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COMPARATIVE ASSESSMENT OF EXTERNAL COSTS AND POLLUTION TAXES IN BALTIC STATES, CZECH REPUBLIC AND SLOVAKIA

Dalia Štreimikienė, Ilona Ališauskaitė-Šeškienė

Introduction

External costs are the main market failure. Pollution taxes are applied to internalise external costs of atmospheric emissions. Also subsidies to renewables in the form of Feed-in prices are also applied to internalize positive external benefits associated with use of renewable energy sources which are carbon free and has lower life-cycle emissions of classical pollutants in comparison with fossil fuel based energy generation technologies.

One reason to support the promotion of renewable energy comes from the internalization of external costs. Economists have shown that when externalities are present, markets are not efficient unless these external costs are internalized and economic agents take into account these costs when making decisions (Markandya, Longo, & Petrucci, 2008). Internalization of external costs of atmospheric pollution allow not only to increase use of renewable energy sources but also have impact on reduction of emissions into atmosphere.

The aim of this paper is to review and compare external costs of atmospheric pollution and pollution taxes in Baltic States, Czech Republic and Slovakia and assess the level of internalization of external costs and their impact on atmospheric emissions of classical pollutants. Seeking to achieve this aim the main tasks are:

- to review literature on external costs and their internalization;
- to analyse and compare external costs of atmospheric pollution in Baltic States, Czech Republic and Slovakia;
- to analyse and compare atmospheric pollution taxes and other policy measures to internalise external costs of pollution in Baltic States and Czech Republic and Slovakia;
- to analyse development of atmospheric pollution by classical pollutants in Baltic States and Czech Republic and Slovakia;

- to develop policy recommendations based on the main findings of analysis conducted. The methods applied: comparative analysis, graphical analysis, systematization and generalization.

1. External Costs of Atmospheric Pollution and Their Internalization Policies and Measures

Almost every energy system, aside from its beneficial consequences to society, causes adverse effects as well (Georgakellos, 2010). In general, costs associated specifically with global warming range widely and differ for fuel (Longo, Markandya, & Petrucci, 2008). In order to compare the environmental impacts of various electricity production technologies the most widely accepted approach today relies on external costs, i.e. monetary value of damages caused by electricity production (Georgakellos, 2010; Krewitt, 2002). External costs are a significant part of total social costs and, in the case of renewable energy sources (RES), are quite low (Mirasgedis et al., 2000), while major damages, such as atmospheric pollution, acid deposition, adverse health effects of pollution, loss of crop yield and biodiversity, soiling of building facades, accelerated corrosion of materials, and various climate change impacts caused by the production of traditional electricity are not reflected in the prices of fossil fuels (Maca, Melichar, & Scasny, 2012; Longo, Markandya, & Petrucci, 2008; Bridges et al., 2015; Štreimikiene & Alisauskaite-Seskiene, 2014; Vasauskaite & Štreimikiene, 2014). Externalities occur at all stages of a fuel cycle (Fouquet et al., 2001), yet path to assessing externalities is mined with difficulties and uncertainties: it can be reduced by improving fuel cycles, switching between fuel cycles, a more efficient end-use of energy and reductions in energy consumption (Fouquet et al., 2001). Nonetheless, ultimate

goal of externalities valuation is achieved when economically efficient allocation of resources is being made – through the integration of externalities in energy prices (Fouquet et al., 2001). This particular integration or so-called internalization of external costs into the full energy production cost has been considered an efficient policy instrument for reducing negative impacts of energy supply and use (Rafaj & Kyreos, 2007). Furthermore, internalization of external costs can be seen as major reason to support the promotion of renewable energy. Economists have shown that when externalities are present, markets are not efficient unless these external costs are internalized and economic agents take into account these costs when making decisions (Markandya, Longo, & Petrucci, 2008). Furthermore, if the market does not reflect all the costs of damage made by traditional fuel energy, market prices do not provide the right signals for economic agents and thus cannot ensure optimal allocation of scarce resources (Maca, Melichar, & Scasny, 2012).

Although a significant research effort in measuring external costs caused by electricity production has been made (European Commission, 1998; Krewitt, 2002; European Commission, 2003; Markandya, 2003; European Commission, 2005), the implementation of appropriate internalization strategies is still hampered by a lack of reliable external cost data (Krewitt, 2002). It is usually the governments' role to step in to ensure prices are right through certain types of regulation (Maca, Melichar, & Scasny, 2012). Moreover, extent to which prices are corrected depends on the degree to which the external costs are internalized). Different internalization measures can be applied in order to internalize external cost into the price of fossil fuel energy. One of them is subsidies, which have been widely used to address externalities (Longo, Markandya, & Petrucci, 2008). These subsidies to renewables in the form of feed-in tariffs are widely applied and are among major instruments used by public authorities to support renewable electricity supplies in their infant stages (Blumberga et al., 2014; Verbruggen & Lauber, 2012). These types of tariffs are structured as fixed-price tariff, which guarantee electricity operators a set price for electricity sold to the grid, or as premium tariff, which adds a definite bonus to the wholesale market price perceived by generators (Blumberga et

al., 2014). Well-designed feed-in tariff systems for renewable energies with guaranteed access to the grid have proven the strongest reliability and success (Fouquet, 2013). Other types of RES support policies exist, such as tradable certificates, tax incentives and investment grants, net metering policies, and tendering schemes all of which are applied in European countries separately and in combination with other policy incentives (Blumberga et al., 2014), however, feed-in tariffs are the most widespread promotion scheme in Europe for electricity made of RES (del Rio & Gual, 2007). Furthermore, European countries have increased their use of environmental tax instruments by designing new tax bases, like taxes on sulfur dioxide, plastic bags, solid waste and batteries (Chiroleu-Assouline & Fodha, 2014). These pollution taxes are applied to reduce other tax distortions in the economy (Parry, 1995) emissions i.e. to internalise external costs of atmospheric emissions and it provide public revenues which can be recycled (Chiroleu-Assouline & Fonha, 2014). Economists agree, in concept, pollution taxes are the most cost-effective means of reducing pollution, nonetheless it remains unpopular mostly due to public distrust of politicians to spend environmental taxes solely on environmental measures and issues of tax distribution – there is concern such a tax burden will be unfairly distributed (Hsu, Walters, & Purgas, 2008).

In the following sections of paper external costs of atmospheric emissions will be compared among Baltic States and Czech Republic and Slovakia and the level of external costs internalization in these countries will be assessed by comparing pollution taxes and feed-in tariffs applied for RES. Dynamics of atmospheric emissions will be compared among Baltic States, Czech Republic and Slovakia in order to define to which extend the internalization of external costs have impact on reduction of atmospheric emission in five analyzed countries.

2. External Costs of Atmospheric Pollution in Baltic States, Czech Republic and Slovakia

Seven major types of damages have been assessed within ExternE methodology during CASES project (CASES, 2008). The main categories are human health (fatal and non-fatal effects), effects on crops and materials.

The impact pathway approach – and coming along with this approach, the EcoSense model, an integrated software tool for environmental impact pathway assessment – was developed within the ExternE project series and represents its core (European Commission, 1998; European Commission, 2003; European Commission, 2005). Impact pathway assessment is a bottom-up-approach in which environmental benefits and costs are estimated by following the pathway from source emissions via quality changes of air, soil and water to physical impacts, before being expressed in monetary benefits and costs. The use of such a detailed bottom-up methodology is necessary, as external costs are highly site-dependent. Two emission scenarios are needed for each calculation, one reference scenario and one case scenario. The background concentration of pollutants in the reference scenario is a significant factor for pollutants with non-linear chemistry or non-linear dose-response functions. The estimated difference in the simulated air quality situation between the case and the reference situation is combined with exposure response functions to derive differences in physical impacts on public health, crops and building material. Not only local damages have to be considered – air pollutants are transformed and transported and cause considerable damage hundreds of kilometers away from the source. So local and European wide modelling was performed during ExternE and its extensions. The currently available values for classical air pollutants correspond to an average height of release. Results are available for emission of NH₃, NMVOC, NO_x PPMco, PPM₂₅ SO₂. For new EU member states such as Lithuania, Latvia, Estonia, Czech Republic and Slovakia external costs of atmospheric pollution were assessed first time (CAES, 2008). Since the background concentration of NH₃, NMVOC, SO₂ and NO_x influences the creation of secondary pollutants there are two further distinctions into values corresponding to conditions in 2010 and values corresponding to possible conditions in 2020 were developed during aforementioned project. It is assumed that in most cases the emissions in 2020 are lower than in 2010. It has to be emphasised that because of non-linear atmospheric chemistry and because of different background concentrations of e.g. NO_x and NMVOC, especially with regard to ozone there

can occur large differences in [Euro per ton] values. Even negative external costs can occur for NO_x emission in 2010 regarding ozone. It is recommendable, especially with regard to cost benefit analysis for future measures to use the set corresponding to the conditions in 2020 to include the “real” effect of an emission reduction in the future. The values have been derived by simulation of a certain emission reduction in different regions. This has been done for all pollutants from “all sources (e.g. including transport, industry, domestic firing systems, but also combustion plants), and for reduction of emissions of primary particles, SO₂ and NO_x (e.g. combustion in power plants) only. Further processing of the results allows [Euro per ton] values corresponding to low and high release height. In Table 1 the external costs values corresponding to “Average Height of Release” are presented in Baltic States, Czech Republic and Slovakia and EU-27 average in 2010.

As one can see from Table 1 the highest external costs of atmospheric emissions can be noticed on Czech Republic following by Slovakia. The lowest external costs were determined in Lithuania and Estonia however in Estonia human health and loss of biodiversity costs related to NH₃ are the highest among Baltic States. Lithuania distinguishes with quite high human health and biodiversity loss costs related to NO_x comparing with other Baltic States. Countries having higher external costs of atmospheric emissions are supposed to have higher pollution taxes aiming at internalization of external costs of atmospheric emissions. Therefore in the following section of paper pollution taxes for the same atmospheric pollutants will be compared among five EU member states.

3. Pollution Taxes in Baltic States, Czech Republic and Slovakia

Air pollution taxes are important flexible pollution reduction measure in energy sector as energy sector is the major sources of classical pollutants (SO₂, NO_x, Particulates, CO) which are usually being charged by air pollution taxes in major EU member states and other countries all over the world (Chiroleu-Assouline & Fodha, 2014). Pollution taxes applied for classical pollutants are the main policies and measures to internalize external costs of energy generation (Parry, 1995; Longo, Markandya, & Petrucci, 2008; Georgakellos, 2010; Markandya, 2003).

Tab. 1: External costs of atmospheric emissions of classical pollutants in 2010 and 2020, EUR/t – Part 1

	EU-27 average	Czech Republic	Estonia	Lithuania	Latvia	Slovakia
2010						
Human Health						
NH3	9,482	16,783	5,103	4,348	4,825	15,094
NMVOC	584	584	163	326	296	389
NOx	5,591	7,302	1,481	3,966	2,590	7,856
PPMco	1,325	1,009	165	390	342	842
PPM25	24,410	25,208	6,159	10,969	8,844	21,640
SO2	6,070	7,235	3,392	4,412	3,854	6,696
Loss of Biodiversity						
NH3	3,266	5,079	3,188	2,229	2,980	5,227
NMVOC	-67	-83	-29	-28	-34	-56
NOx	903	1,341	676	590	638	1,077
PPMco	0	0	0	0	0	0
PPM25	0	0	0	0	0	0
SO2	177	399	167	139	133	332
Crops: Regional: crops N deposition & crops O3						
NH3	-183	-126	-7	-11	-8	-129
NMVOC	189	136	30	35	40	93
NOx	328	399	84	129	119	458
PPMco	0	0	0	0	0	0
PPM25	0	0	0	0	0	0
SO2	-27	-43	-11	-14	-11	-20
Crops: SO2						
NOx	71	127	31	74	47	163
SO2	-13	-14	-9	-28	-16	-6
Materials: SO2&NOx						
NOx	71	127	31	74	47	163
SO2	259	498	95	187	125	469
2020						
Human Health						
NH3	5,837	10,719	3,323	2,371	2,901	9,200
NMVOC	238	151	26	56	35	102
NOx	6,620	10,106	2,064	4,653	3,294	10,718
PPMco	1,381	1,040	190	397	342	845
PPM25	24,191	23,992	7,279	11,169	9,371	22,057
SO2	6,673	8,747	3,653	5,017	4,343	7,598

Tab. 1: External costs of atmospheric emissions of classical pollutants in 2010 and 2020, EUR/t – Part 2

	EU-27 average	Czech Republic	Estonia	Lithuania	Latvia	Slovakia
Loss of Biodiversity						
NH3	3,295	5,273	3,286	2,278	3,093	5,482
NMVOOC	-48	-72	-25	-25	-27	-48
NOx	868	1,280	642	557	595	987
SO2	192	418	189	143	134	343
Crops: Regional: crops N deposition & crops O3						
NH3	-183	-126	-4	-10	-7	-132
NMVOOC	103	62	14	16	17	45
NOx	435	448	74	104	96	428
SO2	-41	-75	-13	-16	-12	-39
Crops: SO2						
SO2	-13	-14	-9	-28	-16	-6
Materials: SO2&NOx						
NOx	71	127	31	74	47	163
SO2	259	498	95	187	125	469

Source: CASES (2008)

The higher tax rates on classical pollutants should have positive impact on reduction of atmospheric emissions (Foquet et al., 2001). However there are other policies and measures aiming at internalization of externalities related to atmospheric pollution in energy generation. These policies are aiming to promote renewable energy sources via subsidies and grants by internalising positive externalities or external benefits (Fagiani et al., 2014; Streimikiene & Alisaukaite-Seskiene, 2014; Streimikiene & Balezentiene, 2012).

The tax rates for the main pollutants discharged from stationary sources of pollution is set for one tonne of pollutants discharged into the environment. The tax rates for pollutants discharged into the atmosphere in analysed countries are presented in Table 2.

As one can see from information provided in Table 2 the highest rates for classical pollutants in energy sector are being applied in Estonia and Lithuania though these countries distinguishes with the lowest external costs of atmospheric emissions. The lowest rates for classical pollutants are being applied in Czech Republic and Latvia. Therefore Czech Republic

having the highest external costs of atmospheric emissions among analysed countries at the same time had the lowest pollution taxes for the corresponding pollutants in 2015.

In Figure 1 the dynamics of revenues from Pollution taxes as percentage of GDP in Baltic States, Czech Republic and Slovakia are presented.

Comparing revenues from pollution taxes as the percentage of GDP between analysed countries one can noticed that the highest share of pollution taxes to GDP is in Slovakia and Estonia. The lowest share is in Latvia (Fig. 3). The steep increase of the share of pollution taxes as percentage of GDP in Slovakia can be noticed in year 2011. This indicates that country is looking forward to green budget reform. In Latvia pollution taxes are very low and do not represent comparable share of GDP for comparative analysis between selected member states. Also very low revenues of pollution taxes to GDP are in Lithuania and Czech Republic. The low pollution tax rates in Czech Republic corresponds to low share of revenues from pollution taxes being applied in this country.

Tab. 2:

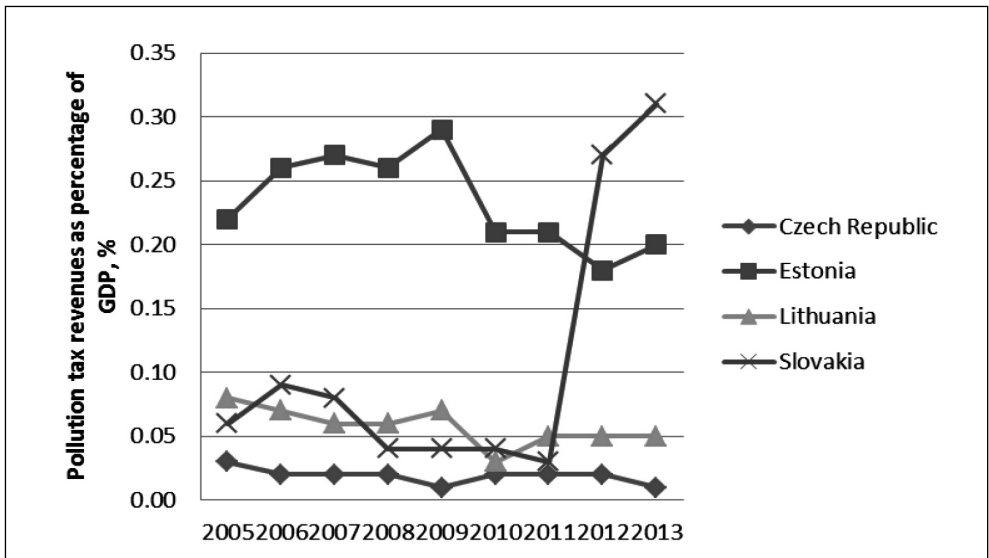
Air pollution tax rates in Baltic States, Czech Republic and Slovakia, valid since 2015, EUR/t

	Czech Republic	Slovakia	Lithuania	Latvia	Estonia
NH3	38.50	66.38	4.00	18.50	122.32
CO	23.10	32.00	24.00	7.83	7.70
Heavy metals	769.90	1,280.20	3,855.00	1,138.30	1,278.00
NOx	30.80	48.01	196.00	85.37	122.32
PPM25, PPMco	115.50	160.00	61.00	75.00	146.16
SO2	38.50	64.01	104.00	85.37	145.50
NMVOC	76.99	66.38	4.00	85.37	122.32

Source: EUROSTAT

Fig. 1:

Dynamics of revenues from pollution taxes in Baltic States and Czech Republic and Slovakia as the percentage of GDP



Source: own

There are other opportunities to internalize external costs of atmospheric pollution, i.e. to apply subsidies in the form of feed-in prices for renewable electricity therefore in the next section of the paper the feed-in prices for RES will be compared among Baltic States, Czech Republic and Slovakia.

4. Feed-in Price and Other Measures to Internalize External Costs of Atmospheric Pollution in Baltic States, Czech Republic and Slovakia

As it was already mentioned in previous sections of the paper the Governments are implementing

various policies to promote renewable energy and to internalize positive externalities related to renewable energy (Fouquet, 2013; Longo, Markandya, & Petrucci, 2008; Maca, Melichar, & Scasny, 2012; Rafaj & Kypreos, 2007; Streimikiene & Sarvutyte-Grigaliuniene, 2012). Renewable electricity policy mechanisms generally can be categorized into price-based and quantity-based policies (Blumberga, 2014). In price-based instruments, the regulator sets a price for a specific variable. The example can be situation, then generators of renewable energy receive financial support in terms of a subsidy per kilowatt of capacity installed, a payment per kilowatt hour produced and sold or a fixed premium above the electricity market price. In quantity-based policies, the desired level of outcome is set and an artificial market is created in which participants act to fulfil the policy target. These systems operates under the principle that a defined member of the electricity supply chain (consumer, generator or supplier) has to present a fixed minimum quantity of certificates originated per megawatt hour of renewable electricity generated (Verbruggen & Lauber, 2012). Feed-in tariffs are among major instruments used by public authorities to support renewable energy. They are the most popular RES-E support scheme in the European countries (Del Rio & Gual, 2007). A feed-in tariff may be structured as either a fixed-price tariff thus guaranteeing electricity operators a set price for electricity sold to the grid, or a premium tariff, which adds a definite bonus to the wholesale market price perceived by generators. The duration, over which the tariff is paid, as well the tariff amount varies between policies applied in countries. Some countries have introduced a mechanism to gradually reduce the tariff rate thus adapting to increasing economic viability of RES-E technologies over time (Jenner, Groba, & Indvik, 2013). Other types of RES-E support policies include: tradable certificates, tax incentives and investment grants, net-metering policies, and tendering schemes all of which are applied in European countries separately and in combination with other policy incentives. In Table 3 the current rates of Feed-in prices for renewable electricity are presented for Baltic States, Czech Republic and Slovakia.

As one can see from Table 3 analysed countries have various Feed-in tariffs applied for various renewable energy technologies and various type and capacities of PP. In Czech Republic the highest Feed-in tariffs in 2014 were applied for biogas PP with installed capacity up to 100 kW–12.9 €/kWh. The lowest Feed-in tariff was applied for biomass (4.8 €/kWh). Tariff for biomass energy in Czech Republic varies according to the technology used from 4.8 to 12.1 €/kWh. In Slovakia Feed-in tariffs varies from 2.6 €/kWh for biomass from straw to 15.5 €/kWh for geothermal. In Lithuania Feed in tariffs in 2014 were in range from 5.5 €/kWh (reconstructed biomass PP with capacity exceeding 5,000 kW) to 20.00 €/kWh (building-integrated installations of solar energy with capacities up to and including 10 kW). Feed-in tariff support scheme was started to be applied in Lithuania from 1 April 2002, and will be managed until 31 December 2020. In Latvia the average feed-in tariff rates paid for operators in 2014 was in range from 10.7 and 11.1 €/kWh (wind power plants and large HPP) to 18.5 and 19.5 €/kWh for biomass and biogas power plants respectively. In Estonia, electricity generation from renewable energy sources is promoted through a premium tariff. The bonus payment on top of the electricity market price amounts to 5.4 €/kWh and does not differ for the individual technologies. However, CHP plants with a production capacity below 10 MW using waste, peat or oil-shale retorting gas are eligible for a tariff amounting to 3.2 €/kWh. Therefore, the lowest and equal to all technologies feed-in tariffs in 2014 were applied in Estonia. The highest feed-in tariffs in the same year were applied in Slovakia and Lithuania. Latvia distinguishes with very high Feed-in tariffs for small hydro and wind energy comparing with other analyzed countries. Lithuania distinguishes with high Feed-in tariffs for solar energy. Therefore again Czech Republic has one of the lowest Feed-in prices among analyzed countries though distinguishes with the highest external costs of atmospheric emissions among selected countries. Conducted analysis allows expecting appropriate dynamics of atmospheric emissions. In the next section of the paper analysis of dynamics of the main atmospheric pollutants emissions will be compared among Baltic States, Czech Republic and Slovakia.

Tab. 3: Feed-in tariffs in Baltic States, Czech Republic and Slovakia in 2014

Renewables	Czech Republic	Slovakia	Lithuania	Latvia	Estonia
Wind energy	approx. 7.3 €/c/kWh	7.03 €/c/kWh	Installed capacity (IC) up to 10 kW: 8.1 €/c/kWh IC exceeding 10 kW up to 350 kW: 7.5 €/c/kWh IC exceeding 350 kW: 6.4 €/c/kWh	10.7 €/c/kWh	5.4 €/c/kWh Restrictions: the tariff scheme will be suspended for the current calendar year as soon as a total of 600 GWh of electricity from wind energy has already been supported.
Solar energy	IC up to 5 kW approx. 11.1 €/c/kWh IC up to 30 kW approx. 9.0 €/c/kWh	9.9 €/c/kWh	Building-integrated installations: IC up to and including 10 kW: 20 €/c/kWh IC exceeding 10 kW up to and including 100 kW: 18.0 €/c/kWh IC exceeding 100 kW: 16.8 €/c/kWh Installations not integrated in buildings: IC up to 10 kW: 15.6 €/c/kWh IC exceeding 10 kW up to and including 100 kW: 14.2 €/c/kWh IC exceeding 100 kW: 13.3 €/c/kWh	–	5.4 €/c/kWh
Geothermal energy	approx. 12.0 €/c/kWh	15.5 €/c/kWh	–	–	5.4 €/c/kWh
Biogas	Landfill gas or sewage gas: approx. 7.1 €/c/kWh Biogas PP up to 100kW of IC: approx. 12.9 €/c/kWh	Landfill gas: 7.03 €/c/kWh Biomethane produced from biogas using anaerobic digestion up to IC of 1 MW: 10.8€/c/kWh Biogas PP using anaerobic digestion IC up to of 250 kW: 12.6€/c/kWh IC from 250 kW – 500 kW: 11.9€/c/kWh IC from 500 kW: to 750 kW: 11.1€/c/kWh IC exceeding 750 kW : 10.7€/c/kWh Biogas produced through thermochemical conversion: 12.3€/c/kWh Biogas produced through anaerobic digestion of bio-degradable waste: 11.9€/c/kWh	PP using landfill gas: IF of up to and including 10 kW: 11.6 €/c/kWh IC exceeding 10 kW up to and including 500 kW: 11.3 €/c/kWh IC exceeding 500 kW: 9.0 per €/c/kWh PP using biogas derived from anaerobic digestion: IC of up to and including 10 kW: 15.3 €/c/kWh IC of 10 kW up to and including 500 kW: 13.9 €/c/kWh IC exceeding 500 kW up to and including 1000 kW: 13.3 €/c/kWh IC exceeding 1000 kW up to and including 2000 kW: 12.7 €/c/kWh IC exceeding 2000 kW: 12.2 €/c/kWh	5.4 €/c/kWh	5.4 €/c/kWh
Hydro-power	Small and reconstructed HPP approx. 9.1 €/c/kWh Small HPP at new locations: approx 11.8 €/c/kWh	IC up to 100 kW: 11.13€/c/kWh IC from 100 to 200 kW: 10.9€/c/kWh IC from 200 to 500 kW: 10.7€/c/kWh IC from 500 kW to 1 MW: 10.52€/c/kWh IC from 1 MW to 5 MW: 9.8€/c/kWh	IC of up to and including 10 kW: 7.8€/c/kWh IC exceeding 10 kW up to and including 1000 kW: 7.0€/c/kWh IC exceeding 1000 kW: 6.4 €/c/kWh	Small HPP (IC <10 MW): 18.1€/c/kWh HPPs (IC ≤4 MW): 14.5 €/c/kWh HPPs (IC >4 MW): 11.1€/c/kWh	5.4 €/c/kWh
Biomass	Tariff varies according to the technology used approx. 4.8-12.1 €/c/kWh	Designated biomass: 9.2€/c/kWh Other biomass from waste: 10.1 €/c/kWh Biomass from straw: 2.6€/c/kWh Bioliquids: 9.4€/c/kWh	New PP using biomass: IC of up to and including 10 kW: 8.7 €/c/kWh; PP using biomass: IC exceeding 10 kW up to 5000 kW: 7.5€/c/kWh IC exceeding 5000 kW: 6.7€/c/kWh Reconstructed PP using biomass: IC of up to and including 10 kW: 7.2€/c/kWh IC exceeding 10 kW up to and including 5000 kW: 6.4 €/c/kWh IC exceeding 5000 kW: 5.5€/c/kWh	18.5€/c/kWh	5.4 €/c/kWh

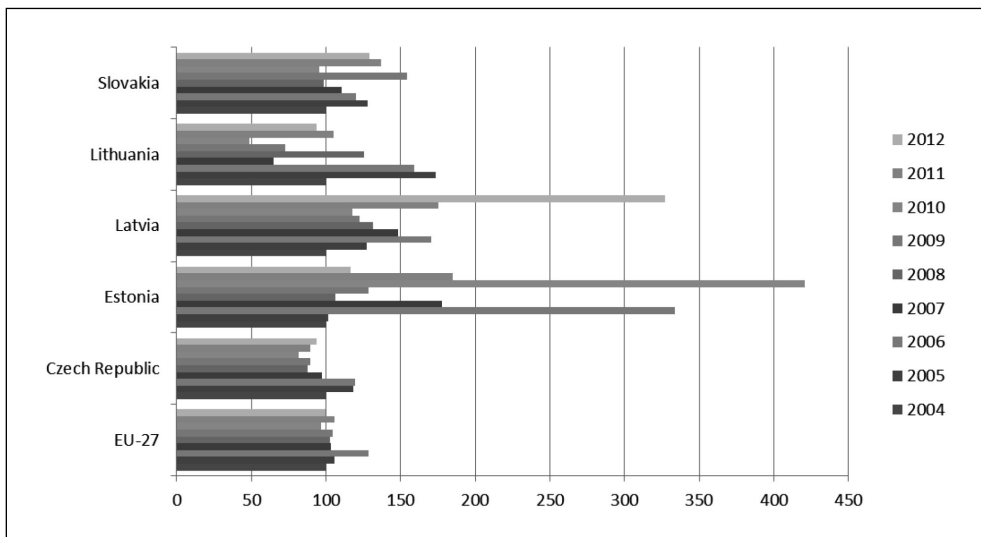
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5. Atmospheric Pollution in Baltic States, Czech Republic and Slovakia

As the analysis of policies to internalize externalities in energy sector revealed quite different situation in Baltic States and Czech Republic and Slovakia it is necessary to analyse dynamics of atmospheric pollution in

selected countries in order to define how the progress achieved in internalizing external costs of energy generation impacts dynamics of atmospheric emissions in these countries. In Figure 2 the dynamics of urban population exposure to air pollution by ozone in Baltic States, Czech Republic, Slovakia and EU-27 is presented.

Fig. 2: Dynamics of urban population exposure to air pollution by ozone in Baltic States, Czech Republic, Slovakia and EU-27 in percentage, 2004 = 100%



Source: EUROSTAT

As it can be seen in Figure 2, dynamics of urban population exposure to air pollution by ozone differs significantly between particular countries. According to data, highest degree of urban population exposure was in Estonia in 2010, while the lowest grade was observed in Lithuania in the same year. On the level of EU-27 countries, highest degree of urban population exposure was captured in 2006. In general positive trends in reduction of exposure to air pollution by ozone can be noticed in all countries except Latvia. In Czech Republic the increase of exposure to air pollution by ozone can be noticed in 2005-2006 and also some increase in 2012 is also obvious.

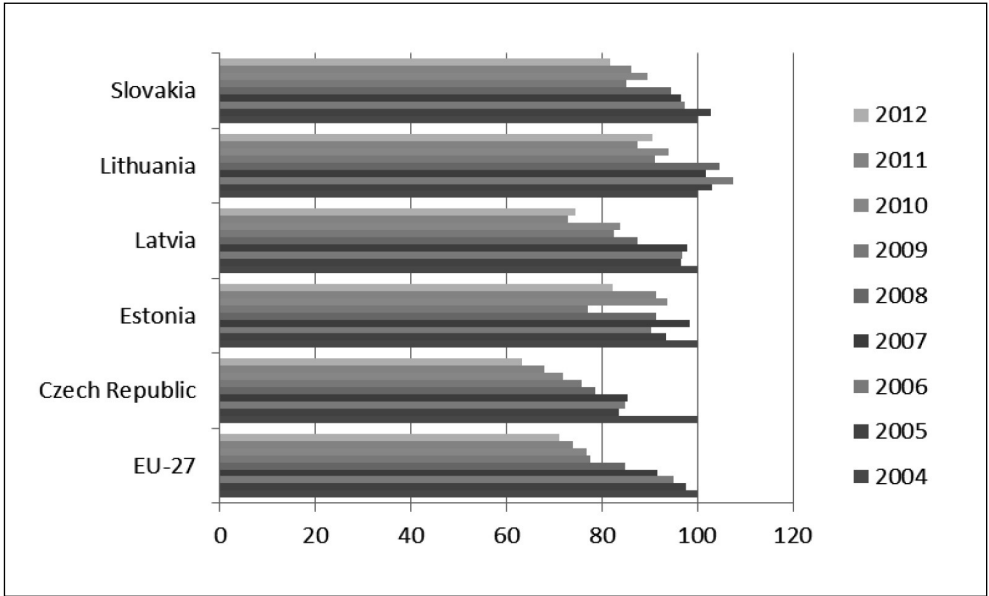
NOx is one of the major anthropogenic pollutants related with energy production and

consumption. Dynamics of NOx emissions in Baltic States, Czech Republic and Slovakia are presented in Figure 3.

In Figure 3, data of emissions of nitrogen oxides (NOx) in Baltic States, Czech Republic, Slovakia and EU-27 is not as scattered as data in Figure 4. Therefore, significant changes are not exactly noticeable. Nonetheless, EU-27 data dynamics suggests emissions of nitrogen oxides (NOx) by source sector declined each year by approximately same percentage and in 2012 was about 70.9% while compared to 2004 data. In all analyzed countries the trend of decline in NOx emissions can be noticed since 2004 however the most significant declined can be noticed in Czech Republic and Slovakia. Therefore quite low pollution taxes for NOx

Fig. 3:

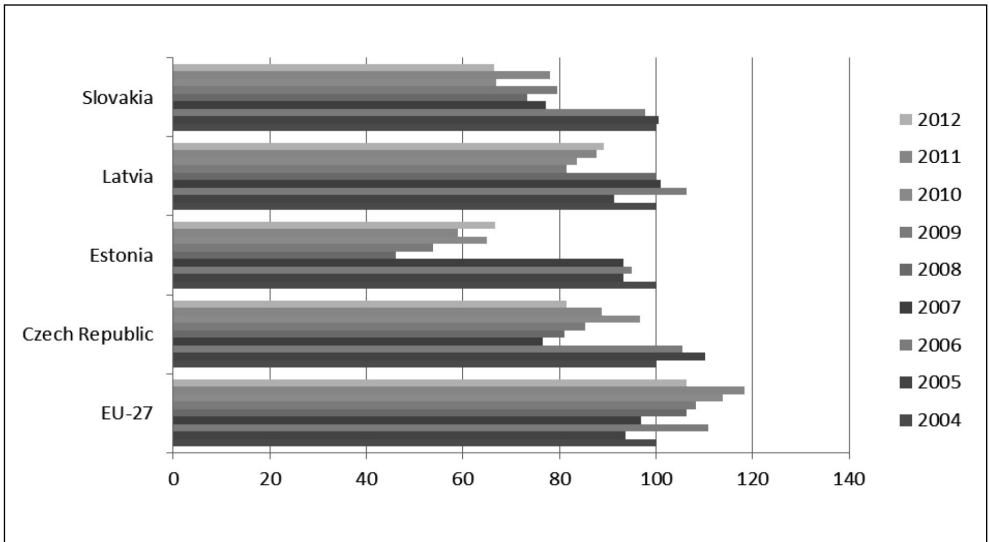
Dynamics of emissions of nitrogen oxides (NOx) in Baltic States, Czech Republic, Slovakia and EU-27 in percentage, 2004 = 100%



Source: EUROSTAT

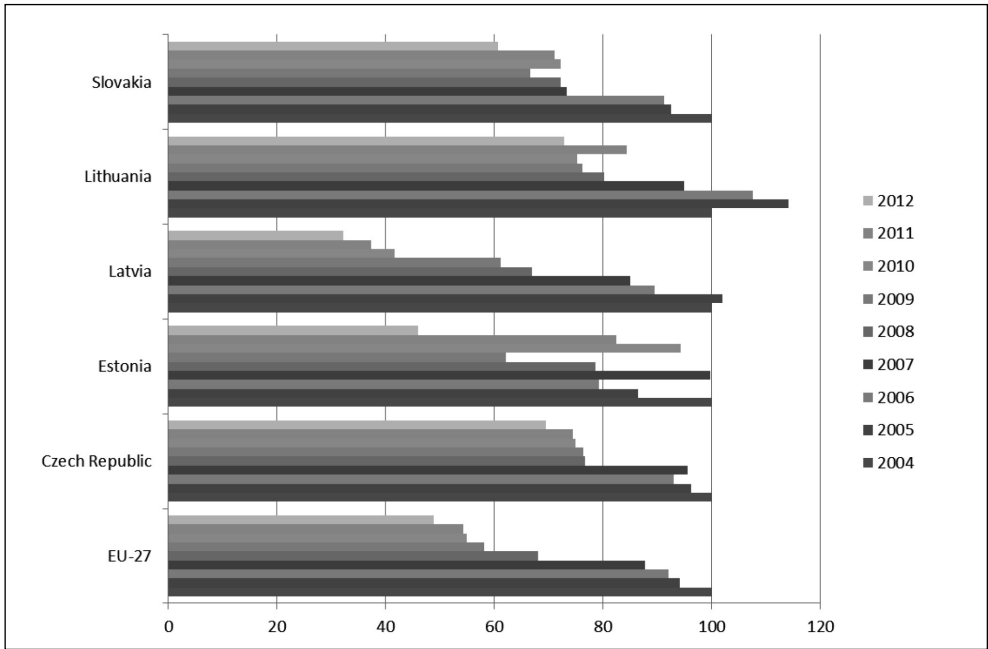
Fig. 4:

Dynamics of urban population exposure to air pollution by particulate matter in Latvia, Estonia, Czech Republic, Slovakia and EU-27 in percentage, 2004 = 100%



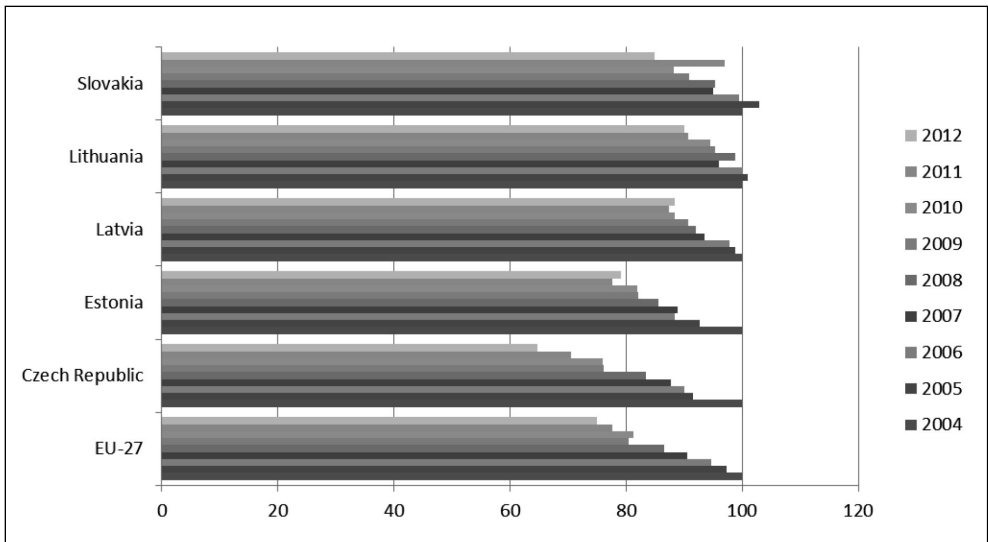
Source: EUROSTAT

Fig. 5: Dynamics of emissions of sulphur dioxide (SO2) in Baltic States, Czech Republic, Slovakia and EU-27 in percentage, 2004 = 100%



Source: EUROSTAT

Fig. 6: Dynamics of emissions of non-methane volatile organic compounds (NMVOC) in Baltic States, Czech Republic, Slovakia and EU-27 in percentage, 2004 = 100%



Source: EUROSTAT

in Czech Republic and low Feed-in prices for renewables didn't have negative impact on reduction of NOx emissions into atmosphere. Particulates are also one of the major anthropogenic pollutants related with energy production and consumption. Dynamics of PM emissions in Baltic States, Czech Republic and Slovakia are presented in Figure 4.

As one can see from Figure 4 although dynamics of urban population exposure to air pollution by particulate matter differs significantly between particular countries, it can be argued, data of Latvia, Estonia, Czech Republic reflects well on overall data of EU-27. Downward trend can be seen approximately until 2008 and then once again urban population exposure to air pollution by particulate matter starts to increase. Just Slovakia distinguishes among analysed countries with clear trend of PM decrease since 2004. In Czech Republic decrease of PM emissions can be noticed just since 2008. Until economic crisis PM emissions were increasing in this country.

SO2 emissions are also one of the major anthropogenic pollutants related with energy production and consumption. Dynamics of SO2 emissions in Baltic States, Czech Republic and Slovakia are presented in Figure 5.

As Figure 5 demonstrates, dynamics of emissions of sulphur dioxide in Baltic States, Czech Republic, Slovakia and EU-27 is distributed unevenly. Nonetheless, on the level of EU-27, significant decreasing trend can be observed. It should be stressed, however, only in Latvia and Lithuania particular data has grown in between 2005 and 2006. Special additions can be observed in Lithuania – in 2005 emissions of sulphur dioxides reached approximately 114% and in 2006 this value has decreased only by 107%, while at the same time in Latvia it was about 89% already. Slovakia and Latvia distinguishes from analysed countries with sharp decrease of SO2 emissions since 2004. In Czech Republic since 2008 SO2 emissions remained stable just in 2012 some reduction can be noticed.

Dynamics of emissions of non-methane volatile organic compounds (NMVOC) in Baltic States, Czech Republic, Slovakia and EU-27 are presented in Figure 6.

As one can see from Figure 6 rather extremely variable data of emissions of non-methane volatile organic compounds (NMVOC) was monitored in the scale of EU-27, while

on the level of individual countries dynamics, although intermittent, is not as evident. As the largest increase was observed in Slovakia in 2005, overall, it can be stated, scale of emissions of non-methane volatile organic compounds (NMVOC) has been declining over the years, and e.g. in Czech Republic in 2012 was about 64%. In Slovakia and Estonia NMVOC emissions also were by almost 20% lower in 2012 comparing to 2004.

Conclusions

External costs are the main market failure in energy sector and make a significant part of total social costs. Energy technologies distinguishes with different levels of external costs of atmospheric pollution. In the case of renewable energy sources (RES), are quite low, while major damages, such as atmospheric pollution, acid deposition, adverse health effects of pollution, loss of crop yield and biodiversity, soiling of building facades, accelerated corrosion of materials, and various climate change impacts caused by the production of traditional electricity are not reflected in the prices of fossil. Therefore special policies are necessary to internalize external costs and therefore to reduce atmospheric pollution caused by energy generation and consumption.

The highest external costs of atmospheric emissions can be noticed on Czech Republic following by Slovakia. This is mainly related with the highest GDP and income per capita adjusted at PPP. The lowest external costs were determined in Lithuania and Estonia however in Estonia human health and loss of biodiversity costs related to NH3 are the highest among Baltic States. Lithuania distinguishes with quite high human health and biodiversity loss costs related to NOx comparing with other Baltic States.

Countries having higher external costs of atmospheric emissions are supposed to have higher pollution taxes aiming at internalization of external costs of atmospheric emissions. Though there are other policies and measures to promote renewables and internalize external costs such as energy taxes, use of subsidies for RES from EU Structural Funds etc. pollution taxes relevant to energy sector and feed-in tariffs for RES are the main measures to internalize external costs of atmospheric pollution.

The conducted analysis showed that the highest rates of pollution taxes are imposed in

Estonia. This also provides for high shares of environmental taxes as the percentages of GDP in this country. Czech Republic distinguishes with quite low rates of pollution taxes among analysed countries though country has one of the highest external costs of atmospheric emissions.

Conducted analysis indicated that the lowest and equal to all technologies feed-in tariffs in 2014 were applied in Estonia. The highest feed-in tariffs in the same year were applied in Slovakia and Lithuania. Latvia distinguishes with very high Feed-in tariffs for small hydro and wind energy comparing with other analyzed countries. Lithuania distinguishes with high Feed-in tariffs for solar energy. Therefore again Czech Republic has one of the lowest Feed-in prices among analyzed countries though distinguishes with the highest external costs of atmospheric emissions among selected countries.

Analysis of the atmospheric pollutants emissions in five selected countries indicated that the positive trends of atmospheric emission reduction can be noticed since 2004 in all analysed countries however countries have achieved different results in reducing specific atmospheric pollutants emissions. Latvia distinguishes with very good results achieved in reduction of SO₂ and NO_x emissions, but the urban population exposure to air pollution by ozone has increased significantly in 2012 in Latvia. Estonia distinguishes from other analysed countries with achieved good results in reduction of emissions of non-methane volatile organic compounds and SO₂ emissions. Czech Republic has achieved good results in reduction of emissions of NO_x though the pollution tax rate for NO_x emissions were the lowest in Czech Republic. This indicates that the degree of internalization of external costs related to specific pollutants does not necessary imply emission reduction of these pollutants as other factors (subsidies, tax allowances etc.) also play an important role.

The further analysis and research are necessary to define the main drivers of atmospheric emissions in the countries having in mind that not the high tax rates on pollution play the major role in emission reduction therefore alternative policies and measures need to be explored further to develop viable recommendations for internalization of externalities in energy sector.

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COMPARATIVE ASSESSMENT OF EXTERNAL COSTS AND POLLUTION TAXES IN BALTIC STATES, CZECH REPUBLIC AND SLOVAKIA

Dalia Štreimikienė, Ilona Ališauskaitė-Šeškienė

External costs are the main market failure. Pollution taxes and other flexible market instruments are applied to internalise external costs of atmospheric emissions. Subsidies to renewable energy technologies in the form of Feed-in prices are also applied to internalize positive external benefits associated with use of renewable energy sources for energy generation as these technologies have lower life-cycle emissions of classical pollutants and GHG emissions in comparison with fossil fuel based energy generation technologies.

The paper reviews and compares external costs of atmospheric pollution and pollution taxes in Baltic States, Czech Republic and Slovakia and assesses the level of internalization of external costs and their impact on atmospheric emissions of classical pollutants in these countries. The literature review allows generalizing results of external costs assessment and their internalization issues. The paper analyses and compares external costs of atmospheric pollution in Baltic States, Czech Republic and Slovakia together with atmospheric pollution taxes and other policy measures used to internalise external costs of atmospheric pollution in Baltic States and Czech Republic and Slovakia. The analysis of trends of atmospheric pollution by classical pollutants in Baltic States and Czech Republic and Slovakia is provided and policy recommendations based on the main findings of analysis conducted were developed.

Key Words: *External costs, atmospheric emissions, environmental taxes, Baltic States, Czech Republic, Slovakia.*

JEL Classification: M12, M53.

DOI: 10.15240/tul/001/2016-4-001

INVESTMENT OPPORTUNITIES FOR FAMILY BUSINESSES IN THE FIELD OF USE OF BIOGAS PLANTS

Darina Myšáková, Ivan Jáč, Michal Petrů

Introduction

In recent years, the importance of renewable energy has been steadily growing. This mainly reflects rising energy prices and increasing dependence on fossil fuels whose reserves gradually decline. In the conditions of the Czech Republic, renewable energy sources are non-fossil natural energy sources, i.e. energy of water, wind, solar energy, biogas and solid biomass, energy of surrounding environment, geothermal energy and liquid biofuels energy (Ministry of Industry and Trade of the Czech Republic, 2009). The law on the environment indicates that these are renewable natural resources that have the ability, when gradually consumed, to be partially or completely restored either by themselves or with the aid of a human (Ley.cz, 2005). They reduce greenhouse gas emissions and the level of pollution, increase security of supplies, and strengthen economic growth, competitiveness and regional development.

This development can focus more on strengthening family businesses in municipalities of a rural type where many owners of forests or larger plots can take advantage of investment opportunities and stabilize the economy of their businesses. However, even more side effects such as new jobs and partial subcontracts from other family businesses or other companies can be noted.

The strengths of family businesses are in agreement between the parties, involvement of family members, knowledge of technology and know-how, flexibility in labor, time and money, long-term planning, stable corporate culture, speed in decision-making, proximity to local markets, pride and credibility, efficiency, productivity, focus on quality (Koráb et al., 2008). In recent decades, corporate social responsibility has been at the forefront of marketing tools of businesses and is often

associated only with the ethical standards that, among other things, seek to minimize negative impacts on the environment. Social responsibility, however, includes all activities that go far beyond the maximum legal requirements, as well as activities through which organizations strive to understand and satisfy the expectations of all interested parties, stakeholders, in the company. Therefore, they focus on the area of health care of human resources and relationship with the local community. Other advantages of family businesses are creation of working positions (mostly show a greater capacity to create new jobs) and socially responsible behavior – they invest in the development of a local community, sponsor local civic activities, have a tendency to greener behavior, take a good care of employees and others (Koráb et al., 2008)

Thanks to the involvement of family businesses, these are mostly indigenous resources which do not rely on the availability of conventional energy sources in the future, and their predominantly decentralized nature contribute to reducing energy dependence on energy supplies from abroad. They, therefore, constitute a key element of a future sustainable power industry (the Ministry of Environment, 2012). This article focuses on biogas plants producing biogas, which is one of the most important renewable energy sources. Biogas plants have a firm place within modern power industry of the 21st century. They ensure a stable supply of electricity and heat, without environmental pollution by emissions. These projects contribute to the environmental protection, not only in reducing greenhouse gas emissions, but also in the disposal of waste from agricultural production or biodegradable municipal waste. The article also draws attention to the economics of these investment projects. After characterization of biogas plants,

there are defined possibilities of funding these projects which have long been supported by the European Union policy. Further, their economic evaluation is discussed.

The text presents the results of a survey in which 313 businesses in the Czech Republic investing in agricultural biogas plants were addressed. The overall success of the investigation which was carried out in May 2014 was 44%, which can be considered a very meaningful questionnaire survey. First, research questions and scientific hypotheses were formulated and then, either confirmed or rejected through the selected research methodology. The set scientific hypotheses were tested using statistical Statgraphics program. The given null statistical hypothesis was verified at a 5% significance level α .

1. Biogas Plants

Biogas plants are technological facilities that use anaerobic digestion process for processing organic waste or any other biodegradable material. Anaerobic digestion or anaerobic fermentation is a process in which microorganisms degrade the organic material without air. It may occur either spontaneously in nature or by a controlled method in biogas plants (EnviWeb, 2009). Biogas, which is produced in biogas plants, is made up of methane and carbon dioxide. Flammable methane is represented by 50-75%, calorific value, therefore, ranges from 19.6 to 25.1 MJ / m³, which is about one third lower calorific value compared to natural gas (Ministry of Environment of the Czech Republic, 2012). Carbon dioxide is represented by 25-45%. Additional components include water vapor, oxygen, nitrogen, ammonia, water and hydrogen sulphide (Quaschnig, 2010, p. 296). Biogas is mostly burned in boilers. Produced heat is used for heating buildings or water heating. Another possibility is a combined production of heat and electricity in a cogeneration unit (EnviWeb, 2009). Electricity produced by a biogas plant can be sold to the network. Power companies are legally obliged to sign a contract for the purchase of this electricity for 15 years at a predetermined price. Nowadays, thanks to favorable purchase prices of electricity from biogas, economic aspect as a reason for the construction of biogas plants prevails. High purchase prices of electricity from biogas has led to the fact that some projects do not count with selling the heat from biogas

plants at all and concentrate just on electric energy (Ministry of Environment of the Czech Republic, 2012). Other products of anaerobic digestion include digestate and fugate. Digestate is a solid residue after digesting with lower content of biodegradable matter. If it meets all the parameters that are given by the Decree of the Ministry of the Environment of the Czech Republic, digestate may be used as a fertilizer, an additive to a compost or ground surface treatments. Fugate is a fluid product of a digestion process, which has the nature of waste water. This process water that is highly turbid and contains products of the anaerobic decomposition of organic substances is usually discharged into the wastewater treatment plant (EnviWeb, 2009).

Thus, the biogas plant produces ecologically and environmentally friendly (with low greenhouse gas emissions and local pollution) heat and electricity. The benefit of this alternative energy source can be shown at a specific example: medium-sized biogas plant produces up to 4,000 MWh of electricity per year, equivalent to theoretical annual consumption of 1,100 households. In addition, this plant can supply the heat to 300 households and reduce emissions of greenhouse carbon dioxide into the atmosphere each year by up to 3,500 tons compared to energy production from fossil sources (Kašpar, 2008). At present, in the Czech Republic, there are about 500 biogas plants in operation. The most widely spread agricultural biogas plants process inputs from primary agricultural production (energy crops and manure). Their construction mostly takes place at the premises of farms. Other types of biogas plants are quite sporadic. These are industrial and municipal biogas plants (Nazeleno.cz, 2010).

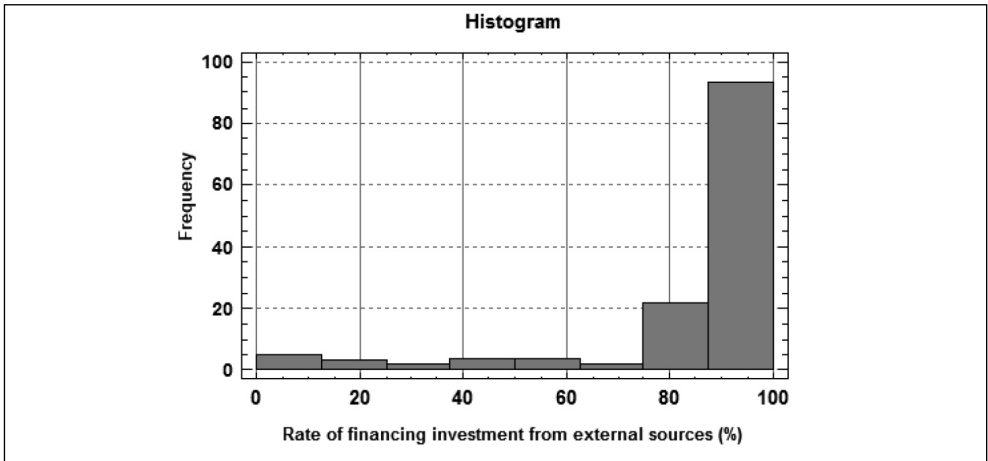
2. Economic Evaluation of Investment Projects of Biogas Plants

Chapter 2 defines the "ideal" approach to investing in biogas plants in terms of capital expenditure and financing of the investment (the ratio of foreign and own resources, the use of the subsidy, bank loan). The attention is also paid to economic indicator of return on investment. It is also necessary to take notice of the development phase of the national economy, where the attenuation stages (signs of recession) generally limit the investment activity in the economy and it is therefore

necessary to consider alternative scenarios of the success of these investments (Jáč, 2012, p. 38). The survey showed that **the investment costs for the construction of biogas plants in the Czech Republic, most often range within CZK 60-70 million**. The survey also pointed to the fact that in the Czech Republic, it is unlikely to build a biogas plant for less than CZK 30 million. On the contrary, the highest financial range, i.e. investment costs exceeding

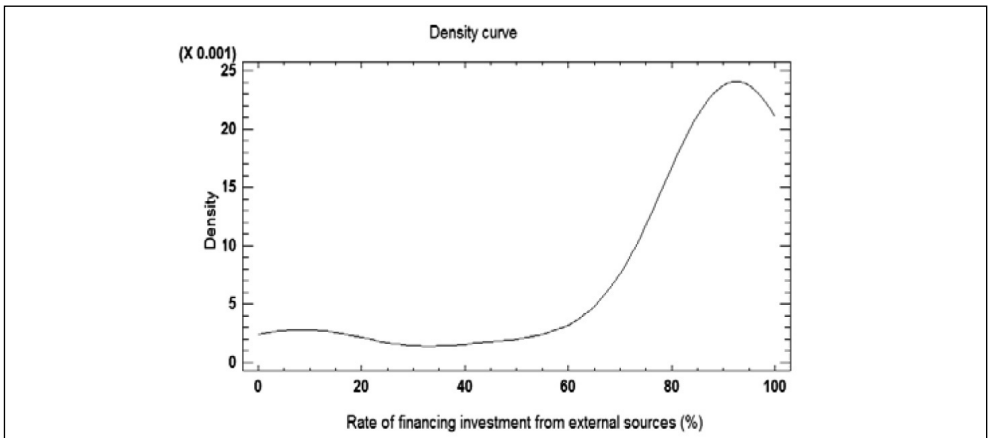
CZK 100 million, is highly probable. Another part of the research concerned the percentage ratio of use of external and company's own sources for financing biogas plants. The results obtained in the form of external versus company's own sources of funding were expressed by a percentage ratio of utilization of external resources. The results are presented using a histogram (Fig. 1) and the density of the appearance curve (Fig. 2).

