key Words

project performance, knowledge acquisition, project education, project experience

JEL Classification: M10, M12

Introduction

Project manager is a specialist responsible for setting clear and realistic goals for the project and assuring their achievement. Project manager must be able to adapt to different internal procedures and create close ties with the authorized representatives of individual departments, teams or other project stakeholders. Every project is different in scope and requires the use of appropriate methods and tools. These procedures are described in project management methodologies that may be created by the organization its-self or by international institutions. The most famous include project management methodologies PRINCE2 and PMI. Managers may acquire the desired project knowledge also in many study programs and learning courses. The main objective of this paper is to identify whether education represents a necessary prerequisite for project success or whether the project manager may gain the knowledge outside the formalized structures. Analysis presented in this paper aims at quantifying via correlation coefficients the

relationships between several project variables related to the background education of project managers, their experience and project performance.

1. Research Background

In their paper, Easton & Rosenzweig [1] focus on the role of experience in the improvement of team activities in six sigma systems where structured problem solving is applied as main project approach. The authors examine various types of experience and their effects on project and organizational outcomes. Their results indicate that in order to improve the performance of the whole team it is first necessary to enhance the performance and experience of the team leader. If the team activities are coordinated by an experienced manager the requirements concerning this set of skills on other team members decrease significantly. Berssaneti & Carvalho [2] came to similar conclusions. According to their research, top management support and having a dedicated project manager considerably contribute to the success of the project. Moreover, in relation to the iron triangle, project management maturity increases the chance of delivering desired outcomes by 4.41 times, while top management support only by 1.86 times.

Further studies on relevance of staff appraisal on project performance confirm the previously described findings. Mir & Pinnington [3] analyzed a limited sample of managers in UAE and tested, using linear regression, various dependent and independent project variables. Their results show that PM leadership and PM staff along with PM Lifecycle Management Processes and PM Key Performance Indicators have the highest coefficient values (0.538, 0.570, 0.556 and 0.578 respectively). Petter & Vaishnavi [4] underline the importance of knowledge sharing via storytelling and narratives transmitted from knowledge contributors to knowledge seekers. By developing Experience Exchange model they propose an easy-to-use approach to collect, store and reuse knowledge gathered from more experienced workers.

Based on a case study course, Alam, Gale, Brown & Kidd [5] conducted a comparative analysis of three surveys examining the effects of project education on profitability and competitiveness. The authors chose for a case study The Project Management Professional Development Program (PMPDP) which is a modular distance learning course. The investigation of Benefits Metrics proves that the knowledge of employees increases with every PMPDP module. It also has a positive effect on managerial certification and IPMA levels (A,B,C,D). Although the positive influence of PMPDP on the knowledge of employees was confirmed, it cannot be satisfactorily concluded that education programs ensure improvements and thus project success.

Most of these studies already confirmed the importance of having a solid project staff base and high-quality project managers. Nevertheless, we did not find any study quantifying the impact of various types of project education that a manager may receive on the overall project performance of the organization. Thus, we postulate the following research questions that necessitate further analysis:

- Q1: What is the relationship between education, experience and project success?

- Q2: To what extent the project success is influenced by the number of organized projects or by the budget?
- Q3: Is it possible to replace project education by experience gained during previous projects?

2. Sample characteristics

For testing purposes we used our own data that we collected during a national survey that was still ongoing in the time of our analysis. Analyzed sample included only information gathered from January until April 6, 2015. All additional data obtained after this deadline will serve, at the end of the survey, for further verification of the results presented in this paper. The survey was conducted via an online questionnaire which was distributed by mail to Czech organizations whose contacts were extracted from Bisnode database using the MagnusWeb application. We received 1116 responses in total from which only 385 were relevant since the remaining respondents did not organize any projects. The respondents were asked to specify the annual number of project, the level of their success/failure, average project budget, experience and type of education their managers have.

The characteristics of our research sample are displayed in tables 1, 2, 3 and 4. In the Czech Republic, the organizations usually manage 1-5 projects at a time. These projects do not generally exceed the budget of 10 million CZK, whereas projects with budget not higher than 1 million represent more than a half of the organizations within this budget range.

Tab. 1: Average number of projects per year

Average number of projects per year	
Intervals	No. of respondents
1 - 2	168
3 - 5	126
6 - 10	43
10 <	48
Total	385

Tab. 2: Project budget (CZK)

Project budget (CZK)	
Intervals	No. of respondents
< 1 million	169
1 - 10 million	154
10 million <	54
not specified	8
Total	385

Source: own

In terms of education and experience, the questionnaire distinguished four categories: project education (tertiary, project study programs, certification according to international standards IPMA, Prince), none or little experience, great experience and having both experience and education (Table 4). The answers concerning project success (Table 3) can be divided into four intervals regrouping failures (0-59%), unsuccessful projects (60-75%), partially successful (76-89%) and successful projects (90-100%).

Tab. 3: Project success

Project success	
Intervals	No. of respondents
0 - 59 %	88
60 - 75 %	82
76 - 89 %	101
90 - 100 %	114
Total	385

Tab. 4: Education and Experience

Education/Experience	
Background knowledge	No. of respondents
Project education	70
Great project experience	89
Little project experience	126
Education and experience	100
Total	385

Source: own

3. Methodology

Firstly, we assessed the main and interaction effects of individual factors (Education and experience, Number of projects per year, Project budget) on the dependent variable of quantitative type (Project success) using ANOVA analysis. The ANOVA table decomposes the variability of Project success into contributions due to various factors. Since Type III sums of squares have been chosen, the contribution of each factor is measured having removed the effects of all other factors. The P-values test the statistical significance of each of the factors. Further analysis of the collected data was done using Pearson product moment correlations and Spearman rank correlations between each pair of relevant variables with the aim of measuring the strength of the linear relationship between these variables.

4. Results

By applying the Analysis of Variance we studied the contribution of each of the selected factors (Education and experience, Number of projects per year and Average project budget) on the Project success. Test values are displayed in Table 5. Since two P-values are less than 0.05, these factors have a statistically significant effect on Project success at the 95,0% confidence level. According to the results listed below, education along with experience and the number of projects per year represent relevant variables worth further analysis. On the contrary, project budget does not seem to have a considerable impact on the project success.

Tab. 5: Analysis of Variance for Project success

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
MAIN EFFECTS					
A:Education and experience	0,386804	3	0,128935	3,35	0,0191
B:No. of projects per year	0,7175	3	0,239167	6,22	0,0004
C:Project budget	0,120216	3	0,0400721	1,04	0,3741
RESIDUAL	14,4288	375	0,0384767		
TOTAL (CORRECTED)	16,2319	384			

Source: own

In order to examine the effects of all studied factors in the questionnaire, we decided to analyze the factor of education and experience more thoroughly. Table 6 shows Pearson

product moment correlations between each pair of variables included in the described category (Education, Little experience, Great experience, Education and Experience). Also shown in parentheses is the number of pairs of data values used to compute each coefficient. The third number in each location of the table is a P-value which tests the statistical significance of the estimated correlations. P-values below 0.05 indicate statistically significant non-zero correlations at the 95,0% confidence level.

Tab. 6: Pearson product moment correlations

	Project succes	Education	Little experience	Great eperience	Education and Experience
Project succes		0,3049	-0,1334	0,3698	0,4782
		(12)	(12)	(12)	(12)
		0,3352	0,6793	0,2368	0,1159
Education	0,3049		0,6847	0,6451	0,7567
	(12)		(12)	(12)	(12)
	0,3352		0,0140	0,0235	0,0044
Little experience	-0,1334	0,6847		0,6281	0,5688
	(12)	(12)		(12)	(12)
	0,6793	0,0140		0,0287	0,0536
Great eperience	0,3698	0,6451	0,6281		0,5002
	(12)	(12)	(12)		(12)
	0,2368	0,0235	0,0287		0,0977
Education and Experience	0,4782	0,7567	0,5688	0,5002	
	(12)	(12)	(12)	(12)	
	0,1159	0,0044	0,0536	0,0977	

Source: own

Although none of the coefficients related to project success is computed at 95% confidence level, we still may consider some of the findings as relevant. If we look closely on the test results, having background project education together with experience has the strongest positive impact on the project success. In addition, the p -value is 0.1159 which indicates that this information has a greater evidential value than the others. Great experience and Education seem to be rather equal in terms of Project success since their coefficients (0.3698 and 0.3049, respectively) and p -values (0.2368 and 0.3352, respectively) are reaching similar values. Having little experience or none is the only variable with negative project output (-0.1334 with p -value 0.6793) and thus may contribute to project failures.

Tab. 7: Spearman Rank Correlations

	Project succes	Education	Little experience	Great eperience	Education and Experience
Project succes		0,3480	-0,2636	0,4700	0,4912
		(12)	(12)	(12)	(12)
		0,2484	0,3819	0,1190	0,1033
Education	0,3480		0,6095	0,6377	0,6861
	(12)		(12)	(12)	(12)
	0,2484		0,0432	0,0344	0,0229
Little experience	-0,2636	0,6095		0,3872	0,5626
	(12)	(12)		(12)	(12)
	0,3819	0,0432		0,1991	0,0620
Great eperience	0,4700	0,6377	0,3872		0,5124
	(12)	(12)	(12)		(12)
	0,1190	0,0344	0,1991		0,0892
Education and Experience	0,4912	0,6861	0,5626	0,5124	
	(12)	(12)	(12)	(12)	
	0,1033	0,0229	0,0620	0,0892	

Source: own

Since education is considered to be an ordinal variable we calculated also Spearman rank correlations coefficients which are recommended as a more valid method for this type of variable. Spearman rank correlations between each pair of variables are listed in Table 7. In contrast to the more common Pearson correlations, the Spearman coefficients are computed from the ranks of the data values rather than from the values themselves. Consequently, they are less sensitive to outliers than the Pearson coefficients. P-values below 0.05 again indicate statistically significant non-zero correlations at the 95.0% confidence level.

The outcomes of Spearman rank correlation analysis do not significantly differ from Pearson product moment correlations. Education and Experience (0.4912, P-value 0.1033) appears to have the closest relationship with project success from all four variables. Unlike the previous test, Spearman coefficients for Education (0.3480, P-value 0.2484) and Great experience (0.4700, P-value 0.1190) differ in a more important way putting Great experience before Education. Having little experience stays a negative impact variable, this time with even higher coefficient than before (Sc -0.2636, Pc -0.1334) and calculated with higher confidence level (Sc P-value 0.3819, Pc P-value 0.6793).

Conclusion and Limitations

In this paper we did not intend to make a complex Critical Success Factor analysis of all project variables that could possible influence the Project success. Based on the previous research done in this area, we assumed the importance of staff knowledge as a valid factor. Thus, we aimed our analysis at exploring only the variables relevant to knowledge gaining: number of implemented projects, project budget, experience (or no experience) and background education.

The results of the ANOVA test suggest that project budget is irrelevant in terms of project success whereas education, experience and the number of implemented projects influence to some extent the project outcomes. However, for future testing we suggest to run along with ANOVA also regression analysis. In this case, we assumed that chosen categories have an effect on project success. Regression analysis is more suitable for situations where the objective is to find out whether the independent categorical variables have any effect at all while ANOVA is used rather to determine whether particular categories have different effects. Pearson and Spearman correlations of the knowledge acquisition related variables indicate some equity between project success – education and project success - great experience constructs implying that project education may not be a necessary prerequisite for success in case the manager (or other staff) has a profound project experience. Spearman correlations even outline the possibility that experience could be more valuable than project education. Obviously, the combination of both education and experience has the strongest positive impact on project success, although the correlation coefficients are not much stronger than for the two previously mentioned variables. This confirms the assumption that after reaching a certain level of knowledge, the effectiveness of their application remains constant. The variable – number of projects – was not included in the correlation analysis since we were not able to relate this variable to other factors due to its characteristics. If we assume that with every implemented project the manager (staff) gains some knowledge than the

number of projects represents experience that is measured on subjective level of each individual.

Conclusions and results presented in this paper may be misleading due to incorrect interpretation of the collected data and their imprecise evaluation. These errors may be caused mainly by the lack of data for all categories (unequal scattering) and thus by necessary aggregation of some values in order to obtain information ready for statistic processing. In addition, used coefficients are rather non-robust to deviations since the correlation is a measure of linear dependence, and when one variable can't be written as a linear function of the other (and still have the given marginal distribution) the possible correlations values can be severely restricted.

Despite the possible deviations, our results nevertheless demonstrate the importance of knowledge and more importantly the importance of experience. In our questionnaire, we specifically asked for qualities the project managers had which makes our analysis rather top management-centered than staff oriented. This approach thus emphasizes the necessity of introducing highly effective techniques of knowledge sharing within and across various projects. As the correlation coefficients suggest, these techniques should be experience based. For this reason, application of Lessons Learned and other methods allowing the storage and formalization of project procedures should be included as elementary project management tools.

Acknowledgement

This work was supported by the project No. SGS-21073 Analysis of project methodologies implemented by small, medium and large enterprises in the Czech Republic.

References

- [1] EASTON, G. and E. ROSENZWEIG. The role of experience in six sigma project success: An empirical analysis of improvement projects. *Journal of Operations Management*, 2012, **30**(7–8): 481–493. ISSN 0272-6963.
- [2] BERSSANETI, F. and M. CARVALHO. Identification of variables that impact project success in Brazilian companies. *International Journal of Project Management*, 2015, **33**(3): 638–649. ISSN 0267-7863.
- [3] MIR, F. and A. PINNINGTON. Exploring the value of project management: Linking Project Management Performance and Project Success. *International Journal of Project Management*, 2014, **32**(2): 202–217. ISSN 0267-7863.
- [4] PETTER, S. and V. VAISHNAVI. Facilitating experience reuse among software project managers. *Information Sciences*, 2008, **178**(7):1783–1802. ISSN 0020-0255.
- [5] ALAM, M., A. GALE, M. BROWN, and C. KIDD. The development and delivery of an industry led project management professional development programme: A case study in project management education and success management. *International Journal of Project Management*, 2008, **26**(3): 223–237. ISSN 0267-7863.

Kamila Turečková

Silesian University in Opava, School of Business Administration in Karviná
Department of Economics and Public Administration
Univerzitní náměstí 1934/3, Karviná, Czech Republic
email: tureckova@opf.slu.cz

Measurement of Income Inequality by Method of Non-Weighted Average Absolute Deviation: Case of South European Countries

Abstract

This present paper presented uses the method of non-weighted average absolute deviation for expressing and comparing income inequality between selected human societies. Allocation of income is mostly considerably unequal through society and income inequality determines how the income of individuals differs from a situation when everybody would have selfsame income. Income inequality creates a perilous space for social and economic discrimination. The aim of this paper is to use new, alternative, method to measure income inequality in case of South European Countries (Portugal, Spain, Italy, Greece, Cyprus and Malta). The results of measures of income inequality though method of non-weighted average absolute deviation is, in practical part of article, compare with two the well-known traditional indicators - Gini coefficient and S80/S20 Ratio. The analysis of income distribution of 6 selected South European countries between years 2005-2013 and its order will be made in quintiles based on empirical data from the Statistics on Living Conditions and Welfare published by European statistical office Eurostat. The text of this article is organized in 4 parts, after Introduction follows the theoretical background where is primarily the method of non-weighted average absolute deviation explained. The third part contains the empirical analysis and results of income inequality and the Conclusion highlights some major conclusions of detailed analysis made in previous chapter. According to results of comparison of measuring via standard method using Gini coefficient and S80/S20 Ratio with the method of non-weighted average absolute deviation, author recommend to use the new one especially for its easy calculation based on commonly available data in the required format provided by statistical offices.

Key Words

Gini coefficient, income inequality, method of non-weighted average absolute deviation, S80/S20 ratio

JEL Classification: C13, D31, I32

Introduction

Income inequality was and also is a natural part of every economy and human societies. In essence it means that different people or different groups of people and households will reach different income and this income dispersion determines how much the great range of individual income in each society at the economy is. There are many possibilities how to look on or measure standards of living in selected countries. One of the best known is GDP per capita. Despite the fact that this indicator could reach relatively large value, it does not predicate differences of incomes in society. Another indicator we could hear

about very often is average wage. Not even its amount is guarantee of economic well-being. It is usual that over 50% of working population of the country cannot reach this amount. One of the best known and used measures of income inequality is Gini coefficient and its graphical representation through Lorenz curve. It could be supplemented by Robin Hood Index and S80/S20 Ratio (Quintile Share Ratio) which are used as other methods of comparison of income inequality [17], [18].

The aim of this paper is to apply other method how to measure and express income inequality in case of South European inhabitants in the period of years 2005–2013. Analysis of income inequality is focused on method of non-weighted average absolute deviation that is normally used to express regional disparities in selected area of representative indicators.¹ The result of measure income inequality by this alternative method is compared with results calculated by Gini coefficient and S80/S20 Ratio. Analysis of income inequality through three mentioned methods will be done based on empirical data of Eurostat in the chosen period of time for 6 south European countries, namely for Portugal, Spain, Italy, Greece, Cyprus and Malta.

The text of the article below this introduction will be organized as follows. Section 1 is oriented to methodology and characterizes used data. Section 2 provides theoretical introduction into method of non-weighted average absolute deviation. Section 3 contains the analysis of the income inequality in selected European countries using the method of non-weighted average absolute deviation. Finally the conclusion highlights some major conclusions of detailed analysis of income inequality and its development during analyzed period of time with evaluation of countries in context of income inequality and their ranking. There are also mentioned results of measurement of income inequality by two standard methods (Gini coefficient and S80/S20 Ratio) and these results are compared here with the result of income inequality obtained by method of non-weighted average absolute deviation.

1. Theoretical background

Income inequality is a natural part of every human society. It could reflect not only measure of poverty of different population groups, but it could also reflect social systems or the distribution of the tax.[17], [18]. Among well-known methods how to measure income inequality belong: Lorenz curve, Gini coefficient, Coefficient of income inequality S80/S20 (or Quintile share ration or S80/S20 Ratio), Atkinson index, Theil index, Robin Hood index and Variation coefficient. [1], [11], [14]. For more information about other indexes see for example [1], [3], [6], [11], [12], [14], [17], [18], [19], [20], [21].

There are used two conventional methods which results will be compared with results of method of non-weighted average absolute deviation. Gini coefficient measures the extent to which the distribution of income within a country deviates from a perfectly equal distribution. A Gini coefficient can have values form 0 to 1 while coefficient of 0 expresses perfect equality where everyone has the same income, while a coefficient of 1 expresses full inequality where only one person has all the income [4]. The income quintile share

¹ For more information see e. g. [9], [15] or [16].

ratio or the S80/S20 ratio is a measure of the inequality of income distribution. It is calculated as the ratio of total income received by the 20% of the population with the highest income (the top quintile) to that received by the 20% of the population with the lowest income (the bottom quintile) [4]. Ratio can have values from 1 to 100 and if ratio (coefficient) is lower (the more close to 1) then less income inequality is between the richest and poorest households in society.

From a methodological perspective the work is about income inequality based on a method of non-weighted average absolute deviation (characterized in the following chapter), Gini coefficient and S80/S20 ratio.¹ The software used was MS Excel. All calculations and graphical analysis is author's own.