Fig. 1: Rate of financing investment from external sources – histogram



Source: own

Fig. 2: Rate of financing investment from external sources – density curve



Source: own

Tab. 1: Frequency table – rate of financing investment from external sources

Class	Lower limit	Upper limit	Middle value	Frequency	Relative frequency	Cumulative frequency	Cumulative relative frequency
	on or lower	0	–	5	0.0357	5	0.0357
1	0	12.5	6.25	5	0.0357	10	0.0714
2	12.5	25.0	18.75	3	0.0214	13	0.0929
3	25.0	37.5	31.25	2	0.0143	15	0.1071
4	37.5	50.0	43.75	4	0.0286	19	0.1357
5	50.0	62.5	56.25	4	0.0286	23	0.1643
6	62.5	75.0	68.75	2	0.0143	25	0.1786
7	75.0	87.5	81.25	22	0.1571	47	0.3357
8	87.5	100.0	93.75	92	0.6643	139	1.0000
	above	100.0		0	0.0000	139	1.0000

Source: own

From the above results, it is evident that to a large extent a significant part of investors used an external capital to finance their investment. From the frequency table (Tab. 1), it is obvious that 82% of investors used more than 75% of external sources of financing for their investment. This can be explained by the fact that external capital is financially more advantageous for investors.

The survey of investors also showed that in financing most biogas plants external sources prevail over their own resources. The possibilities for financing investment projects of biogas plants from external sources include bank loans and subsidies. Subsidies are a very important source of financing biogas plants. Businesses in the Czech Republic could apply for a subsidy for the construction of biogas plants from the Operational Programme Enterprise and Innovation 2007-2013, the Rural Development Programme 2007-2013 and the Operational Programme Environment 2007-2013. Currently, the Czech government has approved Operational Programmes for the period of 2014-2020. Therefore, the concern that the biogas plants would not be subsidized after 2013 was not confirmed. The subsidies for the construction of a biogas plant in the monitoring period of 2014-2020 can be applied from the following programs: the Operational Programme Enterprise and Innovation for Competitiveness 2014-2020,

the Rural Development Programme 2014-2020 and the Operational Programme Environment 2014-2020. These programmes follow up on the same programmes of the period of 2007-2013. **The Operational Programme Enterprise and Innovation for Competitiveness 2014-2020** is intended for businesses (especially SMEs), universities, scientific research institutions and individuals. The OP Enterprise and Innovation for Competitiveness 2014-2020 aims to support key elements that have an impact on the performance of economy. The programme supports projects aimed at business development which is based on research and innovation, as well as reduction of energy intensity in the business sector and the introduction of high-speed broadband Internet. The managing authority of the OP Enterprise and Innovation for Competitiveness 2014-2020 is the Ministry of Industry and Trade. The programme is divided into four priority axes. In each priority axis, there are defined the main areas of support (subsidies EUROPROJECT, 2014a). **The Rural Development Programme 2014-2020** is designed especially for agricultural operators and forest owners, and to a limited extent, for municipalities. The main objective of the programme is restoring, preserving and enhancing ecosystems dependent on agriculture especially through agri-environmental measures, as well as investments for the competitiveness of agricultural enterprises,

landscape infrastructure and promoting young people to join farming. The managing authority of the Rural Development Programme 2014-2020 is the Ministry of Agriculture. A financial contribution from the European Union's Rural Development Programme 2014-2020 is intended to be EUR 1.9 billion. The program is divided into six priority axes. In each priority axis, there are defined the main areas of support (subsidies EUROPROJECT, 2014c). These initiatives are particularly significant for the so called regional disparities that are currently most found in rural regions. These investments can boost the municipality development dynamics (Jáč et al., 2010, p. 115).

The applicant in the Operational Programme Environment 2014-2020 may be a municipality, the organization of state and local government, research and scientific institute, legal entity, individual and non-profit organizations. The programme is divided into five priority axes. In each priority axis, there are defined the main areas of support (subsidies EUROPROJECT, 2014b).

In the survey, businesses were asked whether they applied for a subsidy for the construction of biogas plants. Figure 3 shows that 82% of the surveyed businesses applied for such subsidy. On the basis of statistical

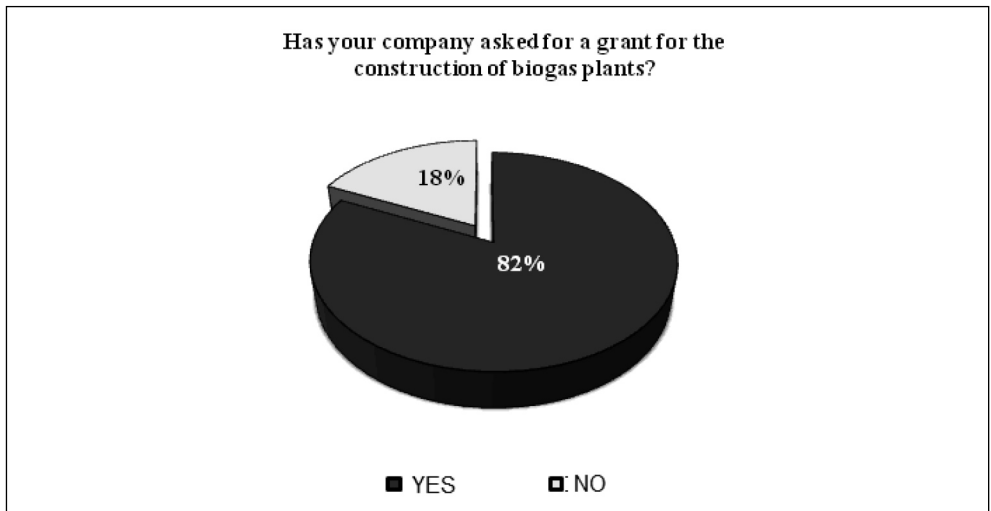
testing of set hypothesis, it can be said that the majority of businesses in the Czech Republic ask for a subsidy for the construction of a biogas plant. Further, the survey found that, as shown in Figure 4, almost 60% of businesses that applied for the subsidy also gained it. It can be stated that a success rate of obtaining financial means from the subsidy for the construction of biogas plants is high.

Furthermore, the survey dealt with the question of what percentage of the investment costs covered the subsidy, if the investment was financed from it. To illustrate the results, a histogram was used (Fig. 5), as well as a box and a scatter plot (Fig. 6) and a density of the appearance curve (Fig. 7).

From the above illustrated results, it is apparent that the level of financing investment from a subsidy ranged mainly (73% of cases) between 20-32%. This can be explained by setting subsidy programmes in such a way that it usually requires at least 50% of the investment costs coverage from the investor.

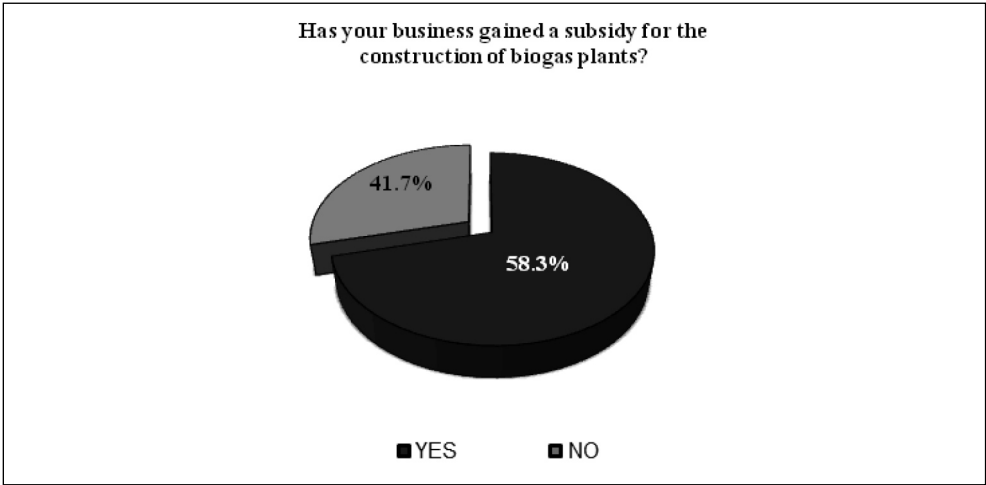
Another significant external source of funding investment projects such as biogas plants is a bank loan. Banks on the Czech market found out that it is an interesting investment project, therefore, it can be stated that there is a wide offer of loans to

Fig. 3: Subsidies for biogas plants



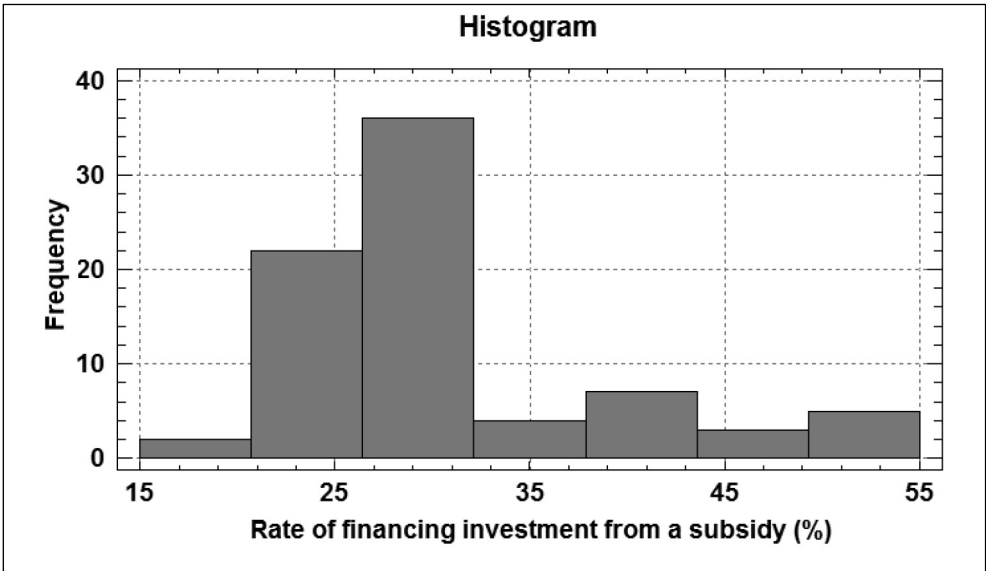
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Fig. 4: The success rate of obtaining the grant



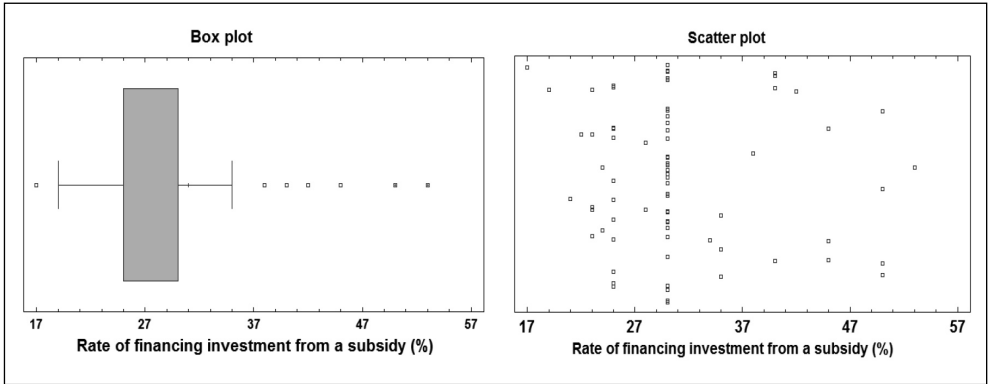
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Fig. 5: Histogram – rate of financing investment from a subsidy



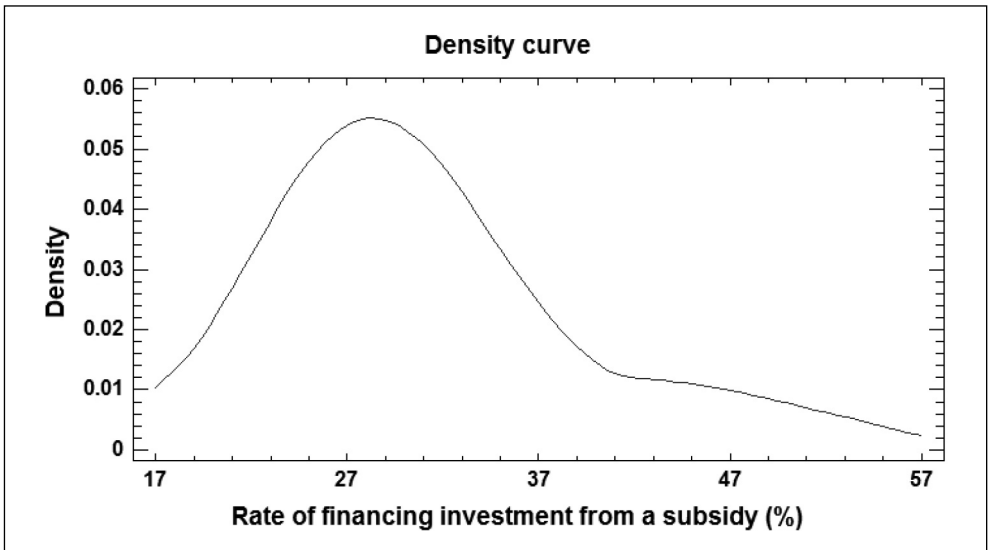
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Fig. 6: Rate of financing investment from a subsidy



Source: own

Fig. 7: Density of the appearance curve – rate of financing investment from a subsidy



Source: own

finance projects of biogas plants in the Czech Republic. Below, there are listed possibilities of financing biogas plants projects offered by the Commercial Bank, Czech Savings Bank, GE Money Bank and UniCredit Bank. **Commercial Bank**, which is one of the three strongest banks in the Czech Republic, offers a special program for financing biogas plants. The bank regards

investing in biogas plant as a new business opportunity for farmers and at the same time it represents a real alternative for the meaningful use of agricultural production.

Commercial Bank provides the following types of loans to co-finance projects of biogas plants as an alternative energy source:

- a short-term bridging loan to cover VAT,

- medium-term loan to pre-finance subsidies,
- long-term investment loan for the construction of a biogas plant,
- merger of medium-term loan for pre-financing a subsidy and a long-term investment loan for the construction of biogas plants into one loan with a special installment after receiving a subsidy,
- postponement of principal payment during construction and commissioning,
- regular repayment from revenues generated by the project, i.e. from sales of electricity or heat.

A company should have a clear idea of the project, mainly a technical, economic, and operational part before entering into negotiations with a bank. Everything should be summarized in a brief business plan. The information a business plan should include is the following: basic information about the company, the reasons for the project, the investment costs of the project, the amount of investors' own financial resources, placement of a biogas plant, a way of providing input, their quantity and structure, output to a network, the use of waste heat and supplier of construction works (Commercial Bank, 2010).

Czech Savings Bank has been financing biogas plants on the Czech market since 2007. Biogas plants are perceived as an appropriate form of diversification of the bank's agricultural customers, as they contribute to its stabilization, which also has a positive impact on the employment in rural areas. The bank also ensures its clients additional revenues from the sale of electricity after a maturity of a loan. As part of its Agroteam, Czech Savings Bank has been dealing with financing agriculture for more than 15 years. Czech Savings Bank became the market leader in financing renewable energy projects in the Czech Republic through specialized advice and experience of project financing. An evidence of its strong position is an established partnership with many professional organizations that operate in agriculture. These partners include Agricultural Association, Czech Biomass Association CZ BIOM, E.ON Energie, the Agrarian Chamber of the Czech Republic or the Czech Biogas Association (Czech Savings Bank, 2012).

GE Money Bank also pays close attention to the financing of energy projects that are among its priority areas. GE Money

Bank specializes in financing projects using renewable energy sources. As one of the first Czech banks, it started to finance biogas plants and has provided loans to more than 40 agricultural biogas projects so far.

In the area of biogas plants, GE Money Bank offers:

- financing up to 100% of the investment costs (depending on the type of project and the economy investor),
- maturity of the loan up to 15 years (depending on the type of project and the economy investor),
- deferral of principal repayments of the loan during the construction of biogas plant (up to 18 months),
- an offer of complete investment insurance under very favorable conditions,
- cooperation with a leading provider of technology,
- assistance when negotiating favorable purchase prices for electricity,
- Assistance in dealing with business partners.

The main assumptions that GE Money Bank assesses in its credit analysis and that precede the approval of financing projects of biogas plants are:

- providing their own input of raw material into a biogas plant,
- history of agricultural company,
- stable economy of an investor,
- size of cultivated land,
- general contractor with references (GE Money, 2015).

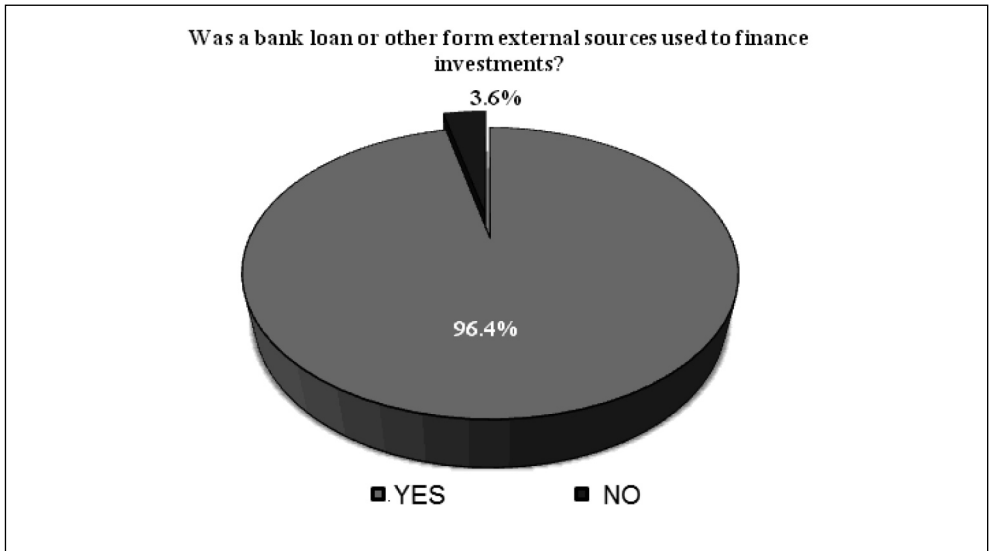
UniCredit Bank also provides investment loans for financing the construction and operation of biogas plants. The basic evaluated conditions are:

- size of a biogas plant is adequate to a crop area of an agricultural company,
- a project has a valid building permit and a future distribution network connection,
- a biogas plant will be owned by or by the project company where the agricultural company is a shareholder,
- general contractor has verifiable references.

Financing which UniCredit Bank offers:

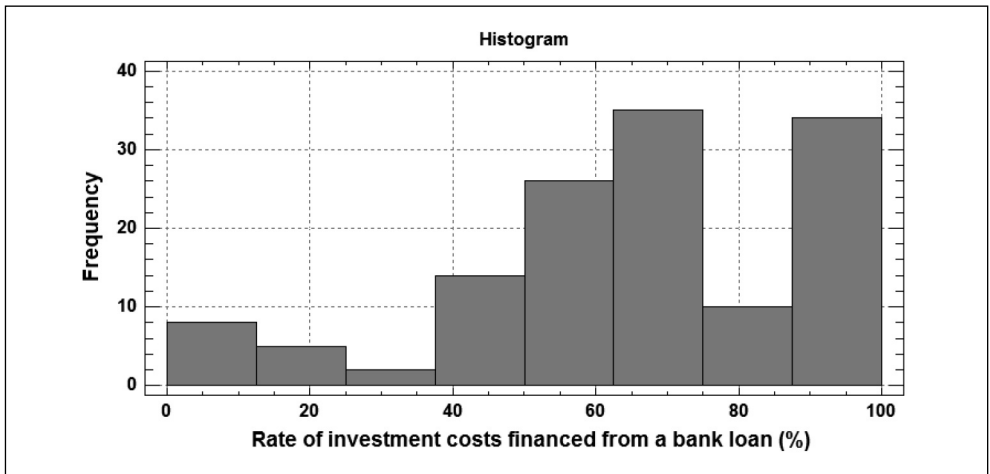
- long-term investment loans with maturities of up to 12 years,
- short-term loan for pre-financing of VAT,
- the possibility of loan installments after the completion of plant construction,

Fig. 8: Financing biogas plants with a bank loan



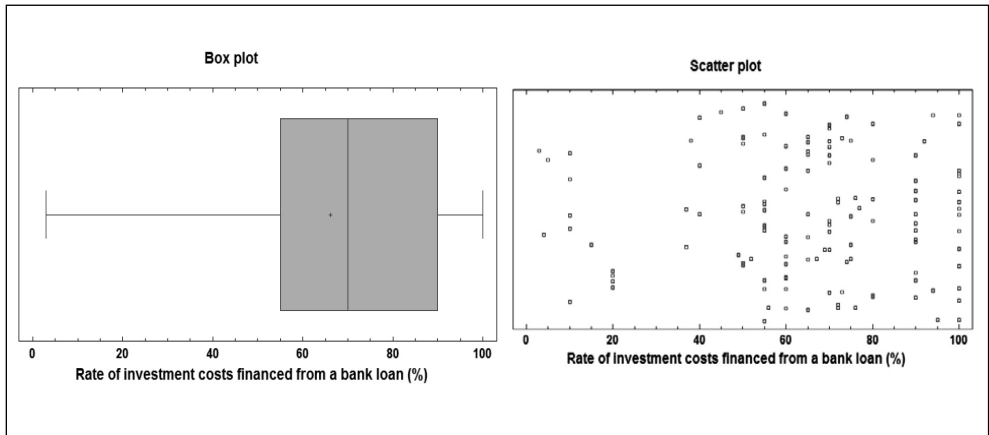
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Fig. 9: Histogram – rate of investment costs financed from a bank loan (%)



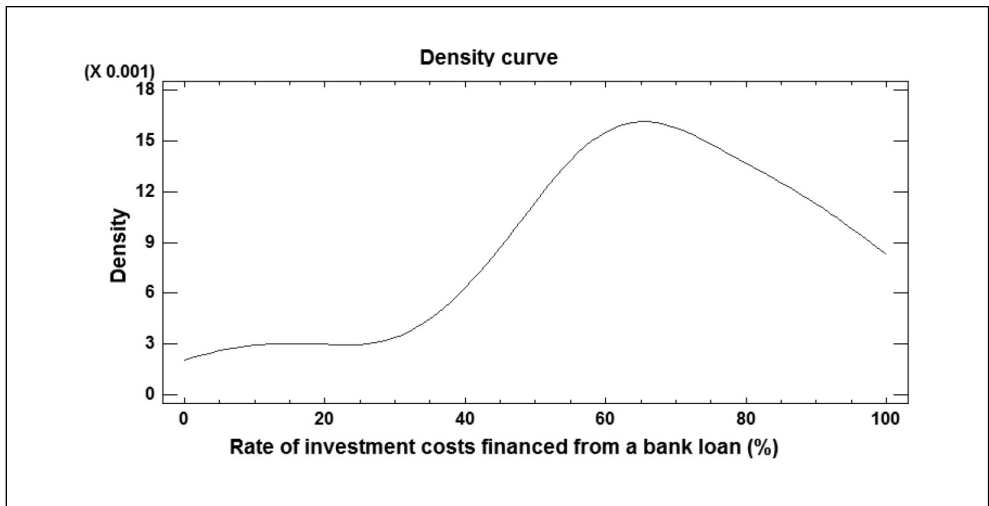
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Fig. 10: Rate of investment costs financed from a bank loan (%)



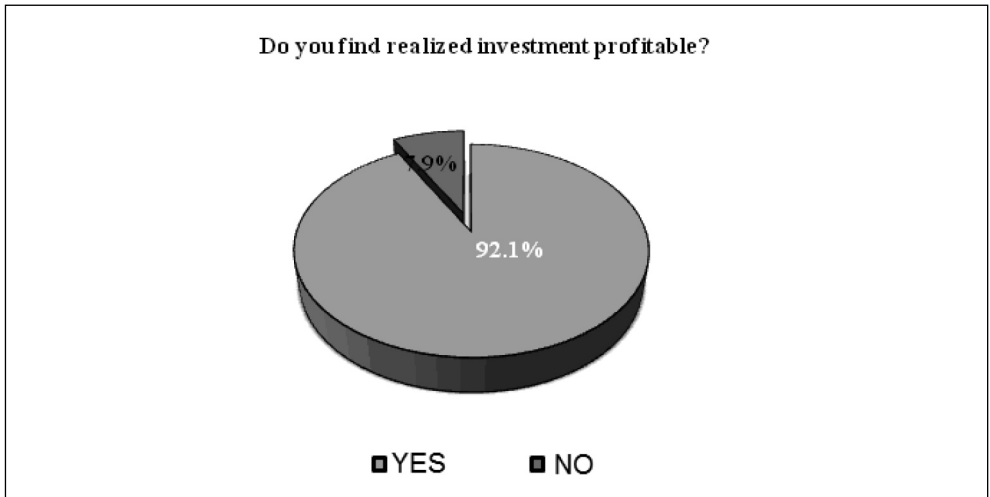
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Fig. 11: Density appearance curve - rate of investment costs financed from a bank loan (%)



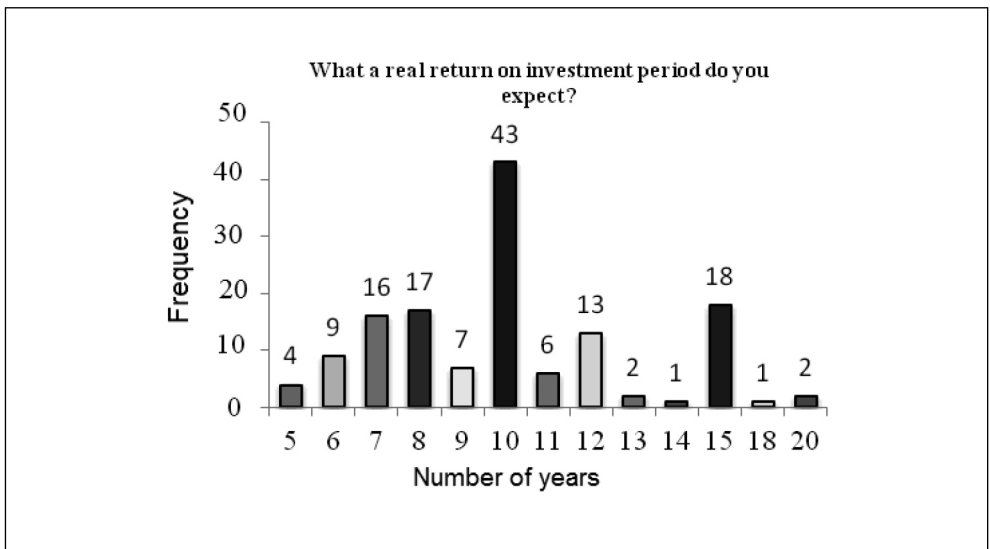
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Fig. 12: Investment profitability (yield)



Source: own

Fig. 13: Return on Investment



Source: own

- interest rate hedges during the entire loan repayment period,
- in the case of quality projects, financed by UniCredit Bank up to 100% of contract for work (UniCredit Bank, 2015).

Over 95% of respondents replied they used a bank loan or other form of external sources to finance an investment (Fig. 8).

To illustrate the results, a histogram (Fig. 9), a box and a scatter plot (Fig. 10) and a density of the response appearance curve (Fig. 11) were used.

From the results shown, inter alia, it is clear that almost 90% of investors used bank loans to finance their investments from 40 to 100%. This can be explained by the relatively easy availability of bank loans. Based on statistical analysis using Statgraphics, we can conclude that over 90% of biogas plants were built using a bank loan or other external sources.

When realizing the investment project, the issue of **profitability (yield) and return on investment** plays an important role for businesses. The survey showed that over 90% of respondents considered realized investments in biogas plants to be profitable (Fig. 12). The businesses in the survey mostly anticipated a 10-year return on investment period (Fig. 13). Figure 13 suggests that more than half of respondents expect a return on investment within 10 years. Statistical testing confirmed that the expected return on investment period in biogas plants is a maximum of 10 years.

Conclusions

Businesses in the Czech Republic responded flexibly to new challenges in the form of investments in biogas plants. It can be stated that the project to build a biogas plant is profitable for them. The fact that the construction of biogas plants in the Czech Republic has a significant support also contributes to this situation. The company that chooses this investment project may contact the Ministry of Agriculture, the Ministry of Industry and Trade and the Ministry of Environment to apply for a subsidy. It may be granted from the Rural Development Programme, the OP Enterprise and Innovation and the Environmental Operational Programme. Banks on the Czech market also responded flexibly to the growing demand for loans suitable for financing investments in renewable energy and came with special programs for

financing biogas plants. Therefore, it can be assumed that, due to favorable conditions, the number of biogas plants in the Czech Republic will be constantly growing. In this way, the Czech Republic will be closer to Western countries contributing to the fulfilment of the EU agreement to increase the share of renewable energy in overall energy consumption and will make the next step to more considerate behavior towards nature. Moreover, it will also significantly help to preserve agricultural sector in the Czech Republic and to greater prosperity of Czech agriculture businesses.

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INVESTMENT OPPORTUNITIES FOR FAMILY BUSINESSES IN THE FIELD OF USE OF BIOGAS PLANTS**Darina Myšáková, Ivan Jáč, Michal Petrů**

This article deals with the economic evaluation of biogas plants which are one of the most important renewable energy sources in the Czech Republic. They provide a stable supply of electricity and heat without polluting the environment by emissions. They significantly contribute to the environmental protection. For businesses, this renewable source of energy means financially a very profitable, safe and a fast repayable investment. These investments are a big opportunity mainly for a family type of business which especially in municipalities in rural areas performs a variety of other economic and non-economic objectives including the use of biomass. Opportunities of family businesses are in agreement between the parties, involvement of family members, knowledge of technology and know-how, flexibility in labor, time and money, long-term planning, stable corporate culture, speed in decision-making, proximity to local markets, pride and credibility, efficiency, productivity, focus on quality. In recent decades, corporate social responsibility has been at the forefront of marketing tools of businesses and is often associated only with the ethical standards that, among other things, seek to minimize negative impacts on the environment This article focuses on their basic characteristics, maps specific ways which the company can use for their financing and analyzes the profitability (yield) and return on these investment projects.

This development can focus more on strengthening family businesses in municipalities of a rural type where many owners of forests or larger plots can take advantage of investment opportunities and stabilize the economy of their businesses. However, even more side effects such as new jobs and partial subcontracts from other family businesses or other companies can be noted.

Key Words: Family business, renewable source of energy, biogas plant, biogas, investment, subsidies, bank credit, investment yield, investment returns.

JEL Classification: Q2.

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THE PARADOXES OF CREATIVITY MANAGEMENT

Tomas Kačerauskas

Introduction

Creativity is a very important aspect of market economy. Some scholars (Howkins, 2007; Florida, 2002) are absolutely enthusiastic about creativity that should give a competitive priority in respect of the competitors. Nevertheless, creativity also raises many problems in management of it from feeling of guilty to threat against identity of organization. In general, creativity is an ambivalent and contradictory phenomenon that covers both positive and negative aspects. As a result, management of creativity faces some paradoxes. The main aim of this paper is to describe these paradoxes. Another aim is to present the different approaches towards creativity management. Finally, the paper seeks to dethrone a naive attitude that creativity in economy solves all possible problems. The biggest challenge to the management is the very creativity.

In the first chapter I will present different concepts of creativity and innovation in the perspective of management. In the second chapter I will analyze ten paradoxes of creativity management including one grand and nine minor paradoxes.

1. Creativity and Innovation in the Perspective of Management

Some scholars (Pečiulis, 2015; Reimeris, 2016) speak about contemporary society as a creative one. The understanding of creativity has an evolution from the concept of genius to the concept of creative systems (Černevičiūtė, 2014). Creativity has been treated in different ways from the perspectives of different sciences (Barevičiūtė, 2014). Besides this, understandings of creativity depend on different cultural environments (Klimczuk, 2014; Pruskus, 2015). Table 1 shows the definitions of creativity in the context of management. It is

an example how certain context changes the understanding of a phenomenon. On the one hand, the intention to manage helps to narrow and understand the phenomenon of creativity. On the other hand, this context like any other presupposes the variety of definitions. The managers treat creativity as a function of work (Amabile, 1998; Arndt et al., 1999; Drazin et al., 1999), of the novel products (Ford & Gioia, 2000; Amabile, 1988; Zhou & Shalley, 2010), of social activity (Ford & Gioia, 2000; Arndt et al., 1999), of divergent thinking and idea generations (Amabile, 1996; Paulus, 2000; Amabile, 1983), of cognition and judgement (Rank et al., 2004; Amabile, 1982; Ford & Gioia, 2000), of relationship between an individual and his (her) environment (Anderson et al., 2014; Ford & Gioia, 2000; Drazin et al., 1999).

Table 2 shows the impact of creativity in a micro environment (in an organization). Besides this, the perspective of management supplements the concept of creativity with the specific characteristics. The impact of creativity is not always positive speaking both – about social connections and about individual feelings. The scholars pay attention to the fact that an individual creativity threatens to the social connections (Arndt et al., 1999; Storr, 1972). Additionally, creativity provokes not only a rejection and criticism (Sutton, 2001), but also the conflicts in an organization (Jung & Lee, 2015). Finally, creativity causes feeling of guilt (Arndt et al., 1999) or can lead to self-destruction (Storr, 1972). As a result, it could be said that the positive aspects of creativity are inseparable from its negative factors. That is why the scholars speak about the complex interactions (Anderson et al., 2014) of creativity. Another source of complexity is the double nature of creativity that is directed towards the social environment, although it stems as the individual aspirations that in

Tab. 1: Definitions of creativity in the context of management

Description	References
A subjective judgment	Amabile, 1982
The generation of "original and useful ideas"	Amabile, 1983
Idea generation	Amabile, 1996
A function of the components as follows: expertise, creative-thinking skills, motivation (intrinsic and extrinsic)	Amabile, 1998
The joint novelty and usefulness of ideas regarding products, processes and services	Amabile, 1988; Zhou & Shalley, 2010
A complex interaction between the individual and his (her) work environment (organization)	Anderson et al., 2014
Characterized by the creative work as original one, i. e. different from what others have done; the case of subculture	Arndt et al., 1999
A critical process necessary for individuals, groups and organizations faced with complex and interdependent work	Drazin et al., 1999
A social activity within particular contexts	Ford & Gioia, 2000
A multidimensional phenomenon that depends on different processes, an area of subjective judgment	Ford & Gioia, 2000
The divergent thinking with the attributes as follows: fluency, flexibility, originality, and elaboration	Paulus, 2000
Involving primarily intra-individual cognitive processes	Rank et al., 2004

Source: own

turn are inseparable from the social world. It is not enough to say that the organizations need a balance between convergent (logical) and divergent (imaginative) thinking (Basadur & Hausdorf, 1996; Chen et al., 2015), between search and creativity (Alexander, 1979) or even between creativity and not creativity (Bilton, 2015). The idea of balance or harmony is inseparable from the idea of comfortable climate in an organization. However, the creative decisions are the results of discomfort, stress or crisis and provoke intolerance, anger or ignorance. The social ties in a comfortable organization could be called micro social capital that exterminates a micro creative capital as possibility of the creative ideas. Florida (2002) speaks about the clash between social capital and creative capital. Nevertheless, Florida is not consequent by rising tolerance as one of three Ts (beside technology and talent) characteristic to creative class. Technology and creativity has been intertwined but not necessary in a positive way (Kanišauskas, 2016).

On the other hand, the so called harmonic relations often hide an authoritarian

management that suppresses any creativity. So the Platonic (to be precise, Pythagorean) idea of harmony is inconsistent with creative dynamics in an organization and could lead to its collapse because of stagnation of the social relations that lead to a deficit of new ideas within it. It is not about a kind of management of creativity – hard one or soft one. Florida (2002) sees only this aspect of management by advocating so called soft management. Sometimes, we need to make very difficult decisions to provoke the creative ideas. Sutton (2001) calls for hiring the persuasive heretics and for fighting between people within an organization. The management of creativity should be creative too. In other words, it should be both unexpected but still having a clear strategy. Greene (2007) speaks about the different war strategies including the area of management. However, the clear managerial strategy does not mean the obtusion of certain tactical ways. On the contrary, these ways should be open for the experiments even if they lead to the failures. That is why Amabile (1988) and Sutton (2001) suggest rewarding

Tab. 2: Characteristics and impact of creativity in an organization

Characteristics	References
An effective generation process combines both search and creativity within a context that balances both	Alexander, 1979
Communication of ideas as part of creative processes	Amabile, 1996; Gilson, 2001
Threatening social connection; feelings of guilt	Arndt et al., 1999
Creativity in organization and divergent/convergent thinking	Basadur & Hausdorf, 1996
Dialectics of creativity and not creativity; 'not creativity' as a "necessary ballast"	Bilton, 2015
Divergent thinking as generating the ideas, imagination, and non-linear thoughts	Chen et al., 2015
Socializing as a positive factor for such aspects of creativity as a freer flow of ideas, more brainstorming, and friendlier work environment	Gilson & Shalley, 2004
Creativity as "the combination of relationship conflict and the relational self"	Jung & Lee, 2015, p. 45
The irrational drive necessary to creative work can lead to the narcissistic, anti-social or self-destructive behavior	Storr, 1972
Rejection and criticism towards creative people confident in their work	Sutton, 2001

Source: own

even the failure by reserving punishment only for inaction. Often, inaction or imitation of work is a result of authoritarian pressure towards the tactical ways that are not open to the workers. In general, managerial culture should be rich (with clear strategy and open tactics) and diverse (soft and hard) enough in order to support a constant contest for the new winning ideas. The environment of creativity is rather a climax of worry and competition or even fighting instead of harmony and tolerance that often hide authoritarian management and inaction. A harmony should be a task but not reality within a multi-colored work group. Not by accident, the scholars (Stahl et al., 2009; Gilson & Shalley, 2004; Staw, 1990) stress that the most productive working groups consist of the inconsistent members in different senses. What concerns reality in such creative environment, the most real things are the innovative ideas to be implemented because of the fact that they change the social (economic) order.

Table 3 shows the peculiarities of innovation in the perspective of management. Creativity is a very broad concept used to describe very different human activities, first of all art and generation of ideas not necessary to be implemented. On the contrary, innovation

deals with the idea implementation (Amabile, 1996; Kazanjian et al., 2000; Lane & Lup, 2015; Bledow et al., 2009; West, 2002) or idea application (Bilton, 2015). Being such, the innovation is a more social process comparing with more or less individual creativity. It appeals both to a collective creativity and to job relationship within an organization. As a result, the innovation is not such a vague object of management as creativity. In other words, the management of innovation could be a model of management of creativity. Speaking about management of creativity, many scholars have in mind namely the innovation, i.e. the applied creativity.

2. Management of Creativity

Management of creativity covers the different managerial practices including challenge, freedom, resources, work-group features, supervisory encouragement and organizational support (Amabile, 1998). According to some scholars (West, 1990), the management of creativity presupposes a social environment of a team and its factors such as rise of vision, participative safety, task orientation, and support for innovation. However, creativity appeals to an individual activity or a tension between the

Tab. 3: Definition of innovation in the context of management

Characteristics	References
Represents inter-individual social processes in the workplace	Rank et al., 2004
Idea implementation	Amabile, 1996
The "application of a creative idea, typically towards new products, new business models or management processes."	Bilton, 2015, p. 154-155
Entrepreneurial innovation as a destructive process	Schumpeter, 1939
Novelty plus value	Bilton, 2015, p. 157
Implementation effectiveness	Kazanjian et al., 2000
Useful creative ideas after the process of their successful implementation	Lane & Lup, 2015
Implementation but not just idea generation	Bledow et al., 2009; West, 2002

Source: own

individual aspirations and the tasks of a team. That is why first of all a question arises how to harmonize a principle of management and a principle of creativity. Speaking about creativity, we face indetermination and uncertainty that could be compared with chaos. Additionally, creativity brakes status quo including social relations within an organization, provokes the conflicts and feeling of guilt as we have seen in the previous chapter. Finally, creativity opens the unstable and unclear future for the organization. It seems that the cost is too big for a more or less successful organization with the stable income. It is not strange that most of managers do not tolerate any manifestation of creativity that have associated with a revolution against them personally and against welfare of their organizations. In this sense, the innovation has better prestige than creativity while the first could be better combined with managerial practices. Here, we face another definition of the innovation as creativity under control or a compromise of chaotic creativity. On the other hand, we can speak about fashion or even mania of innovation routinized in a managerial way. As a result, some scholars speak about managerial orthodoxy as about "dogmatic belief in the power of innovation" (Johnsen, 2015, p. 63).

The aporia or paradox of creativity management is as follows: „the employees should systematically follow the instructions of their managers. However, this prescription fosters conformity rather than sparking new initiatives" (Johnsen, 2015, p. 63). In other words, creativity management is a self-

contradiction since management should control and reduce the chaos associated with creativity. By stimulating creativity, the managers risk to provoke the disobedience for their instructions including an instruction to develop creativity. We can call this contradiction the major or grand paradox of creativity management (GP). Having in mind GP, the Hamel's (2007) argument that management can spark innovation is far from being evident.

This paradox is especially sharp in so called hard control that limits any initiative of the employees. Florida (2002) pays attention that the hard control eliminates any creativity in the organization. However, sometimes all the creativity needs is a "hard" decision of the managers, as mentioned above. Additionally, we have the different managerial traditions including paternalistic ones in the different cultural environment around the world (Zhou, 2006). In general, we have the different combinations of hard and soft control in different environments and situations. Similarly, we have the different models of democracy that is strong because of this variety.

Besides this, we have another paradox that could be called the first minor paradox (MP1). Creativity is the most actual during a period of crisis within an organization. On the one hand, successful period of an organization is an obstacle to develop the creative ideas (Bilton & Cummings, 2014) since the stability and safety has more priority. Routine is an inevitable result of successful present that in turn comes after stormy past period of the creative ideas and their implementation. On the other hand, creativity

is inseparable from destruction, uncertainty, conflicts or even chaos as mentioned. In other words, any organization should avoid it in order to survive as a whole body. However, one of most important conditions to survive in the competition between the organizations is namely creativity and innovation as its implementation. In general, creativity destroys the status quo relationships both inside an organization (horizontal relationships) and outside it (vertical relationships). The latter ones are not only the existing commercial interests of the sellers (producers) and the consumers (Bilton & Cummings, 2014), but also the value chains (Bilton, 2007) within a society. In other words, creativity confuses the social order or even cleans the social board for new relationships. It could be compared with the procedure of bracketing in phenomenology: we take the content of our consciences in the brackets for the sake of new content.

The question of management also asks how to implement the creative ideas – step by step, by using the subtle and incremental changes (Bilton & Cummings, 2014) or by using the radical decisions with failures and mentioned risks (Sutton, 2011). This leads to a paradox too. It could be called the second minor paradox (MP2) or the paradox of innovation. If we choose a way step by step we avoid the undesirable secondary effects such as conflicts or disorder in the organization but we lose a strategic advantage in respect of the competitors. If we choose a radical way it threatens to the very identity of an organization. It sounds also paradoxically, but the situation of an organization should be really bad in order to take the radical decisions. And vice versa, the biggest obstacles towards the innovations are the good results of the organization.

The third minor paradox (MP3) of creativity management is as follows: by increasing creativity in an organization we increase the probability of the conflict, disorder and disharmony within it. Often a microsocial conflict in an organization follows from the situation when “a minority in the team publicly opposes the beliefs, attitudes, ideas, procedures, or policies assumed by the majority of the team” (McLeod et al., 1997). According to Lane and Lup (2015), tensions and contradictions in managing of creativity lead to organizational success. Additionally, the structural solutions could be evaluated as a way to split and place

the contradictory tasks (ibid). As mentioned, creativity destroys the status quo. Although some scholars (Bilton & Cummings, 2014) openly call for such destroy in order to form new environment, it does not guarantee any new order. Even in the case of successful innovation the success could be (and usually is) an apple of discord. We can remember the peripeteias of S. Jobs' career in Apple Company. In general, creativity management is inseparable from conflict management (Gelfand et al., 2008; Hoever et al., 2012; Tekleab & Quigley, 2014; Nijstad et al., 2014; Jung & Lee, 2015; Chen et al., 2015). MP3 has one more aspect. On the one hand, there is a need of higher level of creative entrepreneurs' divergent thinking in order to solve the interpersonal conflicts in organization (Chen et al., 2015). On the other hand, the divergent thinking increases the possibility of the conflicts as nothing else. Here, it is not enough to say in unproblematic way that variety of information, skills and points of view exchange ideas while working together presupposes more novel solutions (Staw, 1990). The different versions of such adoration of variety in a team we face in Howkins (2007) and in Florida (2002). If MP1 deals with the structure of an organization and MP2 appeals to the technology of management, MP3 covers the psychological aspects of the creativity agents.

Besides the mentioned issues, we have also the sociological aspects in creativity management. On the one hand, creativity is an individual activity while an outstanding individual demonstrates the original solutions and approach towards the problems. On the other hand, it is a social activity in twofold sense. First, even the most original ideals arise in a social environment as in the background of these outstanding ideas. Any inventor or innovator is not alone both by being educated in one or another way and by working in a team. Second, the product of creativity appeals to certain social environment (market of consuming). We can call the innovation also as socialization of creativity. As a result, we face one more paradox as follows: every inventor or innovator tries to negate his (her) social environment that has educated and stimulated him (her). It could be called forth minor paradox (MP4).

As mentioned, the alternative between hard and soft management is paradoxical, too.

Actually, creativity needs enough autonomy and does not tolerate any hard control. However, if we have soft control we do not have any creativity, because of its ambivalent nature. It could be said both about individual and social creativity in a team. The history of art shows that almost all masterpieces of art emerge after an artist has the order to create it and certain control of a customer. And vice versa, creativity is impossible without certain freedom of activity and especially without freedom of thinking. The scholars (Oldham & Cummings, 1996; Zhou, 1998) stress job autonomy for experimenting and exploring alternative ideas. Sutton (2001) speaks about management of freedom and gives an example of free idea generation on Frydays at Coming's Sullivan Park R&D lab. As a result of this Fryday freedom, we have invented genomics-technology "that was officially killed by the head of research but was pursued in Fryday afternoon experiments." (Sutton, 2001, p. 100) A kind of hard control is the hierarchical control that presupposes the presence of an authority figure. Usually, it makes a negative impact on idea generation (Mullen, 1991). According to Shalley and Gilson (2004), the hierarchical organizational structures might discourage employees from taking creative approaches to their work. Lane and Lup (2015) call it "mimicria of autocratic government". If we remember Plato (1992) any autocracy or tyranny finally leads to a revolution, disorder and anarchy. We notice it in different contemporary regimes around the world. Usually, a development of the ideas in the frame of a scientific or artistic school is also a kind of safe but constricted activity in respect of novelty. We should always choose between obedience to our school and creative freedom that threatens the sanctions of this school. Not by accident, the most prominent artists have been either outside any school (such as V. van Gogh or M. K. Čiurlionis) or the fathers of them (such as Picasso or S. Dali). Nevertheless, it is already mentioned that the implementation of the creative ideas needs sometimes very hard decisions. This paradox of hard/soft management also follows from GP and could be called the fifth minor paradox (MP5).

Additionally, we face the paradox of negative feedback that is positively associated with creative managerial decisions (Ford & Gioia, 2000). In other words, the worse are the results the more creative are the decisions

in organization. To be more precise, such decisions should be because of the fact that the decisions of the managers have been influenced by many factors. Some of them (for example, the authoritative management) simply block creativity. However, even the deficit of creativity in management could be a challenge for changes both in micro-environment of organization and in ways of management. This paradox could be called sixth minor paradox (MP6).

The seventh minor paradox (MP7) deals with relationship between quantity and quality. On the one hand, we need quantity in order to develop creative quality. On the other hand, the quantity negates the quality. We can speak about this dialectics not only in respect of production, but also in respect of the employees and even of the managers. Should we manage the quantity or quality? For example, Sutton (2001) believes that namely quantity should be managed since quality stems from the latter.

The eighth minor paradox (MP8) is about relationship between knowledge and ignorance (naïveté). It seems that the knowledge is the base of any creativity. Sutton appeals to a company's knowledge in order to "see old problems in new ways" and to "break from the past" (2001, p. 96). However, the knowledge of past success does not allow any new approach towards the future. That is why we need not as much knowledge as naïveté or even ignorance in order to "see-and perhaps solve-problems from a new perspective" (Sutton, 2001, p. 99). In a broader context, Kuhn (1996) speaks about the scientific revolutions implemented either by the young scientists or by the scientist from other areas. In other cases, they are enough naive and ignorant, i.e. not ballasted by traditional scientific approach, to see the new ways. As a result, the companies need not only management of knowledge, but also management of ignorance and naïveté. Speaking about the opposition of wisdom and foolishness in organization, Izak (2013) appeals namely to MP8.

Last but not least, we have the paradox of time in creativity management. The scholars speak about the contrast between "the possible future ('what could be') and the present condition ('what is')" (Johnsen, 2015, p. 64), as well about yesterday's success that becomes the "today's chronic malady in organizations" (Johnsen, 2015, p. 62). That is why the scholars suggest a planning of any activity in an organization.

However, the planning leads to other paradox since creativity has usually been treated as unexpected and spontaneous activity. Nevertheless, the scholars discuss about the influence of such planning skills as penetration and forecasting on creative thought (Osburn & Mumford, 2006, p. 173). Additionally, the planning could be treated as a creative, i. e. inherently generative activity involving the mental simulation of future actions (Anzai, 1984; Mumford et al., 2002; Noice, 1991). According to Osburn and Mumford, "planning may contribute to creative thought through at least three mechanisms: (a) promoting idea refinement, (b) promoting opportunistic exploitation of emergent opportunities, and (c) stimulating the generation of new ideas and approaches in an attempt to overcome anticipated problems" (Osburn & Mumford, 2006, p. 174). Nevertheless, the paradox of time could be deepened by appealing to Heidegger (1996) who speaks about our being towards death. Rephrasing M. Heidegger, all that makes us creative is our possible future collapse. The managers should forget the past success of organization and think about future end of it. In other words, the future death of organization makes the employees alive within it. The paradox of time in management could be called the ninth minor paradox (MP9).

Table 5 shows the specification of all mentioned paradoxes. However, the paradoxes are intertwined with each other. In other words, they walk not alone. For example, Jung and Lee (2015) appeal to the past relationship conflict for the sake of creativity. This argument covers MP3 and MP9. The discussions about organizational ambidexterity and its ingredients such as discipline, stretch, support and trust (Gibson & Birkinshaw, 2004; Lane & Lup, 2015) appeal to MP4 and MP5. The argument of Sutton (2001) that the managers should hire the persuasive heretics in order to increase the creative conflicts within organization appeals to MP3 and MP8.