The empirical calculation and analysis in this paper are based on data from statistical database of Eurostat, concretely from the Statistics on Income distribution and Monetary poverty (SILC), Distribution of income by quintiles as a share of national equivalised income for 6 south European countries defined by Nomenclature of Units for Territorial Statistics as level NUTS0: Portugal, Spain, Italy, Greece, Cyprus and Malta. The period only covered years 2005-2013 because of missing credible data which is not available for a longer period of time. Income understood as a total disposable income of a household that is calculated by counting personal income received by all members of the household plus income received at household level. Disposable household income includes all income from work (employee wages and self-employment earnings), private income from investment and property, transfers between households and all social transfers received in cash including old-age pensions [4].

Method of average deviation reflects the degree of variability, defined as the arithmetic mean of the absolute deviations of individual values of observed indicators from the selected value (given point).² This value chosen here understands the value for the ideal distribution of income in society, ie. the value of expressing absolute equality in income for each inhabitants. In general absolute deviation is constructed on the basis of this formula 1:

$$d_i = |x_i - (x)|, \quad (1)$$

where: d_i presents the absolute deviation from i -th indicator, x_i presents the i -th indicator (data element, variable), (x) is the chosen given point.

Own value of non-weighted³ average absolute deviation we obtained from the formula 2:

$$\bar{d}_i = \frac{\sum_{i=1}^p |x_i - (\bar{x})|^l}{n_i}, \quad (2)$$

¹ The value of S80/S20 Ratio and Gini coefficient calculated based on data from Table 1.

² Generally the deviation is reckoned from the ideal value, recommended value, central value that is constructed as some type of average, median, mean of the data set and other.

³ All indicators have the same weight in the value of average absolute deviation.

where: $\bar{d}_i$ presents the average absolute deviation from i -th indicator, n_i presents the number of values of i -th indicator that we have available, $(\bar{x})$ is the arithmetic mean of i -th indicator.

Particular form for using this method is to set the time integrated value of the index (3) for relevant evaluation of selected indicators during analysed period of time. Based on this calculated index we can determine the intertemporal ranking of the chosen regions or countries or identify differences between them. The value of intertemporal integrated index we compile by following formula:

$$INI_P = \frac{\sum_{i=1}^p |\bar{d}_i|^l}{n_i}, \quad (3)$$

where: INI_P is an integrated index calculated using the average absolute deviation.

Use methods of non-weighted average absolute deviation in context of measurement of income inequality is specify in these areas:

1. indicator (x) is the ideal percentage value of income which get in concrete the percentage of households in society, for example, 40% of households get precisely 40% of total income $((x) = 40\%)$,
2. variable x_i presents real household's money income cumulated into relevant quintiles. Here we can give an example, that 40% of households got 19.8% of total income in Greece in 2010 $(x_i = 19.8\%)$, and
3. integrated index (INI_P) express the average value of variable $\bar{d}_i$ during analysed period of time.

Both value of non-weighted average absolute deviation and amount of integrate index can have values from 0 to 100 and if value of non-weighted average absolute deviation and amount of integrate index is lower (the more close to 0) than less income inequality is between the richest and poorest households in society. Perfect income equality in the society would occur in a situation where both values would come out zero.

The integrated index based on methods of non-weighted average absolute deviation is useful for simple comparison of income inequality in large number of societies (communities) together a long period of time. It is also much easier to use and apply the method of non-weighted average absolute deviation to express income inequality than count Gini coefficient because the results of both methods are essentially identical (see conclusion). The negative of using the intertemporal integrated index is that the value of this index does not tell us anything about the development (or the trend) of income inequality in the society during the time.

2. Empirical results

Empirical analyses were made on the basis of the share of national equivalised income of 6 south European countries household's data from Eurostat. Table 1 shows percentage amount of household money income for relevant quintiles for analysed years.

Tab. 1: Household's money income for relevant quintiles (x_i) of households in selected south European countries (6), in round %, 2005–2013

	Greece					Cyprus				
Year/Households	20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
2005	7.0	19.6	36.5	59.7	100	8.6	22.1	39.7	62.5	100
2006	6.8	19.0	35.8	58.7	100	8.8	22.3	39.8	62.2	100
2007	6.9	19.1	35.9	58.7	100	8.7	22.1	39.4	61.4	100
2008	6.9	19.5	36.7	59.6	100	8.8	22.2	39.6	62.1	100
2009	7.0	19.8	36.9	59.6	100	8.8	22.1	39.4	61.6	100
2010	7.2	19.8	37.0	59.8	100	8.6	21.9	39.0	61.2	100
2011	6.8	19.2	36.5	59.8	100	8.8	22.2	39.5	61.8	100
2012	6.1	18.5	36.1	59.6	100	8.5	21.4	38.1	60.1	100
2013	6.1	18.5	36.2	59.5	100	8.3	20.8	37.1	59.0	100
Ideal Value (x)	20	40	60	80	100	20	40	60	80	100
	Spain					Malta				
Year/Households	20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
2005	7.1	19.8	37.2	60.7	100	9.1	22.8	40.6	64.0	100
2006	7.0	19.8	37.5	61.1	100	9.0	22.9	40.9	64.0	100
2007	7.1	19.9	37.5	61.1	100	9.1	23.2	41.5	64.6	100
2008	6.8	19.7	37.4	61.2	100	8.6	22.2	40.1	63.4	100
2009	6.1	19.1	36.9	60.8	100	9.1	22.7	40.4	63.7	100
2010	5.6	18.3	35.9	59.7	100	8.6	22.2	39.9	62.8	100
2011	5.7	18.0	35.5	59.6	100	9.0	22.8	40.8	64.0	100
2012	5.7	18.0	35.2	59.2	100	9.2	22.9	40.9	63.8	100
2013	6.4	18.9	36.3	59.9	100	8.9	22.4	40.4	63.3	100
Ideal Value (x)	20	40	60	80	100	20	40	60	80	100
	Italy					Portugal				
Year/Households	20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
2005	7.2	20.0	37.3	60.0	100	6.6	17.9	33.3	54.3	100
2006	7.2	20.1	37.6	60.7	100	6.8	18.3	33.7	54.6	100
2007	7.2	20.0	37.5	60.6	100	6.9	18.4	33.8	55.6	100
2008	7.5	20.6	38.2	61.4	100	7.1	18.8	34.7	56.4	100
2009	7.5	20.5	37.9	61.1	100	7.2	19.2	35.2	56.8	100
2010	7.4	20.5	38.2	61.4	100	7.5	19.7	36.3	58.5	100
2011	7.0	20.1	37.8	60.9	100	7.4	19.6	35.8	57.8	100
2012	7.1	20.2	37.8	60.8	100	7.3	19.6	35.9	57.8	100
2013	6.9	19.8	37.4	60.5	100	6.9	19.4	36.0	58.4	100
Ideal Value (x)	20	40	60	80	100	20	40	60	80	100

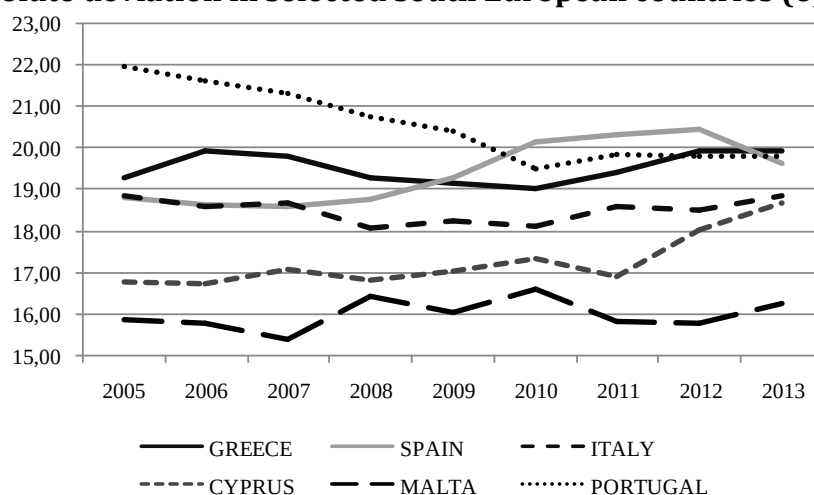
Source: [5]

Subsequently on the basis of the data cited in Table 1 we compute through method of non-weighted average absolute deviation the values that by this way characterize income inequality. We can also compare these values to determine the income inequality between countries or to characterize development of income inequality in relevant country over the period of time.

Figure 1 shows the development of values of average absolute deviation for selected south European countries for years 2005-2013. It shows that the best income equality from

analysed group of countries had Malta followed by Cyprus. Cyprus, however, makes worst his position by 2 points at the end of the analysed period. By contrast, Portugal decreased its income inequality during the 9 years. How we can show from the Figure 1, there were not any significant changes in income inequality/income equality in other 4 selected countries in the set period of time.

Fig. 1: Development of values of income inequality calculated by non-weighted average absolute deviation in selected south European countries (6), 2005–2013



Source: [5], own calculation

The value of (intertemporal) integrated index $INIP$ for each country is shown in Table 2. This index averages the values obtained by the non-weighted average absolute deviation for the whole analysed time series. Based on the amount of this index we can compile the ranking of countries based on their uniform distribution of income in the society.

Tab. 2: Amount of (intertemporal) integrated index for selected south European countries (6), lined up

Country	Malta	Cyprus	Italy	Spain	Greece	Portugal
INIP	16.00	17.27	18.50	19.41	19.54	20.57
ranking	1	2	3	4	5	6

Source: [5], own calculation

The income inequality was lowest in island state Malta during years 2005-2013, where the intertemporal integrated index was 16.00 (see Table 2). About 1.27 points after Malta, in second place with the lowest income inequality, was Cyprus followed within the selected group of countries by Italy, Spain and Greece. The worst situation in context of income inequality was in Portugal where the amount of integrated index was 20.57 points for time period 2005-2013.

Conclusion

There are a lot of methods, procedures and approaches to measurement and describing income inequality in our economy and our society. In this paper is paid attention to new (alternative) method of measuring and expressing income inequality through method of non-weighted average absolute deviation. It was used to map changes in income

inequality of six south European countries, concretely of Malta, Cyprus, Italy, Spain, Greece and Portugal between years 2005-2013. There was also assembling the ranking of these countries in context of a more equal distribution of income in a given society. It was done on the basis of intertemporal integrated index. The highest income equality reached Malta from the analysed group of countries; the worst income equality was in Portugal.

Tab. 3: Correlation coefficient between S80/S20 Ratio (S80/S20), Gini coefficient (GINI) and value of average absolute deviation (VAAD) for selected south European countries (6)

Country/Method	Correlation Coefficient		
	S80/S20 and VAAD	S80/S20 and Gini	Gini and VAAD
Greece	0,8332	0,6553	0,9613
Spain	0,9734	0,9520	0,9964
Italy	0,9376	0,8762	0,9869
Cyprus	0,9902	0,9868	0,9989
Malta	0,9426	0,9206	0,9966
Portugal	0,9672	0,9568	0,9985

Source: [5], own calculation

Tab. 4 S80/S20 Ratio and Gini coefficient for selected south European countries (6), 2005-2013

Year	S80/S20 Ratio	Gini Coefficient	S80/S20 Ratio	Gini Coefficient	S80/S20 Ratio	Gini Coefficient
	Greece		Italy		Malta	
2005	5,757	0,316	5,569	0,309	3,956	0,258
2006	6,059	0,328	5,472	0,303	4,011	0,256
2007	6,000	0,327	5,472	0,304	3,890	0,249
2008	5,870	0,316	5,147	0,294	4,256	0,266
2009	5,771	0,314	5,187	0,298	3,989	0,261
2010	5,583	0,312	5,216	0,294	4,326	0,271
2011	5,926	0,317	5,571	0,301	4,011	0,257
2012	6,623	0,323	5,521	0,301	3,935	0,257
2013	6,639	0,324	5,725	0,307	4,124	0,264
	Spain		Cyprus		Portugal	
2005	5,521	0,306	4,360	0,274	6,924	0,370
2006	5,557	0,302	4,284	0,275	6,691	0,365
2007	5,479	0,302	4,437	0,282	6,435	0,358
2008	5,691	0,303	4,307	0,276	6,127	0,347
2009	6,426	0,310	4,364	0,281	6,000	0,341
2010	7,179	0,325	4,512	0,286	5,533	0,323
2011	7,070	0,328	4,341	0,279	5,703	0,330
2012	7,158	0,332	4,671	0,299	5,795	0,330
2013	6,266	0,319	4,940	0,312	6,029	0,327

Source: [5], own calculation

Table 3 shows the correlation coefficient between the results of measurement and express income inequality through 3 methods, using new methods of non-weight average absolute deviation and two standard methods as described above. How we can see, the correlation coefficients for all three value pairs are very high, that mean that there is a high significant dependence between selected variables. Since the correlation between the results obtained with the method of non-weight average absolute deviation and Gini coefficient is significant, it is advisable to use the method of non-weight average absolute deviation to express the deviation in income inequality place Gini coefficient whose

calculation is considerably more difficult. Non-weight average absolute deviation method can expand the existing portfolio of methods to measure and expression of income inequality between households in society.

Acknowledgement

This article is a part of broad analysis dealing with income inequality in EU countries with point of view on position of income inequality in countries of the Visegrad Group Plus. This paper was supported by the project SGS/13/2015 "Influence of Selected Macroeconomic and Microeconomic Determinants on the Competitiveness of Regions and Firms in Countries of the Visegrad Group Plus".

References

- [1] ATKINSON, A. B. On the Measurement of Inequality. *Journal of Economic Theory*, 1970, **2**(3): 244–263. ISSN 0022-0531.
- [2] BABU, G. J. and C. R. RAO. Expansions for statistics involving the mean absolute deviations. *Annals of the institute of statistical mathematics*, 1992, **44**(2): 387–403.
- [3] DALTON, H. The measurement of the inequality of incomes. *The Economic Journal*, 1920, **30**(119): 348–361. ISSN 1468-0297.
- [4] EUROSTAT. *Category: Living condition glossary* [online]. Brussels: EuroStat, 2014. [cit. 2014-12-12]. Available at: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Category:Living_conditions_glossary
- [5] EUROSTAT. *Statistics: Income, Social Inclusion and Living conditions* [online]. Brussels: EuroStat, 2015. [cit. 2015-01-10]. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/income_social_inclusion_living_conditions/data/database
- [6] KAWACHI, I., P. B. KENNEDY, K. LOCHNER, and D. PROTHROW-STITH. Social Capital, Income Inequality, and Mortality. *American Journal of Public Health*, 1997, **87**(9): 1491–1498. ISSN 0090-0036.
- [7] KOTÝNKOVÁ, M. and K. KUBELKOVÁ. Indikátory lidského rozvoje se zaměřením na chudobu v České republice. In *Reprodukce lidského kapitálu – Vzájemné vazby a souvislosti III*, [CD-ROM]. Praha: Oeconomica, 2010.
- [8] KROL, A. and J. M. MIEDEMA. *Measuring Income Inequality: an Exploratory Review* [online]. Waterloo, Canada: Region of Waterloo, 2009. [cit. 2015-01-06]. Available at: <http://chd.region.waterloo.on.ca/en/researchResourcesPublications/resources/IncomeInequality.pdf>
- [9] KUTSCHERAUER, A. et al. *Nástroje, indikátory a metody pro sledování a hodnocení regionálních disparit. Průběžná výzkumná zpráva* [online]. 2009. [cit. 2014-09-02]. Available at: http://disparity.vsb.cz/vysledky/10_vyzkumna_zprava_3.pdf
- [10] KUZNETS, I. Economic Growth and Income Inequality. *American Economic Review*, 1955, **65**(1): 1–28. ISSN 0002-8282.
- [11] LAPÁČEK, M. *Příjmová nerovnost a ekvivalenční stupnice* [online]. Praha: Vysoká škola ekonomická, 2007. [cit. 2014-08-10]. Available at: <http://nf.vse.cz/download/veda/workshops/inequality.pdf>

- [12] LITCHFIELD, J. A. *Inequality: Methods and Tools. Text for World Bank's Web Site on Inequality, Poverty, and Socio-economic Performance* [online]. Washington, USA: World Bank Group, 1999. [cit. 2014-08-22]. Available at: <http://www.worldbank.org/poverty/inequal/index.htm>
- [13] MCKAY, A. *Defining and Measuring Inequality*. [online]. 2002. [cit. 2015-01-02]. Available at: <http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/3804.pdf>
- [14] SCHUTZ, R. On the Measurement of Income Inequality. *American Economic Review*, 1951, **41**(1): 107–122. ISSN 0002-8282.
- [15] TULEJA, P. Metody měření regionálních disparit v územním rozvoji České republiky [online]. *Regionální disparity Working Paper*, 2008, no. 3, pp. 15–33. Available at: http://disparity.idealnihosting.cz/dokumenty2/RD_0803.pdf
- [16] TULEJA, P. *Možnosti měření regionálních disparit – nový pohled* [online]. 2009. [cit. 2015-02-05]. Available at: http://disparity.idealnihosting.cz/regdis_2008/pdf/13regdis_2008.pdf
- [17] TUREČKOVÁ, K. and E. KOTLÁNOVÁ. Income inequality in the Czech Republic and Slovak Republic. In *Proceedings of the International Workshop Ten years of Membership of the Czech and Slovak Republic in the European Union*. Karviná: OPF SU Karviná, 2014, pp. 240–247. ISBN 978-80-7510-073-3.
- [18] TUREČKOVÁ, K. and E. KOTLÁNOVÁ. Poverty analysis and measuring income inequality in Czech Republic. In *Conference Proceedings from 32nd International Conference Mathematical Methods in Economics MME 2014*. Olomouc: PU Olomouc, 2014, pp. 1063–1067. ISBN 978-80-244-4209-9.
- [19] TUREČKOVÁ, K. Příjmové nerovnosti a jejich měření. *Acta Academica Karviniensia*, 2007, **8**(1): 191–198. ISSN 1212-415X.
- [20] VEČERNÍK, J. Earnings disparities and income inequality in CEE countries: an analysis of development and relationships. *Eastern European Economics*, 2012, **50**(3): 27–48. ISSN 0012-8775.
- [21] WOLFF, E. N. *Poverty and income distribution*. 2nd ed. Chichester, UK: Wiley-Blackwell, 2009. ISBN 978-1405176606.

Tomáš Verner, Silvie Chudárková

Silesian University in Opava, School of Business Administration in Karviná
Department of Economics and Public Administration
Univerzitní nám. 1934/3, 73340 Karviná, Czech Republic
email: verner@opf.slu.cz, chudarkova@opf.slu.cz

The Economic Freedom Effect on Corporations' Output: The Case of European Union

Abstract

Cultural norms and institutions are often believed to explain why certain economies grow and other remain poor. It is confirmed that culture and economic institutions, especially economic freedom, play a role in economic behaving and development. Since the time of Adam Smith economists have pointed out that the freedom to choose and supply resources, competition in business, trade with others and secure property rights are elementary factors for economic progress. Economic theory indicates that economic freedom affects incentives, productive effort, and the effectiveness of resource use. As we can see, economic freedom positively affects economic development, but what about the individual entities within the economy (i.e. sectors of economy). Thus, the main aim of this paper is to find out whether economic freedom promotes corporations' output. Two hypotheses are established for this purpose: (I) economic freedom causes corporations' output; (II) economic freedom positively affects corporations' output. The paper mentioned three ways to measure and capture economic freedom: indices economic freedom by the Heritage Foundation, the Fraser Institute and ease of doing business by the World Bank Group. The Fraser Institute's index was employed as a proxy variable of economic freedom; the ratio of gross value added of non-financial corporations to gross value added of total economy was applied as corporations' output. Annual data 2002-2012 within EU-27 countries were used. Panel data analysis and Granger causality test were performed to examine effect of economic freedom and causality. The positive relationship between economic freedom and output of corporations as well as the causality from economic freedom to corporations were confirmed.