Conclusions

Management of creativity leads to the different paradoxes that could be classified into one grand and nine minor paradoxes. The grand paradox (GP) is about the contradiction between the principle of management and creativity in general. Usually, any management reduces creativity since it requires following the rules of an organization, i.e. to obey the work routine that is inconsistent with creativity. In the case of creativity stimulation, the managers risk to provoke the disobedience for their instructions including an instruction to develop creativity. The minor paradoxes follow from GP and cover

Tab. 4: The paradoxes of creativity management

Paradox	Description
GP	By stimulating creativity, the managers risk to provoke the disobedience for their instructions including an instruction to develop creativity
MP1	Successful period of an organization is an obstacle to develop the creative ideas
MP2	A radical implementation of creative ideas threatens the identity of organization
MP3	Creativity provokes the conflicts in organization
MP4	Every inventor or innovator tries to negate his (her) social environment that has educated and stimulated him (her)
MP5	Although hard management kills creativity, the latter needs sometimes very hard decisions
MP6	The worse the results are, the more creative the decisions in organization are
MP7	Organizations should manage both quantity and quality
MP8	Organization needs not only management of knowledge but also management of ignorance and naiveté
MP9	The managers should forget the past success of organization and think about future end of it

Source: own

the different aspects of mentioned contradiction including the dangers both of successful past and of identity, the creative conflicts, the social environment, the hard decisions, equilibrium between quantity and quality, ignorance and naiveté, as well as future end of organization. All this shows that creativity generates many additional problems instead of giving only a competitive advantage. As a result, we should refuse naive enthusiasm concerning management of creativity.

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Abstract

THE PARADOXES OF CREATIVITY MANAGEMENT**Tomas Kačerauskas**

Creativity is a very important aspect of market economy. Creativity is an ambivalent and contradictory phenomenon that covers both positive and negative aspects. As a result, management of creativity faces some paradoxes. The paper deals with 10 paradoxes of creativity management including one grand paradox (GP) and nine minor paradoxes (MP). By stimulating creativity, the managers risk to provoke the disobedience for their instructions including an instruction to develop creativity (GP). Successful period of an organization is an obstacle to develop the creative ideas (MP1). A radical implementation of creative ideas threatens the identity of organization (MP2). Creativity provokes the conflicts in organization (MP3). Every inventor or innovator tries to negate his (her) social environment that has educated and stimulated him (her) (MP4). Although hard management kills creativity, the latter needs sometimes very hard decisions (MP5). The worse the results are, the more creative the decisions in organization are (MP6). Organizations should manage both quantity and quality (MP7). Organization needs not only management of knowledge but also management of ignorance and naiveté (MP8). The managers should forget the past success of organization and think about future end of it (MP9). The main aim of this paper is to describe these paradoxes. Another aim is to present the different approaches towards creativity management. Finally, the paper seeks to dethrone a naive attitude that creativity in economy solves all possible problems. The biggest challenge to the management is the very creativity.

Key Words: Creativity management, paradoxes, conflict, organization, creative economy.

JEL Classification: B5, J5, L2, M1.

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PERFORMANCE MANAGEMENT SYSTEMS IN CZECH COMPANIES: FINDINGS FROM A QUESTIONNAIRE SURVEY

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Introduction

Increasing globalization and technological revolution represent the primary challenges for maintaining competitiveness in today's business environment. Concerning these challenges, businesses must create a long-term vision and formulate new strategies to allow managers to manage short-term performance in accordance with long-term needs. Therefore, measuring and managing performance is being increasingly emphasized. There are a growing number of companies that have realized that improving performance and increasing competitiveness can be achieved by developing effective performance measurement and management. However, increasing the implementation of performance measurement systems in companies is linked to many problems in need of answering.

Over the last 20 years, we have witnessed a revolution in the approach to measuring performance. In the context of a deeper understanding of this problematic, researchers and managers pose the question, "How can we best use the findings acquired by measuring performance for their management?" In relation to this, Maskel (1991) emphasizes changing the basis of performance measurement. The measures should be seen as part of fast feedback management systems and, at the same time, should be designed to stimulate continual improvement, rather than to merely monitor strategic operations. From this, it can be seen that identifying a relevant group of performance measures is only one aspect of performance management. If we accept this statement, it is possible to see a performance management system as Atkinson (2012) does, as a tool for interconnecting, improving and learning.

Shortcomings in current performance measurement, as shown by the research of

Stivers et al. (1998), are closely dependent on this. The first of these is that measures focused on innovation and employee engagement are not perceived to be as important as the measures of customer satisfaction and market share. The second is that managers realize the advantages and importance of using non-financial measures, although, naturally, a large number of companies still do not use these when measuring. The third shortcoming is that, though many companies acquire enough important information by measuring, managers do not use this information in the planning process. If we concede that intellectual capital is becoming the foundation for creating competitive advantage, it is necessary that the measures concerning innovation and employee engagement be a key part of the system. Unfortunately, more than fifteen years later, current research shows that these measures are still rarely used in current business practice (Stříteská & Jelínková, 2015). Still, it is possible to state that many businesses put distinct effort into implementing measures that reflect all aspects of their performance. However, the focus is mainly on what should be measured today rather than what should be measured in the future (Kennerley & Neely, 2003).

Effective performance management systems should also be based on system dynamics, sustainability and a simulated view of performance (Yadav et al., 2013). The concept of dynamics emphasizes that it is necessary to create a system that constantly monitors internal and external environments and consequently establishes and evaluates goals and priorities (Bititci & Turner, 2002). The system's sustainability should be determined on the basis of stimulating continuous improvement of the measures and, subsequently, the performance management system processes. The dynamics of a performance management system can

be ensured using tools or techniques such as cognitive maps, cause and effect diagrams, etc. (Yadav et al., 2013).

It is possible to see these features and shortcomings as future challenges for performance measurement and management – ones that require solutions. Research, however, always focuses more on performance measurement than on managing performance in a wider context (Neely, 2005). Kennerley and Neely (2003) state that few businesses have a set systematic process for managing the development of their performance measurement systems in a way that reflects organizational context. Furthermore, only few researchers have been dealing with the question, “What factors influence the development of a company's performance management system?”

Therefore, the main aim of this paper is to investigate the level of development of current performance management systems in Czech companies. The level of development is determined by fulfilment of the characteristics of an effective performance management system based on literature review. Attention is also paid to determination whether the level of a performance management system's development is dependent on company size.

1. Literature Review

According to Melnyk et al. (2014), the issue of performance measurement and management is composed of two elements: a performance measurement system and a performance management system. The performance measurement system encompasses the process (or processes) of establishing goals (developing a set of measures) and collecting, analyzing and interpreting data concerning performance. Even though measuring performance is important, it is not sufficient for managing a company on its own. Here, there is a complementary need for a performance management system that includes a process (or processes) for evaluating the differences between actual and desired results, identifying which of these differences are critical, understanding the origin of shortcomings and implementing correctional steps.

The performance measurement system thus becomes the core of the overall performance management system, supporting its philosophy and having fundamental significance for its effective and efficient operation (Lebas, 1995;

Bititci et al., 1997). Two basic functions are accomplished when managing a company's performance:

- facilitating communication between all the organizational units included in the process of target values,
- facilitating the collection, processing and provision of information concerning the performance of people, processes, products, services, activities, business units, etc.

An effectively functioning performance management and measurement system must meet a number of conditions. There are a number of authors in the literature that list these factors (Ghalayini & Noble, 1996; Kennerley & Neely, 2002; Bititci & Turner, 2002, 2006; Ittner et al., 2003; Nita, 2008; Gomes et al., 2011). Using these authors' studies, it is possible to create the following summary of the characteristics they collectively recognize. The system must:

- ensure that there is a relationship between strategies, business activities and measurement of the results,
- provide a balanced view of performance and measure organizational abilities and the learning process,
- reflect non-financial aspects on the basis of the key factors for success; measures must be multidimensional, i.e., they must differentiate between measures focused on control and improvement,
- support an understanding of the causal relationships between measures,
- have measures that are incorporated across all hierarchical levels,
- be linked to a reward system,
- be dynamic and change in reaction to changes in the internal and external environment as well as in strategy.

Furthermore, the following aspects are also listed for what the performance measurement and management system must do:

- it must reflect the requirements of all stakeholders,
- it should stimulate a continual process of improvement,
- it must be understandable, clearly defined and viable.

The performance measurement and management system constitutes one integrated system, i.e., a system that must react in a timely way to changes in the exterior environment, strategy, organizational structure and company

culture. In this context, it is necessary to realize that company strategy, structure and corporate culture determine how this integrated system reacts to these changes. Therefore, it is necessary to focus on the factors that can facilitate but simultaneously impede effective management of the development of the company's performance measurement system. These factors are pinpointed in a study conducted by Kennerley & Neely (2003); the study was based on the analysis of seven case studies of businesses with at least one year's experience using a performance measurement system. The main key factors influencing the development of these systems were identified on the basis of interviews with managers:

- Corporate culture – the existence of a culture that ensures that performance measurement is not perceived negatively.
- People – access to the required knowledge and skills and their use, the ability to reflect company and employee needs, meeting requirements and implementing steps.
- Process – the existence of a process, its establishment, its review and the implementation of measures.
- Systems – the availability of flexible systems to facilitate collecting, analyzing and reporting the necessary data.

The same four key factors for successfully developing and implementing performance measurement and management systems are also identified by Atkinson (2012). Along with each group of these factors, he also lists concrete proposals for their development or reinforcement.

2. Questionnaire Methodology

First, it was necessary to establish research questions in order to achieve the main goal. The research questions concerned three basic areas:

1. Do current performance management systems correspond to the characteristics of effective measurement and management?
2. Do companies effectively manage the key factors influencing the development of the performance measurement system?
3. Is there an association between the level of development of an effective performance measurement and management system and company size?

Defined in this way, the research questions were developed into the form of a questionnaire.

The method of an electronic questionnaire was selected for acquiring data (Punch, 2008). The basic sample was comprised of enterprises from the five most competitive sectors in the Czech Republic; these were identified on the basis of the Czech TOP 100 list of companies for 2014 (see Fig. 1). For achieving the survey goals, two more criteria were set for selecting companies from the sectors listed above: 1) all companies actively conducting business in the Czech Republic with a turnover of CZK 30 million or more and 2) companies having over 50 employees. Namely, medium-sized and large companies were selected, because it can be assumed that they have a developed performance measurement system. Having been defined in this way, the basic sample was identified using the Magnus Web database. In the end, the basic sample included a total of 1,295 enterprises.

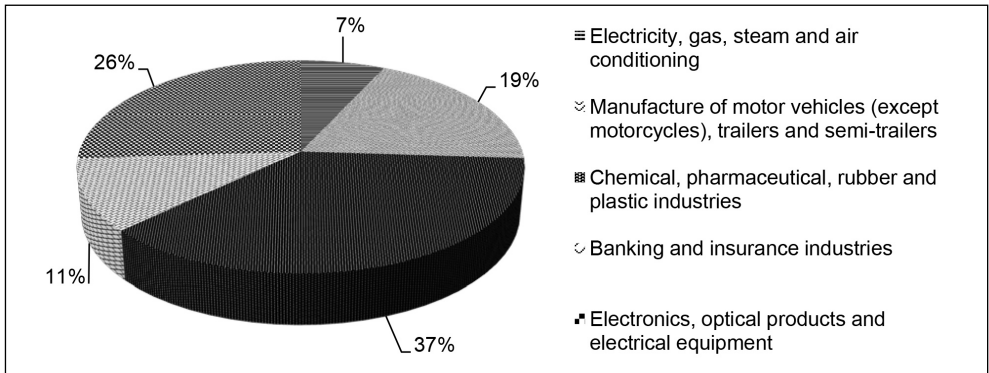
However, 51 questionnaires were not delivered to the respondents. The overall rate of return for questionnaires was 10.1%, i.e., 126 companies. Formulas listed in Čermák (1980) were used to calculate sample size from the basic sample and the subsequent rate of return.

It is possible to describe the sample of companies that participated in the questionnaire using turnover, number of employees and type of ownership. The companies can be divided into two groups by turnover; 52% fall into the group of CZK 30-199.99 million, and 48% have a turnover of CZK 200 million or more. The companies were divided into the following groups by number of employees: medium-sized enterprises with 50-250 employees (50%), medium-sized to large companies with 251-500 employees (15%) and those with 501 or more employees (35%). According to type of ownership, the sample of businesses is comprised of companies with domestic ownership (53%), companies partially or completely owned by international entities (46%) and state-owned enterprises (1%). Regarding the fact that the questionnaire was filled in anonymously, it is not possible to describe the respondents by sector.

3. Statistical Methods

Statistical software STATISTICA was used to calculate the statistics listed below. Pearson's χ^2 -test of independence was used to test the hypotheses concerning the random variable's independence. The testing criterion takes the form (Pacáková et al., 2009):

Fig. 1: The number of surveyed enterprises



Source: own

$$\chi^2 = \sum_{j=1}^s \sum_{i=1}^r \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \quad (1)$$

where

r and s are the numbers of permutations of the investigated categorical random variables, O_{ij} are the observed frequencies and E_{ij} denotes the theoretical frequencies.

The null hypothesis concerning independence of random variables is rejected if, for the given level of significance α , it is true that:

$$\chi^2 > \chi_{1-\alpha}^2((r-1) \cdot (s-1)), \quad (2)$$

where $\chi_{1-\alpha}^2((r-1) \cdot (s-1))$ denotes $(1 - \alpha)$ -quantile of χ^2 -probability distribution with $(r-1) \cdot (s-1)$ degrees of freedom. In that case, the p -value, which is provided by most of statistical software (including STATISTICA), is less than the level of significance α .

For the assessment of the level of demonstrated dependence (association), Cramer's coefficient V was used, which is given by the term

$$V = \sqrt{\frac{\chi^2}{n \cdot h}}, \quad (3)$$

where n is the overall number of units included in the sample and h is the minimum of the numbers $(r-1)$ and $(s-1)$.

4. Evaluation and Discussion

First, attention was given to how long the performance measurement system has been implemented within the companies. The reason is that analysis of the level of the performance management system's development is better to perform in companies that have been focusing on this problematic over the long term. This prerequisite was met, because 60% of the companies have a performance measurement system implemented for longer than 5 years, 20% for three to five years and 10% for one to three years. Only 10% of the companies have a performance measurement system implemented for less than one year. Of the overall number of respondents, 21 did not respond to this question.

The components comprising this system were determined for the companies being investigated in order to map the development of the current performance measurement systems. Otley (1999) considers a performance measurement system's main components to be goals, strategies, target values, reward systems and information flows (feedback and feed-forward). Using the literature review, it is possible to define these components in more detail: establishing a mission statement, vision, strategic objectives, performance measures and their target values; defining links between performance measures; cascading goals and measures down to the level of the individual; interconnection with the remuneration policy

and strategy revision. Sixteen respondents did not reply to this question. Most of the companies have already defined the basic components used to develop strategic management, i.e., mission statement (55%), vision (66%), and strategic objectives (87%). A large number of companies (80%) have also defined performance measures and targets, which wish to achieve in the future. The research of Knápková et al. (2011) conducted in Czech companies found that, on average, 73% of companies base their performance measurements on their company strategies and objectives. Findings of our survey confirmed that there is constantly growing trend and that meeting with medium or large company in the practice who's PMS is not connected with strategy is a rarity.

Less than half (45%) of the companies have cascaded strategic objectives and measures down to the individual level. An interesting finding is that 54% of the respondents stated that their performance measurement system is linked to their remuneration policy. This result is likely influenced by the fact that, for some respondents, a link to remuneration policy exists, though only at the strategic level, i.e., for top or middle management. Therefore, these respondents do not need to have strategic objectives cascaded down to the lowest hierarchical level. The performance measurement system components that the companies listed least frequently are defining logical relationships between performance measures (only 23%) and strategy revision on the basis of performance measurement results (30%).

The comprehensive performance measurement system defined by the authors contained nine components. The findings show that only 9% of the companies have a management process that is composed of all nine components, and 15% of the companies used 8 or 7 components. On the other hand, 22% of the companies have a management process comprised of less than four effective components. For most of the companies (42%), their performance measurement system is composed of four or five components; 12% of the companies include six components.

The component analysis was subsequently used to divide the companies according to whether they met the seven basic characteristics of an effective performance measurement and

management system. These characteristics were defined as follows on the basis of literature review. The performance measurement and management system must:

- have strategic objectives and measures derived from the mission statement or vision,
- be established as a tool for implementing strategy,
- set the targets of performance measures for what should be achieved during the projected period,
- support an understanding of causal relationships between measures,
- have performance measures integrated across the entire hierarchy and all functions,
- be linked to the reward system,
- change dynamically with the strategy and with changes in the internal and external environment.

Companies whose performance measurement and management system has 1-2 characteristics were classified as companies with a low level of development, companies with 3-5 characteristics were companies with an intermediate level of development and companies with 6-7 characteristics indicated a highly developed effective system. On the basis of this analysis, it is possible to state that 47% of the companies show a low level of development, 33% and intermediate level of development and 20% of the companies a high level of development for their performance management system.

Two of the characteristics listed above were investigated in more detail in the survey because they are problematic to implement in practice (Střítěská & Jelínková, 2015). The first of these is the understanding of the causal relationships between objectives or measures. Therefore, it was determined how companies investigate the logical relationships between the performance measures that were used. In the previous question concerning the performance measurement system's components, it was determined that only 23% of the companies actually specify logical relationships. Of these companies, 68% define the relationships using strategic maps, and 32% describe them as part of each measure. Relating to this point, however, it is necessary to emphasize that 77% of the companies do not define logical relationships between objectives or measures. Sixteen respondents did not answer this question. It is

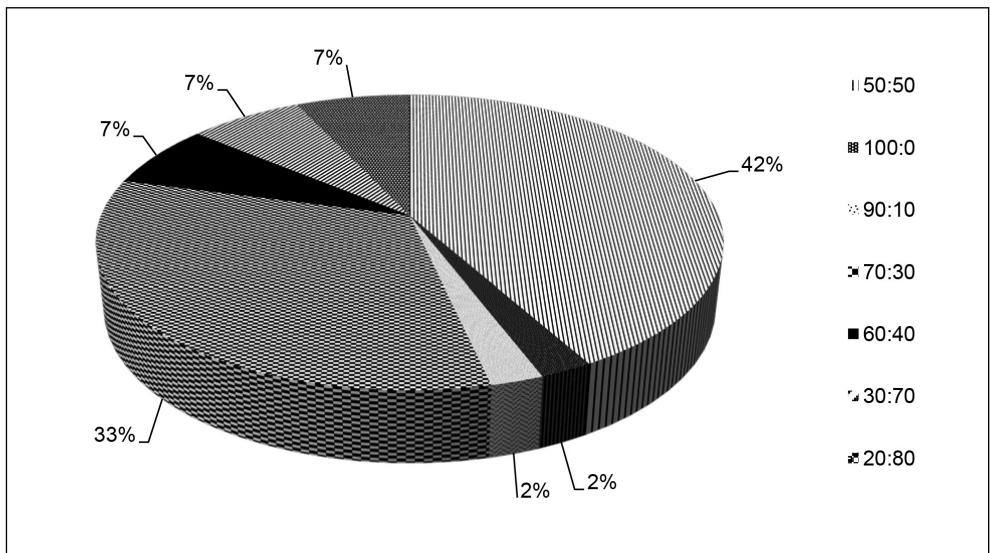
truly surprising that such a high percentage of companies are not at all concerned with logical relationships, because research on causal modeling indicates that strategic maps can greatly simplify and facilitate communication within comprehensive systems (Fiol & Huff, 1992; Forza & Salvador, 2000; Vera-Muñoz, Shackell & Buehmer, 2007; Střiteská & Jelínková, 2015). According to recent research studies, it is necessary to increase the use of strategic maps, mapping tools, better representation of the system's causal structure (Barnabe, 2011) and diagramming tools such as causal loop diagrams and stock and flow diagrams when developing the performance measurement system (Yadav et al., 2012).

The British authors Bititci et al. (2002) state that one significant characteristic of an effective performance measurement and management system is to differentiate between control measures and improvement measures. However, this still proves to be problematic, because KPI are mostly lagging measures that reflect past performance. Furthermore, forward-looking measures are often not integrated, nor do they sufficiently reflect the "soft" issues that determine future performance (Robinson et. al, 2005). On the basis of identifying this

measurement gap, attention was given to the use of measures focused on control and improvement. For 62% of the companies, the performance measurement and management system contains both types of measures; 38% contain none. Unfortunately, this question was the one that the greatest number of respondents did not answer, i.e., 35. Subsequently, the proportion at which these measures were used was determined. The following results are derived from the answers of the respondents who were able to specify this proportion (Fig. 2). Of the companies, 42% use both measures categories at the same proportion; however, 44% of the companies still prefer result-oriented measures to improvement-oriented ones. Only 14% of the companies indicate the reverse and prefer to emphasize improvement measures.

The following question also concerned this problematic; specifically, it dealt with the importance of improvement-oriented measures. The question was whether the respondents perceived measures concerning innovation and employee engagement to have the same importance as, for example, measures concerning market position and the customer. Unfortunately, more than half, 57%, of the companies prioritize the market and

Fig. 2: Proportion of Measures in Performance Measurement System



Source: own

the customer above innovation and employee engagement, i.e., typical improvement-oriented measures. 43% have the opposite perception of these measures and 68% from them listed specific examples of measures that are monitored in the company. The measures concerning innovation were primarily the number of innovations, the percentage of revenues from innovations, the effectiveness of using innovations and kaizen and quality circles. For employee engagement, the respondents most frequently listed the number of suggestions for improvement, the number of suggestions implemented and innovation competitions. This question was not answered by 18 respondents. The survey of Stivers et al. (1998) conducted in U.S. Fortune 500 and Canadian Post 300 companies revealed that customer service factors are perceived to be the most important measures by executives and factors in the innovation and employee involvement categories were perceived to be less important in goal setting. Almost twenty years later, the results of our survey are similar, despite the fact that intellectual capital and innovation are the foundation for maintaining competitive advantage.

The next set of questions was focused on factors influencing effective management of the performance measurement system. First, attention was given to corporate culture oriented on performance, improvement and learning. In a number of other studies, it was demonstrated that this factor plays the most significant role in implementing a performance management system (Střiteská & Sadská, 2015). The greatest number of respondents stated that this type of corporate culture is created by the ability to learn from mistakes and adapt to a changing environment (79%), 43% of companies use information acquired by performance measurement for reacting quickly and revising strategy and processes, 42% use visible commitment and support from top management and 32% use consistent communication and demonstration of the performance measurement and management system. From these results, it can be seen that communication is still an undervalued aspect when creating a performance-oriented culture; therefore, we frequently witness failure to implement a performance measurement and management system. Atkinson (2012) states that communication, concerning progress and

benefits, is one of the most important means to successful implementation. To summarize we can state that only 13% of the respondents check all four aspects of performance-oriented company culture. However, 42% of the respondents utilize only one of the aspects of performance-oriented culture that were mentioned. Of the respondents, 31% utilize two of the aspects mentioned, and 14% utilize three. This question was not answered by 15 respondents.

Another factor that also closely relates to performance-oriented company culture is people. Primarily, this means whether employees have the competence to change how the performance measurement system is configured and, if the answer is yes, whether they have access to suitable tools. Of the companies, 69% stated that they are able to change the performance measurement system; 31% do not have this competence. Of those that have the authority to change the system, 79% have suitable tools. This fact is very positive and relates to the previous factor of performance-oriented company culture because the ability to learn from mistakes and adapt to a changing environment is the thing that most frequently creates such a culture for the companies investigated. However, it is also necessary to further research the question of whether employees have the necessary knowledge and skills to enact such change.

The third factor that was investigated is the existence and quality of the process for reviewing, modifying and implementing performance measures. Unfortunately, 60% of the respondents were unable to answer this question. Still, it is possible to conclude from this that engaging this factor is distinctly problematic in practice. Of the respondents, 40% tried to characterize the process of reviewing performance measures, but only 5% were able to describe the individual steps of this process clearly. The other respondents described this process very briefly or incompletely; it is not possible to consider them to be companies that manage this process effectively. The respondents review the measures once a year at most.

The last factor dealt with in the questionnaire is the existence of information systems used for collecting, analyzing and reporting the acquired data. As stated Myšková (2011) implementation of information system in a company is

a result of major decision-making of company management, because it projects to a number of corporate activities. Even in decision-making phase there are a number of alternatives; this problem includes economic and technical viewpoints. Synergy effect can be reached only if requirements in both areas are fulfilled optimally. The primary factor evaluated was flexibility, i.e., the thing that makes it possible to easily alter these activities. Of the respondents, 87% consider the information systems used in their companies to be flexible; only 13% do not. Those who consider them to be inflexible do not consider the overall performance measurement system to be flexible, because it is managed centrally and is a global tool that does not allow for adapting evaluation to a specific location. This question was not answered by 19 respondents.

The questions listed above that concerned the key factors influencing an effective performance measurement and management system were also evaluated collectively, i.e., the overall number of factors utilized by the companies. This analysis excluded the 19 respondents who did not answer all the questions. In conclusion, it was determined that only 12% of the companies manage all

four factors, and 25% manage three factors. Thus, this included only a little over a third of the companies. The greatest number of respondents utilizes two factors (32%) or only one factor (31%).

The last research question was focused on investigating the variables influencing the level of development of an effective performance measurement and management system. Because the problem is wide-reaching, only one variable, company size, will be dealt with here. Knápková, Homolka and Pavelková (2014) in research conducted in Czech companies dealing with the fact that the use of Balanced Scorecard concept depends on the company size. The results demonstrated this dependency. Based on this finding, we decided to deepen the research in this area and further examine whether the level of development of an effective performance management system linked to the company size.

The first step is to establish the null and the alternative hypothesis to be tested.

H_0 : The level of development of an effective performance measurement and management system is not dependent on company size.

Tab. 1: The observed frequencies O_{ij}

Size of a company	Level of development of e. p. m. s.			
	Low level	Intermediate level	High level	Total
Medium-sized	38	14	3	55
Medium-sized to large	7	7	3	17
Large	7	15	16	38
Total	52	36	22	110

Source: own

Tab. 2: The expected frequencies E_{ij}

Size of a company	Level of development of e. p. m. s.			
	Low level	Intermediate level	High level	Total
Medium-sized	26.000	18.000	11.000	55
Medium-sized to large	8.036	5.564	3.400	17
Large	17.964	12.436	7.600	38
Total	52	36	22	110

Source: own

H_A: The level of development of an effective performance measurement and management system is dependent on company size.

For testing this hypothesis the companies were divided on the basis of two criteria: the level of development of an effective performance measurement and management system (low, intermediate and high) and company size (medium, medium to large, large), see Tab. 1.

For impendence testing was used above mentioned Pearson's χ^2 -test of independence. That is why expected frequencies were calculated (Tab. 2).

The value of the tested criteria for Pearson's χ^2 -test is, in this case, $\chi^2 = 29.301$ and the corresponding p -value essentially equals zero, which unequivocally proves the rejection of the null hypothesis H_0 in favor of the alternative H_A . We can thus state that the level of development of an effective performance management system is dependent on company size.

Cramér's coefficient V is equal to 0.365, which indicates moderate dependence (association).

Conclusion

The basis for managing performance has changed in recent years. It is necessary to see performance management as a systematic process that has a performance measurement system reflecting the wider organizational context at its core. In order for performance management to work effectively in a company, the literature states that a number of characteristics must be met. On the basis of meeting these characteristics we divided the companies examined into three categories. The findings show that 47% of the companies have a low level of development, 33% and intermediate level of development and 20% of the companies a high level of development for their performance management system. The reason is that use of certain of these characteristics proves to be very problematic in practice.

Firstly, the current performance measurement systems at the companies do not contain the components of logical relationships between performance measures and strategy revision. Thus, they do not meet the characteristics of an effective performance management system, because they do not support an understanding of

causal relationships, and they do not change dynamically with the strategy. Two other components that also remain problematic are hierarchical and cross-functional linkages of objectives and performance measures and taking into account motivational aspects.

Secondly, the use of leading measures to facilitate a more proactive performance management style is still not evenhanded. Almost 60% of the companies still prioritize measures relating to the market and customers above innovations and employee engagement, which are considered typical improvement-oriented measures. It is thus necessary to strongly reinforce the role of measures relating to leadership, employee education, innovation, skills, knowledge and personal development in the current performance measurement systems.

Thirdly, the research conducted here revealed that only 12% of the companies manage all four factors that facilitate or impede the successful development of a performance management system and are closely linked to its effectiveness. The essentially non-utilized factor is the existence and quality of the process for reviewing, modifying and implementing performance measures within the performance measurement system. Only 5% of the companies, which is a truly negligible percentage, were able to clearly define the individual steps of this process. The question is whether this result could have been influenced by the position held by the respondents answering the questionnaire and their knowledge of the problematic. Seeing that the questionnaire was sent to individual department managers or general directors, it is possible to presume instead that this process is, in fact, not clearly established in the company.

Another interesting finding is that it is still difficult for companies to manage the factor of performance-oriented company culture. Mainly consistent communication and demonstration of the performance measuring system's benefits is the most undervalued aspect of utilizing this factor. Seeing that utilizing the factors of company culture and process is problematic for most of the companies, their systems are thus unable to change dynamically along with strategy. On the other hand, the fact that the other two factors – people and systems – are largely engaged by the companies can be considered a positive finding.

In conclusion, the hypothesis that the level of development of an effective performance measurement and management system is not dependent on company size was also tested. On the basis of the statistical calculations that were conducted, this hypothesis was rejected, and it is possible to state that the level of development of an effective performance management system is dependent on company size.

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Abstract

PERFORMANCE MANAGEMENT SYSTEMS IN CZECH COMPANIES: FINDINGS FROM A QUESTIONNAIRE SURVEY**Michaela Střiteská, David Zapletal, Lucie Jelínková**

Measuring and managing performance is an integral part of contemporary management systems, which are focused on achieving outstanding business results. This is based on a systematic, comprehensive review of a company's activities and results with the goal of identifying weaknesses and opportunities for improvement.

Therefore, it is put more emphasis on the development of an effective performance measurement and management system as a tool for enhancing business competitiveness. Given the importance and urgency of this issue the revolutionary developments in this area can be observed over the last 20 years. Researchers and managers are constantly trying to understand all the variables affecting the performance of the company. They are looking for an answer to the question of how best to use the lessons learned from performance measurement to its management. They design and develop various concepts, frameworks and methods for measuring and managing performance in the current business practice. They are constantly trying to eliminate the drawbacks of contemporary systems in order to increase their effectiveness. Cognition of these systems, their characteristics and identification of weaknesses can be seen as challenges for performance measurement and management in the future, for which solutions must be found.

Therefore, the primary goal of this paper is to investigate the level of development of current performance management systems in Czech companies. The level of development is determined by fulfilment of the characteristics of an effective performance management system based on literature review. Attention is also paid to determination whether the level of a performance management system's development is dependent on company size. The method of an electronic questionnaire was selected for acquiring data.

Key Words: Performance, measurement, management, system.

JEL Classification: M14, M21, M29.

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SIGNIFICANCE OF STRATEGIC PLANNING FOR RESULTS OF SPORT ORGANIZATION

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Introduction

In the present day dynamic and competitive environment, organizations are constantly facing the issue of a suitable strategy so that they would timely choose the best business model and would avoid strategy collapse (Hambrick & Frederickso, 2005; Vargo & Seville, 2011). In today's world of business and services competition is very high, therefore, in order to function effectively and profitably organizations have to find ways that would enable them to achieve their goals and to compete in the market successfully. When choosing the most appropriate strategy, one of the most important steps is the application of planning activities. Melnikas and Smaliukiene (2007), as well as Schaap (2012) maintain that ability to prepare and implement effective development strategies is becoming the essential factor of organization success allowing expansion and exploitation of strategic advantages and creation of innovative decisions.

Executives of sport organizations can compete in the market more successfully and achieve better activity results in a shorter time period with fewer expenses when the process of organization management includes application of strategic planning activities: determination of vision and mission, creation of specific and real goals, constant environmental analysis, consideration of strengths and weaknesses of the organization, formation of concrete activity strategies and detailed plans for their realization, permanent control and evaluation of the implementation process, as well as revision of strategies.

Probably there is no organization that would not apply strategic planning activities in the management process at least partially. Some organizations are successful in the implementation of the strategy, while others are not. Small and medium businesses without professional management have distinctive characteristics –

specific barriers for strategic planning activities are lack of time and experience, insufficient knowledge of about activities of strategic planning, unwillingness to share strategic plans and ideas with employees and with the others, indefinite environment, the size of business, type of industry, internal barriers for implementation, cycles of business lifetime and the level of development (Vasiliauskas, 2004; Volovikov, 2011). Despite the strategic activity barriers small and medium business without an appropriately chosen strategy is vulnerable as it does not accumulate the necessary resources and does not ensure application of competitive advantages (Abdalkrim, 2013; Adamoniene & Andriuscenka, 2007; Demmings, 2008; Eden & Ackermann, 2013; Ibrahim et al., 2004, Yusuf & Saffu, 2005; Schriefer, 2005; Streimikiene & Kiausiene, 2012; Svagzdiene et al., 2015; Wittmann & Reuter, 2013; Vveinhardt et al., 2015; 2016). Most often sport organizations employ relatively small staff and the executive has to care not only of the organization strategy, therefore there is lack of strategic activity motivation and the mentioned barriers of strategic activity emerge. Finally, the implementation of strategic planning activities is insufficient.

A problem question: What strategic planning activities are applied by a sport organization and what is the significance of this application for the results?

The aim of the article – to evaluate the significance of strategic planning activities for the results of a sport organization.

To achieve the aim, the following objectives were raised:

1. To distinguish the significance of strategic planning activities for the results of an organization in the theoretical dimension.
2. To analyze and evaluate the application of strategic planning activities in Kaunas sport and leisure clubs.

The object of the article – application of strategic planning activities.

Methods employed – analysis of scientific literature, questionnaire and statistical analysis.

1. The Significance of Strategic Planning Activities for an Organization: the Theoretical Aspect

There exist numerous definitions for: strategy, strategic management and planning that are interrelated. Boar (1995) interpreted strategy as a manager's ability to employ prognostication and management skills in combination in order to achieve highest success. Porter (1996) maintains that a strategy is development and application of valuable strategic positions. In his opinion, creation of strategic positions and their application arise from several sources: 1) variety, 2) needs, 3) access. Beaver (2000) stated that strategy is an extremely difficult, complex and subtle management discipline as it includes risk and uncertainty. It also has to be able to prognosticate future.

Thompson, Strickland and Gamble (2007) define strategy as the action plan of a company management. The authors maintain that a strategy is composed of: 1) occupation of a position in the market, 2) execution of daily operations, 3) attracting of clients and satisfaction of their needs, 4) successful competition in the market, 5) achievement of organization goals ensuring the input of every component into the performance of tasks-operations and their control.

According to Abdalkrim (2013), strategic planning is a complex process involving patience and strong efforts of a team and giving life to the vision and mission when striving for the desired goals and objectives of an organization by facilitating the effective process of decision making, as well as everyday activities. Strategic planning offers the overall picture of what you are doing and where you are going.

Stewart (2002) maintains that strategic planning activities are a source of information, influencing success or failure of organization executives who apply strategies. There is no single definition of strategic planning activities. Different organizations are using diverse strategic planning activities; therefore they are difficult to define (Demmings, 2008).

The following are three strategic planning activities according to Forouzandel (2005):

1. The review of the main strategic principles of an organization;
2. Comparison of expected and actual results;
3. Implementation of correction activities to ensure the accuracy of activities according to the plan.

A slightly more detailed list of strategic planning activities is comprised by Abdalkrim (2013):

1. An independent variable;
2. The definition of a mission;
3. External and internal analysis;
4. Strategy implementation;
5. Strategy control and evaluation.

The Richardson model (Stewart, 2002) is the most comprehensive and including even more activities; it covers eight levels of strategic planning:

1. the mission of an organization,
2. the objectives of an organization,
3. the external analysis of an organization,
4. the internal analysis of an organization,
5. the creation of alternative strategies,
6. the choice of organization strategy,
7. the implementation of organization strategy,
8. control.

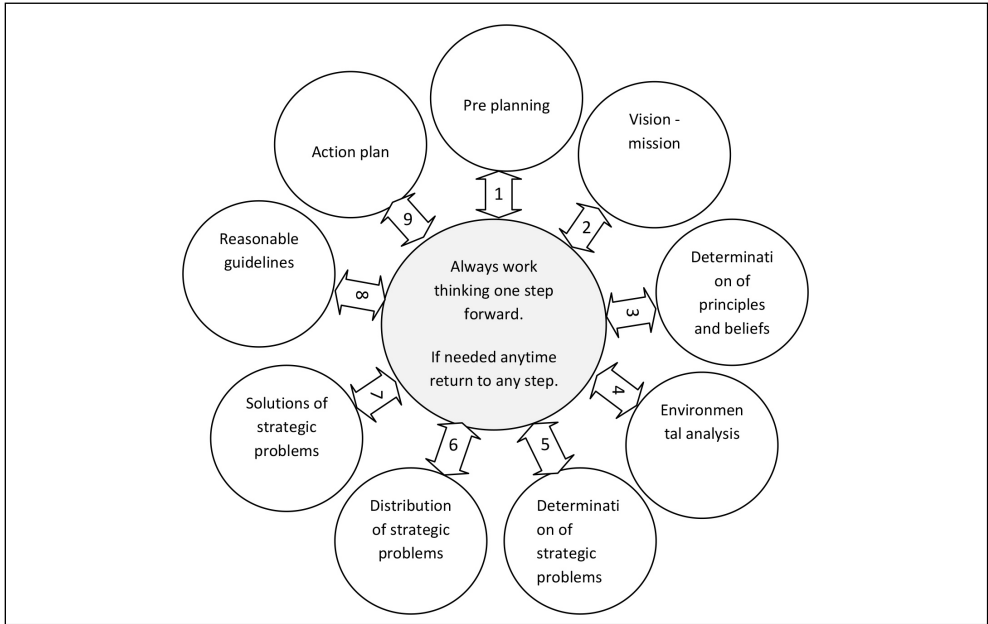
The advantage of this model in comparison with Abdalkrim (2013) and Forouzandel (2005) lies in the fact that later Richardson's model identifies four outlines of growth (Stewart, 2002): a) sales/income, b) base of customers/clients, c) new organizational premises/activity bases, d) employees; therefore it suits perfectly for evaluation of strategic results.

Stewart (2002), having employed Richardson's strategic planning model and the adjusted strategic planning questionnaire, surveyed 100 small companies (up to 500 employees) in the US and determined that official business planning methods had influence on the organization success.

Espinosa (2009) improved Hambricht and Diamantes eight step strategic planning model by adding the ninth step – action plan (Fig. 1).

This model, unlike the previous ones, is presented in steps that permanently move in a circle (pre planning, formulation of vision-mission, determination of main principles and beliefs, environmental analysis, determination of strategic problems, distribution of strategic problems according to priorities, solutions of strategic problems according to priorities, reasonable guidelines for solution implementation, action plan) and are constantly

Fig. 1: The nine step strategic planning model according to Hambright and Diamantes



Source: own based on Espinosa (2009)

observed and corrected. Thus the efficiency of the model is ensured. The drawback of the model is that some steps are too small and strongly connected, e.g. determination and distribution of strategic problems, and, therefore, could be transformed into ones of larger scale. In addition, planning activities in this model are not related with results and their control. The activity of the implemented strategy evaluation could be added.

Finally, a strategy is the ability to discover and invent (Pugh & Bourgeois, 2011). During activities of strategic planning employees of organization are continually learning and gathering knowledge about industry, realized strategies, their abilities, and economical situation. These activities of strategic planning should be able to improve the competitive situation and success of a company.

The previously discussed activities in principle disclose the process of strategic planning. Still it has to be noted that it would be impossible to identify the type of strategy applied by the company according to the performed activities. In this respect business strategy

typologies used by Parnell (2003), Miles and Snow (1978) would be more appropriate. Each strategy type defines the relationship between the organization expenses and the scope of activities depending on the leadership direction. Strategy types and respective explanations can be distinguished:

1. Defender strategy. Companies which supported the defender strategy did not introduce innovations and followed the strategy of cost reduction.
2. Innovator / researcher strategy. Companies supporting this strategy followed the more risky strategy type that would increase profit by employing different opportunities stimulating the growth of income.
3. Analyzer strategy. Companies which supported this strategy based their activity on the analysis of mistakes and developed further action accordingly.
4. Reactor strategy. Companies following this strategy made changes only when alterations in the environment were too significant to continue the development of activity in the same mode.

The differences of these strategic management peculiarities give an opportunity to evaluate the significance of the strategy for the results of an organization. Different researchers signify various aspects of strategic planning activity significance for an organization and its results. Damaskiene (2002), Abdalkrim (2013) maintain that the formation of strategic planning is decided by a number of factors and the way of the organization success in attaining positive business results and endless development opportunities is grounded by constant strategy improvement (Rieker, 2004).

Strategic planning is considered to be the most important component of business success, reflecting the abilities of executives to create vision maintain adaptability and prognosticate the future in the unstable business environment (Demmings, 2008). According to Arimaviciute (2004; 2005), strategic planning also helps to create a rational management system based on the principles of balanced development.

The research shows that the attention of leaders to the implementation of strategic decisions decides profit growth and increases customer satisfaction. When combined with innovations such strategic decisions influence the competitive superiority of an organization (Schriefer, 2005). According to Natzel (2010), implementation of innovations would enable a successful application of a mixed strategic model, oriented towards a conscious decision of executives to connect differentiation price and expenditure control.

The choice and application of strategic planning activity tools can increase the opportunities for small and medium business survival in the competitive business environment and contribute to its growth. Though leaders of small and medium business are striving for success and development, without strategy and tactics they remain vulnerable in connection to the necessary resources and productivity (Demmings, 2008). The environment influences organizations and they change and choose the environment by using organizational strategy in decision making (Scott, 2003). Yusuf & Saffu (2005) determined that, in comparison with other companies, activity results of small and medium companies improved when an official business plan was started to be used. Rieker (2004) says that the attention for strategic management in small and medium business organizations is necessary in order to improve

and develop successfully in the growing markets.

The ability to determine what resources will be necessary and who will supply these resources for the desired development is a very important management skill deciding the strategy of an organization. Knowledge about indispensable resources influences the strategic plan change and implementation. When an innovative leader has ideas and needs that cannot be implemented with the help of own means, a strategic partnership is a perspective decision (Williams, 2012). The strategic decision of an executive to adopt innovations depends on the evaluation of a few influencing factors: a) the need of innovation, b) the relative value of innovation and c) the threats caused by innovation (Eden & Ackermann, 2013).

Hutzschenreuter and Kleindienst (2006) identified a connection between strategic planning, decision making, activity implementation, and successful change management. Thus, on the basis of numerous researches, it could be stated that strategic planning is inseparable from successful development of an organization and there are numbers of factors deciding its formation.

When solving the issue of selection of strategy creation means, various strategy creation concepts have to be taken into account. Different researchers classify strategy formation concepts differently by choosing diverse classification objects:

Strategic concepts have been classified into four theories according to orientation to subjective or objective understanding and orientation to the external and internal (Tamasevicius, 1996).

Strategic schools have been classified into three main groups according to usage options: 1) normative (telling what to do), 2) descriptive (explaining why a certain strategy was adopted) and 3) having normative and descriptive features (Mintzberg, 2005).

Strategic schools have been classified into five groups according to strategy creation imperative: 1. ability to model a situation, 2. ability to disclose the need of changes in a company, 3. ability to prepare the strategy for change; 4. ability to apply reliable methods in the change period, 5. ability to implement the strategy, 6. the significance of entrepreneurial imperatives for strategic leadership (Gudonavicius et al., 2009).

Each distribution of strategic concepts is useful and does not contradict with the rest. Still, Mintzberg's, Ahlstrand's and Lampel's (2005) distribution (three main groups that are subdivided into ten strategic schools) is the most popular among researchers of the field. It was applied by Arimavičiute (2005), Matthews (2005) and others.

Normative strategy school group includes schools of design (projecting), planning and positioning (Mintzberg, 2005). The school of design (projecting) gives exceptional attention to the evaluation of external and internal situation with the help of the classical SWOT analysis (Matthews, 2005). Only proper evaluation of strengths and weaknesses, as well as opportunities and threats helps to achieve positive results. This analysis is grounded on the ability to foresee the development of the situation and create the "map" of future events from separate factors. In addition SWOT analysis is a good diagnostic tool when the scenarios have already been created. This method is applied in all spheres with the exception financial strategic analysis (Gudonavičius et al., 2009). Appropriate evaluation of own strengths and weaknesses, opportunities and threats helps to determine opportunities for the increase of an organization service attractiveness.

Vasiliauskas (2004) maintains that there are two main methodologies in the strategic management literature – deterministic and emergent.

The process of strategic planning covers the organization's mission, vision, goals, creation of strategy, its implementation and analysis, but the strategic management model in deterministic methodology is way more detailed. Unlike the emergent methodology model it distinguishes closely connected stages of strategy creation and implementation, therefore emergent methodology is more flexible. More frequent strategy renewal prevails in the strategic management model of emergent methodology. Here, in a feedback relation, strategy creation and implementation process is connected with the stages of strategic analysis that are distinguished in the model of deterministic methodology.

The model of strategic planning forces the organization to constantly analyze industrial peculiarities which decides long-term organizational success (Ancalade, 2009).

According to Arimavičiute (2005), it could be emphasized that general principles and specificity of strategic management depend on the organization:

- Type of activity (production, services or idea provision);
- Sources of financing (commercial and non-commercial organizations);
- Property (state or privately owned organizations);
- Size (small and large organizations);
- Diversification level (one or several activity fields in a sport and leisure club).

Burgelman and Grove (2006) maintain that it is difficult to relate a strategy with a strategic action. In order to coordinate these things, organizations have to rethink strategies and business models and change traditional ways of business development. To achieve this, strategic decisions have to be made having evaluated environmental factors that could influence the results usually measured by the outcomes of financial activity.

Human resource management has also to be discussed in strategic planning as it is the main auxiliary element in the strategic management of an organization (Ahearne et al., 2014; Jeffrey, 2013; Zafar et al., 2014). Human resource management works for attaining organizational goals in that it places appropriate people with appropriate skills in the right positions in an organization in the right time so that they would reach the set goals and accomplish tasks in the highest quality level (Khoong, 1996). Senior managers most often agree that people and not money or equipment is the main driving force of an organization (Fitzenz, 2000).

The measurement of strategy success in the development of an organization is very complicated. It demands a manifold attitude towards the goals, activity and results of an organization that are connected with the development of each activity and individual staff members (Moulds, 2012).

Four presumptive strategy evaluation criteria could be distinguished (Jucevičius, 1998):

- Strategy consistency;
- Compatibility;
- Reality;
- Superiority.

For the strategic activities to be successful the quality of the available data is exceptionally

impotent (Bettis, 2014). The success of strategic planning also depends on cooperation with employees, attention to their opinion, discussions about suggestions, their evaluation etc. (Searcey et al., 2010):

- Sharing opinions and criteria how to achieve the goal more successfully (by distinguishing the implementation of separate stages).
- Sharing the feedback about each level of activity (to determine the blank sides that could be reinforced (to create an action plan in discussions how to reinforce them).
- Discussion about organization goals (the goals have to be measurable and specific. They have to be observed and analyzed in order to successfully implement the changes).
- Discussion of a self-evaluation system (to create self-evaluation tools).
- Discussion of the main strategic questions and problems (to make mutual decisions how the present situation could be improved).

These discussions result in a common stimulation of more effective development – accomplishment in all discussed strategic planning activities with the management surveillance and assessment (Searcey et al., 2010). Hutzschenreuter and Kleindienst (2006) observe that in scientific research the attention is shifted from strategic planning to new fields thereby emphasizing the positions of individuals participating in strategic activities. Jasinskas, Reklaitiene and Svagzdiene (2013) maintain that thinking employees of an organization are influencing development of their organization. The employees have the closest relation with customers and their qualities are essential for the quality and effectiveness of the organization's activity (Jasinskas et al., 2013). Still, even in this case the activities of strategic planning have to be analyzed, but the field of research has to include the aspect of managers' and other employees' participation in the analysis of strategic planning activities. This aspect could manifest itself in every strategic planning activity.

Jeseviciute-Ufartiene (2010; 2014), Kvedarvicius (2006), suggest that organization management and creation would be shaped with the help of twelve Rac future creation actions, which are: prognostication, floodlighting, projection, programming, planning, scenario making, project implementation, author supervision, expertise, monitoring, organization, management. Jeseviciute-Ufartiene, Mejeryte

Narkeviciene and Widelska (2014) maintained that managers' mind activity as the basic force for organization development should be used in these actions.

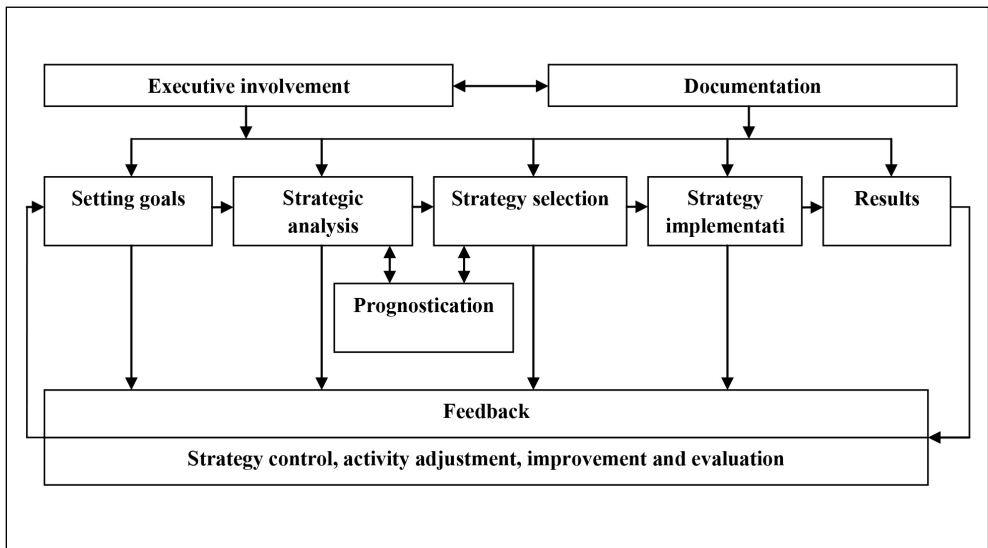
There are numbers of strategy planning activities discussed by Espinosa (2009), Stewart (2002), Thompson, Strickland and Gamble (2007) and other researchers. In order for the organization to function profitably and would exploit its competitive advantage, strategy planning activities have to be constantly accomplished; they have to be improved and changed, otherwise they would not correspond with the environmental conditions. When striving for the strategy compatibility with environmental conditions, strategic analysis covering the dynamics of company network and the development of business complexity and cooperation is of utmost importance (Jeffrey, 2013). Analyses showed that there are distinguished various strategic activities thus it is important to identify the main activities that could be distributed as follows: setting goals, strategic analysis, prognostication, strategy selection and strategy implementation (see Fig. 2).

Executive involvement and documentation are signified in the top part of the model. They both can influence each other based on the previously discussed processes and are significant. The results of Schaap's (2012) research confirm the role of executives and personnel in the strategy implementation. Strategic consensus has positive influence on the implementation of the strategic process and frequent communication from top to bottom in the organizational structures reinforces strategic consensus and thinking through nurturing of common views and values.

It has also been determined that senior managers who have been taught strategic planning and implementation are more likely to realize activity goals than those who do not have strategic planning knowledge (Schaap, 2012). Relying on the presented evidence, it could be concluded that in order to achieve excellent results strategy implementation plans have to be clearly defined with precise dates and specific duties for individuals – there have to be people responsible for the accomplishment of the task and for documentation.

The actual significance of a strategy is reflected in the results distinguished by Stewart (2002) and Wittmann and Reuter (2013) according to an organization's ability

Fig. 2: The theoretical model of the significance of strategic planning activities for the results of an organization



Source: own based on Espinosa (2009), Stewart (2002), Vargo and Seville (2011) and Svagzdiene et al. (2015)

to implement innovative services, expand the network and the scope of clients, create new work places. This data allow the decision to be made about the appropriateness of strategic planning activities.

The model also emphasizes the importance of feedback analysis. Wardwell (2012), Eden and Ackermann (2013) relate strategic feedback analysis with the part of organizational development culture. The results of Inamdar's (2012) research also show the role of control systems and organizational structure is getting more important. The strategy of an organization depends on the feedback and the user needs. The ongoing internal assessments, the encouragement of the organization's staff to keep up with the organization's activities and results and a discussion with them influences the leader of the organization to make the right strategic decisions and thus improve the organization's performance.

The examined models usually focus on feedback, continuous correction of strategic planning activities, their improvement and evaluation; therefore, this model also includes feedback as a separate strategic planning activity.

2. Research Methodology

In order to research and evaluate application of strategic planning activities in Kaunas sport and leisure clubs a quantitative expert research – a questionnaire was planned. The instrumentation for the quantitative research was compiled with the help of Seeman's (1972) methodology and a modified Stewart's (2002) strategic planning activity questionnaire was used:

1. Theoretical concepts were selected including setting goals, prognostication, strategy selection, strategy implementation, results and feedback.
2. The main theoretical concepts were divided into conceptual parts (see Fig. 2).
3. Each conceptual part was defined and analyzed theoretically.
4. Research questions according to the Likert scale were formulated for each conceptual part.

The following statistical methods were applied for data analysis: descriptive statistics (frequencies, means), correlation analysis (Pearson correlations), reliability analysis (Cronbach's alpha), and factorial analysis. In order to determine the significance of results,

two significance levels were chosen, when level of significance is $p: p < 0.01$ and $0.01 < p < 0.05$. The methods employed for the result analysis enabled significant exclusion of dependence between individual research questions connected with strategic planning of a sport organization and the efficiency of its activity. Statistically significant correlation coefficients helped to disclose the results of the quantitative research.