Key Words

non-financial corporations, economic freedom, Granger causality, panel data model

JEL Classification: L50, C23

Introduction

Cultural norms and institutions are often believed to explain why certain countries grow and other remain poor [7]. Reference [14] confirmed that culture and economic institutions, specifically economic freedom, play a role in economic development. According to them economic freedom is relatively more important for growth than culture. In formal economy there are certain economic institutions that provide lots of functions in contrast to informal economy. Reference [14] concludes that culture can be important for economic growth, however economic institutions supporting e.g. private property or rule of law are the basis for a country's economic growth. Since the time of Adam Smith economists have pointed out that the freedom to choose and supply

resources, competition in business, trade with others and secure property rights are fundamental factors for economic progress [10].

Economic theory indicates that economic freedom affects incentives, productive effort, and the effectiveness of resource use. Reference [1] argues that under good institutional environments, individuals devote their time to developing their talents and engage in productive entrepreneurship. However, under poor institutions, individuals face different incentives and engage in unproductive entrepreneurship. Reference [12] empirically confirmed relationship between quality of institutions and entrepreneurship. Similarly, [11] explores the impact of economic freedom on entrepreneurship and asserts that smaller government sector, better legal structure and security of property rights, less regulation of credit, labour or business tend to increase entrepreneurship activities.

The main aim of this paper is to find out whether economic freedom promotes corporations' output. Two hypotheses are established: (I): economic freedom causes corporations' output; (II): economic freedom positively affects corporations' output.

The paper is structured as follows. In Section 1, we deal with economic freedom concept and its measurement. In Section 2, national economy and division to sectors is presented. In Section 3, dataset and used methods are introduced. In Section 4, empirical results of economic freedom and corporations' output are discussed as well as obtained results. Next Section concludes the paper with summary of crucial findings.

1. Economic freedom concept and its measurement

The Fraser Institute by means of [5] defines economic freedom for individuals when property they acquire without the use of force, fraud, or theft is protected from physical invasions by others and they are free to use, exchange, or give their property to another as long as their actions do not violate the identical rights of others. Reference [5] emphasizes the cornerstones of economic freedom:

- Personal choice,
- Voluntary exchange coordinated by markets,
- Freedom to enter and compete in markets,
- Protection of persons and their property from aggression by others.

The Fraser Institute has constructed a summary index which measures the degree of economic freedom in five areas [5]:

- Size of government,
- Legal system and property rights,
- Sound money,
- Freedom to trade internationally,
- Regulation.

Each area includes sub-areas, for more information see [5]. The Fraser Institute has published its annual report since 1996 every year. The index measures the degree to

which the policies and institutions of countries are supportive of economic freedom. The range of the index is from 0 to 10, where 10 denote a greater degree of economic freedom.

There are also other institutions with their approaches to economic freedom, e.g. the Heritage Foundation or World Bank Group. The Heritage Foundation defines the economic freedom similarly to previous one. According to [9] it is the fundamental right of every human to control his or her own labour and property. In an economically free society, individuals are free to work, produce, consume, and invest in any way they please with that freedom both protected by the state and unconstrained by the state. In economically free societies, government allows labour, capital and goods to move freely, and refrain from coercion or constraint of liberty beyond the extent necessary to protect and maintain liberty itself.

The Heritage Foundation has calculated index of economic freedom and published its annual report with studies about economic freedom since 1995. Index consists of ten components, which are grouped into four sub-groups:

- Rule of law,
- Limited government,
- Regulatory efficiency and
- Open markets.

For more details see [9]. The range of the index is from 0 to 100, where 100 indicate the maximum degree of economic freedom.

The World Bank Group has constructed the indicator called ease of doing business index since 2003 every year in The Doing Business Report. Doing Business measures the rules and regulations that can help the private sector thrive. But where regulation is efficient, transparent and implemented in a simple way, it becomes easier for aspiring entrepreneurs to compete on an equal footing and to innovate and expand. Index measures regulations for starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts and resolving insolvency, labor market regulation [13].

2. National economy and corporations

Europe 2020, the new strategy for a current decade is based on three priorities [2]:

- smart growth – increasing country based on knowledge and innovation,
- sustainable growth – promoting a more resource efficient, more ecological and more competitiveness country,
- inclusive growth – achieving high-employment country leading to economic, social and territorial cohesion.

The economy of a country is the outcome of the activity of a very large number of units which carry out numerous transactions of various kinds for purposes of production,

finance, insurance, redistribution and consumption [3]. National economy is by ESA 1995 [3] defined as the sum of resident institutional units. Institutional units which have a similar type of economic behavior are grouping to subsectors and sectors. National economy consists of five resident institutional sectors [3]:

- Non-financial corporations,
- Financial corporations,
- General government,
- Households,
- Non-profit institutions serving households.

The non-financial corporations' sector comprises all private and public corporate enterprises that produce goods or provide non-financial services to the market [3].

3. Data and econometric methodology

The Fraser Institute's index is employed as a proxy variable of economic freedom (hereinafter FI EF). The index was multiplied by 10 due to obtain the range 0-100. The data about output of non-financial corporations are presented in current prices only. Due to inflation the ratios are used. The share of gross value added of non-financial corporations to gross value added of total economy is applied as corporations' output (NFCO). Annual data for European Union 28 countries (EU-28) between 2002 and 2012 are collected from the Fraser Institute and the Eurostat. The Greece economy is excluded due to missing data of corporations' value added. Hence, the paper deals with EU-27 countries (without Greece). All data are transformed to natural logarithm (ln).

To examine the above mentioned causality and relationship panel data analysis and Granger causality test were performed. Panel data cover both a time series and a cross-sectional dimension compared to pure time series or cross-sectional data [15].

A panel data set is formulated by a sample that contains N cross-sectional units (individuals, firms, households, countries etc.) that are observed at different time periods T [15]. Simple linear panel data model can be written as (1):

$$y_{it} = \alpha + \beta X'_{it} + u_{it}, \quad (1)$$

where y represents the dependent variable, X vector of explanatory variables and subscript i denotes cross-section dimension (EU-27 countries) whereas t time series dimension (2002-2012), α , β are coefficients and u is a random disturbance term. In general, three different methods can be used to estimate linear panel data models by means of ordinary least squares: (i) common constant as in equation (1), (ii) fixed effects and (iii) random effects. The common constant method implies that there are no differences among variables of the cross-sectional dimension, so-called homogenous panel. Fixed or random effects allow us to capture the differences among units; hence the random disturbance term u is given by (2):

$$u_{it} = \mu_i + v_{it}, \quad (2)$$

where μ_i denotes unobservable individual-specific effect which is time-invariant and is responsible for any individual-specific effect that is not contained in the regression. In case of fixed effect it is assumed to be fixed parameters to be estimated whereas in case of random effect it is assumed to be random and v_{it} denotes remainder disturbance which varies over individuals and time.

Moreover, it should fulfill the assumptions for standard ordinary least squares error terms, i.e. the remained disturbance is homoskedastic, serially and spatial uncorrelated. In particular, to avoid spurious regression and misleading conclusions we need to find out, if the panel data are stationary or non-stationary. There are a few methods to find out the data stationary or non-stationary; e.g. [8]. This method tests H_0 : each individual time series contains unit root against the alternative hypothesis for at least one time series is stationary. All necessary tests are performed at the 5 per cent significance level.

The Granger causality test is carried out to verify the causality between economic freedom and corporations' output [4]. The key point of the Granger causality is that the future cannot cause the present or the past. However, the past may cause the present or the future. We can say that X is causing Y , if we are better able to predict Y using all available information than if the information apart from X has been used [4]. If this is the case or reversed, it is causality. When X is causing Y and also Y is causing X , the feedback is occurring; and when X is not causing Y and vice versa, than no causality is occurring. The Granger causality assumes stationary series only [4]. Equation (3) represents causality for variable y :

$$y_{it} = \alpha + \mu_i + \lambda_t + \sum_{j=1}^q \beta_j y_{i,t-j} + \sum_{j=1}^q \delta_j X_{i,t-j} + \varepsilon_{i,t} \quad (3)$$

under H_0 : x does not Granger cause y .

4. Empirical results of economic freedom indicators

This section presents briefly economic freedom and output of non-financial corporations in EU-27 countries (without Greece), then Granger causality and economic freedom's effect is discussed.

The average value of economic freedom in EU-28 countries is 73.9 or 74.0 in EU-27 (without Greece) within the selected period (2002 - 2012). The most economic free country in EU-27 is United Kingdom; on the contrary, Croatia the last joined economy to the EU is the least free country.

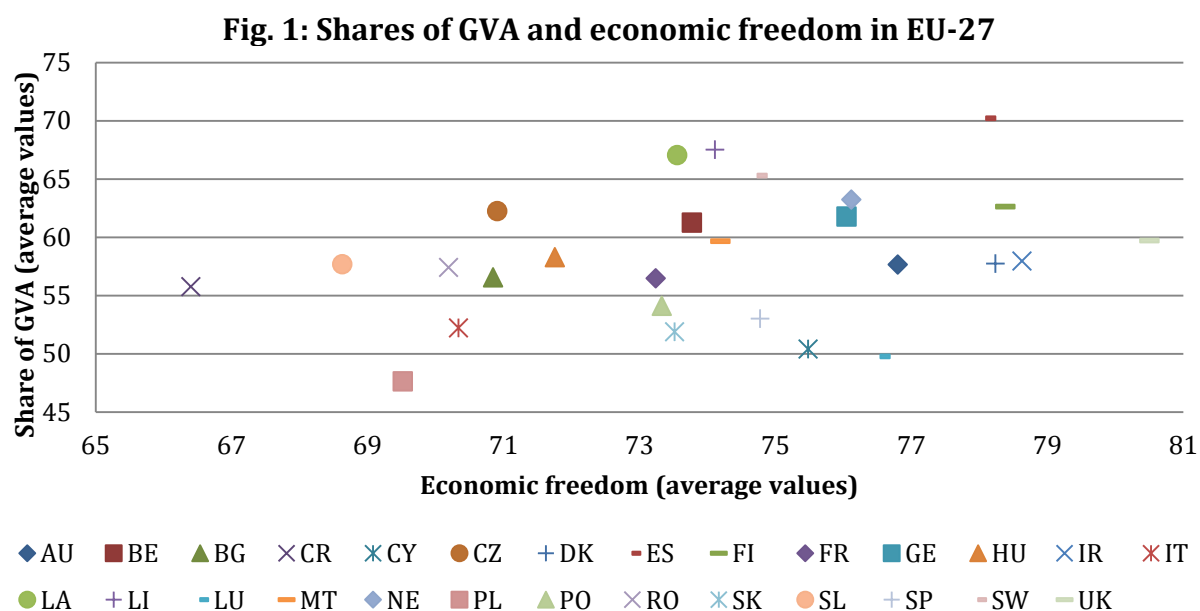
The maximal degree of economic freedom occurred in the United Kingdom in 2003; the minimal degree of economic freedom exhibited Romania in 2002. While United Kingdom

was declining (to 78.1 in 2012), Romania was improving its freedom (to 75.7 in 2012). United Kingdom was also the country demonstrating the lowest variance, following by Spain, Sweden, and France; on the contrary, Romania is situated on the opposite side.

The average share of gross value added in EU-27 countries (without Greece) is 58.4 % within the same period (2002 – 2012). The highest average share exhibits Estonia; on the contrary, the lowest exhibits Poland.

The maximal share to gross value added occurred in Lithuania in 2012; the minimal share exhibited in Poland in 2002. Austria, France, Netherlands, and Belgium exhibit the lowest variance. Lithuania demonstrates the country with highest share but also the county with highest variance.

Figure 1 shows relationship between economic freedom and non-financial corporations' output in European Union 27 countries (without Greece). The corporations' output is measured as a share of their GVA and GVA of total economy. Countries present moderate positive relation, i.e. higher economic freedom means higher output of non-financial corporations'; e.g. the highest values of both indicators exhibits Estonia, whereas Croatia and Poland are situated on the opposite side.



Legend: AU = Austria, BE = Belgium, BG = Bulgaria, CR= Croatia, CY = Cyprus, CZ = Czech Republic, DK = Denmark, ES = Estonia, FI = Finland, FR = France, GE = Germany, HU = Hungary, IR = Ireland, IT = Italy, LA = Latvia, LI = Lithuania, LU = Luxembourg, MT = Malta, NE = Netherlands, PL = Poland, PO = Portugal, RO = Romania, SK = Slovakia, SL = Slovenia, SP = Spain, SW = Sweden, UK = United Kingdom
Source: Fraser Institute, Eurostat, own calculations

One aim of this paper is test the hypothesis about causality (I) from economic freedom to non-financial corporations' output. The EU-27 countries were subjected to Granger causality test. Reference [6] was followed (for the Granger causality and economic freedom's effect); instead of economic growth, the corporations' output is used.

Tab. 1: The Granger causality

Group of countries	Null Hypothesis	Result
EU-27	$\ln(\text{FIEF})$ does not Granger cause $\ln(\text{NFCO})$	Rejected
EU-27	$\ln(\text{NFCO})$ does not Granger cause $\ln(\text{FIEF})$	Accepted

Source: own calculations

The results of Granger causality (Tab. 1) confirm that economic freedom cause output of non-financial corporations. Thus, hypothesis (I) is accepted for EU-27 countries.

Regression of panel data by means of least squares method was carried out. The fixed effect model seems to be the most appropriate one to identify the impact of economic freedom to non-financial corporations' output (see Eq. 4).

$$\ln(\text{NFCO})_{it} = \alpha + \beta \ln(\text{FIEF}) + \mu_i + \nu_{it} \quad (4)$$

The results of regression are presented in Eq. 5 (common coefficients) and individual-specific effects (μ_i) in Tab. 2.

$$\ln(\text{NFCO})_{it} = 2.6857 + 0.3202 \times \ln(\text{FIEF}) + \mu_i + \nu_{it} \quad (5)$$

Positive coefficient β implies positive relationship between economic freedom and output of non-financial corporations in EU-27 countries during 2002 – 2012; hence the hypothesis (II) is accepted. Individual-specific effects tell us the differences of outputs among the EU-27 countries.

Tab. 2: Individual-specific effects in EU-27 countries

Country	Individual-specific effect	Country	Individual-specific effect	Country	Individual-specific effect
Austria	-0.0212	France	-0.0269	Netherlands	0.0741
Belgium	0.0519	Germany	0.0510	Poland	-0.1813
Bulgaria	-0.0156	Hungary	0.0109	Portugal	-0.0700
Croatia	-0.0084	Ireland	-0.0239	Romania	0.0065
Cyprus	-0.1508	Italy	-0.0919	Slovakia	-0.1129
Czech Republic	0.0809	Latvia	0.1433	Slovenia	0.0154
Denmark	-0.0258	Lithuania	0.1474	Spain	-0.0967
Estonia	0.1703	Luxembourg	-0.1621	Sweden	0.1119
Finland	0.0546	Malta	0.0166	United Kingdom	-0.0012

Source: own calculations

Model and coefficients are statistically significant at 5 % significance level. The remained disturbance fulfills the assumptions for used method. Augmented Dickey-Fuller [8] test for unit root testing was carried out and at least one of time series is stationary, thus all of panel data are stationary.

Conclusion

The paper dealt with economic freedom and non-financial corporations' output. The main aim of this paper was to investigate whether economic freedom promotes corporations' output. Two hypotheses were established: (I) economic freedom causes corporations' output; (II) economic freedom positively affects output of corporations.

The Fraser Institute's index was employed as a proxy variable of economic freedom, the ratio of gross value added of non-financial corporations to gross value added of total economy was applied as corporations' output. Annual data from 2002 to 2012 within EU-27 countries (without Greece by reason of any data about corporations) were used. To examine causality and effect of economic freedom, panel data analysis and Granger causality were performed.

The average value of economic freedom is 74.0 within EU-27 countries. The maximal degree occurred in the United Kingdom in 2003, by contrast, the minimal degree exhibited in Romania in 2002. While United Kingdom was declining (to 78.1 in 2012), Romania was improving its freedom (to 75.7 in 2012). United Kingdom was also the country demonstrating the lowest variance, following by Spain, Sweden, and France; on the contrary, Romania is situated on the opposite side.

The average share of gross value added in EU-27 countries is 58.4 %. The highest average share exhibits Estonia; on the contrary, the lowest exhibits Poland. The maximal share to gross value added occurred in Lithuania in 2012; the minimal share exhibited in Poland in 2002. Austria, France, Netherlands, and Belgium exhibit the lowest variance. Lithuania demonstrates the country with highest share but also the county with highest variance.

The results of Granger causality confirm that economic freedom cause output of non-financial corporations. Thus, hypothesis I is accepted for EU-27 countries. Positive coefficient β implies positive relationship between economic freedom and output of non-financial corporations in EU-27 countries during 2002 – 2012; hence the hypothesis (II) is accepted. Consequently, economic freedom should be improved in order to increase corporations' output.

Acknowledgement

This paper was supported by the project SGS/13/2015 "Influence of Selected Macroeconomic and Microeconomic Determinants on the Competitiveness of Regions and Firms in Countries of the Visegrad Group Plus".

References

- [1] BAUMOL, W. J. Entrepreneurship: productive, unproductive and destructive. *Journal of Political Economy*, 1990, **98**(5): 893–921. ISSN 0022-3808.
- [2] EUROPEAN COMMISSION. *Europe 2020 : A European Strategy for smart, sustainable and inclusive growth* [online]. Brussels: European Commission, 2010. [cit. 2015-04-