Leaders of Kaunas sport and leisure clubs with the experience of at least three years were chosen as respondents for the research. According to Stewart (2002), modern leaders-experts of organizations take up different positions: of a director, deputy director, executive, administrator, etc.

Rudzikiene's (2003) model for expert evaluation standard deflection dependence on the expert number was considered (Fig. 3) and it could be stated that 18 experts are enough for the research results to be regarded as sufficiently valuable and reliable.

Considering a low demand in a respondent sample and having a purpose to analyze innovative sport organizations (using IT technologies), all 25 Kaunas sport and leisure clubs – organizations found in the internet company registration systems (Electronical registration system of VZ organizations, 2014; Lithuanian sport statistics document, 2013; Registration system of Organizations, 2014) were chosen. Kaunas was selected as a target respondent group territory where in 2013 there were 162 sport organizations which 2-3 times more than in the capital of Lithuania – Vilnius and significantly more than in any other region of Lithuania. The experts of 18 organizations out of 25 agreed to participate in the survey. The survey was carried out in July-August 2013. The authors want to express their gratitude for Justas Bradauskas who helped to collect the data.

The reliability of the questionnaire presented for the experts was determined by calculating the Cronbach's alpha coefficient. A questionnaire is considered reliable when the value of the coefficient is at least 0.6; otherwise the questionnaire reliability is low. The value of the Cronbach's alpha coefficient of the created expert evaluation questionnaire is 0.902. It means that the questionnaire can be considered very reliable.

As a result of factorial analysis and logical thinking respondents were presented with 38

statements divided according to the unifying meanings corresponding with the concepts presented in the model in Figure 2. Based on Pearson's correlation and arithmetic means, relations between strategic management elements and strategic management results were identified and analyzed.

3. Research Results

The data of the accomplished research enable the interpretation of the theoretical model (Fig. 2) in the context of sport organizations. With reference to the model in Figure 2 and correlations obtained as a result of the research and statistical analysis, a snapshot of sport organizations' strategic planning and management was made (Fig. 3).

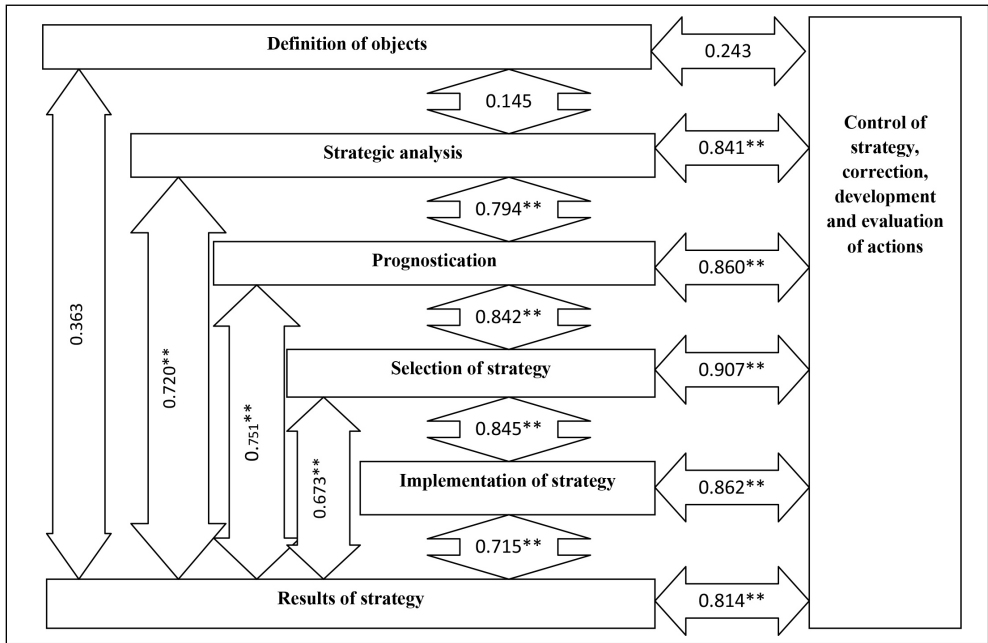
Figure 3 shows that that a goal setting activity could be considered as detached from the strategy in Lithuanian sport organizations because this activity does not have a statistically strong and significant connection neither with the results of the organization, nor with the development of organizational activities. On the other hand, there exists a strong and statistically significant connection among all the remaining elements of strategic planning and management. It is interesting to note that the importance that the respondents attached to goal setting is very high (mean – 4.78, Tab. 1). The interpretation of the received results suggests an idea that sport organizations see goal setting as a very important element of strategic management but it is not connected with the organization activity results (correlation 0.363, Fig. 3) or with the improvement of an organization (correlation 0.243, Fig. 3).

It is likely that goals formulated in the sport organizations do not sufficiently meet the SMART criterion. The formulation of the goal is not sufficiently related with the organization activity results. For this Eason the degree of goal achievement is not evaluated.

It is possible that the formulation of an organization strategy goal expresses the values of the organization more than a specific result to be achieved. This assumption could be made with reference to the received correlations between setting goals and the elements comprising it: mission, goals, and objectives of an organization (Fig. 4).

Statistically strong and significant correlations demonstrate a close connection between strategic goals and the mission that is

Fig. 3: Correlation among management elements of strategy in sports organizations



Source: own

Note: * means $0.01 < p < 0.05$; ** means $p < 0.01$

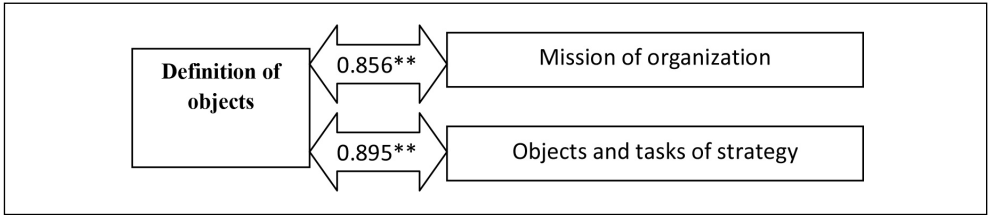
Tab. 1: Influence of employees' evaluation methods on Essential organization feature

	Mean	Active participati- on of executives	Documentation of the plan
Setting goals	4.78	0.412	0.539*
Strategic analysis	3.66	0.220	0.717**
Prognostication	3.54	-0.126	0.480*
Strategy selection	3.82	0.213	0.731**
Strategy implementation	3.81	0.332	0.800**
Active participation of executives	4.67	-	-
Results	3.87	0.156	0.545*
Strategy control, activity adjustment, improvement and evaluation	3.72	0.213	0.639**

Source: own

Note: * means $0.01 < p < 0.05$; ** means $p < 0.01$

Fig. 4: Correlation among elements of strategic objects



Source: own

Note: * means $0.01 < p < 0.05$; ** means $p < 0.01$

the value foundation of an organization. Goals should be formulated considering the mission but they have to acquire a formula reflecting the result in time. Respectively then strategic goals of an organization could be related with an organization's strategic management results.

Another reason for this kind of research results could be connected with the fact that a statistically significant correlation between the executives' active involvement in strategic management and goal formulation in strategic management was not identified in the research results (Tab. 1), though the respondents named the executives' participation in the process of goal setting as a very important activity in strategic management.

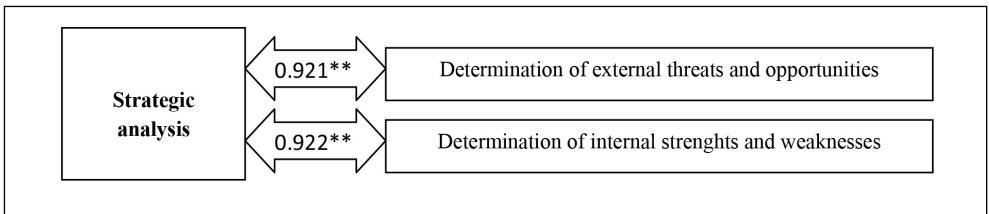
It was determined in the research process that strategic management in sport organizations includes statistically significant correlations between strategic analysis and organization results (0.720**, Fig. 3.) and organization improvement activities (0.841**, Fig. 3). The evaluation of strategic analysis of internal elements (Fig. 5) shows a statistically

significant and strong correlation with the analysis of internal and external factors carried out in the organization. With reference to such research results it could be stated that Lithuanian sport organizations give sufficient attention to the analysis of internal and external environment.

Strategic analysis carried out in sport organizations is significantly and strongly related with the process of strategy documentation and official registration (0.717**, see Tab. 1). On the other hand, an assumption could be made that the process of strategic analysis includes more analytical tasks assigned to employees than the strategic analysis activity that would draw the executives' attention as a statistically significant correlation with the executives' involvement in this process was not identified (0.220, see Tab. 1).

The activity of prognostication significantly correlates with strategic analysis (0.794**, see Fig. 3), with the selection of strategic alternatives (0.842**, see Fig. 3), with the organization results (0.751**, see Fig. 3) and

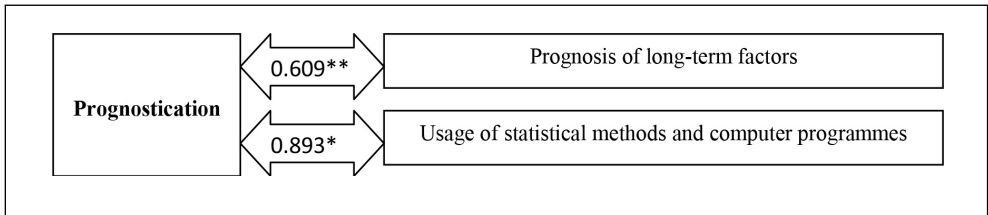
Fig. 5: Correlation among elements of strategic analyses



Source: own

Note: * means $0.01 < p < 0.05$; ** means $p < 0.01$

Fig. 6: Correlation among elements of strategic prognostication



Source: own

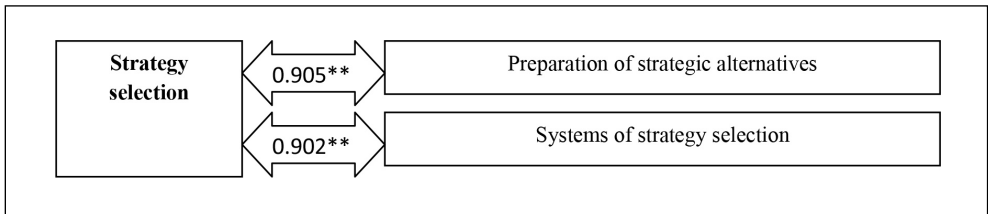
Note: * means $0.01 < p < 0.05$; ** means $p < 0.01$

with the organization control activities, as well as with improvement (0.841**, see Fig. 3). The understanding and evaluation of prognostication are also demonstrated by the correlation of individual prognostication components with this activity (Fig. 6). Considering such research results, it could be stated that Lithuanian sport

organizations are trying to prognosticate and plan their activities respectively.

Prognostication in an organization is not significantly related with the executives' active participation in this activity (see Tab. 1), but it is given sufficient attention in official documentation (0.480*, see Tab. 1).

Fig. 7: Correlation among elements of strategy's selection



Source: own

Note: * means $0.01 < p < 0.05$; ** means $p < 0.01$

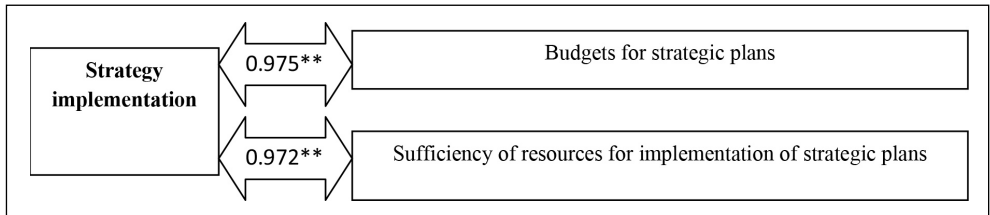
The selection of strategy, as well as its implementation are statistically significantly correlated with each other (0.845**, see Fig. 3), with the organization results (respectively 0.673** and 0.715**, see Fig. 4) and the actions of its correction and improvement (respectively 0.907** and 0.862**, see Fig. 3). A statistically significant and especially strong correlation was identified among the elements comprising strategy selection (see Fig. 7) and its implementation (see Fig. 8).

On the basis of the research results given in Table 1 it could be stated that strategy selection (0.731**) and implementation (0.800**) are connected with process of documentation.

Considering the determined correlations (Tab. 1) it could be maintained that Lithuanian sport organization give sufficient attention to selection of strategic alternatives, documentation of strategic system, budgeting and evaluation of resource availability. Still it is not quite clear how purposeful are these activities as they are insufficiently correlated with the goals set in an organization (see Fig. 3).

On the basis of the research data it could be maintained that the result created in the process of strategic planning and its implementation statistically significantly correlates with the control in an organization and the actions of correction and improvement

Fig. 8: Correlation among elements of strategy's implementation



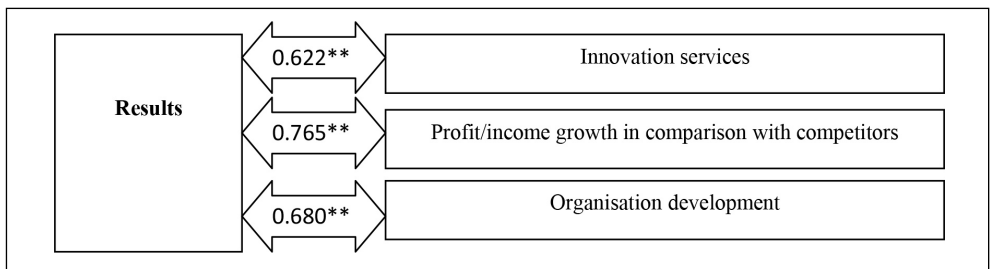
Source: own

Note: * means $0.01 < p < 0.05$; ** means $p < 0.01$

(0.814**, see Fig. 3). Thus it could be stated that Lithuanian organizations are involved in strategic activities. In the opinion of Kaunas sport organizations' experts, strategic activities are performed innovatively enough. Innovativeness is understood as application of statistical programs and prognostication models in strategy creation activities.

Having looked into the result created in the analyzed organizations in more detail (see Fig. 9), it could be noted that activities comprising the result are statistically significantly and strongly correlated with result created in an organization. The created result is documented (see Tab. 1). It could be presumed that the result created in Lithuanian sports organizations allows them to grow and improve.

Fig. 9: Correlation among elements of strategy's implementation



Source: own

Note: * means $0.01 < p < 0.05$; ** means $p < 0.01$

Summarizing the research results, some important aspects of Lithuanian sport organizations' strategic planning and management could be distinguished. Firstly, the organizations under research are striving to orientate towards strategic management activities and to create results directed to the development. Secondly, organizations give sufficient attention for strategic management formalization and documentation. Thirdly, the

connection between goal setting and activities of strategic planning and management is not fully perceived in the organizations. Fourthly, reasons of the latter factor may be connected with insufficient involvement of the executives in the process of strategic planning and management because a statistically significant correlation between strategic planning and management activities and active participation of the executives was not identified (see Tab. 1).

4. Discussion and Significance of Made Theoretical Analyses and Research

Strategic planning is not a new subject in a theoretical analyses and research world. Though theoretical approach made in this article is significant because of made and tested strategic planning model (see Fig. 2). In order to improve strategic management in sport organizations, in addition to the importance of executives and staff involvement in the strategic management determined in the previous research (Schaap, 2012), it is necessary to relate setting of the goals with organization results and improvement of its activities as was disclosed in the present research. Not only strategic consensus or executives' participation in the strategic management are required, but also a connection of strategic goals with activity improvement and results has to be attained. It should be noted that though executives actively participate in strategic management, not all strategic activities are given equal attention.

In spite of these drawbacks of strategic activities, sport organizations under research could be distinguished as innovative. It was not only the feedback analysis disclosed by Inamdar (2012), Wardwell (2012), Eden and Ackermann (2013) that influenced innovativeness, but also the connections between strategic activities – strategic analysis, organization results and organization improvement activities determined in the research. It is possible to achieve innovative results only by connecting strategic analysis, activities of organization improvement and documenting the results.

Theoretically created and empirically tested model of strategic planning could be used in the sport organizations with the purpose to evaluate activities of strategic planning and to reveal systemic actions needed to develop strategic management in that sport organization. This model could be applied even to other small and medium organizations developing their strategic management.

Conclusions

When analyzing strategic planning, researchers have distinguished related activities. Though the analysis showed that strategic planning activities are itemized, the process of their analysis should include distinguishing the main activities that would cover other more

detailed ones. The authors suggest that the main strategic planning activities would be the following: executives' participation, setting strategic goals, documentation, analysis, prognostication, strategy selection, strategy implementation, strategy control and correction, improvement and evaluation of activities.

Strategy results reflected in service innovativeness, network, client scope, and workplace development, could be signified as an individual strategic planning element showing the significance of planning activities.

When researching the strategic planning and management aspects of sport organizations, it was discovered that the importance of strategic activities for the results of these organizations is statistically significant. Sport organizations are oriented towards all strategic management activities and are striving to create results directed to development. The following strategic activity aspects are appropriately evaluated – organizations give sufficient attention to the process of strategic management, its formalization and documentation and innovative results are achieved. The insufficient understanding of connection between goal setting and strategic planning and management activities carried out in an organization could be distinguished as a negative aspect. In order to improve strategic management in sport organizations, it is necessary to relate goal setting activity with organisation results and activity improvement.

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SIGNIFICANCE OF STRATEGIC PLANNING FOR RESULTS OF SPORT ORGANISATION

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The article focuses on the application of strategic planning activities in a sport organization. Firstly, strategic planning activities are distinguished and their significance for organizations analyzed. The following activities are emphasized – setting of strategic goals, analysis, and prognostication, the choice of strategy and its implementation, as well as the feedback. The research deals individually with the issue of management participation in the strategic planning activities and raises the question of their documentation. The significance of strategic planning activities can be identified through the achieved strategic results, i.e. innovativeness and development. The article presents an empiric research with Kaunas city sport clubs as its participants.

Though the analysis showed that strategic planning activities are itemized, the process of their analysis should include distinguishing the main activities that would cover other more detailed ones. Strategy results reflected in service innovativeness, network, client scope, and workplace development, could be signified as an individual strategic planning element showing the significance of planning activities.

When researching the strategic planning and management aspects of sport organizations, it was discovered that the importance of strategic activities for the results of these organizations is statistically significant. Sport organizations are oriented towards all strategic management activities and are striving to create results directed to development. The following strategic activity aspects are appropriately evaluated – organizations give sufficient attention to the process of strategic management, its formalization and documentation and innovative results are achieved. The insufficient understanding of connection between goal setting and strategic planning and management activities carried out in an organization could be distinguished as a negative aspect.

Key Words: Strategic planning, strategic results, sport organization, innovation, organizational development.

JEL Classification: M10, M12, M21.

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PROFITABILITY OF THE FOOD INDUSTRY IN POLAND – AN ORDERED LOGIT MODEL APPROACH

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Introduction

The socio-political changes which started in the late 90's and the Polish accession to the European Union in 2004 fundamentally determined the direction of structural changes of the national economy. These changes resulted in the beginning of the privatization processes, consolidation and concentration, which, together with the accession to the EU and the intensification of the globalization processes, increased their dynamics. Moreover, there was a confrontation with foreign markets, mainly those of the EU, resulting in changes in prices relations, consumer preferences and implementation of legal regulations. These processes covered all sectors, including the food industry – one of the largest and most dynamically developing sectors of the Polish economy, which resulted from the following:

- in 2005-2011 the real value of output increased in this sector by 28.8%, and in 2011 constitute 17.2% of the global output of industrial processing,
- the value added of the food industry increased in real terms in 2005-2011 to 37.5% and in 2011 accounted for 15.7% of the value added of industrial processing,
- the food industry in Poland contributes significantly to GDP; in 2005-2011 the share of the value added of this sector in GDP was in the range of 2.4-3.0%,
- manufacture of food products and beverages is an important place of employment; in 2011 in the food sector in Poland there were 435 thousand people employed, representing 17.7% of the employed in industrial processing,
- the food sector to a large extent dynamises and determines the domestic exports; in 2005-2011 the nominal value of exports in this sector increased by 100.1%, and its

share in the industrial processing export in 2011 reached the level of 9.1%,

- the food industry successfully competes in foreign markets; for 9 years it has been generating a positive balance of foreign trade of food products, which increased from 0.56 billion PLN (2003) to 7 billion PLN (2011), i.e. more than 12.5 times.

The aforementioned economic indicators do not cover, naturally, all areas of the changes which have occurred in the Polish food industry in recent years. They do not include in their scope the achievements of financial nature, which in the long term, are essential for the development of the food sector. The basic and at the same time the most important measures of financial performance include profitability ratios, which are generally perceived in three aspects, namely: return on sales (ROS), return on assets (ROA) and return on equity (ROE). The profitability ratios are widely used in evaluating financial performance of enterprises and the benefits to their owners. However, in practice their usefulness is largely limited due to the synthetic nature and the consequent limited scope of the information content. Hence, in research practice, more broadly are used procedures for disaggregation of financial ratios and their inclusion in indicator systems, which enables a multi-dimensional and cause-and-effect analysis of various financial issues (see e.g. Bednarski, 2007; Bieniasz et al., 2009; Burns et al., 2008; Dudycz, 2001; 2011; Gołaś, 2008; Gołaś & Paszkowski, 2009; Hawawini & Viallet, 2010; Liesz, 2002; Sierpińska & Jachna, 2011; Sierpińska & Niedbała, 2013; Wędzki, 2006).

The main objective of this paper is a multi-dimensional analysis of variation in profitability in the Polish food industry. The analysis has been conducted on the basis of the proposed procedure of decomposition of return on sales combined with the system of indicators

combining the return on sales with the return on assets and the return on equity. Moreover, to determine the significance (the strength and direction of impact) of the individual components of the indicator system the authors applied ordered logit models.

1. Source Materials and Research Methods

This study uses unpublished statistical data of the Central Statistical Office in Warsaw from the years 2006-2011, which enables the analysis of profitability arranged in sections, groups and classes of the food industry and according to the size of enterprises. The food industry includes the manufacture of food products (Section C, Division 10) and the production of beverages (Section C, Division 11). According to the Polish Classification of Activities 2007, which is in conformity with NACE Rev. 2, the manufacture of food products distinguishes 25 sectors (classes 10.11-10.92), and in the manufacture of beverages there are 7 sectors (classes 11.01-11.07). This paper presents the results of a descriptive analysis of profitability at the level of sections and classes and the results of a logit analysis at the level of classes, with the consideration of the size of enterprises. The basis for the analysis has been the decomposition of the rates of return, in which as the starting point there has been adopted the equation of Du Pont model, in which the return on equity (ROE) is recognised as the product of the return on assets (ROA) and equity multiplier (MK) or, more broadly, in the form of the product of the return on sales (ROS), the total asset turnover (ROT) and the equity multiplier (MK):

$$ROE = ROA \times MK = ROS \times ROT \times MK \quad (1)$$

where:

$$ROE = \frac{\text{netprofit (ZN)}}{\text{equity (KW)}} \quad ROA = \frac{\text{netprofit (ZN)}}{\text{assets (A)}}$$

$$ROS = \frac{\text{netprofit (ZN)}}{\text{revenues (P)}} \quad MK = \frac{\text{total assets (A)}}{\text{equity (KW)}}$$

$$ROT = \frac{\text{net revenues (P)}}{\text{assets (A)}}$$

The paper presents an original proposal to modify the above equations by the decomposition of the return on sales (ROS). This proposal translates into the following system of ratios:

WVAB – gross value added ratio:

$$WVAB = \frac{\text{gross value added (VAB)}}{\text{net revenues (P)}} \quad (2)$$

WAM – rate of depreciation costs:

$$WAM = \frac{\text{net value added (VAN)}}{\text{gross value added (VAB)}} \quad (3)$$

WKP – labour cost index:

$$WKP = \frac{\text{profit on sales (ZS)}}{\text{net value added (VAN)}} \quad (4)$$

WPPKO – rate of other operating revenues and expenses:

$$WPPKO = \frac{\text{profit on operating activities (ZOP)}}{\text{profit on sales (ZS)}} \quad (5)$$

WPKF – rate of financial revenues and expenses:

$$WPKF = \frac{\text{profit on business activities (ZDG)}}{\text{profit on operating activities (ZOP)}} \quad (6)$$

WZSN – rate of extraordinary events:

$$WZSN = \frac{\text{gross profit (ZB)}}{\text{profit on business activities (ZDG)}} \quad (7)$$

WEP – tax effect ratio:

$$WEP = \frac{\text{net profit (ZN)}}{\text{gross profit (ZB)}} \quad (8)$$

These indicators allow expressing the return on equity (ROE) as the following equations:

$$ROE = \frac{ZN}{KW} = WVAB \times WAM \times WKP \times WPPKO \times WPKF \times WZSN \times WEP \times ROT \times MK \quad (9)$$

The structure of the above equation indicates that as the starting point in the procedure of decomposition there has been adopted the value added ratio (WVAB) in the form of gross value added (VAB) to the revenues (P), informing about the ability to generate value contributed by the enterprise in relation to the external costs arising from contacts with the environment (Bednarski, 2007; Wędzki, 2006). This indicator is also considered to be the primary determinant of technical and technological advancement (Rachwał, Wiederman, & Kilar, 2009; Wędzki, 2006). To the value added also relate the following two indicators (WAM, WKP), which inform about the impact of the depreciation costs (VAN/VAB) and labour costs

(ZS/VAN) on the level of profitability. The next two indicators (WPPKO, WPKF) determine the impact of other operating activities (ZOP/ZS) and financial activities (ZDG/ZOP) on the increase or deceleration of profit, as a result of positive or negative balance of other operating revenues and expenses and the balance of financial revenues and expenses. The third area of analysis is the extraordinary level. In the proposed model of the decomposition of profitability this has been included in the WZSN ratio (ZB/ZDG), which informs about the impact of extraordinary gains and losses on profitability. The last indicator (WEP = ZN/ZB), the so-called effective tax rate is related to the distribution of profit and informs about the scale of the gross profit deceleration due to corporate taxation. The presented above indicators have been integrated with the ROA and ROE profitability system. As a result, there have been achieved significantly developed analytical systems, which, except for the total asset turnover (ROT = P/A) and equity multiplier (MK = A/KW), allow to model profitability (ROA, ROE) in the context of additional circumstances.

For modelling the return on equity there has been used the multinomial logit model of ordered categories (i.e. ordered logit model which models the cumulative probabilities). In this model the dependent variable is discrete and takes the values from a countable and finite set of values (categories) with a specific hierarchy. It shall be assumed that the i-th unit (in this case a sector of the food industry) is characterised by one of J levels of financial condition (1-very low, 2-low, 3-medium, 4-high). Subject to modelling in this case are the so-called cumulative logits, i.e. the logarithms of the probability quotients of belonging the i-th sector to a category of not more than j-th (p_{ij}) and the opposite likelihood ($1 - p_{ij}$). The category of financial condition of the industry sector (in this case ROE) is determined by k – a set of exogenous variables (a set of indicators of the ROE system) and a random component. In the case of J categories a J-1 logit equations are received (Boroogh, 2001; Hilbe, 2009):

$$\begin{aligned} \text{logit}(p_{ij}) &= \ln \frac{\Pr(y_i \leq j)}{\Pr(y_i > j)} = \ln \frac{p_{ij}}{1-p_{ij}} = \beta_{0g} + \\ &+ \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k + \\ &+ \varepsilon \quad (g = 1, 2, \dots, J-1) \end{aligned} \quad (10)$$

e.g.:

$$\begin{aligned} \text{logit}(p_1) &= \ln \frac{\Pr(y_i \leq 1)}{\Pr(y_i > 1)} = \ln \frac{p_1}{1-p_1} \\ \text{logit}(p_1 + p_2) &= \ln \frac{\Pr(y_i \leq 2)}{\Pr(y_i > 2)} = \ln \frac{p_1 + p_2}{1-p_1-p_2} \\ &\vdots \\ \text{logit}(p_1 + p_2 + \dots + p_{J-1}) &= \ln \frac{\Pr(y_i \leq J-1)}{\Pr(y_i > J-1)} = \\ &= \ln \frac{p_1 + p_2 + \dots + p_{J-1}}{1-p_1-p_2-\dots-p_{J-1}} \\ &\text{and } p_1 + p_2 + \dots + p_J = 1 \end{aligned}$$

To identify factors affecting the financial condition of the sectors of the food industry, measured with the return on equity (ROE), there have been applied the ordered logit model of the form (Cameron & Trivedi, 2005; Greene, 2008; Greene & Hensher, 2008; Winkelman & Boes, 2006):

$$y_i^* = x_i^T \beta + \varepsilon_i \quad (11)$$

where:

y_i^* – unobservable variable relating to the i-th observation (ROE for an industry sector), associated with its discrete counterparts (Boroogh, 2001; Liao, 1994):

1-ROE level for i-th sector, $y_i = 1$ if $\tau_0 < y_i^* \leq \tau_1$,
 2-ROE level for i-th sector, $y_i = 2$ if $\tau_1 < y_i^* \leq \tau_2$,
 ⋮

J-ROE level for i-th sector, $y_i = J$ if $\tau_{J-1} < y_i^* \leq \tau_J$,
 τ_j – cut-points, wherein $-\infty = \tau_0 < \tau_1 < \dots < \tau_{J-1} < \tau_J = \infty$

β – parameter vector,

x_i – vector of exogenous variables (explanatory) for the i-th observation,

ε_i – random component for the i-th observation,
 $i = 1, 2, \dots, N$ – number of observations.

After estimating the parameters of the model, the predicted probability of membership of the i-th unit (sector to the j-th category of financial condition – ROE class) can be described as:

$$\begin{aligned} \Pr(y = j | \mathbf{x}) &= \Pr(\tau_{j-1} \leq y^* < \tau_j | \mathbf{x}) = \\ &= \Pr(\tau_{j-1} \leq \mathbf{x}^T \beta < \tau_j | \mathbf{x}) = \\ &= F(\tau_j - \mathbf{x}^T \beta) - F(\tau_{j-1} - \mathbf{x}^T \beta), \end{aligned} \quad (12)$$

where F is the cumulative logistic distribution of the random component. It should be noted

that in the estimated model the parameters of the explanatory variables are the same for each category j (ROE classes), the so-called proportional odds assumption – parallel regression. It means that the ratio between each pair of the compared groups of categories (ROE classes) is the same, i.e. the coefficients describing the relationship between the variables at the lowest, as compared to all of the higher categories (comparison of Class 1 to other higher ones) of the explained variable are the same as those which describe the relationship between the following higher level of the category and the other higher categories (comparison of class 1 and 2 to other higher ones), etc. If the relationship between all pairs of categories within the same group of comparisons is proportional, then there is only one set of estimated parameters with the explanatory variables. If the assumption of proportionality of odds ratios would not be met, there should be estimated the so-called generalised ordered logit model, which leads to estimating different sets of parameters with explanatory variables between each compared pair of compared categories – ROE classes (Greene & Hensher, 2008; Williams, 2006). In order to verify this assumption the Brant test and the Wolfe-Gould test have been used (Brant, 1990; Greene & Hensher, 2008; Gruszczynski, 2010; Long & Freese, 2006; Wolfe & Gould, 1998). The idea of using these tests for this purpose is based on verifying whether the model without the condition of the parallel regressions assumption would be a more suitable than the model supporting this limitation. The basis of the test is to estimate the $J-1$ binomial regressions. For the Brant test the explained variables in these regressions are defined as follows:

$$z_j = \begin{cases} 1 & \text{for } y_i > j \\ 0 & \text{for } y_i \leq j \end{cases} \text{ where } j = 1, 2, \dots, J - 1$$

The null hypothesis of the Brant test expresses equality of relevant parameters in all binomial regressions for all explanatory variables. The rejection of this hypothesis means that for at least one variable parameters differ in at least two binomial models, i.e. the proportional odds assumption is not met. In contrast, individual tests allow determining for which variables parameters in the binomial regressions differ.

In the case of the Wolfe and Gould test the explained variables in binomial regressions are defined contrary to the previous test:

$$z_j = \begin{cases} 1 & \text{for } y_i \leq j \\ 0 & \text{for } y_i > j \end{cases} \text{ where } j = 1, 2, \dots, J - 1$$

The aforementioned test allows comparing the fit of a set of binomial models with the fit of the standard ordered model. Rejection of the null hypothesis on equal fit of both models means that the parallel regression assumption is not met and forcing it on the model significantly worsens its fit. If the ordered logit model does not meet the assumption of proportional odds there ought to be estimated a generalised ordered model, which considers the variability of the β parameters, depending on the category (in this case the ROE class).

To assess the quality of the estimated ordered logit models of the return on equity the following characteristics have been used:

1. The test of the entire significance of all the explanatory variables (model significance) based on the likelihood ratio test on the basis of statistics, $LR = 2(\ln L - \ln L_0)$, which has a chi-square distribution with degrees of freedom p – equal to the number of estimated parameters (excluding the estimated *cut-points*), L – the likelihood function value of the tested model, L_0 – the value of the likelihood function of the model including only a constant. This test may also be applied to compare any nested models, i.e. such models where one is formed from the other by reducing the number of explanatory variables (e.g. it may be investigated whether the generalised ordered model is better than the standard ordered logit model). In this case in the aforementioned formula for the test statistic instead of L_0 there should be used the likelihood function of a model with a fewer number of estimated parameters. The number of degrees of freedom is the difference between the number of parameters from the compared models.

2. Wald test – the test for the significance of parameter estimates (the null hypothesis assumes no significance of each parameter of the model separately):

$$\begin{cases} H_0: \beta_i = 0 \\ H_1: \beta_i \neq 0 \end{cases} \quad z = \frac{\hat{\beta}_i}{D(\hat{\beta}_i)} \quad (i = 1, \dots, p),$$

where $\hat{\beta}_1$ – estimated parameter, $D(\hat{\beta}_1)$ – standard error of estimated parameter.

3. McFadden's pseudo R-square (Maddala, 1977; McFadden, 1974):

$$R_{McFaddena}^2 = 1 - \frac{\ln L}{\ln L_0} \quad (13)$$

The values of this measure theoretically are from the [0;1] range; however, it cannot be interpreted as the coefficient of determination of the classical linear regression. The higher the value of this measure, the better the estimated model.

4. Count R-square, defined in the context of the proportion of accurate forecasts:

$$\text{Count } R^2 = \frac{\text{number of accurate forecasts}}{\text{total number of observations}} \quad (14)$$

The higher the value of the measure, the better the model.

5. McKelvey & Zavoina Pseudo R-square (Gruszczynski, 2010; Mckelvey & Zavoina, 1975):

$$R_{M,Z}^2 = \frac{\widehat{\text{Var}}(\hat{y}^*)}{\widehat{\text{Var}}(\hat{y}^*) + \widehat{\text{Var}}(\varepsilon)} \quad (15)$$

where: $\widehat{\text{Var}}(\hat{y}^*)$ – variance, $\widehat{\text{Var}}(\varepsilon) \cong \frac{\pi^2}{3}$ exact value in the logistic model.

This measure is most similar to the classical R^2 ; the higher the value the better the model fit.

6. Akaike and Bayes-Schwartz Information Criteria – these criteria do not have a fixed range of values; they are used to compare the estimated models. The lower value of these criteria is, the better the model.

2. Diversity of Structure and Level of Profitability in the Polish Food Industry

Table 1 lists the values of individual profitability ratios and the rate of return (ROS, ROA, ROE) arranged in sections and in total in the food industry in three sub-periods of 2006-2011. Their analysis demonstrates that the sections of manufacture of food and beverages vary considerably in terms of return on sales (from 3.0% to 3.5% and from 4.5% to 6.3%), and the reasons for this should be primarily sought in the differences in the level of the value added ratio (WVAB), labour costs (WKP), other operating

revenues and expenses (WPPKO) and financial revenues and expenses (WPKF). Among these the greatest relative differences are in the value of the labour cost index (WKP). In the food production this indicator in the examined sub-periods was in the range of 29.1% to 31.3%, while in the manufacture of beverages – from 33.5% to 41.6%. This situation is due to significant differences in work performance and is confirmed in the value added ratio (WVAB), which in the food manufacture ranges from 17.1% to 17.7%, and in the manufacture of beverages from 19.7% to 23.7%. These figures indicate that, in relative terms, the value added ratio was in the production of beverages, in relation to the food manufacture, higher by over 20%. In the analysed sub-periods labour productivity measured with the net value added in the production of beverages was 2.5-3 times higher than in the food production. Moreover, a higher evaluation of the production of beverages in terms of labour productivity and labour cost index corresponded to significantly higher labour costs of 1 employee. In the analysed sub-periods the average labour costs per 1 employee (remuneration + derivatives) amounted to respectively: 32-46 thousand PLN (food production) and 53-73 thousand PLN (manufacture of beverages).

Other indicators of the ROS system generally differentiated the sections of the food industry to a much lower extent, which leads to the conclusion that in the analysed sub-periods they affect the level of return on sales to a comparable extent. However, it should be noted that among these indicators and indicators of value added there are noticeable significant differences in the level of variability and the dynamics of change. In the food manufacture the greatest variability in the period 2006-2011 characterised the financial revenues and expenses (which also decreased on annual average $\Delta WPKF = -1.3\%$). This means that in this section there was observed a negative trend of decelerating profit growth due to financial expenses, compensated less and less by financial revenues. In the analysed years, financial expenses in the food production drastically increased. For example, in 2006 these amounted to 1.71 billion PLN, in 2008 they increased to 3.12 billion PLN, in 2011 they declined to 2.64 billion PLN, i.e. a level higher by 51% compared to 2006. Throughout the whole period the main source of financial expenses in

the manufacture of food products was interest constituting respectively: 65% (2006-2007), 40% (2008-2009) and 59% (2010-2011) of the total financial expenses. A significant decrease in the share of interest in financial expenses in the period 2008-2009 was caused by a strong increase in other financial expenses, mainly due to foreign exchange losses.

Other indicators in this section were characterised by lower variability. However, taking into account their average annual rate of change, one can observe that in the period 2006-2011 the changes in ROS, with the exception of the rate of financial revenues and expenses, were determined mainly by the negative direction of changes of the value added ratio ($\Delta WVAB = -1.3\%$) and extraordinary events ($\Delta WZSN = -0.4\%$), and the positive direction of changes of the labour cost index ($\Delta WKP = 3.2\%$).

The beverage industry was characterised by a much greater variability. The data presented in Table 1 show that the smallest stability characterised mainly the following rates: labour costs ($5.6\% \leq V_{WKP} \leq 9.6\%$), value added ($4.2\% \leq V_{WVAB} \leq 9.1\%$) and financial revenues and expenses ($9.2\% \leq V_{WKPF} \leq 12.1\%$). Moreover, in this section higher variability in time was generally associated with a negative, from the profitability perspective, direction of changes in various indicators. This is particularly evident in the case of the value added ratio ($\Delta WVAB = -4.2\%$) and the labour cost index ($\Delta WKP = -5.0\%$).

The aforementioned conditions of the return on sales determined by the ROS system indicators point to a number of differences between the food industry and the beverage industry, both as to their level and variability. The result of these differences are lower values of ROS in the manufacture of food products ($3.0 \leq ROS \leq 3.5\%$), and higher in the manufacture of beverages ($4.5 \leq ROS \leq 6.3\%$). In the food manufacture the lower return on sales shall mainly be ascribed to the weaker ability to create value added, resulting in a less favourable relationship of this value to revenues and, to a relatively large degree of its deceleration due to labour costs. Generally, however, in this section the annual average rate of change of indicators was low, and the annual average increase in ROS amounting to 0.9% indicates a greater impact of positive rather than negative changes, as regarded

from the profitability perspective. In turn, in the beverage industry better abilities to create added value, visible in the multipliers of WVAB and WPKR, noticeably weakened, which, together with changes in other factors (mainly financial expenses), resulted in a strong annual average downward trend in the return on sales ($\Delta ROS = -8.3\%$).

Generally, in a similar context, but taking into account the asset turnover (ROT), should be regarded the changes in return on assets. The research results indicate that in food manufacture the asset turnover ratio was relatively higher ($1.8 \leq ROS \leq 1.9$) than in the manufacture of beverages ($1.5 \leq ROS \leq 1.7$), and moreover, it was subject to slight fluctuations ($V_{ROT} = 3.2\%$), thus giving a weak downward trend ($\Delta ROT = -0.8\%$). The resultant of these changes in the food manufacture was a relatively stable ROA ($5.6\% \leq ROS \leq 6.7\%$) in the analysed sub-periods with a small, within the error margin, upward trend ($\Delta ROA = 0.1\%$). In this respect, less profitable seems to be the beverage industry, where a lower level of turnover in the analysed period was subject to regression ($\Delta ROT = -3.9\%$) and together with the decreasing return on sales ($\Delta ROS = -8.3\%$) it resulted in the depreciation of ROA (from 10.5% to 6.9%). In addition, the average annual growth rate indicates clearly that the strength of the negative impact of the direction of changes in ROS and ROA was over twice the negative impact of the decrease in the asset turnover.

Combining the return on sales and the asset turnover or only the return on assets with the equity multiplier allows estimating the rate of return on equity (ROE). The analysis of these connections leads to the conclusion that the degree of leverage (MK) of the return on equity (ROE) was in both branches of the food industry quite similar, indicating a similar structure of their capital. Furthermore, both in the manufacture of food products ($\Delta MK = -1.0\%$) and beverages ($\Delta MK = 1.0\%$) the equity multiplier was subject to weak changes, which means that on average in the analysed period it also marginally affected the changes in ROE. It also means that the variability of ROE was determined primarily by the variability of ROS and, although clearly to a lesser extent, by the variability of asset turnover.

Table 2 shows the average levels of the analysed indicators divided into classes

Tab. 1: Level, structure and rate of change of profitability (ROS, ROA, ROE) in the Polish food industry in 2006-2011 years

Variables	Food manufacture			Beverages manufacture			Total food industry		
	2006-2007	2008-2009	2010-2011	2006-2007	2008-2009	2010-2011	2006-2007	2008-2009	2010-2011
Average level of determinants of the structure of profitability and rates of return (in %)									
WVAB	17.6	17.7	17.1	23.7	22.7	19.7	18.6	18.6	17.5
WAM	83.9	84.4	84.4	83.6	85.2	84.9	83.8	84.6	84.5
WKP	29.1	28.9	31.3	39.9	41.6	33.5	31.5	31.9	31.8
WPPKO	105.5	108.9	105.9	97.3	96.0	103.2	103.2	105.0	105.1
WPKF	93.1	75.7	87.9	100.3	88.9	93.0	95.0	79.4	88.9
WZSN	100.1	100.4	100.2	100.2	101.2	100.0	100.1	100.7	100.1
WEP	82.0	81.4	83.6	81.3	81.7	81.6	81.8	81.5	83.2
ROS	3.5	3.0	3.5	6.3	5.6	4.5	3.9	3.5	3.7
ROT	1.9	1.9	1.8	1.7	1.6	1.5	1.9	1.8	1.8
ROA	6.7	5.6	6.4	10.5	9.2	6.9	7.5	6.4	6.5
MK	2.1	2.1	2.0	2.2	2.3	2.4	2.1	2.1	2.1
ROE	14.1	11.8	13.0	23.3	21.2	16.4	15.9	13.7	13.5
Coefficient of variation (V) and the average annual rate of change (Δ) of determinants of the structure of profitability and rates of return									
Variables	2006-2011		2006-2011		2006-2011				
	V (%)	Δ (%)	V (%)	Δ (%)	V (%)	Δ (%)			
WVAB	4.2	-1.3	9.1	-4.2	4.6	-2.0			
WAM	0.5	0.3	1.2	0.4	0.5	0.3			
WKP	9.6	3.2	13.6	-5.0	5.6	1.4			
WPPKO	3.1	0.1	5.1	0.9	2.2	0.2			
WPKF	12.1	-1.3	9.2	-0.7	10.8	-1.3			
WZSN	0.3	-0.4	0.9	-0.2	0.5	-0.3			
WEP	2.9	0.4	2.3	0.4	2.6	0.5			
ROS	20.4	0.9	19.9	-8.3	16.9	-1.2			
ROT	3.2	-0.8	7.8	-3.9	3.1	-1.3			
ROA	19.4	0.1	24.7	-11.9	17.1	-2.5			
MK	1.8	-1.0	4.5	1.0	1.1	-0.7			
ROE	19.4	-0.9	23.6	-11.0	17.4	-3.2			

Source: own calculations based on unpublished data of CSO

(sectors) of the food industry in 2009-2011. Their analysis indicates a very strong diversification of sectors, concerning both the level of individual measures of profitability as well as their conditions determined by the levels of the considered indicators. Taking into account the return on sales (ROS) it can be noticed that its

level fluctuated within a wide range, from -0.7% to 17.1%. The most profitable (ROS) sectors of the food industry include: 10.81 – sugar production (17.1%), 11.05 – beer production (8.6%), 10.52 – ice-cream production (7.8%), 10.71 – bread production (7.3%), and 10.73 – pasta production (7.1%). In turn, the group with

the lowest ROS include: 10.85 – manufacture of prepared meals and dishes (–0.7%), 11.01 – alcohol distillation (0.0%), 10.41 – production of oils (0.9%) and 11.03 – cider production (1.0%). The data in Table 2 also show that in each of the sectors ROS is clearly conditioned by diversified levels of the indicators. However, generally it can be stated that, on average, sectors with high ROS in relation to sectors with low ROS, are characterised by a high degree of value added ratio (WVAB), to a clearly lesser extent the value added is reduced there by the labour costs (WKP), the financial results are marginally determined by other operating activities (WPPKO), and the financial activities (WPKF) do not lead to a significant deceleration of profitability. In sectors with low ROS, these indicators are definitely negative. However, it seems that the strongest negative impact on ROS had high financial expenses, to a low degree compensated by financial revenues, which, with a relatively low added value ratio and high labour costs, led to a weak financial performance of a business activity or generated losses from this activity.

In terms of sectors, strong differences are noticeable also in relation to the rate of return on assets (ROA), the average level of which in 2009-2011 was in a wide range from –0.9% to 18.3%. However, ROA classifies the sectors of the food industry very similarly to ROS. This means that the impact of the asset turnover (ROT) on ROA was generally comparable in the analysed sectors, thus, seeking the reasons for the diversity of ROA mainly in the same factors which determine the diversity of the ROS levels. This does not mean, however, that the diversity and the impact of the asset turnover were marginal. The data in Table 2 show that the asset turnover is a very important determinant of the return on assets, which is particularly noticeable in meat processing (classes 10.11,12,13). In the case of these sectors, low ROS ($1.4\% \leq ROS \leq 2.8\%$) was in fact associated with a high level of turnover ($2.8 \leq ROT \leq 3.4$), indicating a short, i.e. about a 4-month cycle of asset reconstruction by revenues, allowing those sectors to obtain the ROA ratio at the level similar to the average in the food industry in total.

Combining ROA with the capital leverage (MK) enables the cause and effect analysis of the return on equity (ROE). The data in Table 2 show that the degree of leverage of the rate of

return on equity did not result in major changes in the classification of the food sectors. In general, sectors with high ROA achieved also high ROE. Nevertheless, it does not apply to sectors with very low or negative return on sales and assets (10.85, 11.01). In their case the high leverage ($3.4 \leq MK \leq 4.6$) was associated with a low or negative return on equity. It is worth noting that in the domestic food industry a particularly high ROE ratio had the brewing industry (48.4%). The high financial performance of this sector results from an above-average return on sales, assets turnover and, consequently, from the above-average return on assets, which, together with a relatively high leverage, leads to a very high return on equity.

3. Ordered Logit Models of Return on Equity

Table 3 presents, in 4 classes of the return on equity (ROE) distinguished on the basis of quartile, some basic descriptive statistics of the 432 analysed sectors of the food industry from 2005 to 2011 included (with the exception of ROE) in the construction of ordered logit model. On the basis of high values of the classic and positional coefficient of variation it may be concluded that in the analysed classes of profitability there is a significant diversity in majority of the variables; furthermore, these variables strongly differentiate the distinguished classes.

Considering sectors of the food industry with very low profitability ($ROE < 6.1\%$) it may be noted that on average they were characterised by a low added value ratio ($\overline{WVAB}_{ROE_1} = 15.3\%$), relatively high labour costs resulting in generating gross loss on sales ($\overline{WKP}_{ROE_1} = -13.0\%$) and a high rate of other operating revenues and expenses ($\overline{WPPKO}_{ROE_1} = 188.3\%$). These sectors are also characterised by a high rate of financial revenues and expenses ($\overline{WPKF}_{ROE_1} = -82.0\%$). The values of the aforementioned indicators on one hand clearly indicate a significant compensation of loss in other operating activities, on the other hand they point to generating loss as a result of a negative balance of financial revenues and expenses.

In addition, on average in this class of profitability, loss on ordinary activities was increased as a result of a negative balance of extraordinary gains and losses ($\overline{WZSN}_{ROE_1} = 98.7\%$). It corresponds to the very

Tab. 2: ROE components in the Polish food industry by branches (average 2009-2011)

Branch ¹	WVAB	WAM	WKP	WPPKO	WPKF	WZSN	WEP	ROS	ROT	ROA	MK	ROE
10.11	12.5	84.9	23.5	107.4	61.7	99.4	69.9	1.5	2.8	4.0	2.2	8.8
10.12	11.2	86.1	22.5	107.2	71.7	100.0	86.9	1.4	3.4	4.8	2.7	12.7
10.13	14.7	86.1	24.1	119.3	84.8	100.0	89.4	2.8	2.9	7.9	2.1	16.7
10.20	16.2	87.8	29.2	110.7	76.1	99.9	77.7	2.8	1.8	5.0	2.6	13.3
10.41	8.5	73.6	36.2	82.9	55.3	100.1	76.7	0.9	1.8	1.9	2.6	5.1
10.42	19.8	88.5	32.8	106.5	99.1	100.0	76.5	5.0	1.6	8.1	1.4	11.4
10.51	13.7	80.5	21.4	124.0	93.4	100.2	83.2	2.3	2.1	4.7	2.1	10.0
10.52	30.8	87.8	33.4	102.0	86.6	100.0	96.6	7.8	1.9	14.6	2.0	28.9
10.71	31.6	87.6	29.9	106.6	90.4	99.9	91.2	7.3	2.0	14.8	1.9	27.4
10.72	26.7	85.2	27.8	122.6	84.8	100.0	87.4	6.2	1.6	10.5	2.1	21.0
10.73	24.5	84.6	32.3	124.0	92.4	100.0	92.1	7.1	1.4	10.1	1.9	19.4
10.81	31.9	85.9	77.0	98.1	101.8	99.9	81.8	17.1	0.9	15.4	1.7	26.1
10.82	25.5	85.6	26.7	100.0	119.1	100.0	85.0	6.0	1.1	6.5	1.7	10.7
10.83	23.8	79.7	36.3	107.1	85.2	100.0	87.1	5.6	1.3	7.5	1.8	12.9
10.84	26.6	91.8	34.6	101.4	95.2	100.0	82.4	6.7	1.8	11.9	1.9	22.2
10.85	17.4	79.4	7.5	209.4	-55.0	101.7	120.2	-0.7	1.7	-0.9	4.6	-7.2
10.86	25.5	84.9	26.7	108.5	92.7	100.0	81.8	4.7	1.3	5.8	1.8	10.4
11.01	7.7	87.0	26.0	86.6	-27.5	100.0	104.9	0.0	1.7	1.0	3.4	3.6
11.03	12.4	79.7	12.3	328.6	39.8	100.0	121.7	1.0	1.9	1.7	2.3	3.5
11.05	25.2	85.0	43.9	100.1	104.4	100.0	89.2	8.6	2.1	18.3	2.6	48.4
11.07	28.9	83.8	26.2	100.4	94.0	100.1	81.2	5.0	1.0	5.2	1.9	9.9

Source: own calculations based on unpublished data of CSO

10.11 – Processing and preserving of meat (excluding poultry), 10.12 – Processing and preserving of poultry meat, 10.13 – Production of meat, including poultry meat products, 10.20 – Processing and preserving of fish, crustaceans and molluscs, 10.41 – Manufacture of oils and fats, 10.42 – Manufacture of margarine and similar edible fats, 10.51 – Operation of dairies and cheese making, 10.52 – Manufacture of ice cream, 10.71 – Manufacture of bread; fresh pastry goods and cakes, 10.72 – Manufacture of rusks and biscuits; preserved pastry goods and cakes, 10.73 – Manufacture of macaroni, noodles, couscous and similar farinaceous products, 10.81 – Manufacture of sugar, 10.82 – Manufacture of cocoa, chocolate and sugar confectionery, 10.83 – Processing of tea and coffee, 10.84 – Manufacture of condiments and seasonings, 10.85 – Manufacture of prepared meals and dishes, 10.86 – Manufacture of homogenised food preparations and dietetic food, 11.01 – Distilling, rectifying and blending of spirits, 11.03 – Manufacture of cider and other fruit wines, 11.05 – Manufacture of beer, 11.07 – Manufacture of soft drinks, production of mineral waters and other bottled waters.

low tax effect ratio ($\overline{WEP}_{ROE1} = 7.0\%$) resulting from a high incidence in this profitability class of sectors with gross and net loss. As a consequence of these conditions was, associated with a relatively lower level of turnover ($\overline{ROT}_{ROE1} = 1.7\%$) and close to the average in total of the level of equity multiplier ($\overline{MK}_{ROE1} = 2.3\%$), a negative average level of

profitability ($\overline{ROE1} = -14.9\%$). It should also be noted that the analysed indicators in the lowest profitability class (ROE 1) are characterised by the largest, compared to other classes, diversity measured with classic and positional coefficient of variation. On the other hand, considering sectors classified in other classes of the return on equity (ROE 2, ROE 3, ROE 4), there is

a certain regularity. It depends on the fact that the higher the ROE class, the higher the value added ratio ($\overline{WVAB}_{ROE_2} = 18.7\% < \overline{WVAB}_{ROE_3} < \overline{WVAB}_{ROE_4} = 24.2\%$); lower the burden of the depreciation costs ($\overline{WAM}_{ROE_2} = 83.1\% < \overline{WAM}_{ROE_3} < \overline{WAM}_{ROE_4} = 87.7\%$) and the labour costs ($\overline{WKP}_{ROE_2} = 23.6\% < \overline{WKP}_{ROE_3} < \overline{WKP}_{ROE_4} = 39.8\%$) placed on the value added, smaller and decreasing but also of positive significance to the financial performance of other operating activities ($\overline{WPPKO}_{ROE_2} = 125.6\% < \overline{WPPKO}_{ROE_3} < \overline{WPPKO}_{ROE_4} = 114.9\%$); clearly weaker influence of financial activity on profitability ($\overline{WPKF}_{ROE_2} = 82.4\% < \overline{WPKF}_{ROE_3} < \overline{WPKF}_{ROE_4} = 97.7\%$); marginal significance of extraordinary gains and losses (\overline{WZSN} oscillates around 100%); more beneficial impact of the tax effect ($\overline{WEP}_{ROE_2} = 81.7\% <$

$\overline{WEP}_{ROE_3} < \overline{WEP}_{ROE_4} = 87.4\%$), stable influence of the financial leverage ($\overline{MK}_{ROE_2} = \overline{MK}_{ROE_3} = \overline{MK}_{ROE_4} = 2.2\%$), higher asset turnover ($\overline{ROT}_{ROE_2} = 1.9\% < \overline{ROT}_{ROE_3} < \overline{ROT}_{ROE_4} = 2.1\%$), and a significant increase in the rate of return on equity ($\overline{ROE}_2 = 9.6\% < \overline{ROE}_3 < \overline{ROE}_4 = 29.8\%$).