- 10]. Available at: http://europa.eu/press_room/pdf/complet_en_barroso__007_-_europe_2020_-_en_version.pdf
- [3] EUROSTAT. *European System of Accounts: ESA 1995*. [online]. Brussels: Eurostat, 1995. [cit. 2015-04-12]. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/national_accounts/introduction/esa1995.pdf
- [4] GRANGER, C. W. J. Investigating Causal Relations by Econometric Models and Cross-spectral Methods. *Econometrica*, 1969, **37**(3): 424–438. ISSN 1468-0262.
- [5] GWARTNEY, J., R. LAWSON and J. HALL. *Economic Freedom of the World: 2014 Annual Report* [online]. Fraser Institute, 2014. [cit. 2015-04-12]. Available at: <http://www.freetheworld.com/2014/EFW2014-POST.pdf>
- [6] JUSTESEN, M. K. The Effect of Economic Freedom on Growth revisited: New Evidence on Causality from a panel of countries 1970-1999. *European Journal of Political Economy*, 2008, **24**(3): 642–660. ISSN 0176-2680.
- [7] LANDES, D. S. *The Wealth and Poverty of Nations: Why are some rich and others poor*. 1st ed. Norton: New York, 1998. ISBN 0-393-04017-8.
- [8] MADDALA, G. S. and S. A. WU. Comparative Study of Unit Root Tests with Panel Data and a new simple Test. *Oxford Bulletin of Economics and Statistics*, 1999, **61**(0): 631–652. ISSN 1468-0084.
- [9] MILLER, T. et al. *Index of Economic Freedom* [online]. The Heritage Foundation, 2012. [cit 2015-04-09]. Available at: http://www.heritage.org/index/pdf/2012/book/index_2012.pdf
- [10] NORTH, D. C. and R. P. THOMAS. *The Rise of the Western World: A new Economic History*. 2nd ed. Cambridge: Cambridge University Press, 1976. ISBN 0-521-29099-6.
- [11] NYSTRÖM, K. The Institutions of Economic Freedom and Entrepreneurship: Evidence from Panel Data. *Public Choice*, 2008, **136**(3–4): 269–282. ISSN 0048-5829.
- [12] SOBEL, R. S. Testing Baumol: Institutional Quality and the Productivity of Entrepreneurship. *Journal of Business Venturing*, 2008, **23**(6): 641–655. ISSN 0883-9026.
- [13] World Bank Group. *Doing Business 2015: Going Beyond Efficiency*. Washington, USA: World Bank Group, 2014. [cit. 2015-04-12]. Available at: <http://www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB15-Full-Report.pdf>
- [14] WILLIAMSON, C. R. and R. L. MATHERS. Economic freedom, culture, and growth. *Public Choice*, 2011, **148**(3–4): 313–335. ISSN 0048-5829.
- [15] WOOLDRIDGE, J. M. *Econometric Analysis of Cross Section and Panel Data*. 1st ed. Massachussets: MIT Press, 2002. ISBN 0-262-23219-7.

Věra Vráblíková

VŠB-Technical University of Ostrava, Faculty of Economics,
Department of Economics
Sokolská třída 33, 701 21 Ostrava, Czech Republic
email: vera.vrablikova@vsb.cz

The Impact of Taxes on Economic Growth in the Long-Run and Short-Run

Abstract

The aim of this article is to analyze the impact of taxes on economic growth in the long-run and short-run. The panel regression analysis and the generalized method of moments were used to explore the relationship between observed variables. Models are verified using data of selected OECD members from the period 1970-2013. Long-run and short-run economic growth is lowered by taxes. The impact of taxes on economic growth is stronger when time base is decreased. The most negative influence was proven for taxes on consumption. The impact of corporate taxes on economic growth is positive. The negative impact of individual tax and value added taxes were evidenced only in the long-run. Statistically significant impact of property tax and social security contribution weren't proven.

Key Words

economic growth, taxes, short-run, long-run

JEL Classification: O47, E62

Introduction

Tax policy is part of fiscal policy. Generally, fiscal policy is very important for future development of every country. The importance of fiscal policy is increasing in recent years, particularly for members of the European Union. Instruments of fiscal policy can only be liberally used by members of Eurozone. Decision about the use of instruments of monetary policy can be made by the European Union. The question about tax burden assessment is discussed very often, and not only by policy makers. Tax burden influences the rate of savings, capital accumulation, human capital and technology, which have an effect on economic growth. From the view of policy makers, taxes are an effective instrument. Tax burden influences the revenue side of a state budget. The main purpose of taxes is to ensure enough financial resources to state budgets. Low revenue to state budget can be a consequence of a low tax burden or a high tax burden. Both situations could be sources of deficit. In the case of an excessively low tax burden, there is a high probability that taxes do not ensure enough financial resources for state budget. On the other hand, economic subjects are not motivated for economic activity when the tax burden is excessively high. Nowadays, the answer to the question about tax burden is ever more important in context of current debt crisis and ageing population. Named factors create the pressure of increasing state expenditure while revenues for the state budgets are decreasing. Ageing population is a characteristic of developed countries [12].

The question about tax burden assessment is also discussed by scientists. They analyze the relationship between tax burden and economic growth. The number of theoretical and empirical studies on the effects of taxes on economic growth is enormous. Conclusions of empirical studies are various. It is a consequence of using of different techniques for estimation, and of using different samples of countries for analysis [6]. Early studies employ the ordinary least squares estimation method [4]. Fix effects, random effects or generalized method of moments on panel data are used in subsequent studies [8]. Most empirical studies explore the relationship between tax burden and economic growth for the time period twenty years or shorter.

This article is different in comparison with most other empirical studies. It is due to a long time period and a huge sample of countries. This paper follows on the articles [11], [12]. These articles are based on the relationship between tax policy and state economic growth from the perspective of both the long-run and short-run. Analysis were performed using the data of 48 states in the USA for the time periods 1965 – 2005 and 1965 - 2007. The aim of this article is to analyze the impact of taxes on economic growth in the long-run and short-run. The time period 1970 – 2013 is the longest time period for 17 OECD countries where every observation is available. Models are based on neoclassical growth model extended by human capital, consumption of households and government expenditure. Tax quota was used as an indicator of the tax burden. This indicator is available for the longest time period in comparison with other indicators of tax burden. For example, it is also possible to use World Tax Index (WTI), which is an overall multi-criteria indicator of the tax burden, but this index is only available for 13 years [8], [9].

1. Literature review

The aim of empirical analyses is to accept or refuse hypothesis about impact of fiscal variables on economic growth. In recent times, knowledge is based on neoclassical growth model. Sooner or later the economy reaches a so called steady state. In a steady state, the growth rate per capita can only change due to exogenous factors. This means either technological advances or changes in the rate of population growth. Fiscal policy is effective in transitional periods between states of permanent equilibrium [13]. The interest in the relationship between taxes and economic growth is increasing mainly in the context of the current debt crisis. Generally, the increasing of taxes negatively influences economic growth. The impact of taxes on economic growth though isn't only negative, as was proven by authors Gemmel, Kneller and Sanz [6]. It is necessary to distinguish the character of taxes. Direct taxes have a higher distortionary effect on the economy in comparison to indirect taxes. Indirect taxes only have an influence through substitutions between leisure time and work. Direct taxes affect economic growth in more ways.

Conclusions regarding the relationship between taxes and economic growth are following [9]. Economic growth is influenced negatively by individual taxes, social security contribution and consumption taxes. Corporate taxes has positive impact on economic growth. This can be a consequence of computation of tax quota. The relationship between value added tax and economic growth is difficult to explore. Results were very sensitive to every small change in specification of models. A statistically significant impact of property taxes on economic growth wasn't revealed by aforementioned study. The

negative impact of tax policy is revealed with two or three years lag [8]. These results were revealed with a sample of OECD countries. A different point of view on the relationship between indirect taxes and economic growth is provided by the paper El-Ganainz [1]. Increasing the tax burden of consumption leads to a consumption decline and saving increase, which helps to create investments and supports economic growth. This was proven for countries in the EU.

The following conclusions were revealed in a sample of US states. The results found out that property taxes lowered long-run and short-run growth. Sales taxes lowered only long-run growth. Income taxes have no short-run or long-run impact [11]. Another look at the short and the long run effect of tax policy on state economic growth is provided by the article Atemis [2]. Results of cited article show that a 1% increase in state and local taxes consides with a 0,37% (0,33%) decrease in growth within the state in the short-run and long-run.

2. Empirical analysis: Methodology, Data and Results

The empirical analysis is focused on the neoclassical growth model extended by human capital, consumption of households and government expenditure. From a methodological point of view, the analyses are based on dynamic panel models and static panel models. Countries within the OECD were chosen for analysis.¹ These countries are homogenous regarding their institutional environment. Homogeneity of analyzed subjects is beneficial when using the panel regression with fix effect (FE). Panel regression is an appropriate method of studying the relationship between selected countries across the time. Dynamic models were solved by generalized method of moments (GMM). All computations were done using the E-Views software.

An economic growth is a level of real gross domestic product per capita (Y_{it}) expressed in absolute value of purchasing power parity in dollars [10]. Models are built by three groups of explanatory variables. Neoclassical growth variables are capital accumulation (I), population (POP) and human capital (HUM) [10]. Capital accumulation is approximated by share of real investment on GNP expressed in purchasing power parity per capita. Population is a variable expressed by the rate of population growth. Human capital is based on the percentage of graduates within a labor force. Additional growth variables contain government expenditure (G) and consumption of households (C). Both of these indicators are expressed per capita. Tax variables are the last one group of explanatory variables. It contains total tax quota (TQ), personal taxes quota (TQP), corporate tax quota (TQC), consumption taxes quota (TQO), value added tax quota (TQV), taxes on property ($TQpro$) and social security contribution (SOC). Data on explained variable and tax variables were found in database of OECD [14]. The remaining variables were taken from database of World Bank, see World Bank [15].

Twelve models were created for both the static panel and dynamic panel. The models were estimated in following way. The model with the longest time period was estimated

¹ These countries were used for analysis: AUT, BEL, CAN, DNK, FIN, FRA, DEU, GRC, IRL, ITA, LUX, NOR, ESP, SWE, CHE, GBR, USA. In this sample of countries was each variable available.

first. It contains 1973 – 2013, first three observations were lost during statistical modification. The time period was gradually reduced. The model based on the shortest time period contains time period 2009 – 2013. Models containing the tax quota (without its sub-index) were built first. Models containing the sub-index of tax quota were made consequently. If model contains tax quota and its sub-index, there is a danger of multicollinearity. Each variable was adjusted by a logarithmic transformation and by a difference transformation which simplifies the interpretation of the models.

Tab. 1: Static panel, chosen results of estimation

Explained variable: dif(log(Y_{it}))	1973 – 2013		2009 – 2013	
	Coefficient (<i>t</i> -statistic)	Coefficient (<i>t</i> -statistic)	Coefficient (<i>t</i> -statistic)	Coefficient (<i>t</i> -statistic)
dif(log(I))	0.21 (18.87)***	0.21 (30.09)	0.23 (11.37)***	0.18 (22.29)***
dif(log(TQ))	-0.06 (-2.43)**		-0.12 (-2.44)**	
dif(log(TQP))		-0.01 (-1.47)		-0.01 (-1.94)
dif(log(SOC))		-5.10E-05 (-0.01)		-0.03 (-0.63)
dif(log(TQC))		0.01 (2.45)**		0.03 (5.76)***
dif(log(TQO))		-0.04 (-4.91)***		-0.06 (-1.94)*
dif(log(TQV))		-0.02 (-2.38)**		-0.01 (-1.20)
dif(log($TQpro$))		-0.00 (-1.22)		-0.02 (-1.53)
<i>F</i> -statistic	58.09	153.84	17.10	12.55
Adjusted R^2	0.59	0.59	0.74	0.76
Number of observations	738	738	85	85

Notes: *t*-statistics are adjusted for heteroskedasticity and autocorrelation; standard deviations are calculated using robust estimates; *, **, *** indicate significance levels of 10 %, 5 %, and 1 %, respectively.

Source: own calculations

In the case of static panel, fixed effects were detected using the Hausman test. The panel regression was applied using the “White period”. This method causes that estimates of parameters standard deviations and tests of hypothesis are in accordance with autocorrelation [3]. Other assumptions for using this method were performed. Each model is statistical significant. From the view of explanatory variables, investment was statistical significant only. Other growth variables were omitted from models. Some tax variables weren’t statistical significant as well. Tax variables were retained in models. It ensures that continuity will be maintained. Table 1 shows the results of chosen models which were estimated using FE. It was revealed that negative impact of taxes is stronger when time base is shorten. It was possible to decrease time period to 2009-2013. The impact of taxes on economic growth wasn’t statistically significant in models based on time period shorter than 2009-2013. The assumption of normality wasn’t approved in such models, which creates a big problem in case of short time base. Probably, it is the main reason why the impact of taxes on economic growth wasn’t proved. The results of estimations show that the long-run and short-run economic growth is lowered by the impact of taxes on consumption and increased by taxes of corporations. These impacts are stronger when time base is decreased. Economic growth is influenced by value added

tax in long-run. The relationship between other taxes and economic growth wasn't revealed.

Dynamic panels were estimated using Arellando-Bond generalized method of moments. This estimator helps eliminate unobserved individual effect [5]. In the case of dynamic panel the robust estimator "White period" was used too. The lagged values of the explained variable were used as the instruments, starting from a lag of two to two for the models 1973-2013 and starting from a lag of two for models 2009-2013. Table 2 provides the results of chosen models which were estimated using the GMM. The results on the relationship between taxes and economic growth are the same in comparison to the results in the text above. A stronger impact was affirmed by taxes on economic growth when time base is decreased. Long-run economic growth is lowered by taxes of individuals by taxes on consumption and by value added tax. The instrumental variable wasn't statistically significant in case of model of economic growth and sub-index of tax quota 2009-2013. These results cannot be interpreted.

Tab. 2: Dynamic panel, results of chosen models, GMM

Explained variable: dif(log(Y_{it}))	1973 – 2013		2009 – 2013	
	Coefficient (<i>t</i> -statistic)	Coefficient (<i>t</i> -statistic)	Coefficient (<i>t</i> -statistic)	Coefficient (<i>t</i> -statistic)
dif(log(Y_{it-1}))	0.09 (7.19)***	0.09 (3.24)***	-0.09 (-1.70)*	-0.05 (-0.46)
dif(log(I))	0.27 (22.08)***	0.26 (18.11)***	0.26 (25.05)***	0.22 (5.72)***
dif(log(TQ))	-0.12 (-3.45)***		-0.18 (-3.98)***	
dif(log(TQP))		-0.07 (-3.51)***		0.00 (0.07)
dif(log(SOC))		-0.01 (-0.58)		-0.11 (-1.85)**
dif(log(TQC))		-0.00 (-0.01)		0.02 (0.65)
dif(log(TQO))		-0.05 (-2.47)**		-0.04 (-1.66)*
dif(log(TQV))		-0.04 (-2.30)**		0.00 (2.31)***
dif(log($TQpro$))		0.01 (0.70)		-0.02 (-1.28)
Instrument rank	18	18	17	17
<i>J</i> -statistic	13.92	15.64	14.41	12.95
Number of observations	738	738	85	85

Notes: *t*-statistics are adjusted for heteroskedasticity and autocorrelation; standard deviations are calculated using robust estimates; *, **, *** indicate significance levels of 10 %, 5 %, and 1 %, respectively.

Source: own calculations

Conclusion

The relationship between taxes and economic growth is considered as negative by theoretical studies. Conclusions of most of empirical studies are in accordance with the fact increasing taxes have negative an impact on economic growth. The impact of direct taxes on economic growth is stronger in comparison to the impact of indirect taxes. This is another frequent conclusion of theoretical and empirical studies, see Kneller [7]. The

relationship between taxes of corporation is difficult to explore by using tax quota. In this case of tax burden, it is better to use an indicator of tax burden WTI. This indicator combines hard and soft data and it is necessary measure in taxes of corporations. There is a high probability that negative consequence of Laffer curve will be revealed [8].

The aim of this article was to analyze the impact of taxes on economic growth in the long-run and short-run. An effect of taxes during time is necessary to realize by makers of tax policy. In case of chosen OECD countries, it was revealed that increasing of taxes does not support long-run and short-run economic growth. The impact of taxes was revealed stronger when time base is decreased. It is necessary to distinguish the type of tax burden. The most negative influence on long-run and short-run economic growth was proven for taxes on consumption. The impact of corporate taxes on economic growth is positive. The negative impact of taxes of individuals and value added taxes was evidenced only in long-run. Statistically significant impact of taxes on property and social security contribution on economic growth weren't proven. The negative impact of taxes on property on long-run and short-run economic growth was revealed on sample of US countries. Short-run economic growth is lowered by sales tax. The impact of income taxes wasn't evidenced [11]. These results are difference in comparison to results of sample of OECD countries. The impact of taxes on economic growth is stronger in case of US countries in comparison to OECD countries [2]. These mentioned articles do not specified how long is short-run [2], [11]. Tax policy effects economic growth with two or three years lag [8]. It is possible that this conclusion could be proven by this article too. Because it was revealed that impact of taxes is stronger in short-run. But there were problems with estimation techniques. Finally, it is possible to consider using another method to explore the relationship of observed variables in the long-run and in the short-run. Models of vector analysis and models of cointegration.

Acknowledgement

This paper was financially supported within the VŠB - Technical University SGS grant project No. SP2015/110 " The Influence of Fiscal Deficit on Economic Growth and the Possibilities of its Decreasing in the Czech Republic".

References

- [1] ALM, J. and A. EL-GANAINY. Value-added taxation and consumption. *International Tax Public Finance*, 2013, **20**(1): 105–128. ISSN 0927-5940.
- [2] ATEMS, B. Another look at tax policy and state economic growth: The long-run and short run of it. *Economics Letters*, 2015, **127**: 64–67. ISSN 0165-1765.
- [3] BALTAGI, B. H. *Econometric analysis of panel data*. Weinheim, Deutschland: John Wiley & Sons, 2008. ISBN 80-864-1929-0.
- [4] CRAIN, M. and K. LEE. Economic growth regressions for the American states: a sensitivity analysis. *Economic Inquiry*, 1999, **37**(2): 242–257. ISSN 1465-7295.
- [5] E-VIEWS. *User Guide II*. Irvine, USA: Campus Drive. 2009. ISBN 04-711-0787-5.

- [6] GEMMELL, N., R. KNELLER, and R. SANZ. The Timing and Persistence of Fiscal Policy Impacts on Growth: Evidence from OECD Countries. *Economic Journal*, 2011, **121**(550): F33–F58. ISSN 1468-0297.
- [7] KNELLER, R. Fiscal policy and growth: evidence from OECD countries. *Journal of Public Economics*, 1999, **74**(2): 171–190. ISSN 0047-2727.
- [8] KOTLÁN, I. and Z. MACHOVÁ. Horizont daňové politiky v zemích OECD. *Politická ekonomie*, 2014, **62**(2): 161–173. ISSN 0032-3233.
- [9] KOTLÁN, I., Z. MACHOVÁ, and L. JANÍČKOVÁ. Vliv zdanění na dlouhodobý ekonomický růst. *Politická ekonomie*, 2011, **59**(5): 638–658. ISSN 0032-3233.
- [10] MANKIW, G., D. ROMER, and N. WEIL. A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, 1992, **107**: 407–437. ISSN 0033-5533.
- [11] OJEDE, A. and S. YAMARIK. Tax policy and state economic growth: The long-run and short-run of it. *Economics Letters*, 2012, **116**: 161–165. ISSN 0165-1765.
- [12] SALIM, R. and H. KAMRUL. Population ageing, income growth and CO₂ emission. *Journal of Economic Studies*, 2015, **42**(1): 54–67. ISSN 0144-3585.
- [13] SOLOW, R. A contribution to the Theory of Economic Growth. *Quarterly Journal of Economics*, 1956, **70**(1): 65–94. ISSN 0033-5533.
- [14] OECD. *Indicators of tax quota and population and economic growth* [online]. Paris: France: Organization for Economic Cooperation and Development, 2015. [cit.2015-04-10]. Available at <http://stats.oecd.org/>
- [15] WORLD BANK. *Capital accumulation, consumption of households, government expenditure and human capital* [online]. Washington, USA: World Bank Group, 2015. [cit.2015-04-10]. Available at <http://data.worldbank.org/indicator>

ISBN 978-80-7494-225-9