Table 4 presents the estimated parameters of the ordered logit model of the return on equity for the food industry sectors, the construction of which includes a set of variables of the proposed ROE system, as well as binary variables representing the categories of enterprise size (W1 – small, W2 – medium, W3 – big). As the reference level the small enterprises sector of the food industry (W1) was adopted. To estimate the parameters of ordered logit models the program STATA 12 was used.

Tab. 3: Descriptive statistics of variables in the ROE model by ROE classes (level)¹

Level of ROE ²	ST ³	WVAB	WAM	WKP	WPPKO	WPKF	WZSN	WEP	ROT	MK	ROE
ROE 1 very low	1	15.3	76.4	-13.0	188.3	-82.0	98.7	7.0	1.7	2.3	-14.9
	2	14.0	78.8	7.4	109.3	37.0	100.0	71.5	1.6	2.5	-0.9
	3	45.8	13.5	-670.7	206.9	-455.5	41.7	4,113.7	37.4	160.1	-365.8
	4	36.9	7.7	191.2	42.8	126.3	0.1	32.3	26.8	24.3	-862.8
ROE 2 low	1	18.7	83.1	23.6	125.6	82.4	100.0	81.7	1.9	2.2	9.6
	2	18.7	83.5	23.1	112.5	79.4	100.0	82.5	1.6	2.2	9.9
	3	34.9	5.1	39.9	46.7	48.6	1.5	8.9	38.8	21.7	18.8
	4	27.0	3.4	23.0	14.2	11.1	0.1	5.6	30.1	13.6	14.7
ROE 3 medium	1	19.1	83.9	29.9	129.9	88.6	101.3	87.3	2.0	2.2	15.6
	2	17.7	84.6	29.8	109.7	87.5	100.0	86.6	1.8	2.2	15.3
	3	39.5	4.9	33.5	72.4	17.4	12.0	12.0	38.1	19.9	14.2
	4	32.8	3.0	22.2	8.8	8.2	0.0	3.7	30.0	10.0	12.8
ROE 4 high	1	24.2	87.7	39.8	114.9	97.7	100.8	87.4	2.1	2.2	29.8
	2	25.5	87.7	36.2	104.5	94.5	100.0	87.2	2.0	2.0	25.1
	3	36.0	4.3	31.6	57.4	36.4	7.5	6.7	32.4	51.7	36.9
	4	28.1	3.0	24.1	5.9	4.0	0.0	5.2	17.4	15.4	22.9
total	1	19.3	82.8	20.1	139.7	46.7	100.2	65.9	1.9	2.2	10.0
	2	18.5	84.2	26.6	107.7	83.9	100.0	84.9	1.8	2.2	12.5
	3	42.0	9.0	242.8	147.8	433.3	21.7	224.0	37.6	86.8	321.3
	4	34.3	3.8	33.3	11.8	15.2	0.1	6.7	26.7	18.0	55.4

Source: own calculation

¹All variables, with the exception of ROT and MK, in %.

²Class ROE: ROE 1 < 6.1%; 6.1% ≤ ROE 2 < 12.4%; 12.4% ≤ ROE 3 ≤ 19.9%; ROE 4 > 19.9%.

³ST – descriptive statistics: 1 – the arithmetic mean, 2 – median, 3 – Classic coefficient of variation based on the arithmetic mean and standard deviation (in %), 4 – positional coefficient of variation based on the median and quartile deviation (in %).

On the basis of the Wald test for the significance of parameter estimates there have been found a statistical significance of almost all parameters for the explanatory variables at the significance level of $p = 0.05$. Only the variables representing the impact of extraordinary gains and losses (WZNS) and the size of the enterprise (W2 – medium-sized enterprises sector) have proven to be insignificant ($p > 0.05$). It should be noted that in the estimated model parameters for the explanatory variables are the same for each j -class of the return on equity, which is due to the a priori adopted assumption of proportional odds (parallel regression assumption). In order to verify this assumption the Brant test and Wolfe and Gould test have been conducted. As indicated by the data in Table 5, the combined Brant and Wolfe and Gould tests for all the parameters are statistically significant ($p < 0.05$), which indicates a violation of the parallel regression assumption. However, individual tests indicate that responsible for this are two variables, the rate of depreciation costs (WAM), informing about the impact of depreciation, and the labour cost index (WKP), informing about the impact of wage costs on ROE. This means therefore that the rates for these explanatory variables

differ significantly between the pairs of the compared ROE classes. In turn, the parameters for other variables differ considerably less, the least for the WPPKO variable (the rate of other operating revenues and expenses) ($p = 0.901$), informing about the impact of the so-called other operating activities on ROE.

As a consequence of violation of the assumption of proportional odds (parallel regression, parallel lines), on the subsequent stage of the analysis there have been estimated the parameters of the generalised ordered logit model, which includes a variability of parameters with explanatory variables depending on the ROE class (level).

Presented in Table 6 the generalised ordered logit model is characterised by a very good fit to the empirical data (McKelvey & Zavoina's R-square = 0.994, Count R-square = 0.780; pseudo R-square = 0.655) and statistical significance ($p < 0.05$) of majority of parameters at the explanatory variables. In the first group of comparison of the level of return on equity (ROE 1 to ROE 2, 3, 4), statistically insignificant ($p > 0.05$) have been found parameters for the WAM, WPPKO, WPKF, MK as well as W2 and W3 variables. This means therefore that a very low rate of ROE (ROE 1), in relation to higher

Tab. 4:

Results of estimating the parameters of the ordered logit model of the return on equity (ROE) for the Polish food industry sectors

Explanatory variables	Estimation of parameter $\hat{\beta}$	Standard error	z – Wald statistics	Significance p	Odds ratio $exp(\hat{\beta})$
WVAB	0.233	0.029	8.120	0.000	1.263
WAM	0.134	0.034	3.940	0.000	1.144
WKP	0.148	0.014	10.230	0.000	1.159
WPPKO	0.002	0.001	3.700	0.000	1.002
WPKF	0.057	0.009	6.090	0.000	1.058
WZSN	-0.016	0.013	-1.250	0.210	0.984
WEP	0.109	0.017	6.450	0.000	1.115
ROT	2.062	0.272	7.570	0.000	7.860
MK	1.309	0.298	4.400	0.000	3.702
W2	0.413	0.304	1.360	0.175	1.511
W3	0.768	0.337	2.280	0.023	2.155
cut1	36.026	3.590	-	-	-
cut2	39.989	3.754	-	-	-
cut3	43.177	3.875	-	-	-

Source: own calculation

Tab. 5: Results of estimating parameters of logit models for pairs of the compared groups in the return on equity (ROE) for the food industry sectors and Brant and Wolfe and Gould tests

Explanatory variables	ROE 1 compared to ROE 2,3,4	ROE 1 and 2 compared to ROE 3,4	ROE 1,2,3 compared to ROE 4	Test statistic chi ²	Significance P
WVAB	0.2565	0.2347	0.3263	2.090	0.351
WAM	0.0738	0.0612	0.2952	9.990	0.007
WKP	0.0903	0.1547	0.1990	9.400	0.009
WPPKO	0.0007	0.0032	0.0056	0.210	0.901
WPKF	0.0418	0.0413	0.0532	1.360	0.508
WZSN	0.0599	0.0786	-0.0073	1.240	0.537
WEP	0.1565	0.1641	0.0694	5.880	0.053
ROT	2.9737	2.1482	2.7255	1.370	0.503
MK	0.4864	1.4330	1.4890	3.000	0.223
W2	-0.4827	1.1166	0.5691	4.410	0.110
W3	0.7316	1.2705	0.7404	0.750	0.687
constant	-39.2560	-48.2120	-60.0090		
Brant overall test	-	-	-	79.130	0.000
Wolf-Gould overall test	-	-	-	54.94	0.000

Source: own calculation

rates of ROE (ROE 2, 3, 4), is not determined by the depreciation costs, the efficiency of other operating activities, financial activities, financial leverage and the enterprise size. On the other hand, considering the subsequent comparison of the ROE level (ROE 1, 2 to ROE 3, 4 and ROE 1, 2, 3 to ROE 4), it may be noticed that irrelevant have proven to be only the parameters at the variables informing about the impact of extraordinary events (WZSN), the influence of the tax effect (WEP) and the impact of the size of enterprises (W2, W3).

Analysing the parameters of the generalised ordered logit model in table 6, it can be seen that a very low return on equity (ROE 1), compared to other higher classes (ROE 2, 3, 4), was strongly connected with the value added ratio (WVAB), labour cost index (WKP), the rate of financial revenues and expenses (WPKF), the tax effect ratio (WEP) and asset turnover (ROT). These variables had a positive effect on the possibility to change the lowest class of profitability (ROE 1) for a higher one (ROE 2, 3 or 4). For example, a unit increase (by 1 pp) of the WVAB variable increases the

chance of food industry sectors with very low profitability (ROE 1) to move to a higher level (ROE 2, 3, 4) of profitability (under the ceteris paribus assumption) up to 1.229 times. In contrast, a unit increase of the WKP rises this chance by 1.083 times, WPKF – 1.037 times, WEP – 1.140 times and ROT – even 9.503 times (which is connected with the unit in which the ROT variable is measured). It can therefore be concluded that the reasons for the transition from a very low return on equity should be primarily sought in: improving the ability to create value added, financial expenses reduction, tax optimisation and more productive use of assets.

In turn, comparing the food industry sectors with a very low (ROE 1) and low (ROE 2) level of ROE with sectors with a medium (ROE 3) and high profitability (ROE 4) it has been noticed that all the explanatory variables (with the exception of WZSN, W2, W3) had a significantly positive effect on the chance to improve the financial situation. This means that a unit increase of these variables rose the chance of transition from low (ROE 1, 2) to high (ROE 3, 4)

categories of the return on equity. Therefore, fundamental capabilities in achieving good financial results measured with the rate of return on equity (ROE 3, 4) should be sought mainly in: stimulating technological progress allowing to achieve a high ratio of the value added to revenue (WVAB); rational investment in fixed assets and rational management of these assets (WAM); labour productivity growth, reducing unit labour costs and thereby increasing the share of profits on sales in the added value (WKP); effective

management of other operating activities (WPPKO); rational policy of financing activities reducing the scale of profit deceleration caused by financial expenses (WPKF), combined with a reasonable level of financial leverage (MK) and tax optimisation (WEP) and in the increase in productivity of assets (ROT). It may also be noticed that the higher the starting class of the return on equity, the greater the chance of transition to a higher class due to the increase in the aforementioned variables.

Tab. 6: Results of estimating the parameters of the generalized ordered logit model of the return on equity (ROE) for the Polish food industry sectors (Part 1)

Explanatory variables	Estimation of parameter $\hat{\beta}$	Standard error	z – Wald statistics	Significance p	Odds ratio $exp(\hat{\beta})$
Very low (ROE 1) level of ROE compared to low (ROE 2), medium (ROE 3) and high (ROE 4) ROE level					
WVAB	0.206	0.067	3.080	0.002	1.229
WAM	0.117	0.063	1.850	0.064	1.124
WKP	0.080	0.022	3.680	0.000	1.083
WPPKO	0.001	0.001	0.980	0.328	1.001
WPKF	0.036	0.009	4.160	0.000	1.037
WZSN	0.050	0.060	0.830	0.407	1.051
WEP	0.131	0.028	4.610	0.000	1.140
ROT	2.252	0.775	2.910	0.004	9.503
MK	0.543	0.487	1.110	0.265	1.721
W2	-0.140	0.720	-0.190	0.846	0.869
W3	0.871	0.804	1.080	0.279	2.388
constant	-37.390	9.371	-3.990	0.000	0.000
Very low (ROE 1) and low (ROE 2) level of ROE compared to medium (ROE 3) and high (ROE 4) ROE level					
WVAB	0.309	0.057	5.370	0.000	1.361
WAM	0.116	0.054	2.140	0.033	1.123
WKP	0.242	0.034	7.020	0.000	1.274
WPPKO	0.017	0.003	4.900	0.000	1.017
WPKF	0.059	0.010	5.740	0.000	1.061
WZSN	0.219	0.168	1.300	0.194	1.244
WEP	0.196	0.035	5.570	0.000	1.216
ROT	2.834	0.517	5.480	0.000	17.016
MK	2.145	0.535	4.010	0.000	8.546
W2	0.440	0.506	0.870	0.385	1.553
W3	0.765	0.556	1.380	0.169	2.148
constant	-78.676	19.079	-4.120	0.000	0.000

Tab. 6: Results of estimating the parameters of the generalized ordered logit model of the return on equity (ROE) for the Polish food industry sectors (Part 2)

Explanatory variables	Estimation of parameter $\hat{\beta}$	Standard error	z – Wald statistics	Significance p	Odds ratio $exp(\hat{\beta})$
Very low (ROE 1), low (ROE 2) and medium (ROE 3) level of ROE compared to high (ROE 4) ROE level					
WVAB	0.399	0.065	6.120	0.000	1.491
WAM	0.327	0.078	4.160	0.000	1.387
WKP	0.241	0.034	7.000	0.000	1.273
WPPKO	0.020	0.004	5.390	0.000	1.020
WPKF	0.104	0.025	4.160	0.000	1.110
WZSN	0.043	0.027	1.610	0.108	1.044
WEP	0.034	0.034	1.000	0.319	1.034
ROT	3.587	0.626	5.730	0.000	36.132
MK	2.396	0.813	2.950	0.003	10.979
W2	0.370	0.651	0.570	0.570	1.447
W3	1.029	0.722	1.430	0.154	2.798
constant	-77.863	11.052	-7.030	0.000	0.000
McKelvey & Zavoina's $R^2 = 0.994$; count $R^2 = 0.780$; pseudo $R^2 = 0.655$					

Source: own calculation

Conclusions

The socio-political transformations connected with the Polish accession to the European Union fundamentally determined the direction and dynamics of structural changes in the national economy. These processes included all sectors, also the food industry, which is one of the largest and most dynamically developing sectors of the Polish economy. The dynamics of changes in the Polish food industry in 2005-2011 is definitely confirmed by a dynamic real increase in output (of over 28%) and value added (of over 37%) as well as over a 100% nominal export growth, indicating a strong competitive position of the domestic food industry on the EU market. Together with the dynamic changes of these economic categories also the determinants of financial condition indicating profitability changed in a positive way. However, the profitability level (of sales, assets, equity) was clearly differentiated in the food industry sectors. The proposed in the paper system of decomposition of the return on equity has allowed a multidimensional analysis of profitability determinants. Its implementation in the food industry sectors, using the logit

regression models of ordered categories, has proven that the reasons for different ROE in the food industry sectors should be primarily sought in the ability to create value added, labour costs, rational management of financial expenses, efficient use of assets as well as in more aggressive shaping the capital structure, determining the level of financial leverage. In conclusion, the applied in the paper ordered logit model of the return on equity has proven to be a very good tool to assess the significance of the factors affecting the level of ROE rates in the food industry sectors. In addition, the proposed model apart from its applicability also possesses a practical value. It allows to predict probable scenarios of transition from a very low level of the return on equity to more favourable financial results measured with this profitability category.

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PROFITABILITY OF THE FOOD INDUSTRY IN POLAND – AN ORDERED LOGIT MODEL APPROACH**Zbigniew Gołaś, Izabela Kurzawa**

The article addresses the problem of financial determinants of return on equity (ROE) in the food industry in Poland. The analysis was conducted on the basis of the decomposition of the rate of return on sales and in conjunction with the system of indicators linking the return on sales to return on assets and equity. In addition, in order to identify the significance of individual components of the ROE system, ordered logit regression models were estimated.

The proposed in the paper system of decomposition of the return on equity has allowed a multidimensional analysis of profitability determinants. Its implementation in the food industry sectors, using the logit regression models of ordered categories, has proven that the reasons for different ROE in the food industry sectors should be primarily sought in the ability to create value added, labour costs, rational management of financial expenses, efficient use of assets as well as in more aggressive shaping the capital structure, determining the level of financial leverage. In conclusion, the applied in the paper ordered logit model of the return on equity has proven to be a very good tool to assess the significance of the factors affecting the level of ROE rates in the food industry sectors. In addition, the proposed model apart from its applicability also possesses a practical value. It allows predicting probable scenarios of transition from a very low level of the return on equity to more favourable financial results measured with this profitability category.

Key Words: Food industry, Poland, return on equity, system of financial ratios, ordinal regression.

JEL Classification: L66, G3, C52.

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DO THE DATA ON MUNICIPAL EXPENDITURES IN THE CZECH REPUBLIC IMPLY INCORRECTNESS IN THEIR MANAGEMENT?

Milan Půček, Michal Plaček, František Ochrana

Introduction

By way of public budgets is in economically developed countries redistributed approximately one half of the produced GDP. According to the EUROSTAT data (EUROSTAT, 2012), total government expenditures in the EU countries (EU-27) accounted in 2012 for 48.9% of GDP, of which expenditures on the local governments' level accounted for 11.5% of GDP. In the Czech Republic, these expenditures stood in 2012 at 43.9% of GDP, while local governments' spending accounted for 9.8% of GDP. A more detailed comparison of the ratio of total public expenditures to GDP and expenditures of local governments to GDP brings the following table.

Distribution of public expenditures between central and local governments depends on

a type of the model of fiscal federalism adopted in individual countries. For most of the reviewed countries, we may register a decrease in public expenditures of local governments. The cause could be attributed to a drop in tax revenues due to the economic crisis. Local governments, unlike central governments, do not aim to stabilise the economy using a fiscal policy. With respect to the significant volume of allocated resources, it is desirable to possess information on how are these incurred expenses economically treated. The present state of theoretical reflection is such that examination of municipal expenditures is usually oriented towards analysing municipal expenditures related to a specific area, such as efficiency in provision of municipal services (Pavel & Sičáková-Beblavá, 2009), in contracting

Tab. 1: Comparison of total government expenditures to GDP and expenditures of local governments to GDP in selected countries of Central Europe

Country	2010		2011		2012	
	Total government	Local government	Total government	Local government	Total government	Local government
Czech Republic	43.0%	11.3%	42.5%	10.8%	43.8%	9.8%
Slovakia	42.0%	7.3%	40.6%	6.8%	40.2%	6.4%
Slovenia	49.2%	9.8%	49.8%	9.4%	48.1%	9.5%
Hungary	49.7%	12.6%	49.9%	11.5%	48.7%	9.3%
Poland	45.9%	15.0%	43.9%	14.1%	42.9%	13.3%
Romania	39.6%	9.5%	39.2%	10.3%	36.4%	9.6%

Source: Eurostat (2012)

public services at a local level (Nemec, Ochrana, & Šumpíková, 2008), on analysis of municipal finances (Peková, 2011) and their indebtedness. In addition to these examinations, further ways are being sought with the aim to streamline outlays of municipal expenditures with a possibility of introducing public administration controlling (Štandová, Mihalíková, & Mitařalová, 2007) or indentifying suitable institutional forms (Beblavý & Šičáková-Beblová, 2006) or forms of ownership in the provision of services. At the same time, it appears as necessary to look for ways of how to detect possible incorrectness in the management of municipal expenditures and how to improve the public expenditure control system. Towards one of the possible ways points also this study. Using Benford's test, it aims to examine expenditures of the Czech Republic's

municipalities recorded in 2012, analyse uncovered results and formulate conclusions with respect to a more effective operation of the control system of public expenditures. As far as our knowledge based on analysis of expert literature goes, Benford's test has not yet been applied within the realm of control of public expenditures. The presented study attempts to carry out such an analysis (on the example of the Czech Republic's municipal expenditures in 2012). The aim of this study is to explore by way of Benford's test municipal expenditures of the Czech Republic that were undertaken within one reference year and based on results of the empirical research to carry out a discussion on the given issue and to formulate theoretical generalisations and practical recommendations for the domain of a control of public expenditures.

Tab. 2: General architecture of the control system of public expenditures (case of the Czech Republic)

Criterion	Type of control	Subject of control	Monitored indicator	Monitoring question
Content focus	Content control	Control of results (audit of results, performance audit)	Agreement between achieved results and specified expenditure targets	How are performance indicators being met? How are met criteria of economy, efficiency and effectiveness?
	Formal control	Control of receipts and legal review of documents	Compliance with the Act on Accounting and legal compliance with expenditure documents	Are accounts and expenditure documents kept correctly from a formal aspect?
Time aspect	Preliminary	Ex ante control of planned expenditure activities	Choice of the most appropriate allocation variant of public expenditures	Has the chosen variant been economically the most appropriate one?
	Running	Continuous monitoring of achieved results and control of receipts and documents	Continuous monitoring of meeting the predetermined indicators	Are the predetermined indicators being met at review time points? Do expenditure activities correspond with formal requirements?
	Subsequent and concluding	Concluding content and formal review of the undertaken expenditure activity	Final control of the achieved results and the degree of compliance with accounting and legal practices	Do the final results correspond with the planned objective? Are all the formal (accounting and documentation) procedures in accordance with the principles of accounting and the legal code?
Institutional	Internal control	Content, formal, preliminary, running and concluding control by the institution itself	Indicators of the content and formal control listed above, monitored by an internal audit	Do the controlled indicators correspond with the norm specified by the Act on Financial Control and other relevant legal norms?
	External control	Content, formal, running and concluding control carried by an external independent institution – in CZE severely limited (by the Supreme Audit Office)	Indicators of the content and formal control as listed above, monitored by an external audit	Do the controlled indicators correspond with the norm specified by the Act on Financial Control?

Source: own based on Act No. 320/2001 Coll., On Financial Control in Public Administration

1. Theoretical Foundations of the Research

The starting point for control of public expenditures is a duly effective control system of public spending. The issue of a control of public expenditures has already been studied within expert literature for several decades. Authors usually devote in detail to a particular aspect of a control of public expenditures, such as e.g. the issue of a financial control, audit of public sector organisations or program evaluation and performance measurement. Within countries of the former Eastern bloc emerges the issue of a control of public expenditures approximately for the past ten years (see e.g. Štangová, Mihalíková, & Mitařová, 2007). Based on the analysis of a discussion on the issue of a control of public expenditures within expert literature and the existing control system of public expenditures in the Czech Republic, the system of a control of public expenditures may be characterised from different perspectives, as shown in Table 2. The table provides a synthesis of views on the issue of a control of public expenditures. As a starting point it takes the situation as within conditions of the Czech Republic specified by the Act No. 320/2001 Coll., On Financial Control in Public Administration.

From the content perspective, the control system of public expenditures focuses both on the economic aspect of spending activities (monitoring of the achieved results) as well as on the formal (accounting and documentation) verification of the correctness of carried expenditure activities. From the time aspect, we distinguish between preliminary, running and final inspection. It may be directed both to the area of auditing results of implemented spending activities as well as on a formal verification of the correctness (accounting and documentary) of the way those expenditure activities are recorded. From the institutional point of view, the control may be carried either by the institution itself (internal control) or by an external institution. One problematic aspect, however, represents the fact that the control system of municipal expenditures has under the conditions of the Czech Republic its weaknesses and limitations. Municipal expenditures (as opposed to central government expenditures) can not be checked by the Supreme Audit Office. On the part of the Supreme Audit Office can be checked only

those expenditures that local governments derive from the state budget. What is missing is thus one of important independent information channels that would serve a feedback on how were municipal expenditures implemented.

Another problem poses the fact that in the practice of control activity, there is established a relative separation of the content control from the formal control. The consequence is that both types of controls in question do not co-operate; respectively, they are often implemented separately (or independently). Expenditure controls usually either intentionally focus only on checking of economic results related to the undertaken expenditures, or concentrate purely on a verification of the formal (accounting and documentation) correctness of the carried outlays. The fact that both types of control remain unlinked means some valuable information get lost or remain potentially unused while they could lead to an increase in efficiency of the control system of public expenditures, exposure of formal and material errors in resource allocations or possible frauds and machinations in the management of public resources. Therefore, it is desirable to seek ways to contribute to a more effective control of public spending and to utilise acquired information in a comprehensive monitoring of expenditure activities. One of these ways may represent signalling of accounting and record-keeping irregularities in expenditure management activities, acquired through a formal control. This information may subsequently trigger a content control to review the economic rationality (economy, efficiency and effectiveness) of the carried expenditures. One of the tools that are instrumental to acquire signalling information on possible errors in the management of public expenditures is the use of Benford's test.

Benford's Law builds on the idea of the "first digit law", formulated in 1881 by an American astronomer Simon Newcomb in the article entitled "Note on the Frequency of Use of the Different Digits in Natural Numbers" published in *The American Journal of Mathematics*. In this article he holds that the probability of the first digit in a number being 1 is not 0.111 ($1:9 = 0.111$) as might be expected, but rather 0.301. This proposition was rediscovered by Frank Benford and formulated in detail in the article "The Law of Anomalous Numbers" (Benford, 1938). Benford supported his investigation by

an analysis of more than 20,000 data samples. Within his analysis, Frank Benford sought to utilise the widest possible data sources from random numbers, street numbers, lake surface areas, population data, or statistics from the American Basketball League (Nigrini, 2011).

Mathematical application of Benford's Law is dealt with by Hill (1995a; 1995b; 1998) and Berger and Hill (2011). As fundamental may be considered the following theorem, based on the Central Limit Theorem: "Provided the chosen distribution is a random one and provided from any such a distribution we pick a random sample, significant numbers from this distribution converge to the logarithmic distribution, alias Benford's distribution", as put by Hill (1998).

The probability of an occurrence of the first digit D1 based on Benford's distribution is:

$$P(D_1 = d_1) = \log\left(1 + \left(\frac{1}{d_1}\right)\right) \quad (1)$$

$$d_1 \in \{1 \dots 9\}$$

The probability of an occurrence of the second digit D2 based on Benford's distribution is:

$$P(D_1 = d_1) = \log\left(1 + \left(\frac{1}{d_1 d_2}\right)\right) \quad (2)$$

$$d_1 = 1 \quad d_2 \in \{1 \dots 9\}$$

If we extend our analysis to the occurrence of a number on the *n*-th position, we make use of the following general formula:

$$P_n\{d\} = \frac{1}{\ln(B)} \sum_{k=B^{n-1}}^{B^n-1} \ln\left(1 + \frac{1}{kB+d}\right) \quad (3)$$

The first application of Benford's Law in the field of accounting was performed by Carslaw (1988) who claimed that when the net income of a company is just below a given psychological level its managers will tend to round this income up. For example, if we have a net income of 798,000 and 19.97 million, managers will try to round these numbers to the amount of 800,000 and 20 million, respectively. This activity is understandable due to the management incentive programs. Carslaw claimed that this behaviour can be detected using Benford's Law, i.e. within the data set there will be a higher

occurrence of zeros in the second position and a lower incidence of the number 9 in the second position when compared to Benford's distribution.

The research of Carslaw was followed by Thomas (Nigrini & Mittermaier, 1997) who examined rounding of tax losses in the USA. His further analysis focused on Earnings per Share (EPS), for which the number nine occurred on the last position less frequently than expected. This resulted in a claim that Earnings per Share are rounded up while losses are rounded down. In 1993, Gupta and Christian (Nigrini & Mittermaier, 1997) analysed data of taxpayers reported in tax returns. The study focused on taxpayers with an income less than USD 100,000. Provided a taxpayer in this category reduces his income by a few dollars, he may fall into a lower tax rate bracket. The findings uncovered an income misrepresentation by taxpayers who ranked on the border line for an increase in their marginal tax rate.

A significant shift in the theory of Benford's Law application in the domain of accounting fraud detection is credited to Nigrini (1993; 1996; 2011). Nigrini in his first study (Nigrini, 1993) examined the first and second digit in interests paid and interests credited on a sample of about 200,000 tax returns from 1985 to 1988. The result was a bias towards lower numbers for interests accrued and higher numbers for interests paid. This research was followed by practical case studies of specific companies, such as the test of first digits, second digits and first two digits of invoices issued by an oil company in order to detect duplicates in documents. Another application was an analysis of rounding in numbers.

Examinations by Nigrini are summarised by Durtshi, Hillison and Pacini in their study "The Effective Use of Benford's Law to Assist in Detecting Fraud in Accounting Data" (Durtshi, Hillison, & Pacini, 2004) where they also provide a guide for the application of Benford's Law in forensic audit. Conclusions from the mentioned sources can be summarised into the following overview table (Tab. 3).

Results of this generalisation (see Tab. 3) related to conditions and instances of the use of Benford's Law within the domain of a formal control (in this case accounting) will be adopted as a basis for an empirical analysis of aggregate data on municipal public expenditures in the Czech Republic.

Tab. 3: Terms and examples of use of Benford's Law in accounting

Nr.	Data for the use of Benford's Law should satisfy the following conditions	Nr.	Benford's law can be used to detect the following data manipulations
1	All data in the data set must be recorded in the same unit	1	Rounding of economic performance by managers, e.g. rounding of profit from 789,000 to 800,000
2	Data must not be limited by their maximum and minimum value	2	Upward rounding of net income and EPS (earnings per share)
3	Data can not be numbers used for identification purposes and they are not generated randomly	3	Downward rounding of losses
4	Data should consist of rather small values	4	Duplicity of financial figures, e.g. invoices
5	It is advisable to have larger data sets	5	Wiping data off
6	Data should not be influenced by a psychology, e.g. pricing ending with 99	6	Rewriting figures

Source: own based on Nigrini and Mittermaier (1997); TPA Horwath (2011)

Tab. 4: Conclusions from the analysis of studies applying Benford's Law on the control of macroeconomic data

	Study # 1	Study # 2	Study # 3
Name of the study	On the Application of Benford's Law to International Macroeconomic Statistics	Benford's Law and Macroeconomic Data Quality	Fact and Fiction in EU Governmental Economics Data
Year of publication	2007	2009	2011
Topic	Tests of data on the development of GDP in OECD countries and Africa.	Macroeconomic data of 80 countries and comparison of results with an alternative method of assessment of the macroeconomic data quality – the IMF's Data Assessment Framework.	National accounts of the EU MSs on data related to compliance with the SGP: (1) Government deficit and debt, (2) Government revenue, expenditures and main aggregates, (3) GDP, (4) Balance sheet, consolidated assets and liabilities.
Main conclusions	(1) Most of the data converged to Benford's distribution. (2) Benford's test may serve as an indicator of poor quality and manipulations with data.	(1) Data for some countries did not converge to Benford's distribution despite the fact that their statistical data were on the basis of the IMF ranking marked as good (Japan, Finland). (2) Non-conformity with the test may be caused e.g. by structural changes in the economy, seasonal adjustments, etc.	(1) The largest deviations from Benford's distribution indicated data for Greece and Lithuania while the lowest deviation recorded data for the Czech Republic (tested for the first time) and Poland. (2) Benford's test can be used as a first instance test that may indicate data manipulations.

Source: own based on Nye and Moul (2007); Gonzales and Pastor (2009); Rauch et al. (2011)

Within the scope of Benford's Law application on macroeconomic data, there were published three major studies. In the first study "*On the application of Benford's Law to International Macroeconomic Statistics*" Nye and Moul (2007) focus on tests of data related to the development of GDP in OECD member states and Africa. In the second study ("*Benford's Law and Macroeconomic Data Quality*"), its authors Gonzales and Pastor (2009) focus on testing of macroeconomic data collected from 80 countries while the results were compared with an alternative method of assessment of the macroeconomic data quality, the IMF's Data Assessment Framework, based on which are compiled rankings of countries according to the quality of statistical data (Data Dissemination Reports on the Observance Standards and Codes). The last published study (Rauch, Göttische, Brähler, & Engel, 2011) examined national accounts of the EU member states on data related to the performance of the Stability and Growth Pact. The authors formed a ranking of countries based on the average deviation of χ^2 test results. Comparison of these studies and their conclusions are summarised in Table 4.

Authors of all three studies agree that the application of Benford's test on macroeconomic data may help to identify data with a higher probability of data manipulation. At the same time, however, it is necessary to take into account also the constraints that from this adoption arise. These include primarily erroneous results due to structural changes in the economy, adjustments for seasonality and macroeconomic transformations. Conclusions of these studies are relevant for interpreting results of empirical examinations that use Benford's Law.

In addition to the above-mentioned adoption within the domain of accounting, auditing and analysis of macroeconomic data, application of Benford's Law was also tested in analysing results of the elections in the USA (Decker, Myagkov, & Ordeshook, 2011), in fiscal (tax) control (Watrín, 2008), insurance (Maher & Akers, 2002) and also in verifying credibility of regression coefficients in scientific articles, as reported by Diekmann (2007), Diekmann and Jann (2010) and Tödter (2009). In the literature, we were unable to identify any application of Benford's test on a lower than macroeconomic level, e.g. within the domain of municipalities.

This study, therefore, likely stands to be the first examination that audits municipal expenditures using Benford's Law.

2. Results of the Empirical Research

The research focused on examination of data from municipalities in the Czech Republic. To be specific about the general characteristics of the object of investigation, let us observe that as of December 31, 2012, there were in total 6,246 municipalities in the Czech Republic with 10,503,477 inhabitants, while in municipalities over 2,000 inhabitants there lived in total 73.2% of the overall population. Management of municipalities is in the Czech Republic governed by their annual budget and the budget outlook, as specified by the Act No. 250/2000 Coll., On Budgetary Rules of Regional Budgets. Within the research, we have worked along the lines of the binding classification of municipal budgets – the budgetary structure, specified by the Regulation of the Ministry of Finance of the Czech Republic No. 323/2002 Coll., On Budgetary Structure. Description of public administration reforms in the Czech Republic is provided e.g. in (Špaček & Neshybová, 2010).

For the purposes of empirical analysis were used aggregate data sourced from the Ministry of Finance of the Czech Republic. The data refer to the year 2012 and represent sums of public expenditures in the structure of the statement of budgetary execution and control of all municipalities in the Czech Republic, divided into categories according to the population (see Tab. 5). For the data analysis there were used statistical methods, hypothesis testing, linear regressions and comparisons. The aim was to examine whether aggregate data on public expenditures of municipalities in the Czech Republic converge to Benford's distribution. For this purpose, municipalities in the Czech Republic were divided into 12 categories according to the size of their population, as shown in Table 5.

Aggregation of data using the respective size of municipalities was chosen for two reasons. The first reason is the fact that with regard to the total number of municipalities in the Czech Republic (6,246 municipalities), within this study it was not practicable to examine all expenditures for all municipalities. The second reason for opting for an aggregation was the fact that size-categories of municipalities allow benchmarking and therefore make it possible to

Tab. 5: Number of tested data in municipality-size categories

Nr.	Municipal size-category based on population	Number of municipalities	% number of municipalities	Total population of the category	% population	Average population
1	0-100	477	7.64%	34,406	0.33%	72
2	101-200	1,001	16.03%	149,812	1.43%	150
3	201-500	2,007	32.13%	656,988	6.25%	327
4	501-1,000	1,362	21.81%	960,870	9.15%	705
5	1,001-2,000	726	11.62%	1,016,461	9.68%	1,400
6	2,001-5,000	400	6.40%	1,215,137	11.57%	3,038
7	5,001-10,000	142	2.27%	971,336	9.25%	6,840
8	1,0001-20,000	68	1.09%	954,676	9.09%	14,039
9	20,001-50,000	42	0.67%	1,217,062	11.59%	28,978
10	50,001-100,000	16	0.26%	1,137,171	10.83%	71,073
11	100,001-1,000,000	4	0.06%	947,894	9.02%	236,974
12	1,000,001+	1	0.02%	1,241,664	11.82%	1,241,664
	Total	6,246	100.00%	10,503,477	100.00%	1,682

Source: Data on the number of municipalities from the Czech Statistical Office. Table and calculations by authors.

compare the test results of a specific municipality with results of a particular municipality size-category. The aim was to test the hypothesis that aggregate data on municipal expenditures converge to Benford's distribution.

Data for the year 2012, requested from the Ministry of Finance of the Czech Republic, were structured based on sections of the sectoral breakdown, where each section contained all items based on class breakdown that have over the period reported some movement (i.e. at least one municipality included in the respective size-category has accounted for this item). Until 2012, reporting of the public sector in the Czech Republic has been based on the so-called Cash Principle. This approach differs from the practice in Western countries (e.g. United Kingdom, Finland, Switzerland) where are put higher demands on the explanatory power of accounting statements of the public sector, as shown by Sinervo (2014), Lombrano and Zanin (2013) and Bergman (2012). Transition from cash-based accounting of the public sector towards accrual accounting is one of the core

tools of public financial management reforms in line with the philosophy of the New Public Management (Hood, 1995).

Within the first part of the empirical analysis, we have verified on aggregate data whether the data on municipal public expenditures converge to Benford's distribution. The test criterion is Mean Absolute Deviance (hereinafter MAD), calculated as follows:

$$MAD = \frac{\sum_{i=1}^K |AP-EP|}{K} \quad (4)$$

where:

AP – proportion of occurrence of individual numbers in the empirical distribution,

EP – proportion of occurrence of individual numbers in Benford's distribution,

K – number of digits.

The following Table 6 shows critical MAD values for empirical data, based on which we can decide on the conformity with Benford's distribution – 3 degrees of conformance, the fourth one for nonconformity. These values

Tab. 6: Critical MAD values for the first number

MAD value	Degree of conformity with Benford's distribution
0.000-0.006	Close conformity
0.006-0.012	Acceptable conformity
0.012-0.015	Lower conformity
0.015 and more	Nonconformity

Source: Nigrini (2011)

Tab. 7: Results of Benford's test applied to aggregate data on municipal public expenditures in the Czech Republic according to size-categories based on population

Size-category based on population	Number of tested data	MAD value	Order based on MAD	Assessment verdict
0-100	1,404	0.006941550	10	Acceptable conformity
101-200	2,446	0.004812095	5	Close conformity
201-500	4,203	0.003228490	1	Close conformity
501-1,000	4,679	0.005652321	6	Close conformity
1,001-2,000	4,371	0.006520248	9	Acceptable conformity
2,001-5,000	4,866	0.004004314	3	Close conformity
5,001-10,000	4,374	0.003456433	2	Close conformity
10,001-20,000	3,870	0.004362737	4	Close conformity
20,001-50,000	3,518	0.005951687	7	Close conformity
50,001-100,000	2,950	0.007030236	11	Acceptable conformity
100,001-1,000,000	2,434	0.012114151	12	Lower conformity
1,000,001 and more	2,365	0.005994241	8	Close conformity

Source: own

were derived from empirical studies by Nigrini (2011).

Results broken down by municipal size-categories are listed in Table 7.

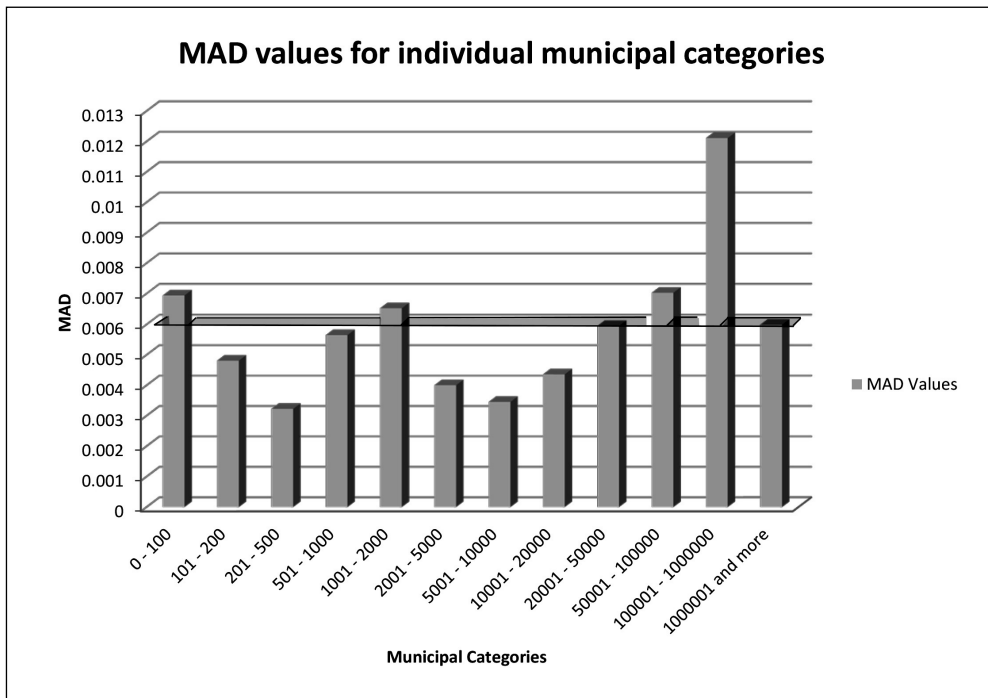
MAD values are also shown in the following chart. Research results given in Table 7 and Figure 1 indicate that the data on public expenditures of municipalities in the Czech Republic converge to Benford's distribution. Eight size-categories (including the City of Prague) recorded the value of MAD at the level of "close conformity" and three categories ranked as "acceptable conformity". Larger, but still acceptable level of deviation from logarithmic distribution recorded only data for the size-category of municipalities with a population from 100,001 to 1,000,000 inhabitants ("lower conformity"). This group includes four cities.

3. Application of Benford's Test on the Data of Czech Cities for 2012

The third objective of the research was to conduct an empirical analysis of municipal expenditures in 2012 and to analyse the results / draw conclusions applicable for the control of public expenditures at the level of municipalities of the Czech Republic. The test hypothesis was that based on the analysis of content and structure of the statement of execution and control of city budgets, Benford's test should (most likely) identify statements of cities with types of data manipulations and errors such as rewriting numbers, duplicities, rounding of numbers, wiping off data.

Given the specific nature of the public sector and the character of reported statements it can be assumed that Benford's test should be

Fig. 1: MAD values for individual municipal categories



Source: own

able to detect intentional shifts of expenditures between individual budget headings. This activity may be aimed at covering e.g. administrative misconducts of breaching the budgetary discipline. Another motive may be an attempt to move items between the operating and investment parts of the budget in an effort to improve operating results and thus meet the evaluation criteria for securing a bank loan. Another motive may be of a purely political nature, e.g. an attempt to cover up expenses for legal and other consulting services (see findings of the Supreme Audit Office for the period from August to September 2013). The reason for such a data manipulation is to “protect itself” from a negative public reaction towards expenditures related to outsourcing of legal and consulting services by public administration institutions.

For further testing were used data from all municipalities in the Czech Republic with a city status. In total, analysed were public expenditures in the statement of budgetary

execution and control of all 602 Czech cities for the year 2012.

On the empirical data was applied the first-level test, i.e. for convergence towards Benford's distribution was tested the first number. This test is generally regarded as the most informative one (Nigrini, 2011). When analysing the convergence of empirical data towards Benford's distribution, we can utilise primarily tests of goodness of fit (Chi-square test, Z-test, Kolmogorov-Smirnoff test). However, these tests are affected by the number of data records (Nigrini, 2011) and at lower numbers of records their values may be distorted. To avoid a possible distortion of results due to a low number of records, we have used as a test criterion the value of Mean Absolute Deviation. The results of Mean Absolute Deviation, however, correlate with the results of tests of goodness of fit.

Based on previous findings, we have applied Benford's test on statements of budgetary

Tab. 8: Summary results of an application of Benford's test on individual cities in the Czech Republic

Degree of conformity	Number of cities	Share in %
Close conformity	6	0.997
Acceptable conformity	126	20.930
Lower conformity	183	30.399
Nonconformity	287	47.674

Source: own

execution and control of individual cities in the Czech Republic. The results are summarised in the following Table 8.

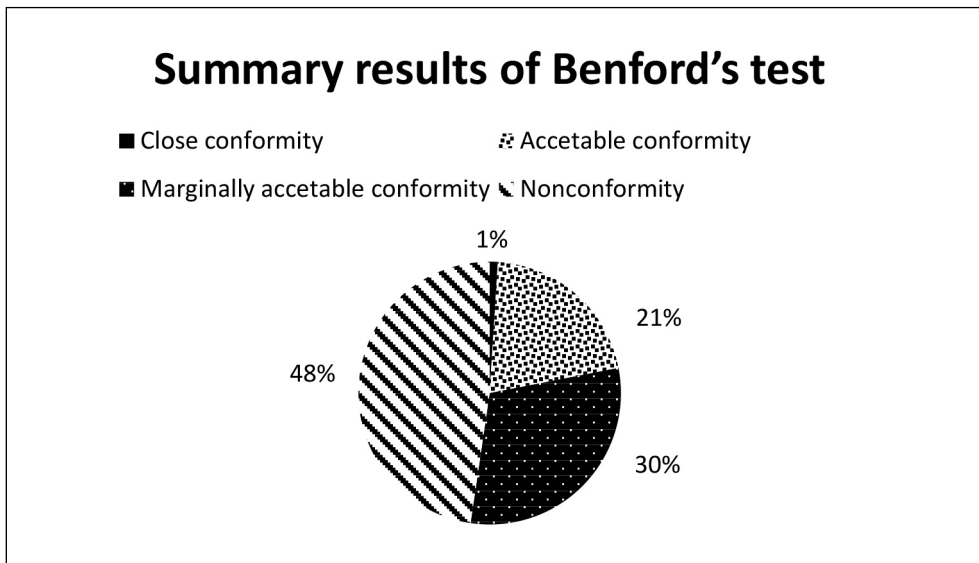
Summary results are presented in Fig. 2.

According to the results presented in the following table, the application of Benford's test shows a considerable instability. Data in the statements of 47.7% Czech cities did not converge towards Benford's distribution. This result certainly can not be interpreted in a sense that 47.7% of statements contained manipulated data. It is only possible to assert that for the given controlled entities (cities), there can be expected existence of a higher probability of errors or data manipulations.

To analyse causes of these results, we sought to identify dependence of Benford's test results on the size of the given city (in terms of its population) and dependence of results on the number of tested data (i.e. the number of items in statements). In order to achieve a greater explanatory power, we have removed from the analysis outliers that were recorded by the cities with largest populations (Prague, Brno and Ostrava).

The tests have shown a significant dependence of MAD on the number of tested data and on the size of cities. Pearson's correlation coefficient reached the value of -0.4587 for the number of tested data and -0.2095 for the city

Fig. 2: Summary results of Benford's test



Source: own

size. Provided we include in our calculations also the cities of Prague, Brno and Ostrava, we still arrive at statistically significant results. Pearson's correlation coefficient reaches the value of -0.147205 for the size of a municipality and -0.390394 for the number of records.

Data were also subjected to a regression analysis, where we tried to explain the behaviour of the dependent variable MAD in response to changes in the above mentioned factors. The research results are shown in Table 9 and Table 10.

Although the factors "population" and "number_of_data" represent, based on the p-value, significant explanatory variables, there still remains unexplained a significant part of the MAD behaviour. To find out the causes of deviations of data for individual cities from Benford's distribution, it would be necessary to carry out the analysis of data and public expenditures directly on the spot. At the same time, it is also necessary to take into account possible significant changes in the structure of expenditures between the years 2011-2012. Such an analysis, however, is outside the scope of ambitions of the presented study, as it would require significant research implementation

costs. Nevertheless, based on the examination carried out it is possible to conclude that the results support an argument that Benford's test is appropriate for larger data samples (Nigrini, 2011). At the same time, we face the same problems as earlier studies by Nye and Moul (2007), Gonzales and Pastor (2009), Rauch et al. (2011).

Although Benford's test focuses on the formal aspect of control activity of public expenditures when it e.g. allows detecting intentional shifts between individual budget chapters, such information still provides an impetus for examining the allocative efficiency of public expenditures. That is, the aforementioned shift in expenditures actually represents a change in the purpose of public expenditures and its examining in turn falls under the domain of economic (content) control (see Tab. 2).

Benford's test may indicate also other violations of effectiveness in incurred expenditures, represented by a transfer of items between current and capital expenditures in order to improve the image of the municipal economic management so as to meet the bank criteria to secure a loan. It can also

Tab. 9: Results of regression analysis (omitting extreme values of Prague, Brno and Ostrava), observations used: 1–599; dependent variable: MAD

	Coefficient	Std. error	t-stat	p-value
Const	0.0231963	0.000626024	37.0533	<0.00001
Population	5.93548e-08	1.65552e-08	3.5853	0.00036
Number_of_data	-3.24696e-05	2.73206e-06	-11.8846	<0.00001
Adjusted coefficient of determination	0.224474			
P-value (F)	4.64e-34			

Source: own

Tab. 10: Results of regression analysis (including extreme values of Prague, Brno and Ostrava), observations used: 1–602; dependent variable: MAD

	Coefficient	Std. error	t-stat	p-value
Const	0.0223251	0.000571761	39.0461	<0.00001
Population	3.84603e-08	5.37213e-09	7.1592	<0.00001
Number_of_data	-2.81572e-05	2.28721e-06	-12.3107	<0.00001
Adjusted coefficient of determination	0.216610			
P-value (F)	6.50e-33			

Source: own

lead to shifts between individual items for other reasons, such as, for example, when the municipal management tries to use shifts between individual items of expenditure types to hide from public criticism towards a certain type of spending activities. Also in this case, the original intent (purpose) of the expenditure is being violated. As evident, Benford's test can be one of supporting tools of streamlining the system of control of public expenditures. Its application points at the possibility of systemic interconnection of individual types of municipal expenditure controls into a comprehensive, complex control system of public expenditures, as presented in Table 2.

The performed analysis shows that the aggregate data for municipalities, assembled into individual categories, converge to Benford's distribution (see Tab. 7). Application of Benford's test on statements of budgetary execution and control of individual Czech cities results in highly unstable results. Based on the correlation analysis, we may conclude that there is a significant correlation between the values of MAD and the number of surveyed data. This means that Benford's test has a greater explanatory power when applied to a larger volume of data, as evident from the case of larger cities. This argument is consistent with other empirical analyses by Nigrini.

The undertaken research indicates that, in addition to errors and data manipulations already specified in the literature, Benford's test may also be adopted for a check against manipulations and data shifting between individual budgetary chapters, which could give a signal to supervisory authorities on a possible (probable) risk of a breach of budgetary discipline.

However, the empirical analysis has shown considerable limitations in the application options of Benford's test, especially due to instability of the results, unavailability of suitable data, the need to transform data before applying the test and a risk of distortion of the results due to incorrect choice of test statistics. Certain restrictions for the use of Benford's test represent also the current level of knowledge and generalisation of its application onto different types of data and accounting statements. In its application, it is therefore necessary to take into consideration other possible factors that may affect the quality of data, such as structural changes in

the economy, specifics, and characteristics of individual sectors.

Despite the aforementioned problems, Benford's test may still prove useful to the staff of internal audit and control departments as one of supporting tools that may within data analysis warn against likely occurrences of data manipulation. Subsequently, we may examine whether or not there came to a violation of the principle of effective management of public expenditures. This procedure can also be used as a tool to indicate possible fraud in the normal course of business of organisational units of the public sector (e.g. when examining incoming and outgoing invoices, donations, etc.). Benford's test thus becomes a suitable tool for boosting the efficiency of the public expenditure control system, when within the first stage it allows to identify "problem" subjects, towards which may subsequently focus an in-depth control of public expenditures. Using Benford's test can thus contribute towards finding the ways of how to achieve savings and reduce waste in the public sector (Půček & Ochrana, 2014), improve the performance of public administration (TPA HORWATH, 2011) and to create an effective system of control of public expenditures.

Conclusions

The study aimed at adopting the Benford's test to examine municipal expenditures in the Czech Republic for one reference period (year 2012) and based on the empirical analysis to carry out a discussion on the given issue and to formulate relevant theoretical generalisations for the domain of a control of public expenditures. The empirical analysis has confirmed our assumption that Benford's test may be adopted also for examination of municipal expenditures. Nevertheless, there need to be constantly kept in mind the inherent limits of this method. Results of the applied Benford's test show that this test is a suitable tool for the initial detection of data *with a higher probability* of incorrectness in the handling with public expenditures. We therefore recommend incorporating Benford's test into the system of a control of public expenditure as specified in Table 2. The main contribution of Benford's test for the system for a control of public expenditure is an increase in efficiency and reduction in costs associated with control activities. This way, the controlling body may focus on subjects that prove a higher

degree of risk of data tempering. A prerequisite, however, is the ability to analyse, evaluate and handle the risk by the controlling body.

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Abstract

DO THE DATA ON MUNICIPAL EXPENDITURES IN THE CZECH REPUBLIC IMPLY INCORRECTNESS IN THEIR MANAGEMENT?**Milan Půček, Michal Plaček, František Ochrana**

Limited public resources confront public administration bodies with the question of how to handle them in an economically rational manner. Audit of public expenditures necessitates an ongoing creation and modification of an effective control system. Such a system is made up by subsystems of a formal (accounting and documentation) and economic control, responsible for monitoring the efficiency, effectiveness and economy of managing public expenditures. Significance of such interconnection rests in the fact that the formal control may signal possible improper management of public expenditures. This may become a stimulus for the economic control subsystem to verify the effectiveness, efficiency and economy of outlaid expenditures. For identification purposes related to potential accounting and record-keeping incorrectnesses in the management of public expenditures is proposed adoption of Benford's Law (Benford's test). Benford's test is applied on municipal expenditure data for the year 2012. Data represent sums of public expenditures in the structure of the statement of budgetary execution and control specified by the Regulation of the Ministry of Finance of the Czech Republic No. 323/2002 Coll. For the data analysis there were used statistical methods, hypothesis testing, linear regressions and comparisons. Although the empirical analysis points at a limited use of Benford's test in the conditions of municipal expenditures in the Czech Republic (mainly due to the instability of results and unavailability of suitable data), the analysis showed that Benford's test can be adopted as a supporting tool, suitable for building into the control system of public expenditures. It is one of the ways to increase the effectiveness of a complex control of public expenditures.

Key Words: Control of public expenditures, municipal expenditures, manipulation of public expenditure data, Benford's Law, Benford's test as a signalling tool for auditing public expenditures.

JEL Classification: H72, C12, M42.

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COVERAGE OF FINANCING DEFICIT IN FIRMS IN FINANCIAL DISTRESS UNDER THE PECKING ORDER THEORY

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Introduction

Capital structure has been a frequent topic in financial literature because it is one of the most important decisions a firm can make. Although many important contributions have been made in this area, most of the research does not include firms in financial distress, so the financing decisions adopted by these firms are still not well known. The financing decisions of those firms are very important because most of the strategy decisions such as investments, market entry, or product diversification are considerably affected by the financial constraints faced by them (Bowe, Filatotchev, & Marshall, 2010).

Over the years, two main explanations for the capital structure of companies have been proposed (Barclay & Smith, 2005; Flannery & Rangan, 2006; Frank & Goyal, 2009; Muradoğlu & Sivaprasad, 2012). The first one is the static trade-off theory, which proposes a trade-off between the tax advantages of debt financing and the costs of financial distress. Too much debt can lead to financial distress and too little debt can give rise to low returns on equity. Therefore, companies select the capital structure that maximizes their value, which leads to an optimal debt level. The second one is the pecking order theory, which postulates the existence of a hierarchy of financial resources, so firms do not target optimum capital structures. When outside funds are necessary, firms can mainly resort to three sources: retained earnings, debt, and equity. Whereas retained earnings have no adverse selection problem, both equity and debt have an adverse selection risk premium because of information asymmetries between managers and investors. Investors demand higher returns on equity than on debt. Therefore, if companies do not have enough retained earnings to finance their investment project, they will prefer debt to equity.

Although these two theories have been tested using different methodologies, the evidence is controversial as the empirical results tend to support the predictions of both theories. Some studies highlight the importance of the pecking order theory and others show the relevance of the trade-off theory. In this regard, Shyam-Sunder and Myers (1999) find strong support for the pecking order theory when they analyze the relationship between net debt issued and financing deficit. Fama and French (2002) and Leary and Roberts (2005) show that firms' debt ratios adjust slowly or relatively infrequently toward their target, which is more consistent with the pecking order theory. Agca and Mozumdar (2004) and Lemmon and Zender (2010) propose a concave relationship between net debt issued and financing deficit, which enables a less strict financial hierarchy of the pecking order theory. On the other hand, several authors find evidence consistent with the trade-off theory (Cotei, Farhat, & Abugri, 2011; Flannery & Rangan, 2006; Frank & Goyal, 2009). Besides, some studies tend to bear out both theories. Frank & Goyal (2003) only find support for the pecking order theory among large firms, and Leary and Roberts (2005) show that both theories help explain some aspects of financing decisions. Finally, a lot of recent studies focus their attention on firms with different characteristics, such as small, large family controlled or diversified firms (González & González, 2012; La Roccaa, La Roccaa, Geraceb, & Smark, 2009; Pindado & De la Torre, 2008; Selvarajah & Ursel, 2012).

Most previous studies have analyzed the capital structure of healthy firms. However, the results of these studies are not directly applicable to firms in financial distress, mainly because these firms have overinvestment and underinvestment problems, less financial sources available and are affected by bankruptcy

laws (Davydenko & Franks, 2008; López, Torre, & Sanfilippo, 2012; Gian & Strahan, 2007). The little evidence about firms in financial distress is controversial, because the studies do not find support for the trade-off theory, but they do not provide conclusive results about the pecking order theory either. For example, Gilson (1997) finds that the high transaction costs borne by firms in financial distress prevent them from adjusting their capital structure to optimum levels. In this regard, Pindado, Rodrigues and De la Torre (2006), when analyzing a sample of small and medium-sized Portuguese firms, find that the financing decisions of firms in distress do not depend on their previous debt levels or on the existence of target debt ratios, and therefore do not support the trade-off theory. Liang and Bathala (2009) perform a study on a small sample of firms in financial distress in the United States, but their results are not very conclusive. They find that the firms' financing decisions did not seek an optimum debt ratio. However, they also find little support for the pecking order theory, as their results show a weak relationship between financing deficit and debt.

The trade-off theory proposes that firms pursue an optimal debt level by weighing the benefits of debt (especially debt-related tax shields) and the costs of debt (bankruptcy problems). However, many firms cannot quickly adjust their debt in response to changes in their target debt because they bear transaction costs. Firms in financial distress have a lot of trouble reaching their optimal capital structure proposed by the trade-off theory because they have high transaction costs (Asquith, Gertner, & Scharfstein, 1994; Chou, Li, & Yin, 2010). To reduce their debts, firms in financial distress must negotiate new payment terms with creditors or sell assets that implies complicated adjustments. To this regard, Gilson (1997) finds that distressed firms hardly ever manage to reduce their debt level in order to reach their optimal capital structure, so their debt ratios continue to be high. Another argument against the trade-off theory in firms in financial distress is that these firms cannot often take advantage of the debt-related tax shields. Financial distressed firms often incur losses, so they can seldom benefit from the tax deductibility of interest (Barclay & Smith, 2005). Therefore, these firms find it quite hard to strike a balance between the advantages and disadvantages of debt financing.

The pecking order theory postulates the existence of a strict hierarchy of financial resources because of information asymmetries between managers and investors (Myers & Majluf, 1984; Shyam-Sunder & Myers, 1999). Firms would start using internal funds, then debt, and finally equity. However, the imposition of this strict hierarchy might not necessarily be applicable in firms in financial distress for two reasons: First, Shyam-Sunder and Myers (1999) suggest that these firms could cover their financing deficit by issuing equity or selling assets to avoid increasing their debt ratio and/or debt restructuring. Moreover, equity might be the only security that outside financiers or investors are willing to buy; second, Chirinko and Singha (2000) show how a hierarchy of debt and equity is not necessarily followed strictly when firms face a restriction on their debt capacity, a common situation for firms experiencing difficulties. All in all, firms in financial distress frequently have to use all of their available financial resources to cover their financing deficit and have more and more difficulties to issue debt. This implies that firms in financial distress increasingly turn to sources of funds other than debt issues as their financing deficit grows. Therefore, the relationship between net debt issued and financing deficit established by the pecking order theory cease to be linear and become concave quadratic. This quadratic relationship might well explain the controversy about the capital structure of firms in financial distress.

The main contribution of this study is to test a potential concave quadratic relationship between net debt issued and financing deficit in firms in financial distress, which has not been studied previously. If this quadratic relationship exists, the financing decisions of firms in financial distress will be different from the financing decisions of healthy firms, so the formers will not follow the strict financial hierarchy proposed by the pecking order theory due to their specific situation. Another important contribution of this study is that, different from previous research papers, we also analyze the probability of issuing equity. If firms in distress do not follow the strict hierarchy of the pecking order theory, a great probability of issuing equity can be expected than in healthy firms.

In this study we include healthy and distressed firms, so we are able to test the quadratic relationship in both sets of firms and

compare their different financing behavior. Also, the methodology used allows us to overcome some limitations of previous studies. In the first analysis, the System GMM methodology of panel data is used, which enables controlling for the model's individual heterogeneity and the existence of potential problems of endogeneity. Subsequently, in the study of the probability of issuing equity, we use, for the first time in this kind of studies, a new Heterogeneous Choice Models (HCM) methodology developed by Williams (2009) applied to a logistic function. This methodology allows us to avoid the bias caused by the differences in the degree of residual variation between healthy firms and firms in financial distress. Previous studies do not consider those differences, so their results could be biased.

The analysis is performed on a sample of 3,337 listed firms from Germany, Canada, the United States, France, Italy and the United Kingdom from 1995 to 2006. The inclusion of these countries covers a broad spectrum of institutional environments. The sample period ends in 2006 to avoid the biases of the financial crisis. The results indicate a quadratic relationship between financing deficit and net debt issued for firms in financial distress. This relationship is concave, so that as the financing deficit increases, the net debt issuance proportion decreases. However, the financing decisions of healthy firms follow a linear relationship rather than a quadratic one. Finally, the second analysis shows that firms in financial distress have a greater probability of issuing equity, which supports our results regarding the existence of a concave quadratic relationship. Thus, equity financing could be an alternative to debt issuance as a source of funds for firms in financial distress.

The structure of the study is as follows: The sample used is described in Section 1. Section 2 presents the model and main results in relation to the existence of a quadratic relationship. It also describes the analysis of the probability of issuing equity and displays the results. We finish with the conclusions and the references.

1. Sample and Data

To test the existence of the quadratic relationship, we use a sample of non-financial firms listed on the stock exchange in Germany, Canada, the United States, France, Italy and the United Kingdom. The inclusion of these

countries allows covering companies operating under different institutional environments with a broad spectrum of bankruptcy systems. This prevents that these circumstances condition the analysis by controlling for the country. For each country, we have an unbalanced panel of firms with information available for a minimum of seven consecutive years between 1995 and 2006. To calculate the second-order serial correlation test, fundamental for guaranteeing the robustness of the estimations made via the System GMM methodology, data for each company of at least four consecutive years is required. In addition, to calculate certain variables in our analysis, we required variables lagged three years. We restrict the sample period to end in 2006 so that our results are not affected by the financial crisis. After the onset of the financial crisis, the firms' financing behavior could be conditioned more by the availability of funds in the economy and the disruption of the financial systems than by the firms' situation, which could have given rise to a bias in our results. The economic-financial information for each firm is from the DataStream database, of the Thomson Financial Services group. The macroeconomic information is obtained from the World Bank's World Development Indicators database and OECD statistics.

Tab. 1 shows the temporal and country distribution of the firms for the six countries included in the analysis. By including only listed companies, the number of firms traded on each of the securities exchanges conditions the size by country. However, the table shows that the sample size, for all years and countries analyzed, is adequate for performing the analysis.

Since the financial distress situation is not directly observable, we employ two different proxy measures to distinguish the firms in financial distress.

First, we use the Z-Score model (Altman, 1968). The Z-Score model is:

$$Z = 1.2 \cdot X_1 + 1.4 \cdot X_2 + 3.3 \cdot X_3 + 0.6 \cdot X_4 + 1 \cdot X_5 \quad (1)$$

where X_1 is the working capital to total assets ratio; X_2 is the retained earnings to total assets ratio; X_3 is the earnings before interest and taxes to total assets ratio; X_4 is the market value equity to book value of total liabilities ratio; X_5 is sales to total assets ratio.

Tab. 1: Sample description

Temporary distribution of the sample							
Year	Canada	France	Germany	Italy	United kingdom	USA	Total
1995	76	119	161	47	311	789	1,503
1996	89	129	176	54	324	953	1,725
1997	97	133	183	59	344	1,056	1,872
1998	108	142	191	65	364	1,164	2,034
1999	153	147	202	70	443	1,353	2,368
2000	170	143	197	76	475	1,541	2,602
2001	186	234	252	113	506	1,585	2,876
2002	208	250	258	129	534	1,611	2,990
2003	199	245	246	129	519	1,519	2,857
2004	191	241	237	128	505	1,463	2,765
2005	187	223	234	123	489	1,424	2,680
2006	169	189	215	112	453	1,231	2,369
Total	1,833	2,195	2,552	1,105	5,267	15,689	28,641
Observations per country							
Country	Observations						
	Total	Distressed Z-score	Distressed O-score				
Canada	1,833	516	122				
France	2,195	436	149				
Germany	2,552	568	246				
Italy	1,105	429	80				
United kingdom	5,267	643	425				
USA	15,689	2,343	1,128				
Total	28,641	4,935	2,150				

Source: own

The value of Z-score has the following intervals. Values higher than 2.99 are considered the "safe zone", and it means that the possibility of company's bankruptcy is very low. Values between 1.81 and 2.99 are considered the "grey zone" or "zone of ignorance", because of the susceptibility to error classification. Values below 1.81 are considered "distress zone", and it means that the possibility of a company's bankruptcy is high. So, we identify firms in financial distress when they are situated in the "distress zone", when they have in a particular year a Z-score less than 1.81.

Second, we use the O-Score to classify firms in financial distress (Ohlson, 1980). The O-Score is based on Ohlson's predicted

bankruptcy probabilities p , following this specification:

$$p = \frac{1}{1 + e^{-y_{it}}} \quad (2)$$

$$y_{it} = -1.32 - 0.407 * SIZE + 6.03 * \\ * TLTA - 1.43 * WCTA + 0.757 * \\ * CLCA - 2.37 * NITA - 1.83 * \\ FUTL + 0.285 * INTWO - 1.72 * \\ OENEG - 0.521 CHIN, \quad (3)$$

where SIZE is the log of total assets to GNP Price-level index ratio; TLTA is the total liabilities to total assets ratio; WCTA is the working capital to total assets ratio; CLCA is

the current liabilities to current assets ratio; NITA is the net income to total assets ratio; FUTL is the funds from operations to total liabilities ratio; INTWO is equal to one in net income is negative in the previous 2 years or zero otherwise; OENEG is equal to one if total liabilities are greater than total assets or zero otherwise; $CHIN = \frac{NI_t - NI_{t-1}}{|NI_t| - |NI_{t-1}|}$, where NI_t is the net income for year t .

We identify firms in financial distress when the bankruptcy probability is greater than or equal to 50%.

These two models have been widely used to identify firms in financial difficulties in both American and international studies (Dichev, 1998; Griffin & Lemmon, 2002; Bhagat, Moyen, & Suh, 2005; George & Hwang, 2010; Lopez et al., 2012). On average, firms in financial distress represent 17% of the observations when we use the Z-Score model and 13% when we use the O-Score model.

2. Empirical Analysis

2.1 Methodology

Shyam-Sunder and Myers (1999) present a test of the pecking order theory based on financing deficit under the premise that this deficit is covered entirely by issuing new debt. Thus they propose the following relationship:

$$\Delta D_{it} = \alpha + \beta_{PO} DEF_{it} + e_{it} \quad (4)$$

where ΔD_{it} is the amount of net debt issued or withdrawn; DEF_{it} is the financing deficit; e_{it} is the random error term. According to Shyam-Sunder and Myers (1999), a simple version of the pecking order theory predicts $\alpha = 0$ and $\beta_{PO} = 1$.

This method of assessing the pecking order theory has been widely criticized (Frank & Goyal, 2003; Leary & Roberts, 2010). In the case of firms in financial distress, and according to Chirinko and Singha (2000), this model does not admit the possibility of simultaneously issuing debt and equity as we propose in this article. In this regard, Liang and Bathala (2009) find that the β_{PO} coefficient was positive and significant, but considerably lower than 1 in firms in financial distress. This result might well reflect that firms in financial distress cover their financing deficits not only with debt but with equity. In order to solve this problem, we will introduce the financing deficit square (DEF^2) into the equation (4):

$$\Delta D_{it} = \alpha + \beta_{PO} DEF_{it} + Y DEF_{it}^2 + e_{it} \quad (5)$$

The use of a quadratic term allows testing not only the simultaneous issue of debt and equity, but also the existence of a hierarchy different to that proposed by the pecking order theory (Lopez et al., 2012). If firms in distress depend less on debts (and more on equity), or use debt issues decreasingly to cover their financing deficit, when this financing deficit increases, the β_{PO} coefficient in these firms would be positive, but considerably lower than 1, and the Y coefficient would be negative. Thus the percentage of debt issued to finance the financing deficit would decrease as this financing deficit increased.

As our study simultaneously analyzed healthy firms and those in financial difficulty, we modified equation (5) so that the model to be estimated would be as follows:

$$\begin{aligned} \Delta D_{it} = & \alpha + (\beta_1 + \beta_2 DIF_{it}) DEF_{it} + \\ & + (Y_1 + Y_2 DIF_{it}) DEF_{it}^2 + \Sigma \rho_i Country_{it} + \\ & + \Sigma \lambda_j Sector_{it} + \Sigma \phi_l Year_{it} + \epsilon_{it}, \end{aligned} \quad (6)$$

where ΔD_{it} is the net debt issued to total assets (Frank & Goyal, 2003; Lemmon & Zender, 2010; Liang & Bathala, 2009; Shyam-Sunder & Myers, 1999); DEF_{it} is the financing deficit divided by total assets. This variable includes dividend payments, net investment and changes in working capital, and is reduced by operating cash flows after interests and taxes; DIF is a dummy variable that takes value 1 for firms in distress and 0 for healthy firms. For this, as we showed earlier, we followed two alternative approaches: the Altman Z-Score (DIF_2) and the Ohlson O-Score (DIF_O). ϵ_{it} represents the random error term. We also included dummy variables for country, year and sector.

The β_1 and Y_1 coefficients, respectively, show the linear and quadratic effects for healthy firms. The $(\beta_1 + \beta_2)$ coefficients show the linear effect for firms in financial distress, and the $(Y_1 + Y_2)$ coefficients show the quadratic relationship for firms in distress. To test the significance of the $(\beta_1 + \beta_2)$ and $(Y_1 + Y_2)$ coefficients, it is necessary to perform a joint significance test under the null hypotheses $H_0: \beta_1 + \beta_2 = 0$ and $H_0: Y_1 + Y_2 = 0$. If firms in financial distress decreasingly used debt to cover their financing deficit as this financing deficit rises, $(\beta_1 + \beta_2)$ can be expected to be positive and significant,

but considerably less than 1, and $(Y_1 + Y_2)$ can be negative and significant.

To test the robustness of the analysis, we introduced the variables used by Frank and Goyal (2003) into the model (6), as proposed by Agca and Mozumdar (2004). This controls for other factors (apart from financing deficit) whose relevance has been demonstrated in previous studies of firm financing decisions. The resulting model would be as follows:

$$\begin{aligned} \Delta D_{it} = & \alpha + (\beta_1 + \beta_2 \text{DIF}_{it}) \text{DEF}_{it} + \\ & + (Y_1 + Y_2 \text{DIF}_{it}) \text{DEF}_{it}^2 + \beta_3 \Delta T_{it} + \\ & + \beta_4 \Delta \text{MTB}_{it} + \beta_5 \Delta \text{LS}_{it} + \beta_6 \Delta P_{it} + \\ & + \Sigma \rho_j \text{Country}_{it} + \Sigma \lambda_j \text{Sector}_{it} + \\ & + \Sigma \varphi_j \text{Year}_{it} + \varepsilon_{it}, \end{aligned} \quad (7)$$

where T refers to the tangibility of assets to total assets; MTB is the market-to-book ratio; LS is

the natural logarithm of sales and P is the return on assets.

Tab. 2 presents summary statistics for the sample. We estimated the models (6) and (7) using the generalized method of moments (System GMM). This method allows controlling for potential problems of endogeneity through the use of instruments, by including the lagged right-hand side variables.

2.2 Results

Tab. 3 shows the results of the analyses. In model (a), the Altman Z-Score was used to identify the firms in financial distress, while in model (b) the Ohlson O-Score was used.

In models (a) and (b), the quadratic term of the DEF variable was introduced. In the case of healthy firms, the DEF variable has a positive and significant coefficient, but considerably less than 1. Therefore, the pecking order theory

Tab. 2: Sample statistics

	Mean	Standard deviation	Minimum	Maximum
AD	0.0137	0.1108	-0.9713	0.6989
DEF	-0.0351	0.1761	-0.9877	2.4510
DIV	0.0138	0.0215	0.0000	0.2970
I	0.0691	0.0994	-0.9310	0.8892
ΔWK	0.0078	0.1287	-1.8135	1.3271
CA	0.1258	0.1646	-1.7118	1.1355
T	0.3226	0.2318	0.0002	0.9968
MTB	1.7125	1.2493	0.1845	19.1626
LS	12.6820	2.0845	2.8865	19.2228
P	0.0604	0.1237	-0.9779	0.6554
ΔT	0.0180	0.0957	-0.9566	0.8456
ΔMTB	-0.0347	0.9701	-16.4099	14.4661
ΔLS	0.0904	0.3254	-4.8684	5.9904
ΔP	-0.0009	0.0805	-0.9131	0.9371
LIQ	0.4898	0.2313	0.0032	0.9982
NDS	-0.0013	0.0337	-0.5281	0.6804
DEBT	0.5313	0.1983	0.0054	0.9984
LOGSIZE	5.5391	0.8878	2.8948	8.7543

Source: own

Note: ΔD is the net debt issued to total assets; DEF is the financing deficit divided by total assets; DIV is dividend payments to total assets; I is the net investment to total assets; CA refers to cash flow to total assets; ΔWK is the change in working capital to total assets; T refers to the tangibility of assets to total assets; MTB is the market-to-book ratio; LS is the natural logarithm of sales; P is the return on assets; LIQ refers to the current assets to total assets; NDS is non-debt tax shields to total assets; DEBT is the leverage ratio; LOGSIZE is the logarithm of total assets.

Tab. 3: Results (DIF variable non-lagged)

	(a)	(b)	(c)	(d)
DEF	0.1662 ** (2.48)	0.1641 ** (2.32)	0.0953 * (1.83)	0.0613 * (1.71)
DEF*DIF _z	0.2713 ** (2.36)		0.2995 *** (4.46)	
DEF *DIF _o		0.2353 *** (2.73)		0.2142 *** (3.63)
DEF ²	-0.0927 (-0.67)	-0.0413 (-0.28)	-0.0876 (-0.96)	0.0324 (0.49)
(DEF*DIF _z) ²	-0.1174 (-0.95)		-0.1820 * (-1.79)	
(DEF *DIF _o) ²		-0.2470 (-1.47)		-0.2517 *** (-2.66)
ΔT			0.4591 *** (6.24)	0.5002 *** (8.94)
ΔMTB			0.0011 (0.14)	-0.0053 (-1.37)
ΔLS			0.0225 (1.18)	0.0053 (0.6)
ΔP			-0.2113 *** (-3.6)	-0.0837 * (-1.81)
CONS	0.0540 (1.48)	-0.0057 (-0.25)	-0.0083 (-0.30)	-0.0024 (-0.31)
(β ₁ + β ₂)	0.4375 ***	0.3994 ***	0.3949 ***	0.2755 ***
(Y ₁ + Y ₂)	-0.2101 ***	-0.2883 ***	-0.2696 ***	-0.2192 ***
m ₂	0.951	0.452	0.171	0.12
HANSEN	74.26 (0.179)	104.57 (0.194)	151.4 (0.131)	263.47 (0.212)

Source: own

Note: Coefficients associated with each variable. In brackets, T-student; *** indicates a level of significance of 0.01, ** indicates a level of significance of 0.05, * indicates a level of significance of 0.1; m₂ is the 2nd order serial correlation statistic. Hansen is the over-identifying restriction test (p-value in brackets). (β₁ + β₂) is the tests of joint significance under the null hypotheses H0: β₁ + β₂ = 0. (Y₁ + Y₂) is the tests of joint significance under the null hypotheses H0: Y₁ + Y₂ = 0. Time-dummy variables, country dummy variables and sector dummy variables are also included in the estimations although the results are not shown in the tables to focus on the main results obtained.

does not appear to have a higher explanatory power in the financing decisions adopted by the healthy firms in our sample. The DEF² variable is not significant and therefore a quadratic model would not be suitable for these firms.

Regarding firms in financial distress, model (a) shows that the joint significance test (β₁ + β₂), under the null hypothesis H0: β₁ + β₂ = 0, is positive and significant. The joint significance test of the quadratic component (Y₁ + Y₂), under the null hypothesis H0: Y₁ + Y₂, is

negative and significant. Therefore, unlike in healthy firms, a concave quadratic relationship can be observed in firms in financial distress. So, firms in financial distress would use debt decreasingly as their financing deficit increases. In fact, the linear coefficient is considerably less 1, so the firms in financial distress in our sample did not strictly follow the pecking order theory. This coefficient, as we proposed, indicates that different financial resources are used to cover the financing deficit. Model (b) shows the same

result, where the Ohlson O-Score was used to identify firms in distress. The test of the joint significance ($\beta_1 + \beta_2$) is positive and significant and ($Y_1 + Y_2$) is negative and significant.

In models (c) and (d), the Frank and Goyal variables (Frank & Goyal, 2003) were introduced. In this case, the previous results were maintained since firms in financial distress show a concave quadratic relationship, whilst in healthy firms only a linear effect is observed. For the control variables introduced, ΔT coefficient is positive and significant, showing the usefulness of tangible assets as collateral to support greater level of leverage. As previous studies have shown greater profitability has a negative effect on leverage (Frank & Goyal, 2003; Mackay & Gordon, 2005).

To check the robustness of our results, the previous models were estimated again, introducing the DIF variable lagged one year. We used this to confirm the effect of financing deficit on net debt issued one year after a firm experiences financial distress. The results, not shown in this paper, are similar to those obtained in Tab. 3.

2.3 Analysis of Equity Financing

The results of the previous analysis show a concave quadratic relationship between net debt issued and financing deficit for firms in financial distress due to the fact that this deficit is covered by using different financial resources. As we explained earlier, the main source available to these firms might well be equity financing. If firms in distress do not follow the hierarchy of the pecking order theory, a great probability of issuing equity can be expected than in healthy firms. To test this idea, we propose a discrete choice analysis based on a logistic model in which the dependent variable takes value 1 if the firm issues equity and value 0 otherwise. However, the inclusion of two groups of firms (healthy and distressed) makes it very probable that the homoscedasticity of random errors will not be fulfilled because of the existence of differences in the degree of residual variation between both groups of firms. Unlike linear models, in non-linear models this fact gives rise to significant biases in the estimation of the model parameters (Yatchew & Griliches, 1985). To overcome this problem in the current study, we performed an analysis using the Heterogeneous Choice Models (HCM) applied to a logistic function. These models control for

the differences in the random error variance between the groups, which allows avoiding the biases in the estimations (Williams, 2009). The proposed model is as follows:

$$\begin{aligned} \text{Prob}(y = j) &= \Lambda(x_i\beta / \exp(z_i Y)) \\ x_i\beta &= \alpha_i + \beta_{1i} \text{DIF} + \beta_{2i} P_i + \beta_{3i} \text{LIQ}_i + \\ &+ \beta_{4i} \text{DIV}_i + \beta_{5i} \text{NDTS}_i + \beta_{6i} \text{DEBT}_i + \\ &+ \beta_{7i} \text{LOGSIZE}_i + \beta_{8i} \\ &PE_i + \sum \rho_i \text{Country}_i + \sum \lambda_i \text{Sector}_i + \\ &+ \sum \varphi_i \text{Year}_i + \varepsilon_i \end{aligned} \quad (8)$$

where $\Lambda(\cdot)$ represents a logistic process; the dependent variable "y" takes value 1 if there is a net increase in external equity of at least 5% of total assets, otherwise value 0 (Hovakimian, Opler, & Titman, 2001; Leary & Roberts, 2010; Vanacker & Manigart, 2010); z_i is a vector of variables used to determine the error variances linked to certain Y parameters. To select the control variables included in x_i , previous studies on financing and equity issuance was followed (De Haan & Hinloopen, 2003; De Jong & Veld, 2001); DIF is a dummy variable that takes value 1 for firms in financial distress and 0 for healthy firms (as in previous analyses, the Altman Z-Score and Ohlson O-Score were used); P is the return on assets; LIQ refers to the current assets to total assets; DIV is dividend payments to total assets; NDTS is non-debt tax shields to total assets (Pindado et al., 2006); DEBT is the leverage ratio; LOGSIZE is the logarithm of total assets; PE is a dummy variable that takes value 1 if the firm has used equity financing during the previous year and 0 otherwise. We also included dummy variable for country, year and sector. Summary statistics of the variables is showed in Tab. 2.

Tab. 4 shows the results of the analysis. Models (a) and (b), which include the variables without lags show that there is a greater probability of equity financing in firms in financial distress as the marginal effects of the DIF_z and DIF_o variables are positive and significant. These results support the existence of a concave relationship between the net debt issued and financing deficit obtained in the previous analysis. The absence of a strict financial hierarchy implies the simultaneous use of different sources of financing. This analysis demonstrates that equity financing could be an alternative to debt issuance as a source of funds for firms in financial distress as this would allow them to avoid excessive debt ratios or debt restructuring.

With regard to the control variables, the results are similar to those of previous studies (De Haan & Hinloopen, 2003; Vanacker & Manigart, 2010). Profitability, liquidity, the leverage ratio and prior equity financing have a negative and significant effect on the probability of issuing equity, whilst firm size and non-debt tax shields have a positive influence

on this probability. Like previous studies, dividends do not affect the probability of equity financing.

To check the robustness of our results, the previous models were estimated again, including all the variables lagged one period to avoid possible endogeneity problems (De Haan & Hinloopen, 2003). The results, not shown in

Tab. 4: Marginal effects – HCM – logistic models

	(a)			(b)		
DIF _z	0.0405	(8.25)	***			
DIF _o				0.0201	(3.29)	***
P	-0.0483	(-7.09)	***	-0.0597	(-7.66)	***
LIQ	-0.0009	(-0.21)		-0.0139	(-3.12)	***
DIV	-0.0306	(-0.61)		-0.0567	(-1.09)	
NDS	0.0734	(3.14)	***	0.0854	(3.61)	***
DEBT	-0.0511	(-9.43)	***	-0.0381	(-7.15)	***
LOGSIZE	-0.0049	(-3.93)	***	-0.0042	(-3.23)	***
PE	0.0981	(13.78)	***	0.1017	(14.07)	***
Pseudo R ²	0.2128			0.2181		

Source: own

Note: Marginal effects (incremental effects for dummy variables) associated with each variable. In brackets, T-statistic; *** indicates significance at the 1% level, ** indicates significance at the 5% level, * indicates significance at the 10% level. Time-dummy variables, country dummy variables and sector dummy variables are also included in the estimations although the results are not shown in the tables to focus on the main results obtained.

this paper, are very similar to those obtained in Tab. 4, as firms in financial distress continue showing a greater probability of issuing equity.

Conclusions

This study focused on analyzing the financial decisions of firms in financial distress. A strict hierarchy of financing sources does not appear to be applicable in these firms. The study analyses the existence of a concave quadratic relationship between financing deficit and net debt issued, which provides additional evidence to previous research on the capital structure of firms experiencing financial difficulties.

The analysis was performed using a sample of 3,337 non-financial firms listed on the stock exchanges in Germany, Canada, the United

States, France, Italy and the United Kingdom during the period between 1995 and 2006. The estimates were based on System GMM methodology of panel data, which makes it possible to control for endogeneity problems, and on HCM models applied to a logistic function, which control for the existence of differences in the degree of residual variation between healthy and distressed firms.

We found evidence that neither the trade-off nor the strict hierarchy suggested by the pecking order theory would be applicable in firms in financial distress. Our results show that as financing deficit grows, these firms use debt decreasingly and have a greater probability of issuing equity. This leads to a concave quadratic relationship between financing deficit

and net debt issued. This means that the costs of bankruptcy outweighs the benefits of debt related tax shields, so these firms attempt to avoid excessively increasing in their leverage ratios. Equity issuance can be very beneficial to firms in financial distress because it delays high debt level and gives them time to carry out the necessary operational and financial restructuring. Moreover, it can also alleviate the underinvestment behavior that arises from excessive debt levels and financial distress. However, we must bear in mind that on many occasions, firms in financial distress have no choice but to issue equity because equity might be the only security that outside financiers or investors are willing to buy when the debt levels are very high. Our results also reveal the pecking order theory is not the main reason behind financing decision in healthy firms. These firms seem to make their financing decisions based on both trade-off theory and pecking order theory. On the one hand, these firms are more likely to pursue an optimal debt level as our results show that they only cover a small proportion of their financing deficit using debt. On the other hand, healthy firms have less likelihood of equity issuance than firms in financial distress.

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COVERAGE OF FINANCING DEFICIT IN FIRMS IN FINANCIAL DISTRESS UNDER THE PECKING ORDER THEORY

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The financing decisions adopted by firms in financial distress are very important because most of the strategy decisions such as investments, market entry, or product diversification are considerably affected by the financial constraints faced by them. However, these decisions are still not well known and empirical evidence about firms in financial distress is controversial. Previous studies do not find support for either the trade-off theory or the pecking order theory, which explain the financial decisions of healthy firms. Distressed firms frequently have to use all of their available financial resources to cover their financing deficit. This could give rise to a concave quadratic relationship between financing deficit and net debt issued, which might well explain the ambivalent results about the financial decisions of these firms. To analyze this quadratic relationship, which has not been studied previously, we perform an empirical analysis on a sample of 3,337 listed firms from Germany, Canada, the United States, France, Italy and the United Kingdom. Our results show that the pecking order theory does not appear to have a higher explanatory power in healthy firms. Moreover, the hierarchy suggested by the pecking order theory is not totally applicable in firms in financial distress. Our results show that as financing deficit grows, these firms use debt decreasingly, which gives rise to a concave quadratic relationship between financing deficit and net debt issued. This suggests that firms in financial distress have difficulty issuing new debt. Our results also show that firms in financial distress have a greater probability of issuing equity. Therefore, these firms can use equity financing as an alternative to debt issuance.

Key Words: Capital structure, financial distress, pecking order.

JEL Classification: G32, G33.

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FAILURE PREDICTION FROM THE INVESTORS' VIEW BY USING FINANCIAL RATIOS. LESSON FROM ROMANIA

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Introduction

The economy's globalization which culminated with the global financial crisis that erupted in 2007 has affected the economies around the world demonstrating that the results of research studies on bankruptcy risk prediction are insufficient. Furthermore, the studies conducted so far do not provide direct insight into the capital market to investors for whom the first step in a company's failure is manifested by delisting the company from the stock exchange. According with Altman (1968) "in the case of listed companies, in a 4 days interval before announcing bankruptcy, investors lose about 41% of the capital invested in bankrupt companies." The ability to predict the companies' bankruptcy from the early stage of delisting is the main novelty of the present study.

In the specialized literature there are relatively few concerns about bankruptcy's risk prediction from the investor's perspective. Most studies evaluating the bankruptcy risk were structured to approach bankruptcy from a "legal" perspective according to which companies were grouped into failing companies (for which there is a statement in this regard at the court) and the other group consists of non-bankrupt companies. There is though, another group of studies which analyse bankruptcy risks from an "economic" perspective according to which the companies were grouped into failing companies (represented by companies with low financial and economic performance) and non-bankrupt companies (represented by companies that have different performance indicators considered to be high). An even fewer number of studies are focused (in the economic approach) on the investors' angle,

according to which companies become bankrupt beginning with the delisting phase (Christidis & Gregory, 2010; Tuvadaratragool, 2013; Wang & Campbell, 2010).

Our paper has the following main objectives: First of all, we aim to identify which financial indicators have a significant impact on the probability of a company to face bankruptcy risks expressed from the investors' perspective by studying the impact on the prospects of stocks' delisting from the stock exchange.

Secondly, we would like to determine to what extent are these indicators identified in other studies as significant bankruptcy signs. Is there any difference between the indicators identified as having a major impact from the investors' perspective compared to the general one?

The paper is structured as follows. In the next section (Section 1) we present a review of the literature in terms of bankruptcy risk where the "failure" concept is presented, we present the importance given to financial rates in bankruptcy risk studies highlighting the main methods used in bankruptcy's risk analysis and finally we emphasize the time and space limits of failure prediction models that exist in the literature. Section 2 refers to the general presentation of the elaboration methodology. Further, Section 3 is dedicated to the description of the obtained empirical results, their alignment to other empirical findings and to highlighting the changes in bankruptcy predictors. The last part of the paper (Conclusions) is allocated to describing the conclusions and to highlighting the added value of this study in order to cover some gaps in the niche of developing some bankruptcy risk models from the perspective of the capital market investors.

1. Literature Review

1.1 On the “Failure” Concept

Firstly it is necessary that we clarify the term of “failure”. Investigating the studies on bankruptcy risk, we can conclude that corporate “failure” is approached from two perspectives: a legal one and an economic one.

Under a legal aspect, a company's bankruptcy occurs when there is a strong bankruptcy statement in a court. For US an ailing firm might file either for liquidating its assets or for business reorganisation (Altman & Hotchkiss, 2006). According to Balcaen and Ooghe (2006) the most studies used ‘legal’ interpretations of the relevant terms because of the objective's perspective to discriminate failed and non-failed firms. Among these studies we can mention the following: Anghel (2002), Altman (1968), Beaver, McNichols and Rhie (2005), Chi and Tang (2006), Platt and Platt (1990; 1991; 2008), Shumway (2001).

Under an economic aspect, a failure can be defined through the company's financial performance that can be represented by:

- “Insufficient revenues to cover costs and where the average return on investment is below the firm's cost of capital” (Altman & Hotchkiss, 2006);
- “negative equity and/or negative earnings” (Robu-Mironiuc, 2012; Tuvadaratragool, 2013);
- “reductions in dividends, violations of debt covenants” (Tuvadaratragool, 2013);
- “going private for a publicly listed company” which is similar to delisting the companies' shares (Christidis & Gregory, 2010; Ohlson, 1980; Tuvadaratragool, 2013; Wang & Campbell, 2010).

On the other hand, there are various studies which opt for “economic” interpretation when determining the two types of companies: bankrupt or non-bankrupt; as follows: Beaver (1966; 2005), Christidis and Gregory (2010), Ohlson (1980), Robu-Mironiuc (2012), Tuvadaratragool (2013), Wang and Campbell (2010).

According to Altman and Hotchkiss (2006) four common terms are widely used in bankruptcy studies, namely: failure, insolvency, default and bankruptcy. We can add here the term of “financial distress” which is similar with the economic failure (Tuvadaratragool, 2013) which means that the company has financial problems but is not in bankruptcy yet.

As we can see, there are a wide range of applications of the term “failure”, according to the specific objectives of each study and the specific needs of various decision-makers. In this paper, the concept of corporate “failure” is used from the investors' perspective, for whom the delisting of the company from the stock market is synonymous with bankruptcy itself because their investment is compromised, a trading platform wouldn't be existing anymore (Wang & Campbell, 2010). In other words, in our study, both business “failure” and “delisting” are used interchangeably.

1.2 The Role of Financial Indicators in Predicting the Financial Distress

The international accounting regulation consists in International Financial Reporting Standards. The financial statements' objective is to provide information about the *financial position, performance and changes in the entity's financial position* that are useful to a wide range of users in making economic decisions. It goes without saying that the financial information from the financial and accounting status is designed to highlight the company's financial condition.

Moreover, several studies conducted by Beaver, Correia and McNichols (2010) highlight that “the financial statements have been used for more than 100 years to assess financial distress' likelihood”. From the financial information's category, financial ratios are the most commonly used in bankruptcy risk assessment because it is believed that their use compared to that of the indicators' absolute levels provides a general degree of applicability for the companies. By using financial ratios, the limits generated by the companies' size are thereby significantly reduced.

The preference of using financial ratios in bankruptcy risk assessment has been manifested since the studies of Beaver (1966) and Altman (1968). In his univariate analysis, Beaver (1966) identified the cash flow indicator to total debt ratio to be extremely sensitive for a company's financial condition. Subsequently, Altman (1968) introduced the multivariate analysis and identified five representative financial ratios for the financial condition: working capital/total assets; total retained earnings/total assets; earnings before interest and taxes/total assets; market value of equity / book value of total debt; sales/total assets.

Another pioneer of bankruptcy risk assessment namely Ohlson (1980) introduced the Logit model in his analysis and found that a company's size, profitability and liquidity represent a negative correlation with the failure probability. Also, he found that the company's gearing is positively correlated with the failure probability.

Also, Chen and Shimerda (1981) reviewed 26 articles that classified 65 financial ratios incorporated in predictive studies between 1966 and 1975, and selected 41 financial ratios that were considered to be important. Emphasizing the importance of using financial ratios in the analysis, they found that, by using the financial ratios, the accuracy of the prediction of a company's bankruptcy exceeds 90%.

Anyway, we can classify the business performance as follows (Achim & Borlea, 2014): the accounting-based measure of financial performance (represented by Return on assets, Return on equity, Leverage ratio; Flexibility and so on) and the market-based measure of financial performance (represented by Market capitalization; Price to book ratio; Market to Book ratio, Price Earnings ratio, Dividend Yield ratio, Tobin's Q and so on). Even if the effect of variables other than those accounting-based measure on the probability of bankruptcy is already proven (by macroeconomic variables, market-based measure variables, corporate governance variables, etc.), recent research revealed that financial variables are still considered significant variables for the company's performance, providing the majority influence on bankruptcy risk probability (Achim & Borlea, 2012; 2013; Agraval & Taffler, 2008; Beaver et al., 2005; Karas & Režňáková, 2014; Tuvadaratragool, 2013). Moreover, the effects of non-accounting based measure variables ultimately still reflect in financial performances (increase of sales, increase of net income, increase of wealth and so on). These results are also supported by the findings of Beaver et al. (2005) which reflect that "market-based variables are not a substitute for the accounting-based information but rather a proxy for the predictive power attainable by capturing the total mix of information, including both the financial statement and non-financial statement information." Therefore, the market-based measure variables include many other influences other than reflecting the internal performance and ultimately they also go-

back within the value of accounting based-measure. So, based on the literature review, the accounting-based measure variables finally seem to be the best in reflecting the business performances.

1.3 Review of Used Methodologies

The development of predictive business failure models was the subject of numerous researchers' studies. Since 1968, the primary methods that have been used for model development are the multivariate discriminant analyses (MDA), developed by Altman (1968; 1970; 2005; 2006) and Beaver (1966; 1968; 2005; 2010).

Ohlson (1980) criticizes the MDA, especially the restrictive statistical requirements imposed by the model and introduces for the first time the logistic regression method meant to better predict the company's failure. The benefits of the logistic regression method are subsequently recognized by many authors, the major advantage being that while the MDA model calculates a bankruptcy score using a linear function, the Logit model predicts that probability as a "dichotomous dependent variable that is a function of a vector of explanatory variables" (Aziz & Dar, 2006). In their large survey, Bellovary et al. (2007) found that the multiple discriminant analysis is the most common method of predicting bankruptcy risk, being used in 36% of the investigated studies. On the second place (with 25%) are the Logit and Probit models.

Later, other methods supported the development of bankruptcy risk prediction models as alternatives to the two models mentioned above: *neural networks*, *hazard model*, *distance to default cox regression*.

1.4 Limits of Failure Prediction Models

The interest in developing some bankruptcy risk models was manifested by researchers from the whole world; they would be applied not only to developed countries but also to the emerging countries, too. For developed countries, among the most important bankruptcy risk studies, we can mention: Beaver (1966), Altman (1968; 2005; 2006), Ohlson (1980), Shumway (2001) (for US), Christidis and Gregory (2010) (for UK). For developing countries from Central and Eastern Europe, we can mention: Dominiak and Mazurkiewicz (2011) (Poland), Šarlija and Jeger (2011) (Croatia); Dun and Bradstreet

(2014), Karas and Režňáková (2013; 2014), Pitrova (2011) (Czech Republic); Elenkov and Fileva (2006) (Bulgaria); Szeverin and László (2014) (Hungary); Ugurlu and Aksoy (2006) (Turkey); Anghel (2002), Siminica (2010), Robu and Mironiuc (2012) (Romania). For developing countries from Asia we note the studies of Wang and Campbell (2010) (China), Suntraruk (2010; 2013) and Tuvadaratragool (2013) (Thailand); Lee W-C (2007) and Lee M-C (2014) (Taiwan).

Despite the efforts of globalization and convergence the economies around the world, there are still large disparities between the world's countries' national economies that make impossible the existence of a global model of assessing bankruptcy risk. A complex survey conducted by Platt and Platt (2008) in three global regions namely Asia (including Australia), Europe and the US highlights that international differences in accounting rules, lending practices, management skills' levels and legal requirements have determined the rejection of the null hypothesis that assumed that a single global model would explain financial distress on each region in favour of a fully relaxed model which created individual financial distress models for each region. Some similar studies were conducted by Laitinen and Suvas (2013) on a sample of 30 European countries and their findings highlighted the significant differences in the shape and power of predicting bankruptcy risk models influenced by characteristics specific to each country, like: economic environment, company status classification and coding systems, legislation and culture. On the same level, Altman and Hotchkiss (2006) also highlighted the most important differences between emerging and developing markets, like currency vulnerability, industry risk, and competitive position and take these factors into account to develop a bankruptcy risk assessment model specifically for emerging economies under the Emerging Market score (EMS) Model.

A limited category aimed to create the models from the investors' perspective. Their demands are different from those of other decision-makers, therefore the results could not be used for a general purpose, but for a specific one. In this regard, Wang and Campbell (2010) in their study on Chinese Publicly Traded Companies analysed which financial indicators have a significant impact on a company's delisting state from the stock. They found that

negative own equity and a negative net income for the last two years are the two most influential variables in failure prediction from the investors' perspective. By using this perspective, Christidis and Gregory (2010), in their survey on the companies listed on the London Stock Exchange, identified eight variables as being significant for the companies' risk failure, such as: liquidity indicators (working capital over total assets, quick assets over current assets), profitability (change in net income, a dummy variable equal to one if net income was negative for the last two years, earnings before interest and tax over share capital), cash flow, funds-flow and leverage (measured by total liabilities over total assets). For the Asian stock market, more specifically for Thailand's stock market, Tuvadaratragool (2013) identified eight statistically significant ratios such as: three ratios (current assets to current liabilities, quick assets to current liabilities and working capital to total assets) in the liquidity group; two ratios (sales to total assets and sales to inventory) in the turnover group; two ratios (earnings before interest and tax to interest and total equity to total liabilities) in the leverage group and one ratio (net income to total assets) in the profitability group. Investigating the above results, it cannot be established that the variables would have a significant impact on stock market delisting.

Such limitation of bankruptcy risk models' application in space and time is highlighted by many authors such as Balcaen and Ooghe (2006) or Cîrciumaru (2011). For instance, Cîrciumaru (2011) also remarked that even for the same economy, the periods of economic instability affect the failure predictions' results and therefore it is necessary to regularly update the models in order to capture the new economic and financial conditions. We can add here that even if the bankruptcy prediction models are created specifically from the investors' perspective, they significantly differ from country to country, from one working methodology to another, from the period in which these models were created (if they were created in a period of economic growth, the results no longer apply to those from the period of economic crisis) etc.

2. Methodology

2.1 Sample and Data

In this study, the choice of the two groups of companies is made from the investors'

point of view on the stock market. As long as a company is delisted, it becomes worthless for the investor because a trading platform no longer exists. Even if the company, being delisted, will continue to operate for a period of time, "the shareholders have essentially lost their investment" (Wang & Campbell, 2010).

For our study a firm is identified as failed if it is delisted from the Bucharest Stock Exchange. Otherwise, if the firm is listed, it is identified as non-failed.

The statistic population consists in 88 large non-financial companies that are traded on Bucharest Stock Exchange at the end of 2013. Banks and other financial institutions are excluded from the study because their financial statements are prepared on a different basis from those of industrial firms (Bryant, 1997; Charitou, Neophytou, & Charalambous, 2004; Flagg, Giroux, & Wiggins Jr., 1991; He & Kamath, 2006; Ohlson, 1980; Tuvadaratragool, 2013). Further, the non-financial companies belong to different area of business such as: industry, commerce, construction and accommodation.

From the sample of 88 non-financial companies, we have identified 65 listed companies and 21 delisted companies. The companies listing on the Bucharest Stock Exchange is classified on three categories (Tier 1, Tier 2 and Tier 3) according to their performances, as follows (Bucharest Stock Exchange, "Issuer's guide of Stock and bonds", 2010):

- **Tier 1** includes the companies which have an equity value at least of 30 million EURO in the last financial year and have obtained a net profit in the last two years of activity. We have 16 non-financial companies, at the end of 2013.
- **Tier 2** includes the companies which have an equity value at least of 2 million EURO in the last financial year. We have 48 non-financial companies, at the end of 2013.
- **Tier 3** includes the companies which have an equity value at least of 1 million EURO in the last financial year. We have only one companies, at the end of 2013.

A special category of companies traded on the Bucharest Stock Exchange is represented by *delisted* companies. Delisting means the removal of a listed company from the Bucharest Stock Exchange, voluntarily or involuntarily, because it is not anymore in compliance with

the listing requirements of the Bucharest Stock Exchange (no longer qualified for listing, in none of the above mentioned categories). At the end of 2013 there are 21 delisted companies.

Based on economic and statistical reasons, we will withhold in the "Listed" category only those companies that meet the highest performance criteria. More specifically, from the total sample of listed companies (65 companies) we retain only those listed in Tier 1 (namely, 16 companies).

The statistical reasons on which the decision of establishing the samples for bankruptcy risk's prediction analysis relied, aim the balance between the two samples. Although there is a common defaulters' share of less than 10% in the entire database, this imbalance can lead to large default prediction errors. Marqués, García and Sánchez (2013) mentioned in their study the problem of imbalanced data and found that the use of resampling methods could consistently improve the performance given by the original imbalanced data. Many studies focused on these aspects and used balanced samples in their risk failure studies: Beaver (1966; 1968) used 79/79, Altman (1968) used 33/33, Deakin (1972) used 32/32, Bei and Liu (2005) used 31/31, Hossari (2007) used 247/247, Ugurlu and Aksoy (2006) used 27/27, He and Kamat (2006) used 20/20, Tuvadaratragool (2013) used 14/14.

The economic reasons for choosing the two samples are based on the fact that the Tier 1 consists of those companies that meet the most rigorous performance requirements and under these circumstance the likelihood that financial performance variables to be more sensitive to the two non-failure/failure states, is higher.

Finally, our study will be conducted based on two samples: a non-failed sample which consists in 16 listed companies and a failed companies sample which consists in 21 delisted companies. Our two samples are homogeneous, on the one hand, in terms of the companies' size (we consider only large companies) and, on the other hand, in terms of the performed activity (we only sample the companies with an economic profile and therefore the financial institutions are not included).

The data were collected from the companies' annual financial statements, between 2002 and 2012, which are available on the site of the Bucharest Stock Exchange (www.bvb.ro). For the delisted firms, financial data up to two years

prior to delisting were used in our analysis. For the listed firms, we used the financial data from the last 3 years, namely between 2010 and 2012. The result was of 90 observations.

2.2 Method of Work

The dependent variable D_n is a binary variable: $D_n = 1$ for the stock delisted companies; $D_n = 0$ for the stock listed companies. Since the dependent variable is binary, the binary models were used for identifying the delisting probability (bankruptcy risk), which was modelled to depend on regressors. The index function formulation explains an unobserved continuous random variable y^* (latent variable), but all we observe is the binary variable y , which takes the 1 or 0 value according to whether y^* crosses a threshold or not. Different distributions for y^* lead to different binary outcome models. Let y^* be an unobserved variable. The regression model for y^* is the index function model (Cameron & Trivedy, 2009):

$$y^* = X'\beta + u \tag{1}$$

where the regressor vector X is a $K \times 1$ column vector with j th entry X_j , the parameter vector β is a $K \times 1$ column vector with j th entry β_j , and the error vector u is a $K \times 1$ column vector with j th entry u_j . Let a vector of data denoted as $X_i = (X_{i1}, \dots, X_{ik})$ from N observations. Then $X_i'\beta = \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_k X_{ik}$. The model (1) cannot be estimated because y^* is not observed. We have

$$y = \begin{cases} 1 & \text{if } y^* > 0, \\ 0 & \text{if } y^* \leq 0, \end{cases} \tag{2}$$

where the zero threshold is a normalization. Given the latent-variable models (1) and (2) we have

$$Pr(y = 1/X) = F(X'\beta) \tag{3}$$

where $F(X'\beta)$ is the cumulative distribution function (c.d.f.) of $-u$. We obtain the Probit model if u is standard normally distributed and the Logit model if u is logistically distributed. Given the model (3), a more relevant form with conditional probability is given by

$$p_i \equiv Pr[y_i = 1/X] = F(X_i'\beta) \tag{4}$$

For binary models, the maximum likelihood estimator (MLE) is natural estimator, because

the density is unambiguously the Bernoulli. For a sample (y_i, X_i) , $i = 1, \dots, N$, of N independent observations, ML estimation, $\hat{\beta}$, maximizes the associated log-likelihood function. The $\hat{\beta}$ is obtained by iterative methods and is asymptotically normally distributed. The Wald test and the likelihood-ratio (LR) test are used to produce the test statistics and p-value for a test of the significance of individual coefficients, the confidence intervals for individual coefficients, and the tests of overall significance. In the statistics literature a very common interpretation of the coefficients is in terms of marginal effects. We are interesting in determining the marginal effect of change in a regressor on the conditional probability that $y = 1$. For general model (3) and change in the j th regressor, assumed to be continuous, this is

$$\frac{\partial Pr(y_i = 1/X_i)}{\partial x_j} = F'(X_i'\beta)\beta_j \tag{5}$$

The marginal effects differ with the point of evaluation X_i . In measuring marginal effects we calculate the change in the probability $Pr(y = 1)$ when regressors change by one unit. Marginal effects of logit variables are estimated. A measure of goodness of fit in the linear regression model is R^2 . The generalizations to nonlinear models are called pseudo- R^2 . This measure is not always computable but it is for the binary outcome model. This yields the R^2 measure for binary models proposed by McFadden. We used a good guide (Cameron & Trivedy, 2009) that explains how an econometrics computer package such as Stata, may perform regression analysis of a qualitative binary variable.

Based on investigating the aforesaid findings, at the initial stage, we considered 12 financial ratios. These variables are grouped as follows:

- A. Profitability
 1. Return on assets = Net results / Total assets (ROA)
 2. Return on equity = Net results / Own Equity (ROE)
 3. Net profit margin = Net results / Sales (NPM)
- B. Leverage
 4. Leverage ratio = Debt / Shareholder's equity (LEV)
 5. Stability ratio = Engaged capital / (Own equity + Liabilities) (STAB)

C. Liquidity and solvency

6. Current liquidity ratio = Current assets/ current liabilities (CL)
7. Flexibility ratio = Net working capital/ Total assets (FLEX)
8. Cash-flow/Net results (CWR)
9. General solvency = Total assets/Total debts (SOLV)

D. Activity

10. Assets turnover = Sales/Total assets (ASTU)
11. Current assets turnover = Sales/Current assets (CASTU)
12. Current debts turnover = Sales/Current debts (CDTU)

The correlation results between the selected variables are provided in the following table:

Tab. 1: Correlation matrix

	ASTU	SOLV	FLEX	LEV	STAB	CL	ROE	NPM	CASTU	CDTU	CWR	ROA
ASTU	1.0000											
SOLV	-0.2375	1.0000										
FLEX	-0.0834	0.4034	1.0000									
LEV	0.0282	-0.1392	-0.0381	1.0000								
STAB	-0.2812	0.4932	0.8176	0.0171	1.0000							
CL	-0.1746	0.7191	0.5288	-0.1046	0.3730	1.0000						
ROE	0.0636	0.0802	0.1509	-0.8210	0.0110	0.1045	1.0000					
NPM	0.2374	0.0376	0.0436	0.0342	0.0454	-0.0726	-0.0291	1.0000				
CASTU	0.4965	0.1032	-0.2161	0.0974	-0.0438	-0.3046	-0.1060	0.2146	1.0000			
CDTU	0.3071	0.6486	0.4163	0.1043	0.4103	0.5649	0.1111	0.2434	0.3610	1.0000		
CWR	0.3433	-0.0825	0.0169	0.0044	-0.0239	-0.0441	-0.0294	0.0280	0.1868	0.0755	1.0000	
ROA	0.1310	0.1122	0.4706	-0.0042	0.4088	0.0888	0.1559	0.5755	0.0113	0.3122	-0.0327	1.0000

Source: own calculations

With a few exceptions, which we will consider, Table 1 shows no strong correlation among the ten variables which are mentioned above. They can be used together as potentially explanatory variables in any order or in any combination. From the selected variables, in terms of the information's impact, three models are considered to be relevant to the probability of stock exchange delisting. It is well known that either Logit and Probit models can be used for identifying the variables that are significant and have predictive power, because they have similar shapes for central values of $F(\cdot)$ but differ in the tails as $F(\cdot)$ approaches 0 or 1.

3. Empirical Results and Discussions

Empirical results of Model 1, Model 2 and Model 3 are provided in the following. The McFadden's R^2 marginal effects and the percentage of correctly classified observations provide the explanatory power of variables in models.

Model 1

The results of the Logit model are presented in Table 2. All regressors, FLEX, ASTU and CASTU are statistically different from zero at the 0.05 level. The null hypothesis that the coefficients of FLEX, ASTU and CASTU are zero is rejected at the 0.05 level. This is confirmed by the LR test. The sign of the coefficient is also the sign of the marginal effect presented in Table 3.

The variables FLEX and CASTU have negative coefficients which means that increasing the flexibility and also the turnover in current assets conduct to a decrease of the probability of delisted $\Pr(D_n = 1)$. Both coefficients have an expected signs (negatives) meaning that by assuring an adequate value of working capital and a high ratio of replacing the current assets by turnover activity, a well efficiency in operating activity is performed. To the contrary, the variable ASTU has a positive coefficient, means that increasing the turnover in total assets conduct to an increase of the

Tab. 2: Logistic regression

Dn	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
FLEX	-3.66313	1.508794	-2.43	0.015	-6.62032	-0.70595
ASTU	4.38998	1.232050	3.56	0.000	1.97521	6.80475
CASTU	-1.08176	0.369810	-2.93	0.003	-1.80658	-0.35695
_cons	-0.89814	0.491670	-1.83	0.068	-1.86181	0.06552

Number of obs. = 90

Wald chi2(3) = 12.93

Prob > chi2 = 0.0048

Log pseudolikelihood = -39.891217

Pseudo R² = 0.3585

Source: own calculations

probability of delisting. By taking account the above comments, it is means that the small value of the fixed assets cause problem of disinvestment, conducting to increase of the probability of delisting. We will comment in details all these results after we run all the considered models.

For the fitted Logit model the McFadden's R² is 0.3585. Table 2 shows a good model of the impact of FLEX, ASTU and CASTU on Pr(Dn = 1).

Table 3 provides an estimate of the marginal effect at $X = \bar{X}$. Among the three stock exchange delisting determinants, flexibility ratio

(FLEX) shows that it has the highest negative marginal impact on dependent variable (Dn = 1) and assets turnover (ASTU) has a high positive marginal impact. An important point to note is that for the marginal of all three Logit variables i.e. FLEX, ASTU and CASTU on Dn, stock exchange delisting is statistically significant with a significant level of 0.015, 0.00 and respectively 0.003 and they contribute with 52.59% to the probability of stock exchange delisting. The marginal effect of the model's predictive power on stock exchange delisting is of 0.5259 i.e. 52.59%.

Tab. 3: Marginal effects after Logit

Variable	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]		X
FLEX	-0.91332	0.36985	-2.47	0.014	-1.63822	-0.18842	0.07215
ASTU	1.09454	0.29883	3.66	0.000	0.50885	1.68024	0.84165
CASTU	-0.26971	0.09048	-2.98	0.003	-0.44704	-0.09238	2.24492

y = Pr(Dn) (predict)

= 0.525912

Source: own calculations

One measure of goodness of fit is the percentage of correctly classified observations. For the fitted Logit model, we obtain Table 4.

Table 4 compares fitted and actual values. The percentage of correctly specified values is of 83.33%. In this Table, 5 observations are misclassified as 1 (stock exchange delisted) when the correct classification is 0 (stock exchange listed), and 10 values are misclassified as 0 (stock exchange listed) when the correct value is 1 (stock exchange delisted).

In the following, we present Model 2 and Model 3 compared to Model 1, to show the insignificant impact of some variables considered at the initial stage.

Model 2

Assets turnover (ASTU) represents the determining factor of the probability of stock exchange delisting. Table 1 shows no strong correlation among ASTU and CDTU. The results of the Logit model with ASTU and CDTU

Tab. 4: The percentage of correctly classified observations

Logistic model for Dn			
Classified	True		Total
	D	~D	
+	32	5	37
-	10	43	53
Total	42	48	90
Correctly classified	83.33%		

Source: own calculations

as the regressors are presented in Table 5. The null hypothesis that the coefficients of ASTU and CDTU are zero is rejected at the 0.05 level. The sign of the coefficient is also the sign of the marginal effect presented in Table 6. As in the model 1, the coefficient of variable ASTU is also positive (we comment on this). As for the variable CDTU, the negative coefficient has an economic significance, meaning that a higher ability of a company to pay its debts, the smaller is the probability of delisting. McFadden' R^2 is 0.2960. Table 5 shows a good model of the

impact of regressors on the delisting probability $\Pr(Dn = 1)$, but a smaller than that from Model 1.

The marginal effects of two Logit variables i.e. ASTU and CDTU on Dn, is statistically significant and they contribute with a probability of 51.83% to stock exchange delisting.

The percentage of correctly specified values (presented in Tab. 7) is with 80% smaller than that from the first model. The predictive power of the model on the stock exchange delisting doesn't change significantly.

Tab. 5: Logistic regression

Dn	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
ASTU	3.44703	1.02342	3.37	0.001	1.44115	5.45291
CDTU	-0.36271	0.15072	-2.41	0.016	-0.65812	-0.06731
_cons	-1.53414	0.47610	-3.22	0.001	-2.46729	-0.60099

Number of obs. = 90

Wald chi2(2) = 11.83

Prob > chi2 = 0.0027

Log pseudolikelihood = -43.774824

Pseudo R^2 = 0.2960

Source: own calculations

Tab. 6: Marginal effects after logit

Variable	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]		X
ASTU	0.86060	0.25191	3.42	0.001	0.366874	1.35433	0.84161
CDTU	-0.09055	0.03737	-2.42	0.015	-0.163803	-0.01731	3.56632

y = Pr(Dn) (predict)

= 0.518330

Source: own calculations

Tab. 7: The percentage of correctly classified observations

Logistic model for Dn			
Classified	True		Total
	D	~D	
+	30	6	36
-	12	42	54
Total	42	48	90
Correctly classified	80.00%		

Source: own calculations

Observation. If in Model 2 NPM and LEV are added, the model indicates that there is no statistically significant improvement in the results.

Which is the ROE variable's impact on the probability of stock exchange delisting? In order to explain this, we will introduce in Model 2 the ROE variable.

Model 3

Table 8 indicates that at the 0.05 level, the coefficient of ROE is not statistically significant (p value = 0.349 < 0.05). The impact of ROE variable on $\text{Pr}(D_n = 1)$ is not significant. The signs of the coefficients of variables ASTU and CDTU are the same as in the two previous models (positive and respectively negative) and are statistically significant.

From Tables 9 and 10 we can conclude that Model 3 doesn't significantly improve the results obtained in Model 1.

Tab. 8: Logistic regression

Dn	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
ASTU	3.49977	1.07377	3.26	0.001	1.39521	5.60432
ROE	0.42666	0.45532	0.94	0.349	-0.46575	1.31907
CDTU	-0.37770	0.16096	-2.35	0.019	-0.69319	-0.06222
_cons	-1.52037	0.47563	-3.20	0.001	-2.45260	-0.58814

Number of obs. = 90

Wald $\chi^2(3) = 11.23$ Prob > $\chi^2 = 0.0105$

Log pseudolikelihood = -43.50051

Pseudo $R^2 = 0.3004$

Source: own calculations

Tab. 9: Marginal effects after logit

Variable	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]		X
ASTU	0.87343	0.26357	3.31	0.001	0.35684	1.39003	0.84161
ROE	0.10648	0.11344	0.94	0.348	-0.11586	0.32882	0.01176
CDTU	-0.09426	0.03984	-2.37	0.018	-0.17235	-0.01617	3.56632

$y = \text{Pr}(D_n)$ (predict)
= 0.520757

Source: own calculations

Tab. 10: The percentage of correctly classified observations

Logistic model for Dn			
Classified	True		Total
	D	~D	
+	30	5	35
-	12	43	55
Total	42	48	90
Correctly classified	81.11%		

Source: own calculations

Several general observations: In other variables combinations as well, the ROE variable's impact is not significant. By adding the SOLV, STAB and CL variables, the coefficients are not statistically significant at the level 0.05. Also, in each of the three models, the impact of ROA and CWR is insignificant at the 0.05 level. The difference between the same coefficient of ASTU variable, as it is estimated in Model 2 and Model 3, do not significantly differ. The difference is significant between the same value estimated in Model 1 and any of the other two models. It is normal that the impact of ASTU on the delisting probability $Pr(D_n = 1)$ vary depends on the circumstances of the factors considered in each model.

In summary, Model 1 provides the highest explanatory power. Three variables such as Flexibility ratio (FLEX), Assets turnover (ASTU) and Current assets turnover (CASTU) are found to be significant determinants for listing on the stock exchange. These three variables provide 52.59% of correct prediction of bankruptcy risk and the percentage of correctly classified observations for the fitted Logit model is that of 83.33%. In other words, more than half of the variables significant for bankruptcy risk belong to an accounting-based measure indicators type (three in number) and the other half is due to other factors: market-based indicators, market transactions' volume, corporate governance, corporate social responsibility, etc. In addition to the financial information needs reflected in the financial reports, there is a more acute need for extra-financial information, characteristic of the information needs related to the new economy. Therefore, the study conducted by the consulting company Mc Kinsey (2001) on the view of institutional investors from emerging countries (Asia, Eastern Europe and Latin

America) on corporate governance, reveals that investors pay at least the same importance to non-financial information on corporate governance like that to financial information that their decisions are based on. Given that non-financial information get increasingly more attention in the last decade (see Achim & Borlea, 2013, p. 83), our results support the significant importance of a company's financial performance reported to its overall performance, this fact being reflected in the company's survival on the market.

In what the models' accuracy is regarded, similar studies conducted to similar percentages with those that we obtained. For the capital markets of Asia and Pacific, Chi and Tang (2006) found a percentage of correctly specified values of 85%. In Thailand, by applying the Logit model, the classification's accuracy rate recorded a result of up to 86%. For Turkey, Uğurlu and Aksoy (2006) found a higher percentage of correct classification of 95.6% and the predictive results of the Logit model are 94.5 percent (a number of 11 predictors of distress were found to be significant, therefore the addition of one more variable contributes to explain variance by 8.6 percent). In comparison, our study reveals a much higher percent of 17.5 explaining the variance by one of variables.

Regarding the variables that we found out to be representative for our model, we consider our findings for Romania to be both aligned to other findings and also spectacular and original, at least for the following three reasons:

The First Reason Regarding the Variables' Nature

Analysing the nature of the variables with significant impact on delist risk, we can conclude that they are represented only by activity ratios

(ASTU and CASTU) and liquidity ratios (FLEX). Our study did not select any indicator of return or leverage as having a significant impact on the delisting risk.

Our results though, are partially aligned with similar studies conducted for the emerging countries, like in Croatia by Šarlija and Jeger (2011). By comparing financial distress prediction models before and during recession in Croatia, by using data from 2006 until 2009, they also found that activity ratios represent the majority group for predicting the financial distress' likelihood (three ratios belong to the activity group, namely Total Revenues/Total Assets, Total Revenues/Short-term Assets and Short-term Assets-Inventory)/Sales). Similar studies were conducted in Turkey by Ugurlu and Aksoy (2006), who found that activity variables (Sales/Current assets, Sales/Fixed assets, Sales/Net working capital) have a significant impact on delisting.

Returning to our study, the insignificant impact of leverage ratios on the delisting risk found by our study could be explained as an atypical behaviour that the Romanian companies adopt concerning the leverage decision. According to the study conducted by Brendea (2014) from 2004 to 2011, the Romanian companies' behaviour in attracting external sources is negatively correlated with the amount of fixed assets which is contradiction with the findings obtained for developed countries (eg, Germany, France and Italy) and more advanced developing countries (e.g. the Czech Republic and Estonia), but are in line with a country similar to Romania, namely Bulgaria. As a result of this atypical behaviour of the listed companies concerning the financial structure, it cannot "predict" accurately a company's delisting and our results are therefore supported by these findings.

By making a comparison with other studies conducted in Romania, our variables' nature differ significantly with those from other studies on bankruptcy risk (Anghel, 2002; Robu-Mironiuc, 2012; Siminica, 2010). Only one variable, namely Current Assets turnover (CASTU) is identified in other studies as well, namely in that conducted by Siminică (2010). However, in none of the studies mentioned in Romania has been developed a bankruptcy prediction model from the investors' perspective, namely the risk of delisting. As shown in our study, companies can have high rates of profitability but there is

a possibility that a financial distress reflected in the company's stock exchange delisting to be unpredictable. Moreover, neither the financial structure indicators (e.g. Leverage ratio) seem to be capable of predicting such a delisting, as previously mentioned.

The Second Reason Regarding the Type of Variables

If we especially refer to the types of variables that were selected in our study, our results are in line with various similar findings. Therefore, FLEX variable is an highly encountered indicator in studies from different emerging countries like Thailand (Tuvadaratrogol, 2013) but also in studies from developed countries like US (Altman 1968; 2005; Ohlson 1980) or UK (Christidis & Gregory, 2010).

Referring to the ASTU or CASTU ratios of activity that were identified as having a significant impact on the delisting risk, in Turkey, Ugurlu and Aksoy (2006) found similar variables for a company's delisting probability and Chi and Tang (2006) making a bankruptcy risk study in seven capital markets from Asia and the Pacific (Hong Kong, Japan, Korea, Malaysia, Singapore, Thailand and the Philippines) they identified the Fixed Assets turnover ratio as having a significant impact in predicting bankruptcy.

The Third Reason Regarding the Sign of the Coefficients

For two of the three resulted variables, specifically for FLEX and CASTU the results are aligned with the expectations based on the economic theory. The variables' coefficients are negative and in terms of marginal effects reflect as an increase by one unit of the company's flexibility (FLEX) and respectively of current assets turnover (CASTU) conducting to a decrease in the delisting probability. The results based on the economic theory are as expected. By analysing the indicators' averages, we found that the average for FLEX for non-failed firms is of 0.1422 compared to the negative values of -0.007 for failed firms. Also the average of CASTU for non-failed firms is of 2.21 compared with a lower value of 0.1449 for failed firms.

The third variable, ASTU Assets turnover (ASTU) has a positive coefficient, fact that reflects that the higher the total assets' turnover rate, the bigger is the possibility of a bankruptcy

(in our case delisting). The result is contrary to the expectations based on the economic theory. Indeed, returning to our results, the Assets turnover's average (ASTU) for non-failed firms is of 0.5487 compared with 1.1763 for failed firms. By further analysing the active components, we can conclude that for the non-failed companies the average of Fixed assets turnover is significantly lower than that of failed firms (a value of 2.29 for listed companies compared with a value of 3.18 for delisted companies). This is the main cause because of which the non-failed firms have a 0.63 lower Assets turnover average compared to that of the failed firms. Trying to find some explanations regarding these results that contradict the economic theory, we continued the analysis and found that, on average, the Fixed Assets/Current Assets report for failed firms is significantly lower than that for non-failed firms (0.93 for delisted companies compared with 1.71 for listed companies). Thus, it is reflected a lower ratio of Fixed Asset in total assets for failed firms (in average of 48.18%) comparing with that of non-failed firms (63.15 %). In other words, disinvestment of the failed firms was the main cause that led to a more pronounced degree of replacement of Fixed Assets by turnover and not to a higher efficiency of their use.

The results are in line with those obtained for other developing countries (Turkey, Asia-Pacific countries, Taiwan). In Turkey, Ugurlu and Aksoy (2006) identified Current assets turnover as having a negative impact on failure probability and Fixed assets turnover as having a positive impact on failure probability. Generally, the higher these ratios are, the more efficient is the firm's utilization of these assets. For fixed assets, as it is the case with our study, the theory is not validated. The mean of the fixed assets turnover is significantly higher for the failed firms implying that "these firms have low investment in fixed assets and/or are using highly depreciated assets". Chi and Tang's study (2006) attested for Asia and the Pacific's capital markets similar findings regarding fixed assets turnover, which reflected a higher level of fixed turnover, leading therefore to a higher risk of failure. For Taiwan, Lee (2014) found also a positive impact of Fixed assets turnover on the probability of failure.

On the other hand, our results contradict the findings of Altman (1968; 2005; 2006) and Taffler (1983) conducted for developed

countries (US). They found that an increase in assets turnover should lead to a decrease in the probability of bankruptcy (the results are within the theory). We also found in literature many other opposite findings to the theoretical approach in the area of failure risk model. For instance, for Thailand (Tuvadaratragol, 2013), according to the indicators' marginal effect, one unit increase in liquidity (represented by quick assets to current liabilities and also by working capital to total assets) will cause an increase in the probability of financial distress, which is against the theory of financial ratios' analysis. He explained these findings according to the applied methodologies and noted that "this characteristic is quite often encountered in the case of Logit-based studies". But, this explanation is not very well assessed since, by using other models, the results could be also contrary. For instance, in Taiwan, Lee (2007), as a result of applying Genetic Programming Decision Tree, found that the coverage ratio has a positive impact on failure probability. Later, by applying the Hazard model, he found fixed asset turnover, capital turnover and price to book value as having a positive impact on failure probability. In other emerging country (Turkey), by applying both MDA and Logit analysis, Ugurlu and Aksoy (2006) found the gross profit margin as being one of the most important financial distress' predictors, the coefficient being positive. They explained the findings which were contrary to the theoretical expectations, as being "higher costs of production and/or lower levels of sales" of the failed firms which could conduct to higher gross profit margin ratios comparing to the non-failed firms. Finally, they explained the causes for which the coefficients' signs of some significant predictors are contrary to the expectations reflecting "problems of the economic system" of the emerging markets such as Turkey.

We could accept the reasons for some against theory findings as being revelatory for the emerging economies' problems, if we wouldn't identify similar studies conducted in developed countries which reject our hypothesis. For instance, a study on corporate Failure conducted in the US for the manufacturing Industries by Darayseh, Waples and Tsoukalas (2003) revealed some against theory findings. They found that net profit margin has a positive impact on the failure risk. They explained these findings as "profit margin on sales being

a “measure of profitability position in the short-run”, the profitability variables “would be more important over the short and long-term”.

However, we identified results opposite to the economic theory in greater measure among emerging countries than in the developed countries, fact that still sustains the hypothesis on the explanation of such against theory results and that is, that they are based on in transition economy systems, which still face great deficiencies compared to the developed ones. Moreover, compared to similar East Central European countries (Poland, Czech Republic, Hungary) the capital market in Romania (on which this study was based) is a young one, recording major shortcomings in the main market indicators, such as: Low liquidity and a pronounced imbalance between the traded instruments’ share (for operations).

Conclusions

A number of 37 firms, 16 listed and 21 unlisted on the stock exchange were examined in order to determine the significant variables in predicting stock exchange delisting via Logit Model. 12 variables were used in estimating three alternative Logit models for determining their signs, significance, predictive power, goodness of fit tests. Model 1 provided the highest explanatory power. Three variables such as Flexibility ratio (FLEX), Assets turnover (ASTU) and Current assets turnover (CASTU) were found to be significant determinants for a company’s listing on the stock exchange.

These three variables provided a bankruptcy risk correct prediction of 52.59%, the rest being attributed to factors different than accounting-based measure indicators, such as: corporate governance, corporate social responsibility, the auditor’s opinion, stock exchange transaction, macroeconomic factors etc. The percentage of correctly classified observations for the fitted Logit model is of 83.33%.

The results are largely in line with those obtained for emerging markets, but also we emphasized the specific of the results in bankruptcy risk as a consequence of the investor’s view perspective.

Therefore, we revealed that the model’s features are generated by the Romanian economy’s specific and thus the Romanian capital market, which is a young market with great flaws in key market indicators (low liquidity, low informational efficiency, reduced funding on

the capital market for the Romanian companies etc). These are the system deficiencies that led to some results that are contrary to the expectations based on the economic theory such as those on Assets turnover, which show a positive impact on failure probability. On the other hand, according to the expectations generated by the economic theory, Current assets turnover and Flexibility ratio represent a negative impact on failure probability. In line with the authors’ opinions (Altman, 1968; 2005; 2006; Taffler, 1983; Walton et al., 2003), it is important that financial ratios of a specific business to be best interpreted as a group, because the interpretation of a single financial ratio can provide an altered image at a specific moment.

This paper is intended to be an original material because of the elaboration for the first time in Romania of a financial failure model intended to be of use to investors on the capital market by providing necessary clues on the upcoming shares’ delisting on the stock exchange, a time when from the investors’ point of view the company is already bankrupt. Studying bankruptcy from the investors’ point of view is a rather rarely treated subject in the literature (compared to other legal and economic approaches) and in Romania it is the first study of this kind. Thus, our research can bring added value to current research in the field of bankruptcy risk, coming to cover a gap on the niche of developing some bankruptcy risk models from the investors’ perspective.

As future research perspective, we consider trying to identify the bankruptcy predictors for other emerging countries’ capital markets (Czech Republic, Poland, Hungary and Bulgaria) from the investors’ perspective and analyse possible differences from Romania.

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Abstract

FAILURE PREDICTION FROM THE INVESTORS' VIEW BY USING FINANCIAL RATIOS. LESSON FROM ROMANIA**Monica Violeta Achim, Sorin Nicolae Borlea, Lucian Vasile Găban**

The purpose of our study is to identify which financial indicators have a significant impact on the probability of Romanian companies' bankruptcy risk from the investors' point of view by studying the impact on the probability of shares delisting from the stock exchange. The research is conducted on a sample of 16 failed and 21 non-failed non-financial companies listed on the Bucharest Stock Exchange between 2002 and 2012.

The Logit analysis is used for identifying the variables that are significant and have predictive power on distress likelihood. By using 12 main financial ratios, we estimate three alternative Logit models for determining their signs, significance, predictive power, efficiency of fit tests. The first model provides the highest explanatory power. Three variables such as Flexibility ratio (FLEX), Assets turnover (ASTU) and Current assets turnover (CASTU) are found to be significant determinants for stock exchange delisting. These three variables provide 52.59% of correct prediction of bankruptcy risk. The percentage for correctly classified observations for the fitted Logit model is of 83.33%.

Moreover, this research attempts to reveal the changes that may appear among bankruptcy predictors given that the bankruptcy risk model is developed from the investors' point of view and not from that of a simple decision-making person. For a stock market investor, bankruptcy already starts at the stage of delisting the company because the investment was strongly compromised, whether or it continues its activity or not. Orientation towards investors when predicting bankruptcy risk is the main element of originality that our research adds to the scientific achievements in bankruptcy, until this moment.

Key Words: Delisting, failure prediction, financial ratios, Logit model.

JEL Classification: C25, C52, G33.

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COGNITIVE-AFFECTIVE MODEL OF ACCEPTANCE OF MOBILE PHONE ADVERTISING

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Introduction

There are high expectations for mobile phone marketing (Yang, Kim, & Yoo, 2013). Four trends in particular contribute to the medium's marketing potential worldwide: (1) the significant growth in the use of mobile devices (Khalifa & Shen, 2008); (2) the forecasts of considerable growth in mobile advertising (MMA Mobile Marketing Association, 2012) compared to the predicted steady decline in spending on conventional media (Infoadex, 2014); (3) the development of increasingly sophisticated mobile devices (Miguel-Dávila, López, & De Pablos-Heredero, 2012), which has opened up new avenues and formats for marketing communication with consumers; and (4) the strong results achieved by companies with mobile marketing campaigns. In various European markets, such as the United Kingdom, Spain and Italy, these campaigns have registered response rates of up to 47% among their target audience (IAB Spain Research, 2012).

However, there is a barrier to success: getting users to agree to receive marketing actions on their mobile phones. Field studies on this topic, known as permission-based mobile marketing, are increasingly numerous and representative (Bamba & Barnes, 2007; Barwise & Strong, 2002; Carroll, Barnes, & Scornavacca, 2005; Jayawardhena, Kuckertz, Karjaluoto, & Kautonen, 2009), as are studies on the adoption of mobile technology (López-Nicolás, Molina-Castillo, & Bouwman, 2008) and its use as a medium for advertising communication (Lee, Tsai, & Jih, 2006). However, the literature on the factors that determine attitudes towards and/or intention to receive mobile advertising, and on the relationships between attitude, intention and behaviour, remains minimal and contradictory (Choi, Hwang, & McMillan, 2008; Okazaki, Katsukura, & Nishiyama, 2007; Tsang, Ho, &

Liang, 2004; Xu, 2006; Xu, Liao, & Li, 2008). Moreover, while the benefits of considering both cognitive and affective factors in order to better understand peoples' appraisals have been widely recognized in the literature (Levav & McGraw, 2009; van Waterschoot, Kumar Sinha, Van Kenhove, & De Wulf, 2008; Zielke, 2011), it is not yet known how these factors combine to influence attitudes towards mobile advertising and, thus, the intention to receive it. In this context, the first aim of this paper is to fill these gaps.

Additionally, the literature has recognized the influence of reference groups on people's attitudes, intentions and behaviour (Bagozzi, 2000; Fishbein & Ajzen, 1975). With regard to mobile marketing communications, authors such as (Bauer, Barnes, Reichardt, & Neumann, 2005), (Muk & Babin, 2006) and (Rohm & Sultan, 2006) have shown that reference groups can positively influence the intention to participate in mobile marketing. However, the literature has not determined how these reference groups moderate cognitive and affective factors in the formation of attitudes. The second aim of this paper is thus to answer that question.

In light of these limitations identified in the literature, we have proposed a model to meet the stated aims. The results show the advisability of treating attitudes towards mobile advertising as a two-dimensional variable including both cognitive factors (ease of use and perceived usefulness) and affective ones (positive and negative emotions). The research also shows how social influence (reference groups) moderates the effect of emotions on behaviour and how the reference group's opinion can increase the gap between attitude and behavioural intention.

The paper is divided into three parts. The first section, which focuses on the theory,

reviews the literature in order to propose the research hypotheses and the conceptual model to be tested. The second section reports on an empirical study carried out according to the proposed research methodology. Finally, the third section presents the conclusions and discusses the implications for management taking into account certain limitations.

1. Background and Hypotheses of the Cognitive-Affective Model of Acceptance of Mobile Advertising

As noted, both cognitive and affective factors influence subjects' appraisals (Dean, Raats, & Shepherd, 2008). Affect and cognition take place through an interlocked dual system that comes together in natural human behaviour (Boehner, DePaula, Dourish, & Sengers, 2007).

In the context of mobile communications, few studies have taken a holistic approach to these interrelated factors. Instead, most research has sought to assess only one of these dimensions, usually, the cognitive one. From a joint cognitive-affective perspective, the theoretical background underlying the assumptions of the model for attitudes towards mobile advertising includes both eminently cognitive variables, such as ease of use and perceived usefulness (Karjaluo, Lehto, Leppäniemi, & Jayawardhena, 2008; Soroa-Koury & Yang, 2010), and eminently affective ones, such as positive and negative emotions (Kolsaker & Drakatos, 2009).

1.1 Ease of Use and Perceived Usefulness

To identify the determining factors for the acceptance of mobile advertising, (Zhang & Mao, 2008) proposed a modified technology acceptance model (TAM) based on Davis's TAM (1989) and the theory of reasoned action. This model examines, among other key factors, the influence of usefulness and perceived ease of use on the intention to engage with advertising. The conceptual model validated by Karjaluo et al. (2008) Lehto, Leppäniemi, showed how perceived ease of use and, in particular, perceived usefulness are both factors that positively influence attitudes towards mobile advertising. However, subsequently, Soroa-Koury and Yang (2010), using the extended technology acceptance model (TAM2), studied a sample of 343 university students who engaged

with advertising text messages and found that perceived usefulness predicted attitude towards mobile advertising, while perceived ease of use did not.

Based on the contradictory findings in the literature, we proposed testing the following hypotheses:

H1: Perceived ease of use of mobile phones positively affects attitudes towards receiving mobile advertising.

H2: The perceived usefulness of the mobile advertising received positively affects attitudes towards it.

1.2 Emotions

Although emotion has been defined in many different ways (Cohen, Pham, & Andrade, 2008; Scherer, 2005), according to the theory of components, certain shared minimum features make it possible to delimit the concept as a whole (Russell, 2003; Scherer, 2001): need for a stimulus, attribution of the cause of the stimulus, cognitive appraisal, physiological reactions, feeling of pleasure-displeasure, unique qualitative feeling, characteristic action tendencies, and short-term processes.

The literature shows that some emotions trigger action, while others cause individuals to become inhibited or change (O'Neill & Lambert, 2001; White & Yu, 2005). In general, objects that cause positive emotions are assessed favourably, while those that cause negative emotions are assessed unfavourably (Bagozzi, Gopinath, & Nyer, 1999; Mano, 2004). People are naturally inclined to make decisions that minimize the probability of experiencing negative emotions (Lerner, Han, & Keltner, 2007; Schwarz, 2000).

In the field of mobile communications, research has focussed on the emotional attachment users feel towards their devices (Vincent, 2005). (Kolsaker & Drakatos, 2009) showed that only users with a strong emotional attachment to their devices are receptive to and perceive greater potential benefits in mobile advertising. With regard to the role of emotions, in a study of 48 students, (Park & Salvendy, 2012) found that the positive emotions 'desire' and 'affection' are positively correlated with attitudes towards mobile advertising, while the negative emotional dimensions of 'stress' and 'apathy' are negatively correlated. Tsang et al. (2004) and Xu (2006) showed that 'entertainment' positively influenced attitude,

while Tsang et al. (2004) moreover found that 'irritation' negatively influenced it.

Based on the above findings, we proposed the following hypotheses:

H3: Positive emotions towards mobile advertising positively affect attitudes towards it.

H4: Negative emotions towards mobile advertising negatively affect attitudes towards it.

1.3 Relationship between Attitude and Intention

The intention to receive messages is defined as a person's willingness to receive marketing communications on his or her mobile phone. Previous studies have considered the attitude variable to be a determinant of mobile phone users' behaviour and intentions to accept mobile advertising. Tsang et al. (2004) found a direct relationship between attitudes towards mobile advertising, the incentives offered and intentions and behaviour. The model in Lee et al. (2006) shows that favourable attitudes towards mobile advertising that correlate with strong motives lead to greater intentions and positive actions. In a survey of 300 university students, Soroa-Koury and Yang (2010) found that attitudes towards mobile advertising were predictive of the intention to accept/adopt the advertising. Likewise, in a study in China, Xu (2006) found a direct relationship between consumers' attitudes and intentions.

In light of this empirical background, we proposed the following hypothesis:

H5: Positive attitudes towards mobile advertising positively affect the intention to receive it.

1.4 Subjective Norm: Normative Reference Groups

The influence of the subjective norm can be defined based on what consumers believe other people might think about a given behaviour. Gauging the influence of reference groups, Peter and Olson (2005) identified two reference groups that contribute to the influence of the subjective norm: (1) normative groups, such as parents and peers (Fitzgerald & Arndt, 2002), and (2) comparative ones, such as idols (Childers & Rao, 1992).

The theory of reasoned action (TRA) model (Fishbein & Ajzen, 1975), as well as its extension in the theory of planned behaviour (TPB) model (Ajzen, 1991), and the TAM2 model (Venkatesh

& Davis, 2000) provide the rationale for linking the subjective norm to behaviour towards mobile advertising. Knowing how audiences are affected by the subjective norm – more specifically, by the normative reference group (NRG) due to the daily use of mobile devices – as a moderating variable can help to explain mobile advertising acceptance. In this context, the results of the model proposed by Zhang and Mao (2008) confirmed the influence of the subjective norm (Bagozzi, 2000) on the intention to engage with mobile advertising. With similar aims in terms of understanding social influence and how consumers respond to mobile advertising, Soroa-Koury and Yang (2010) likewise confirmed the influence of the social norm on attitudes towards mobile advertising as expressed by perceived usefulness. Also useful for the formulation of the proposed model were the findings of Lu et al. (2005) and López et al. (2008) on the influence of social norms on attitude and intentions to adopt mobile innovations and the confirmed positive influence of the subjective norm on the perceived ease of use and perceived usefulness thereof.

Based on these results, this paper seeks to further explore the moderating role exerted by the NRG on cognitive and affective dimensions of the attitude towards mobile advertising, as well as the moderating effect of this attitude on the intention to receive mobile advertising. Given the small volume of literature on this moderating effect, it was incorporated through the following propositions:

P1: The NRG plays a moderating role in the positive relationship between the perceived ease of use of mobile advertising and attitudes towards it.

P2: The NRG plays a moderating role in the positive relationship between the perceived usefulness of mobile advertising and attitudes towards it.

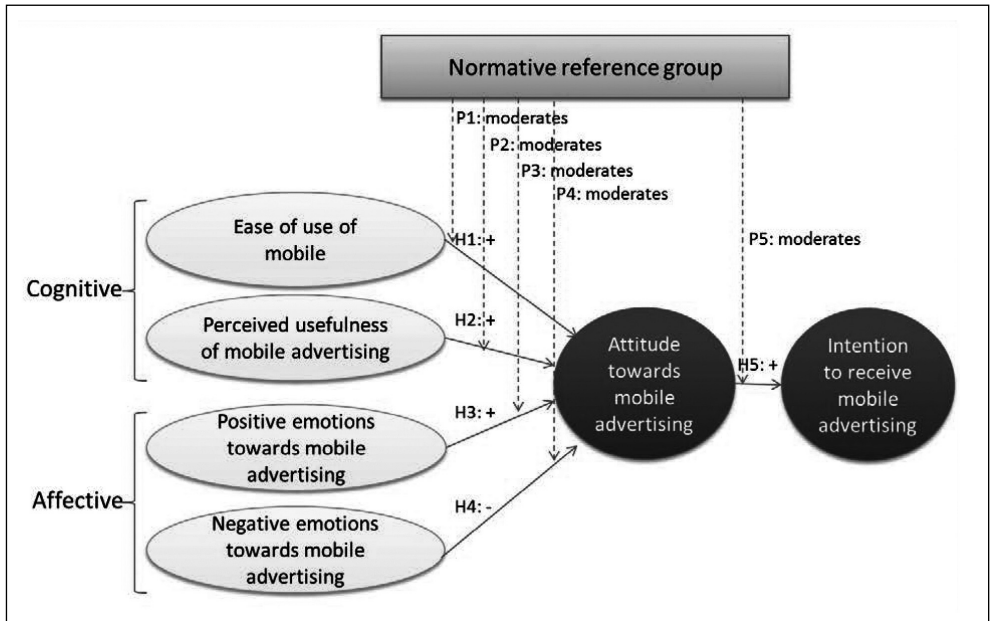
P3: The NRG plays a moderating role in the positive relationship between positive emotions towards mobile advertising and attitudes towards it.

P4: The NRG plays a moderating role in the negative relationship between negative emotions towards mobile advertising and attitudes towards it.

P5: The NRG plays a moderating role in the positive relationship between attitudes towards mobile advertising and the intention to receive it.

The proposed hypotheses and propositions make up an integrative theoretical model of the

Fig. 1: Theoretical model of mobile advertising acceptance



Source: own

variables influencing attitudes and intentions with regard to mobile advertising (Fig. 1).

2. Research Methodology

2.1 Methodology

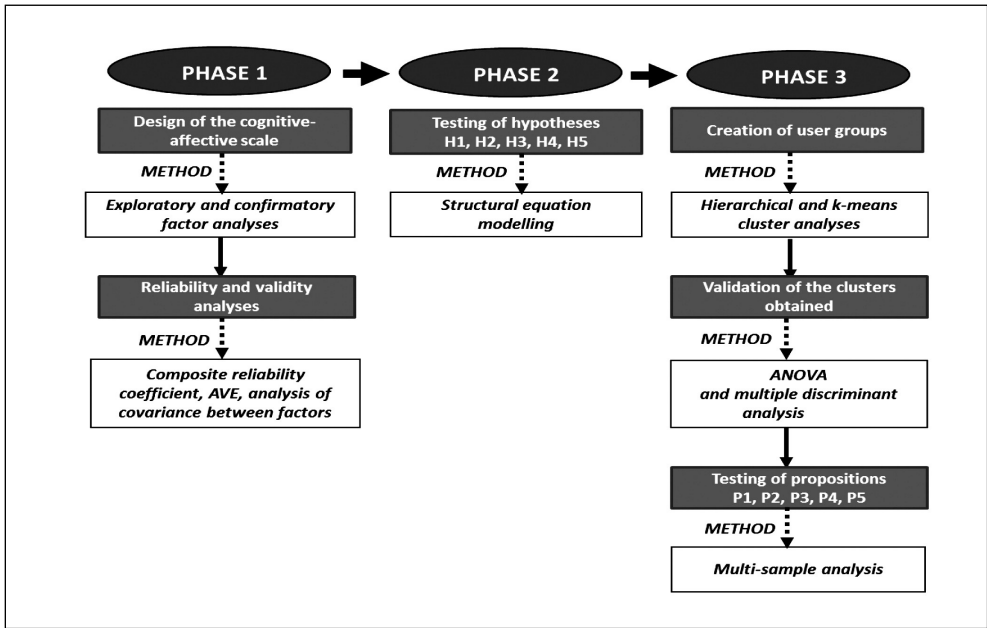
To test the working hypotheses, a sequential process was followed (Fig. 2). In the first phase, given that cognition and emotion come together in human behaviour, we developed a cognitive-affective scale (Tab. 1) that includes both perceived usefulness and ease of use and the positive and negative emotions generated by mobile advertising. Confirmatory factor analysis was used to test its structure, reliability and validity. In the second phase, we used structural equation modelling to test the model's hypotheses. In the third phase, to study the moderating effect of the reference group (the model's propositions), we used sequential cluster analysis to generate groups of individuals based on their NRG. This gave rise to two groups, independent and influenced, on which we then conducted a multi-sample analysis.

2.2 Description of the Sample and Measurement of Variables

The data was obtained in two steps: (1) randomized 9,000 sending invitations with a response rate of 26% and (2) select only individuals receiving mobile advertising by taking into account the structure of the Spanish population by gender and age. The sample was of 612 individuals who were representative of the Spanish adult population and received advertising on their mobile phones. 92.3% of the sample had been using a mobile phone for more than 5 years, and 35.9% had more than one mobile.

Table 1 shows how the research variables were measured on five-point Likert-type scales. Two consecutive rounds of pre-testing were conducted to verify proper comprehension of the questionnaire and the adaptation thereof to the aims of the research.

Fig. 2: Research methodology



Source: own

3. Analysis of Results

The goodness-of-fit results for the confirmatory factor analysis were satisfactory: BBNFI = 0.96; BBNNFI = 0.96; CFI = 0.97; robust CFI = 0.96; GFI = 0.93; AGFI = 0.90; and RMSEA = 0.07. With regard to convergent validity, Table 2 shows that the indicators converged in the assigned factors, as the standardized lambda parameters were significant and greater than 0.5 (Anderson & Gerbing, 1988). It moreover shows that the average variance extracted (AVE) was greater than 0.5 for all four factor (Hair, Anderson, Tatham, & Blanck, 1999), and that the composite reliability coefficient was over 0.7 (MacKenzie, Podsakoff, & Jarvis, 2005), higher than the 0.6 recommended by Bagozzi and Yi (1988).

With regard to discriminant validity, Table 3 shows that the factors are different from each other. The confidence interval around the absolute value of the covariance does not include 1. There is thus no problem of covariance among the factors involved, and the discriminant validity requirement is met.

In the second phase, we used structural equation modelling to test the hypotheses (Fig. 3). The results showed a good fit and the acceptance of all five hypotheses. To reach the confirmatory factor analysis solution, a number of modifications were made. We applied the Lagrange multiplier test (LM test) and the Wald statistic, which evaluates the effect of releasing (or not) a set of parameters simultaneously (Hair et al., 1999). We then considered the convergence of the parameters in the factors to respecify the model (Anderson & Gerbing, 1988). In our case, we considered it appropriate to eliminate the parameters that contributed little to the factor to which they belonged ($\lambda < 0.6$).

Tab. 1: Measurement scales

Variables / Items	References questionnaire
EMOTIONS TOWARDS MOBILE PHONE ADVERTISING	
EMO1. I feel that it is nice	Xu (2006/2007); Park et al. (2008); Tsang et al. (2004); Park and Salvendy (2012).
EMO2. I feel that it is interesting	
EMO3. I feel that it is entertaining	
EMO4. I feel that it is interactive	
EMO5. I feel that it is convincing	
EMO6. I feel that it is credible	
EMO7. I feel that it is motivating	
EMO8. I feel that it is irritating	
EMO9. I feel that it influences me	
EMO10. I feel that it is misleading	
EMO11. I feel that it is persuasive	
PERCEIVED USEFULNESS OF MOBILE ADVERTISING	
PU1. The immediacy of the message makes mobile advertising more useful	Dodds et al. (1991); Woodruff (1997); Zeithaml (1998); Grewal et al. (1998); Sweeney and Soutar (2001).
PU2. The fact that mobile advertising can be accessed whenever you want makes it more useful	
PU3. The fact that mobile advertising can be accessed wherever you want makes it more useful	
MOBILE'S EASE OF USE	
EOU1. It is easy for me to use a mobile phone	Soroa-Koury and Yang (2010).
EOU2. I learn how to use new mobile services quickly	
EOU3. I know what services I can use on my mobile phone	
EOU4. It is easy for me to access mobile services	
NORMATIVE REFERENCE GROUP	
NRG1. I receive mobile advertising because my friends do	Childers and Rao (1992); Peter and Olson (2005); Bagozzi (2000); Fitzgerald and Arndt (2002); Bauer et al. (2005); Rohm and Sultan (2006); Muk and Babin (2006).
NRG2. I open mobile advertising because my friends do	
NRG3. I discuss the advertising sent to my phone with my friends	
NRG4. The people I care about think I should receive mobile advertising	
ATTITUDE TOWARDS MOBILE ADVERTISING	
ATT. In general, I like mobile advertising	Tsang et al. (2004); Soroa-Koury and Yang (2010).
INTENTION	
INT. Intention to receive mobile advertising	Choi et al. (2008), Tsang et al. (2004).

Source: own

Note: Items shown in italics were removed during the streamlining process.

Tab. 2: Convergent validity and reliability analysis

Construct/dimension and indicator	Standardized parameters > 0.5 and t-value > 1.96	Composite reliability coefficient > 0.7	Average variance extracted (AVE) > 0.5
F1. Positive emotions (Reflective)		0.95	0.72
I feel that it is motivating	0.88 (27.4)		
I feel that it is entertaining	0.87 (26.7)		
I feel that it is convincing	0.87 (27.0)		
I feel that it is credible	0.85 (25.6)		
I feel that it influences me	0.75 (21.6)		
I feel that it is interesting	0.88 (27.3)		
I feel that it is nice	0.87 (27.0)		
I feel that it is interactive	0.79 (23.2)		
F2. Negative emotions (Reflective)		0.73	0.58
I feel that it is misleading	0.90 (28.1)		
I feel that it is irritating	0.60 (14.9)		
F3. Ease of receiving mobile advertising (Reflective)		0.85	0.59
I learn to use mobiles quickly	0.81 (22.4)		
I know what services I can use	0.85 (24.1)		
My mobile is easy to use	0.61 (15.2)		
Accessing services on my mobile is easy	0.77 (20.9)		
F4. Perceived usefulness (Reflective)		0.91	0.77
Useful because of when it is received	0.93 (29.3)		
Useful because of where it is received	0.90 (28.1)		
Useful because of the message's immediacy	0.80 (23.3)		

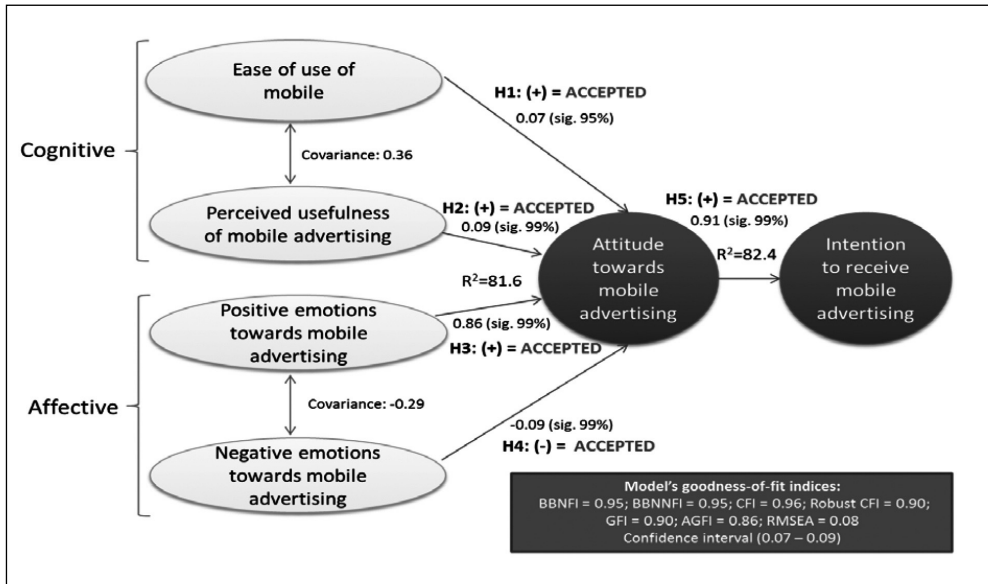
Source: own

Tab. 3: Discriminant validity analysis

Factors involved	Covariance	Standard error	Confidence interval		Out-of-range value
F1-F2	-0.292	0.055	-0.402	-0.182	1
F1-F3	0.586	0.031	0.524	0.648	1
F1-F4	0.322	0.039	0.244	0.400	1
F2-F3	-0.183	0.052	-0.287	-0.079	1
F2-F4	-0.100	0.049	-0.198	-0.002	1
F3-F4	0.359	0.045	0.269	0.449	1

Source: own

Fig. 3: Model results and goodness of fit



Source: own

Next, clusters of users were defined based on the influence exerted by the NRG on users' attitudes and behavioural intentions with regard to mobile advertising. To achieve this, we applied a sequential cluster analysis (hierarchical and then k-means clustering), and then validated the solution using the ANOVA test and discriminant analysis. The ANOVA results reflect the existence of inequality of means between the groups with a confidence interval of 99% in all variables. In the discriminant analysis, Wilks's lambda, with a p-value < 0.01, allows us to accept the hypothesis of differences between the groups of users in the scores awarded to the independent variables. Box's M-test shows that the F-statistic is 32.56, with a significance level of less than 0.001, allowing us to reject the null hypothesis that the variance-covariance matrices show no statistically significant differences between the groups. Finally, the confusion matrix shows that 97.4% of the originally grouped cases were correctly classified. All of this confirms that the two clusters obtained are different and were correctly identified:

- **GROUP 1.** Users who are independent of their NRGs. These people are not

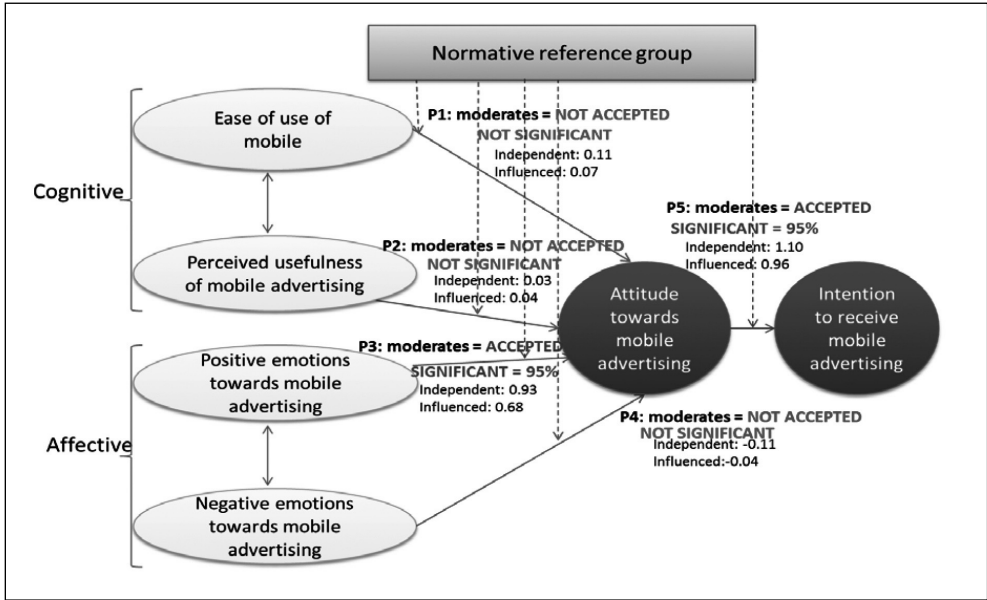
influenced by their NRGs and are thus unlikely to imitate the people closest to them with regard to receiving mobile advertising (average score of 1.24 on a scale of 1 to 5 for this variable) or their behaviour towards it (1.26), to discuss the mobile advertising they receive with them (1.91) or to share the same opinion as the group about it (1.27). This group constituted 65.36% of the sample.

- **GROUP 2.** Users influenced by their reference groups. This group consists of people who are highly likely to imitate their NRG with regard to mobile advertising, specifically in terms of receiving it (3.33) and their behaviour towards it (3.13), their tendency to discuss it with the members of the group (3.68), and to share the same opinion of it with them (3.32). This cluster accounted for 34.64% of the sample.

Once the two groups had been defined, we applied the model to each one. Figure 4 shows the Path model for the independent and influenced users, as well as their non-standardized parameter values, the results of the multi-sample analysis and their goodness of fit. We chose to show the values of the non-

Fig. 4:

Path models with the non-standardized parameters for the independent and influenced groups



Source: own

standardized regression coefficients, as they better illuminate the differences between the groups (Jaccard & Wan, 1996).

The chi-square difference test of the multi-sample analysis makes it possible to see whether the removal of the restriction on equality between the groups' parameters significantly improves the model and, therefore, if a model without equality in these parameters

would be advisable. In our case, the model improved when the equality in the parameters of the relationships between the influence of positive emotions on attitude and the influence of attitude on the intention to receive mobile advertising was eliminated (Tab. 4).

Finally, Figure 5 shows the full model with both the accepted hypotheses and propositions and those we could not confirm.

Tab. 4: Results of the comparison of the parameter values between the groups

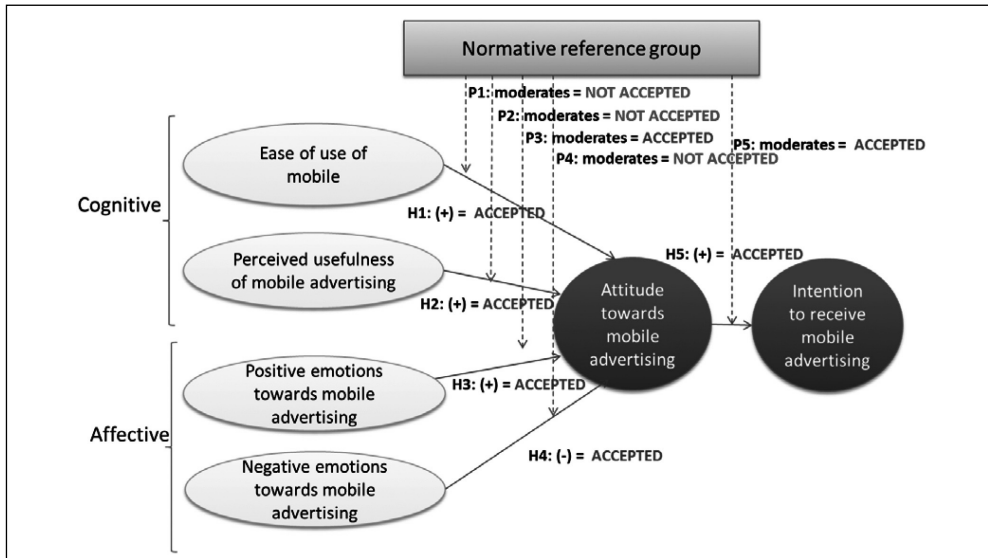
Relationships	Chi-Square Difference	Probability
Ease of use => Attitude towards mobile advertising	0.01	0.973
Perceived usefulness => Attitude towards mobile advertising	3.46	0.063
Positive emotions => Attitude towards mobile advertising	4.94^a	0.026
Negative emotions => Attitude towards mobile advertising	2.09	0.149
Attitude towards mobile advertising => Intention to receive mobile advertising	4.55^a	0.033

Source: own

Note: a = p < 0.05

Fig. 5:

Acceptance of hypotheses in the cognitive-affective model of attitude towards mobile advertising



Source: own

Conclusions

As in other fields (Schwarz, 2000), our results confirm that both cognitive and affective factors should also be taken into account when examining attitudes towards mobile advertising (acceptance of H1, H2, H3 and H4). We accept the direct, positive influence of this attitude on the intention to receive mobile advertising (acceptance of H5), in keeping with the work of Tsang et al. (2004), Lee et al. (2006), Soroa-Koury and Yang (2010), and Xu (2006).

In terms of cognitive factors, the easier it is for users to use their mobile phones, the more positive the attitude they develop towards receiving mobile advertising. Similarly, the greater the perceived usefulness of the mobile advertising, the more positive the attitude developed by users towards receiving it. In short, our results are in line with the ideas proposed by Karjaluoto et al. (2008) but contradict those laid out by Soroa-Loury and Yang (2010). At the same time, they represent an advance with regard to previous studies, which were limited to universes of young people and students and, crucially, referred only to text messages.

With regard to affective factors, the development of positive emotions in users

generated as a result of having received mobile advertising leads to a positive attitude towards this means of communication. Moreover, it is worth noting that, in our model, these emotions are the variables that most affected the formation of attitudes towards mobile advertising. The strong effect of positive emotions on attitudes could be interpreted as two overlapping concepts. However, attitude is viewed as a broader concept, which includes emotion as an integral part of its formation (Bagozzi et al., 1999; Scherer, 2005), and, also, as an evaluative judgement rather than an affective state (Bagozzi et al., 1999; Cohen et al., 2008).

The development of negative emotions leads to more negative attitudes towards receiving mobile advertising. These findings support those reported by Park and Salvendy (2012) in their study of 48 students, although in our case the sample was far more representative.

To our surprise, the NRG was found to play a moderating role in two of the five established relationships (propositions P1, P2 and P4 could not be accepted, while propositions P3 and P5 could). Unlike in previous studies, we identified two user groups based on the influence exerted

by their reference group with regard to mobile advertising: independent and influenced users. Among independent users, the positive emotions generated by mobile advertising have a greater influence on the development of a positive attitude towards receiving mobile advertising (P3 is accepted). Also among independent users, a more intense positive relationship was found between the attitude towards mobile advertising and the intention to receive it (P5 is accepted). These are very interesting results, as we found that the weaker the influence of others' opinions on a subject, the stronger the relationships between attitudes towards mobile advertising and behavioural intention. The relationship between positive feelings and attitudes was also stronger among independent users.

Users who allow themselves to be influenced by their reference group try to fit into it. Therefore, the group's opinion can weaken the influence of these users' positive emotions on the formation of their attitude towards mobile advertising and of said attitude on their behavioural intention. Moreover, no differences were found between independent users and users influenced by their NRGs with regard to the formation of attitudes due to ease of use, perceived usefulness or negative emotions.

The results have several relevant **implications for business managers**. First, the results with regard to the cognitive dimension suggest that managers should provide more knowledge to mobile phone users, as it fosters more positive attitudes towards mobile advertising. In this regard, mobile apps should be developed that are easy to use and designed to maintain and strengthen the relationship with customers. Moreover, to reach segments that do not make extensive use of mobile apps, they should support the development of more user-friendly mobiles tailored to these specific segments.

A second recommendation for mobile advertisers is to engage in actions that increase the usefulness of receiving advertising via mobile, such as including a discount in a useful application for the recipient, including a suitable app (own or third-party) in the advertisement, or offering tangible or intangible rewards (e.g., additional memory on a virtual device) that can be claimed with a code obtained in the advertisement.

The third recommendation is related to emotions, as mobile advertising managers

should seek to promote positive emotions in order to foster a positive attitude towards this channel and prevent the production of negative emotions (above all, the sensation of *having been deceived*). Chances are, if you own a smartphone, you have received or seen an advertising message based on humour or sex on your mobile device. Some mobile advertisements even manage to infiltrate their audiences' mobiles' files (galleries), slipping in amongst their personal photos. Advertisements should seek to generate positive emotions, such as pleasure, interest, entertainment and interaction, that are at once credible and motivating. Pleasure can be achieved with images (colour and movement), sound (evocative melodies), and text (credible, memorable slogans). Audiences' interest can be piqued, for example, by using celebrities. Recurring humorous or erotic themes can be used in advertisements to entertain.

It is important to stress the need for credibility and to ensure that promises are kept, that mobile advertisements are truthful. Otherwise, they can generate negative emotions.

The fact that the model is more conducive to generating positive attitudes and behavioural intention among users who are independent from their NRGs gives rise to a fourth recommendation, namely, to carry out advertising campaigns aimed at taking advantage of this opportunity to reach these individuals, seeking their personalized enjoyment.

Additionally, users often have special relationships with their phones. In this regard, we conducted an experiment with our students in which they were asked to record a purchase with their smartphone. When they came to class, they were supposed to give their mobile to a classmate to listen to and evaluate the transaction. Much to our surprise, some students refused to hand over their phones. They would rather get a zero on the activity than share their phone. In short, some people have a very strong emotional tie to their mobile phone (Kolsaker & Drakatos, 2009), which leads us to our fifth recommendation: to strengthen these emotional bonds with a view to increasing the effectiveness of mobile advertising. For example, iPhone users end their e-mails with the signature 'Sent from my iPhone', offering proof of their affective relationship with their phone.

The sixth recommendation is for companies to carry out direct mobile marketing campaigns with those customers who give them their permission to do so. It is a medium that yields very good results and whose costs can be tailored to the financial possibilities of each company.

With regard to the **limitations of this research**, while we believe that the study sample was sufficient and representative, a larger sample size would have been desirable. Another key limitation was the lack of applied research in the literature on the moderating role of the subjective norm in the mobile advertising acceptance process, which required us to propose research propositions instead of hypotheses based on a robust theoretical framework.

Our study sought to determine how NRGs can moderate the effects of cognitive and affective dimensions on attitudes towards mobile advertising and on the moderating role played by such attitudes with regard to the intention to receive mobile advertising. As a future line of research, we propose studying the direct effects of the NRG on the set of variables not previously examined in the literature.

Because mobile marketing communications can take so many different forms, it would be interesting to apply the proposed model to the various types of advertising used by advertisers.

Finally, in keeping with the discussion of our results, a further necessary step in this research is to identify the factors affecting responses to mobile advertising when customers are not aware of having given permission to the advertiser to send it, for example, because they agreed to the conditions automatically upon signing the contract.

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COGNITIVE-AFFECTIVE MODEL OF ACCEPTANCE OF MOBILE PHONE ADVERTISING

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There are high expectations for mobile phone marketing and mobile advertising. In various European markets, such as the United Kingdom, Spain and Italy, mobile marketing campaigns have registered response rates of up to 47% among their target audience.

The main aim of this paper is to validate a cognitive-affective model of acceptance of mobile phone advertising that integrates the utilitarian perspective through the technology acceptance model, the affective dimension through emotions, and the moderating role of the normative reference group (NRG). This model was tested with structural equation modelling in a sample of 612 individuals (R^2 of 82.4%). To analyse the moderating effect of the NRG, a sequential cluster analysis was applied, generating two groups of users: independent and influenced. A multi-sample analysis was then performed.

The results showed the advisability of considering attitudes towards mobile advertising to be a variable shaped by conceptually complementary cognitive (perceived usefulness and perceived ease of use) and affective dimensions (positive emotions and negative emotions). Positive emotions had the strongest effect on the formation of this attitude. Negative emotions and cognitive dimensions had a few effect for the acceptance of mobile advertising. With regard to the moderating role of the NRG, among independent users, positive emotions affected the attitude more intensely and a stronger positive relationship was found between this attitude and the intention to receive advertising. No differences were found between independent users and users influenced by their NRGs with regard to the formation of attitudes due to ease of use, perceived usefulness or negative emotions. The paper thus provides a comprehensive analysis of the acceptance of mobile advertising that integrates both cognitive-affective views and the moderating role of the NRG with implications for management.

Key Words: *Mobile advertising, attitudes, perceived usefulness, ease of use, reference group, emotions.*

JEL Classification: M3.

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UNDERSTANDING COSMOPOLITAN CONSUMERS' REPEAT PURCHASING IN THE eMARKETPLACE: CONTRIBUTION FROM A BRAND ORIENTATION THEORETICAL PERSPECTIVE

Christian Nedu Osakwe, Henry Boateng, Simona Popa, Miloslava Chovancová, Pedro Soto-Acosta

Introduction

Brands, branding, brand management, brand orientation and their related terms have received substantial attention from marketing scholars and practitioners (Peng, Chen, & Wen, 2014). This could probably be due to their strategic importance to organizations (Urde, Baumgarth, & Merrilees, 2013). Consumers on the other hand have also come to embrace the concept, as it helps them in their purchasing decisions by offering them signals for improved efficiency in information processing and for selecting products (Kotler & Pfoertsch, 2007; Shi & Chow, 2015; Zablah, Brown, & Donthu, 2010). As a result, organizations and consumers alike tend to become brand oriented (Keller, 2009). Urde (1999) defined brand orientation as a process by which a firm develops, builds and protects a brand and its identity as it interacts with actual and potential customers with the intention of obtaining sustainable competitive advantage(s). This means that brand orientation is meant to achieve a strategic purpose and the central aim of this is to earn a good reputation in the marketplace and, importantly, do so by building good relationships with consumers via communication platforms (Xin, Ramayah, Soto-Acosta, Popa, & Ping, 2014; Soto-Acosta, Popa, & Palacios-Marqués, 2016). Given the role of social media sites in our contemporary society, it makes a lot of sense for businesses, and in particular online retailers, to build a 'two-way' symbiotic relationship with their consumers through some of these popular social media platforms (Curras-Perez, Ruiz-

Mafe, & Sanz-Blas, 2014; Soto-Acosta, Molina-Castillo, Lopez-Nicolas, & Colomo-Palacios, 2014). Again, it can be inferred that engaging customers on a social media site is critical for brand orientation as social media promotes customer-firm (brand) interaction (Boateng, 2014). However, this is yet to be proven empirically and this study seeks to address these gaps. It also seeks to ascertain if consistent engagement with vendors' social media site by consumers will lead to an electronic word-of-mouth – (e)WoM effect. Again, since brand orientation is a resource (Urde et al., 2013), this study aims to find if there is a correlation between brand orientation and reputation of the enterprise (e.g. online retail vendor), which is of great importance to marketing practitioners (Capozzi, 2005).

Some studies (Fombrun, Gardberg, & Barnett, 2000; Sung & Yang, 2008) have pointed to the several marketing outcomes of the reputation of the business enterprise, including monetary and non-monetary outcomes. However, it is not clear if these benefits are attainable in an online context. Bartikowski and Walsh (2011) noted that while corporate reputation has attracted considerable attention in marketing discipline and practice, there is a dearth of literature on the effects of corporate reputation on most actions of consumers. For example, can a vendor's reputation lead to (e)WoM effect and draw customers to its social media sites? Does a vendor's reputation influence consumers' repurchase intentions in an online environment? These questions

require answers, which this study seeks to address. Although, some studies (e.g. Jalkala & Salminen, 2009) have been conducted in a business-to-business context, Aarikka-Stenroos and Makkonen (2014) argue that the relevance of the findings might not be same in consumer market and therefore call for more studies to be conducted in a business-to-consumer relationship.

In sum, in this paper, we address research issues connected to the role that brand orientation (potentially) plays in critically influencing the constructs social media site engagement and (online) vendor reputation; the assumption that vendor reputation may also strongly influence the constructs social media site engagement, (e)WoM effect, and repurchase intention is also interrogated. Additionally, this scientific paper tests the assumption about the direct effect of (e)WoM on customers repurchase intention within the context of the electronic marketplace (eMarketplace). Accordingly, the study's major objective is to facilitate the better understanding of the interrelationships amongst the phenomena of brand orientation, (e)WoM effect, social media engagement, vendor reputation, and repurchase intention in the eMarketplace context.

By and large, this scientific publication is grounded in the relationship marketing literature. The remainder of the paper is organised as follows. Section two focuses on the theoretical background of the study, including the research hypotheses, while section three presents the methodology employed. Section four offers the findings, which are discussed in section five. Conclusions, limitations and future research are dealt with in section six.

1. Theoretical Background and Hypotheses Development

1.1 Brand Orientation (BO) Social Media Site Engagement (SME) and Vendor Reputation (VRP)

Brands create impressions and emotions and elicit behavioural responses through their unique identity (Brakus, Schmitt, & Zarantonello, 2009). Whenever consumers come into contact with a brand they form perceptions, and these influence their decision to use the brand, recommend it to others and pay attention to any promotion about it (Ambler et al., 2002). Some studies (e.g. Hutter, Hautz, Dennhardt,

& Fuller, 2013) argue that consumers continued interaction with a brand contributes to their positive perceptions about the brand. In other words, brand orientation can impact on a vendor's reputation since brand orientation adopts a continued interaction approach with customers to build strong brand identity (Urde, 1999). As a result, some organizations adopt a brand orientation approach where they create, grow and protect the identity of the brands (Urde, 1999). Sahin, Zehir and Kitapaci (2011) found that, brand orientation is positively associated with consumer brand trust. This provides a basis for the effect of brand orientation on a vendor's reputation, since some organizations gain their reputation by being trustworthy (Miyamoto & Rexha, 2004). A reputable vendor instils trust and confidence in its customers by delivering services as promised and so creates value for its customers (Agustin & Singh, 2005). Algesheimer, Dholakia and Herrmann (2005), on the other hand argue that, brand relationship quality influences consumers' engagement with a brand community. It is safe, therefore, to argue that brand orientation contributes to consumers' engagement with the social media site of a vendor. Moreover, in another related study by Jayawardhena, Wright and Dennis (2007), the authors presume that online shoppers who are more brand motivated (or oriented) are equally likely to brand-loyal shoppers. Thus, it is expected that these brand oriented (or savvy) consumers would be more inclined to shop with highly reputable online retail vendors. Again, since certain factors incline human beings to bond with other people or objects, customers can bond with a vendor's website; however, this will depend on the reputation of the vendor (Park & Kim, 2014). Furthermore, King, So and Grace (2013) explored the effect of service brand orientation on the attitude of employees in a hotel and found that service brand orientation positively affects employee brand-oriented behaviour. Again, applying the same logic, it can be concluded that brand orientation can contribute to customers' engagement with a vendor's social media site. Based on the evidence above, the following hypotheses incorporate our expectations:

H₁: Brand orientation is positively associated with vendor's reputation.

H₂: Brand orientation is positively associated with social media site engagement.

1.2 Social Media Site Engagement (SME) and (e)WoM

The radical revolution of Internet and its related technologies has created a new tool for individuals and businesses to network, engage and interact with each other (Leitner & Grechenig, 2007; Wang, Xu, & Chan, 2015; Zheng, Cheung, Lee, & Liang, 2015). Social media technologies especially provide opportunities for business organizations to attract consumers and engage them in conversations on their social media platforms. Social media sites (SMSs) have been defined as web-based applications that help to generate profiles, upload pictures, videos and share with other people who are connected in the network (Boyd & Ellison, 2007; Warren, Sulaiman, & Jaafar, 2015). Social media platforms represent powerful tools for interaction and information sharing in general (Imran, 2014). On the part of vendors, they present tremendous opportunities for these brands to build an engaging relationship with their consumers via customer (fan)-brand followership. On the one hand, customers can use these tools to pass positive and negatives comments about brands. Chu and Kim (2011) noted that, consumers have employed SMSs such as Facebook, Qzone, MySpace, Instagram, Twitter, and LinkedIn to create and share product related information with other consumers, consequently influencing their purchasing decision (Henning-Thurau, Gwinner, Walsh, & Gremler, 2004; Wang & Doong, 2010). This means that Social media sites are vitally important channels for (e)WoM. Some consumers, especially those that are highly price conscious, spend time seeking opinions from others in various online communities with regard to best prices, and subsequently share this information with other customers they engage with online and even in some instances via offline communication (Kang, 2007). This according to Harris and Dennis (2011) is one of the benefits of social websites. This is an indication that social media engagement can influence (e)WoM. Some studies (e.g. Walsh, Mitchell, Jackson, & Beatty, 2009) have found that customers who are loyal and committed to some organizations support them through additional role behaviour. In this sense, these consumers are more likely not only to engage (by means of interaction) with their favourite vendor's brand social media fans' pages, but, more importantly, they are

also likely to pass on positive comments about online retail vendors. Against this backdrop, the following hypothesis is formulated:

H₃: Social media site engagement is positively related to (e)WoM.

1.3 Vendor Reputation (VRP), (e)WoM Effect and Repurchase Intention (RPI)

From the resource-based view of the firm perspective, corporate reputation can be regarded as a valuable resource that can enable organizations to gain a lasting competitive edge (Capozzi, 2005). However, this will depend on how well the firm uses this reputation. Reputable vendors can influence their consumers to pass on favourable comments, which can lead others to buy from those vendors (Ahrens, Coyle, & Strahilevitz, 2013; Xun, 2014). Consumers have positive attitudes towards reputable vendors and this results in a positive brand response such as passing on positive comments about the vendor, which in turn may lead to repeat purchasing among the online shoppers as well as customer patronage of some online retail vendors (Gupta, Melewar, & Bourlakis, 2010; Maditinos & Theodoridis, 2010; Huang, 2014; Soto-Acosta, Perez-Gonzalez, & Popa, 2014). Additionally, Fombrun et al. (2000) and Sung and Yang (2008) assert that customers of well-reputed vendors engage in supportive behaviours. This is an indication that customers of reputable vendors will engage in (e)WoM for the vendors and patronise their brands. Lin, Lu and Wu (2012) examined the effect of corporate image and relationship marketing on trust and consumer purchase intention and found that corporate image significantly and positively impacts on consumers' purchase intentions; and word-of-mouth enhances this effect. From these findings, it is safe to conclude that vendors' reputation and (e)WoM influence shoppers' repurchase intentions online. Brengman and Karimov (2012) argue that, since it is difficult to assess intrinsic features of brands online, online shoppers may seek unbiased opinions in their purchasing decisions. Consequently, online product evaluation has become common among online consumers and a source of information for purchasing decision (Hu et al., 2008). In recent times, some vendors have employed and embraced social media in order to obtain consumer insights (Hudson & Hudson, 2013), and use the opportunity to initiate

(e)WoM. They do this by including a “tell-a-friend” feature on their fan pages, or promoting online product ratings (Ahrens et al., 2013). Based on the foregoing arguments, these lead us to formulate the following hypotheses:

H₄: Vendor’s reputation is positively associated with (e)WoM.

H₅: (e)WoM is positively associated with customers’ repurchase intention.

1.4 Vendor Reputation (VRP), Social Media Site Engagement (SME) and Repurchase Intention (RPI)

Keh and Xie (2009) find that corporate reputation positively affects customer trust and customer identification, so for customers to engage and interact with a vendor will depend on how reputable the vendor is. Vendor reputation can have several outcomes. Brengman and Karimov (2012) note in their study that incorporating social media into corporate communication can influence customers towards unfamiliar e-tailers and “purchase intentions”, but they caution that a vendor should only integrate appropriate and important ones. In an online environment, cues such as vendor’s image information (Jin, Park, & Kim, 2008) can instil trust and confidence in consumers and consequently they trust the

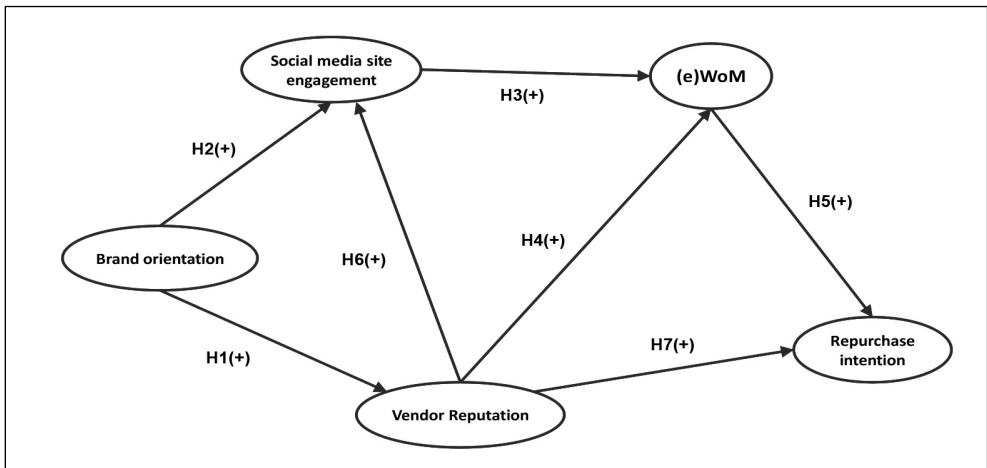
online retailer (Wu, Chen, & Chung, 2010; Wu & Huang, 2015). However, Wu et al. (2010) note that this information might not be present when dealing with an unfamiliar e-vendor and therefore the initial trust formed would be based on the features of the vendor’s site. Bennett and Gabriel (2001) assert that a positive corporate reputation gives customers consistent positive reinforcement, which commits them to the organization. Yoon, Choi and Sohn (2008) also shared a similar opinion with the aforementioned authors. Against the views that have so far been expressed in the literature, one may expect that the (perceived) vendor’s reputation will play a leading role as to the online shopper’s commitment to engage with the vendor’s brand in social media platforms. Likewise, it seems very likely that the vendor’s (perceived) reputation is even more important than ever before, as it is a critical determinant of customer patronage. In line with the above argumentation, we make the following hypotheses:

H₆: Vendor’s reputation is positively related to social media site engagement.

H₇: Vendor’s reputation is positively related to customers’ repurchase intentions.

The set of relations is illustrated in Fig. 1.

Fig. 1: Research Model



Source: own

2. Research Design

2.1 Sample and Data Collection

The target respondents in our study were 'cosmopolitan' Slovak citizens. In this study, we defined cosmopolitan Slovaks as those who could write and speak in English. Thus, our unit of analysis is a bilingual (Slovak–English) speaker and at the same time a Slovak with Internet literacy. Accordingly, sample data were collected using a structured questionnaire and this was mainly despatched through an invitation to participate in a web-based survey. The survey link was also posted on some popular Facebook forums that are currently been utilized by Slovak nationals. To encourage participation, we assured the respondents of the confidentiality of their information and also made it explicitly clear that the research serves for academic purposes only. Data collection took place during the first and second quarters of 2014; in all, we were able to gather 125 effective responses from the study participants. Interestingly, nearly almost of the participants reported to have online shopping experience; and as might be expected most of the respondents were Slovak youths (see

Tab. 1 for further details about the participants). Importantly, our sample size exceeds the “ten times rule” for evaluating the suitability of a sample size used in a multivariate (regression) analysis (Costafreda, 2009; Detilleuxa, Theron, Beduin, & Hanzen, 2012; Green, 1991; Hill, 1998; VanVoorhis & Morgan, 2007). More specifically, the ratio of sample size to the number of parameters to be estimated in our research model is 25:1. From the sample data, we also found that nearly all the respondents use Facebook compare to few others who make use of any one of Twitter, Instagram, Linkeldn and Google+ (output omitted).

2.2 Measures

A five-point Likert scale, ranging from completely disagree (1) to completely agree (5) was used to elicit responses from the participants. All the measures used in the empirical survey were obtained from earlier studies and fully modified to remove any form of ambiguity from the items listed as part of the final scale. The measures for vendor reputation were adapted from Doney and Cannon (1997); Kim, Yang and Kim (2013) and Jarvenpaa, Tractinsky, and Vitale (2000),

Tab. 1: Demographic profile of study participants

Sample characteristics			
Gender:	%	Internet Purchase:	%
Female	64.8	No	4.8
Male	35.2	Yes	95.2
Age Group:		Frequency of Internet Purchase:	
17-25	63.2	Daily	17.6
26-34	25.6	Weekly	42.9
35-43	7.2	Monthly	29.4
44-52	3.2	Three or more times a year	10.1
53-61	0.8	Once or Twice yearly	–
61+	–		
Educational Status:		Patronage of Vendors' Website outside Slovakia:	
High School	28	No	23.8
Undergraduate/Bachelor's	29.6	Yes	76.2
Post Graduate (Master's, PhD)	32.8		
PhD/Professor	8		
Others	1.6		

Source: own

Tab. 2: Reliability and convergent validity of measurement model

Constructs	α	CR	AVE	Indicators	FL	Bootstrapped T-Statistics
BO	0.728	0.831	0.554	BO1	0.714	7.484
				BO2	0.789	8.968
				BO3	0.816	9.609
				BO4	0.645	4.815
SME	0.778	0.852	0.591	SME2	0.711	4.084
				SME3	0.693	3.429
				SME4	0.785	4.547
				SME5	0.875	5.089
VRP	0.725	0.828	0.547	VRP1	0.705	8.031
				VRP2	0.812	12.965
				VRP3	0.706	7.067
				VRP4	0.731	10.359
(e)WoM	0.735	0.834	0.557	WoM1	0.686	11.479
				WoM2	0.751	13.257
				WoM3	0.771	13.262
				WoM4	0.774	16.424
RPI	0.849	0.898	0.690	RPI2	0.844	22.863
				RPI3	0.880	28.997
				RPI4	0.901	43.600
				RPI5	0.680	7.788

Source: own

Note: Insignificant items are dropped (SME1 and RPI1)

while the items measuring the construct of brand orientation were adapted from Ling, Chai, and Piew (2010) and Seock (2003). The measures for (e)WoM effect were obtained from Awad and Ragowsky (2008), Mikalef, Giannakos, and Pateli (2013) and Zeithaml, Berry, and Parasuraman (1996). The items measuring social media site engagement with vendor brands were based on Karakaya and Barnes (2010), Laroche, Habibi, Richard, & Sankaranarayanan (2012), and Ramnarainand and Govender (2013). The repurchase intention construct was adapted from Bhattacharjee (2001), Mathieson (1991), and Thong, Hong, and Tam (2006). Constructs and associated indicators in the measurement model are listed in the Appendix.

2.3 Common Method Bias (CMB)

Since we used a self-reported questionnaire study, we checked for CMB in the collated

dataset. Based on the suggestion of Podsakoff, MacKenzie, Podsakoff, and Lee (2003), we ran a post-hoc statistical analysis of the surveyed data by means of Harman's unrotated single factor technique, using the principal component analysis (PCA) toolbox in SPSS. Our results show that the first dominant dimension accounted for a 21.6% variance. Furthermore, no single factor emerged from this unrotated factor analysis; all five distinct components had eigenvalues of greater than one. This hints at the absence of CMB in the surveyed.

2.4 Psychometric Properties of Research Constructs

First, we checked the internal consistency reliability of our measurement instruments by using Cronbach's alpha, manifest variables' loadings and composite reliability. From our output (see Tab. 2), all the constructs'

Cronbach's alpha values are above the criterion value of 0.7 (Nunnally, 1978). The manifest variables' loadings are within the range of 0.645 to 0.901 and are all statistically significant at the 0.01 level; about five items with insignificant loadings were purged out from the final analysis. Moreover, the composite reliability of each of the constructs is similarly above the suggested value of 0.7 (cf. Hair, Sarstedt, Ringle, & Mena, 2012; Shahriar, 2014). In addition, the convergent validity of all the latent reflective constructs was checked by the average variance extracted (AVE), which are all above the commonly accepted threshold of 0.5 (cf. Rodriguez, Reina, & Rufin, 2015).

Thereafter, we checked for discriminant validity of the measurement model using the approach suggested by Fornell and Lacker (1981). The results show that the square roots of the AVEs, which are in the diagonal cells (see Tab. 3) exceed the inter-correlations between

the reflective latent variables. To further confirm the discriminant validity of our constructs, we went ahead by taking a look at the items' cross loadings. All the items were found to load differently on their assigned constructs and the average cross loading was about 0.2 (output omitted). To sum up, our measurement model shows that our research constructs have suitable reliability and construct validity. All the computations were carried out using the SmartPLS 2.0 (Ringle, Wende, & Will, 2005) structural equation modelling software with a non-parametric bootstrap of 5,000 subsamples used to generate the T-Statistics. In this article, we opted to use PLS path modelling due to the exploratory nature of our study. Besides, we are mainly interested in the predictive validity of the research model given also our limited sample size. All these factors and even more warrant the use of PLS over the covariance-based SEM method.

Tab. 3: Discriminant validity of measurement model

Latent Variables	Mean	SD	1	2	3	4	5
1. SME	2.949	0.818	0.769				
2. BO	3.298	0.668	0.263	0.744			
3. RPI	3.483	0.726	0.167	0.106	0.831		
4. VRP	3.933	0.661	0.093	0.256	0.266	0.740	
5. (e)WoM	3.830	0.348	0.192	0.161	0.457	0.484	0.746

Source: own

3. Hypotheses Testing

According to relevant studies (e.g. see Hair et al., 2012; Tenenhaus, Vinzi, Chatelin, & Lauro, 2005), authors are expected to evaluate the inner model's coefficient of determination (R^2), path coefficients, predictive relevance (Stone-Geisser's Q^2) of the model and its global Goodness-of-Fit (GoF) in order to assess the overall quality of the model. Based on the results, our research model is able to capture about 26% of the variance in (e)WoM effect and 21.2% of the variance in repurchase intention is captured in the research model. Please refer to Tab. 4 for more related information. In terms of the predictive relevance of the exogenous constructs, we used the blindfolding procedure (with omission distance, $d = 7$). More specifically, we used the cross-validated redundancy

measure (Stone-Geisser Q^2 test) and all Q^2 values for each of the endogenous constructs are positive values. Therefore, we can conclude that the predictive ability of the exogenous constructs is relatively stable and high. To assess the effect size of the overall global model, we used the GoF index (Tenenhaus et al., 2005). A GoF index value of 0.1 stands for a small effect size, 0.25 (GoFmedium) and 0.36 (GoFlarge) (cf. Osakwe & Chovancová, 2015). We obtained a GoF index value of about 0.3, which is considered as a slightly large effect size of R^2 , thus, indicating an adequate global validation of the overall PLS model (Wetzels et al., 2009).

Although the hypotheses were stated in a one-directional format, nevertheless, we used a two-tailed test (with a cut-off probability value,

Tab. 4: Results of the Path Modelling

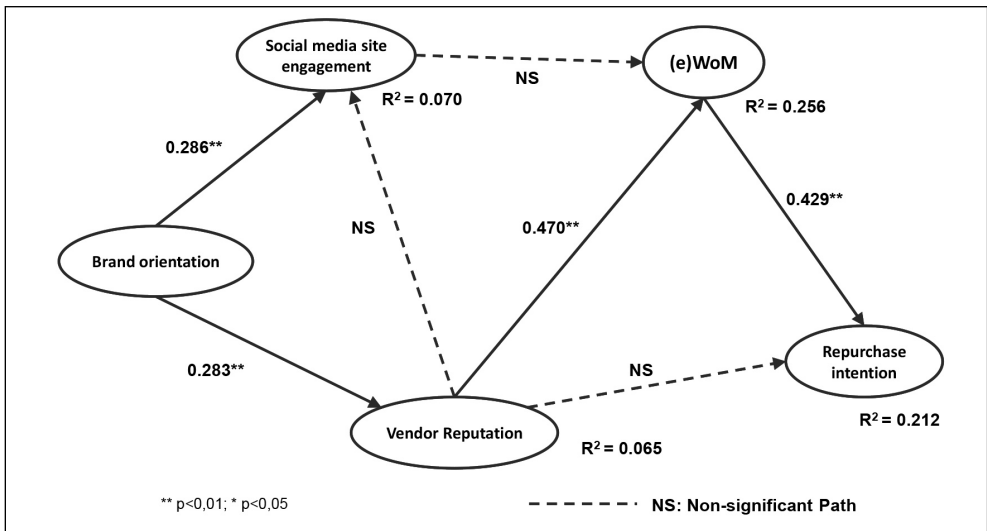
IV -> DV		Path Coefficient		T-Statistics (Bootstrapped)
BO -> SME		0.286		2.498
BO -> VRP		0.283		2.979
VRP -> (e)WoM		0.471		5.518
(e)WoM -> RPI		0.429		5.088
SME-> (e)WoM		0.148		1.623
VRP -> RPI		0.059		0.857
VRP ->SME		0.028		0.291
Coefficient of Determination		Cross-validated redundancy (Q ²)		Model's GoF
R ² for (e)WoM	0.256	Q ² for (e)WoM	0.13	0.298
R ² for RPI	0.212	Q ² for RPI	0.127	
R ² for SME	0.070	Q ² for SME	0.040	
R ² for VRP	0.065	Q ² for VRP	0.037	

Source: own

p < 0.05) to determine the statistical significance of our hypotheses. More importantly, the results (see Fig. 2 and Tab. 4) show that four out of the seven stated hypotheses were supported. Brand orientation is positively associated with a tendency to use social media sites to engage

with vendors' brands ($\beta = 0.286, p < 0.01$). Also, consumers that are more brand oriented are more likely to have a higher perception of a vendor's reputation ($\beta = 0.283, p < 0.01$). Moreover, a vendor's reputation was found to positively and to significantly contribute to

Fig. 2: Empirical results



Source: own

(e)WoM effect ($\beta = 0.471$, $p < 0.01$). Similarly, (e)WoM effect is positively associated with online customers repurchase intentions ($\beta = 0.429$, $p < 0.01$). On the other hand, social media engagement with a vendor's brand is positively related to (e)WoM effect, but it is not statistically significant ($\beta = 0.148$, $p > 0.05$). Similarly, we found that VRP does not have any significant influence on SME ($\beta = 0.028$, $p > 0.05$). This was equally the case with vendor reputation and repurchase intention ($\beta = 0.059$, $p > 0.05$). Just to briefly mention that a post-hoc analysis, though results not reported here due to space limitations, is indicative that (e)WoM is a mediator between VRP and RPI.

4. Discussion of Findings

The research offers empirical on the strong relationship between brand orientation and consumers engagement with vendors' social media site. This study contributes to the brand orientation literature while it also broadens our understanding of the broader subject area of relationship marketing at the same time. It finds that brand orientation leads to a higher perception of vendors' reputation online. Additionally, it finds that vendors' reputation has a significant effect on (e)WoM. Furthermore, the study confirms the significant effect of (e)WoM on repurchase intentions. Although the study found a relationship between consumers engagement with vendors' social media site, this was not substantial. Similarly, there was a relationship between vendors' reputation and consumers' engagement with vendors' social media site but it was not significant. Although, vendors' reputation was found to positively influence online shoppers' repurchase intentions, we could not establish any statistical significance for the result.

As most shoppers (especially, brand oriented consumers) prefer to buy famous brands online (Hutter et al., 2013), being brand oriented is one way of driving traffic and influencing consumers to engage with vendors' social media sites. As noted by Algesheimer et al. (2005) most consumers (very likely to be brand-oriented shoppers) prefer visiting and shopping on websites of well-known brands. Since most consumers are risk avert, especially when online, they will usually want to choose popular brands and therefore will shop most of the time on websites that are less risky. Consequently, once consumers find

their preferred brand on a particular site, they stick to it (Hutter et al., 2013). In line with some existing studies (e.g. Sahin et al., 2011), this study found that brand orientation (on the part of online shoppers) creates a higher perception of vendors' reputation. In other words, brand orientation creates an impression in consumers' minds that a vendor is reliable and is trustworthy. The result suggests that this group of shoppers is more particular about the reputation of the vendor they buy from online because some online vendors do not keep to their promise and sell inferior brands. Consequently, some vendors spend more resources on building strong brands to distinguish themselves from the competition (Urde, 1999). The results in several ways align with the traditional thinking about the role that a brand plays in consumer decision-making, as a shopper's brand orientation has been established in the study to critically influence the shopper's interaction with the vendor's social platforms and this is also likely to make the consumer form an impression of the reputation of an online retail vendor.

Vendors' reputation as noted by Yoon et al. (2008) influences consumer behaviour. It is therefore not surprising that this study found a significant effect of vendors' reputation on (e)WoM. Consumers who buy from reputable vendors normally engage in product review online and support vendors by recommending them to other consumers online. Consumers who encountered and enjoy the services of reputable vendors talk to their friends and family about them. It is important to note that consumers do not only pass on good comments about vendors. Dissatisfied online shoppers are more likely to spread negative comments about vendors. As a result, having a good reputation online is highly essential for positive (e)WoM. In a similar vein, since 'most' consumers might not trust some of the online vendors; they are highly likely to rely on other consumers when making purchasing decisions. Consistent with Lin et al. (2012), this study found that (e)WoM affects repurchase intentions. This is probably because third party information source is seen to be more credible than information coming from an online retail vendor.

On the other hand, although this study found a positive relationship between customers engagement with vendors' social media site and (e)WoM, this relationship was statistically insignificant. This means that customers

engagement with vendors social media site does not necessarily lead to (e)WoM. The vendors' website must contain credible information (Henning-Thurau et al., 2004) and provide users with relevant and timely information (Chu & Kim, 2011). Additionally, contrary to some studies (Yoon et al., 2008; Bennett & Gabriel, 2001), this study found an insignificant relationship between vendors' reputation and repurchase intentions. This is probably because the vendors' site lacks status information, which according to Jin et al. (2008) is very important in an online shopping environment. In the absence of this and other reputation cues on the site, consumers might not trust the vendor and therefore might not want to shop from the vendor (Wu et al., 2010). Again, it might be that the shoppers are not familiar with the online vendor (Wu et al., 2010). This study also found a positive relationship between vendors' reputation and customers' engagement with vendors' site; however, as mentioned earlier our finding was statistically insignificant. This is probably because the social media that the vendors are using are not appropriate and relevant to customers (Brenngman & Karimov, 2012). In this case, it is important that online vendors consider users' preference in their choice of social media.

Conclusions

This scientific paper has attempted to critically explore the dominant roles that online shoppers' brand orientation and vendors' reputation play in eMarketplace context. Targeting brand-oriented consumers in the online retail environment would go a long way in building an enduring and an interactive customer-brand relationship in this particular setting since it has been shown in this study that BO positively affects SME. The findings have been underpinned with substantial evidence which shows that brand-oriented shoppers are more inclined to engage with online retail brands across popular social media platforms. This implies that online retail brands should 'push' their product offerings via some of the popular social networking sites (SNSs) and, importantly, endeavour to keep track of those online users in the social media community who most likely have affinity towards their brands and/or other similar brands.

Furthermore, this study shows that BO directly affects VRP positively. That is, online shoppers that are more brand-oriented are more likely to be associated with a vendor's

brand that has a good reputation in the (e)marketplace. Thus, it is important for online retailers to come to the understanding that the key to gaining a strong foothold in the eMarketplace is primarily based on consistently building a good reputation with the firm's target customer groups, especially those savvy and sophisticated customers who over time have been identified as brand-oriented shoppers. A good tool that can be used to identify and/or track brand-oriented shoppers is web analytics to track customers' purchase patterns. It is important for online retail managers to note that any significant 'failing' in a vendor's reputation is likely to be an irritant to their customers, especially the brand-oriented shoppers who are equally likely to be their valued and loyal customers.

From the above, it is also clear that VRP is a direct antecedent to (e)WoM effect. There is no gainsaying the fact that online retail managers that seek to have a positive (e)WoM must as a matter of priority and necessity deliver consistent service to their customers before they can be perceived and/or seen as reliable and trustworthy online retail merchants. It is important for an online retail merchant to assure customers that they would consistently deliver on their promises to their customers. In case of any breach in their contractual promise with their customers, a proviso should have been made known to the customer(s) prior to any service failure on the part of the web merchant. Online retail managers should not forget either the fact that (e)WoM effect is not only the cheapest means of gaining favourable popularity against the competition but is also an important source for a retailer to build a good brand followership and ultimately a good brand image in a virtual environment that has tilted a substantial amount of marketing power to the online shopper(s). Not too surprisingly, this study has empirically demonstrated that RPI is a direct consequence of (e)WoM. That is, online shoppers repurchase intention is positively associated with (e)WoM. Consequently, it is vitally important for online retail practitioners to encourage their customers and/or prospects to recommend their services to their associates and/or family members either through electronic channels or oral conversations. Also, web retailers should endeavour to collect customers' feedbacks via their websites and equally keep track of customers' ratings of their services

in third-party product review sites. Online retail managers need not be too dismayed even when their services are receiving low product reviews, they should, rather, see this as a surmountable challenge to improve their overall service offerings to their customers.

Although in this study, we could not empirically establish the role of SME as a support for (e)WoM, this does not mean that online retail managers should not be bothered about building an engaging social media conversations with their various fans and/or customers. Not doing this alone would amount to losing focus of what the social media bring to businesses in terms of brand visibility and followership. Even though VRP might not significantly influence SME and RPI as reported in the current study, it is highly possible that VRP indirectly influences RPI through (e)WoM as this study has established an empirical link that stems from VRP to (e)WoM as well as from (e)WoM to RPI (see Tab. 4). Importantly, for VRP to significantly influence SME, online retail managers should find a way of directly bringing brand evangelists and/or social media 'info mavens' on board to their online conversations since it is this set of individuals that can really give more 'life' to a retail firm's social media engagement with online users. The result of a post-hoc analysis as was mentioned above suggests that (e)WoM may play an auxiliary role in terms of acting as a strong mediator between VRP and RPI (i.e. repurchase intention). This additional finding though not part of our initial set of hypotheses warrants further scrutiny in further research. We shall also revisit other future lines of research in the concluding sentences of this scientific article.

To conclude, and from a managerial perspective, this study has brought to the fore the roles that shoppers brand orientation and vendors reputation play in the online retail setting, and more particularly the case of the alleged Slovak cosmopolitan online retail shoppers. Although this is an exploratory research, the findings may still help online retailers to focus on contextual factors that are most relevant to increasing online shoppers' repurchasing frequency as well as word-of-mouth effect using either electronic or non-electronic means. Despite the findings of the research, we can boldly point to three shortcomings of the research. First, due to the type of data that we have collected, that is

cross-sectional data, the findings in this study are bereft of any form of causality. Thus, it is important for readers to know that the reported findings in this study are at best correlations. The second limitation of this study has to do with the fact that this study was situated in a single EU country, Slovakia. Hence, it is highly likely the study's findings may not be universally applicable to other EU countries and non-EU countries. Another important limitation has to do with the fact that in a bid to have a parsimonious model, we were unable to capture other relevant variables such as online customer service/support, bargain incentive(s), information quality, and consumers' attitudinal loyalty to a web retailer's brand which may likely influence the outcome variables – (e)WoM and RPI. Although, our choice of statistical modelling (i.e. PLS) compensates for the limited sample size, still it would have been better had we gotten a larger sample size; efforts were also made in this direction but it did not yield any significant success. Nonetheless, the few limitations and/or the challenges of the current study should be seen in light of future research opportunities. First, there is the potential to replicate the findings of the study in another country, especially in other Visegrad Group countries in the EU region, so as to extensively assess the validity of the research findings. Generally speaking, larger sample sizes could help explain some of the insignificant links in our research model (see Fig. 2). Next, authors should endeavour to incorporate other relevant variables that we were unable to capture directly in our research model. Also, future research may have to expound on the results of our study by conducting a longitudinal research design in order to capture the underlying dynamics of the constructs used in the study. In addition, future research should explore the moderating effect of online shoppers' brand orientation on the interrelationships between social network engagement, vendor's reputation, (e)WoM effect and brand loyalty. Finally, to improve the generalizability of the reported findings in this study, conducting a cross-country study will improve our general understanding of the research constructs vis-a-vis (cosmopolitan) consumers' behaviour in the eMarketplace context.

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Appendix 1: Measures

Constructs & indicators	Literature support
<p>Brand orientation BO2 – Most times, I prefer to buy a well-known brand from a web retailer BO2 – The most popular brands are usually my first pick/choice BO3 – I am particular about a good brand name while shopping online BO4 – For me, buying a popular brand online is less risky</p>	Ling et al. (2010); Seock (2003)
<p>Social media site engagement SME1 – I would prefer to buy from a website that I am connected to on a social network site-facebook, twitter, instagram, flicker, etc... SME2 – I think it is good for an online seller to have a Facebook / Twitter/ LinkedIn / Google+ Page SME3 – I would like my online shopping websites to keep me updated with latest sales/products on my social network sites SME4 – To me, it's important that companies engage with their customers through social network sites SME5 – On the whole, I follow the activities of the companies I like on social network sites</p>	Karakaya and Barnes (2010); Laroche et al. (2012); Ramnarain and Govender (2013)
<p>Vendor Reputation VRP1 – I can only buy from an online vendor that is reliable VRP2 – I prefer to deal with a trustworthy web merchant VRP3 – I am more particular about the reputation of any Internet seller VRP4 – I like a website which is truthful about its offers</p>	Doney and Cannon (1997); Kim et al. (2013); Jarvenpaa et al. (2000)
<p>(e)WoM WoM1 – For me, online product reviews will influence my purchasing decision WoM2 – My friends and I sometimes talk about our shopping experiences WoM3 – If I like/dislike a product, I tell my friends and family members WoM4 – I will easily recommend a good online shopping website to others</p>	Awad and Ragowsky (2008); Mikalef et al. (2013); Zeithaml et al. (1996)
<p>Repurchase intention RPI1 – Given the convenience of Shopping on the Web, I will always use it RPI2 – I will continually use the Web for my shopping needs RPI3 – I have made some recent purchases online and would most likely buy more items online RPI4 – I will continually use the Internet for my shopping RPI5 – I see my use of Internet shopping increasing in the nearby future</p>	Bhattacharjee (2001); Mathieson (1991); Thong et al. (2006)

Source: own

Note: five-point Likert-type scales

Abstract

UNDERSTANDING COSMOPOLITAN CONSUMERS' REPEAT PURCHASING IN THE eMARKETPLACE: CONTRIBUTION FROM A BRAND ORIENTATION THEORETICAL PERSPECTIVE**Christian Nedu Osakwe, Henry Boateng, Simona Popa, Miloslava Chovancová, Pedro Soto-Acosta**

As this scientific paper is positioned under the relatively big umbrella of relationship marketing; it thus makes a fruitful attempt to bridge the gap between scholarship and practice. Our overriding objective of this study was to explore critically the contribution of customers' brand orientation as well as other vital constructs such as social media engagement, (e)vendore reputation and (e)WoM on repeat purchasing intention amongst cosmopolitan consumers in eMarketplace context. Data were collected through a non-probabilistic sampling technique from cosmopolitan consumers in one of the EU-27 countries, Slovakia. Data was analysed using the Partial Least Squares structural equation modelling. This study modelled online consumers' repeat purchasing decision using constructs such as brand orientation, vendor reputation, vendors' social media site engagement. The study found that brand orientation leads to a higher perception of vendors' reputation online. The findings showed that a positive and significant relationship exists between brand orientation and consumers engagement with vendors' social media site. Furthermore, this study found that vendors' reputation has a significant effect on (e)WoM. Importantly, this study confirmed the substantial effect of (e)WoM on repurchase intentions. These findings imply that online retail brands should 'push' their product offerings via some of the popular social networking sites (SNSs) and, importantly, endeavour to keep track of those online users in the social media community who most likely have affinity towards their brands and/or other similar brands. By and large, the paper has demonstrated that the studied constructs are key in consumers' decision making online. Hopefully, the findings of the research will assist the online retail vendor in its execution of (robust) customer friendly policies.

Key Words: Social media engagement, (e)vendore reputation, brand orientation, (e)WoM, repurchase intention.

JEL Classification: L81, M30, M31, O33.

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SUCCESS EVALUATION MODEL FOR PROJECT MANAGEMENT

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Introduction

The need for effective planning and management is on the increase along with the increasing complexity and laboriousness of making changes or creating new value. Project management is an ideal tool in this respect (Schwabe, 2011; Bočková et al., 2005). The risks associated with deadlines or budgets are extremely serious. Problems of project modelling and simulation are highly topical at the present time, because the application of project management principles is expanding into further areas – change management (Cummings et al., 2016; Yin-xiang, 2013), crisis management (Wimelius & Engberg, 2015), innovation management (Balkienė, 2013; Dudzevičiūtė & Tvaronavičienė, 2011; Grossmann, 2009), etc. – which have only very basic features of projects. A number of problems related to change or innovation are now solved using various methods, techniques and tools of project management. The project team often finds itself in a situation in which it must make various project-related decisions. In many cases, such decisions may be classified as serious, as the consequences of the wrong decision may be catastrophic for the project. This is why project teams try to minimise the consequences of wrong decisions. Due to the turbulent and inter-cultural environment of contemporary, often highly complex, projects, these efforts are extremely complicated. Modelling enables the project team to obtain valuable information for future decision-making (Colin & Vanhoucke, 2016; Wauters & Vanhoucke, 2016). For example, modelling enhances knowledge of the functioning of the system for projects that are still in the proposal phase (model – original). The possibility of experimentation and simulations with the model under changing conditions is a considerable benefit.

Project management employs a number of methods, techniques and tools for project planning and management. Projects must be implemented within planned deadlines with planned resources and costs in order that defined goals are met. This endeavour is the principal goal of project management, whose outcome should be a successfully planned, managed and implemented project. The modelling technique has proved over the long term to be an effective tool used to support decision-making. Decision-making problems are resolved by project teams comprised of experts from various areas and countries in everyday practice for the duration of the project life cycle. A number of decision-making problems are generally resolved in conditions of uncertainty. The risk arising from incorrect decisions represents a considerable threat to the given project or portfolio of projects. There is a natural tendency to try to minimise this risk. Modelling allows project teams to provide valuable information to support future decision-making, provides greater knowledge of the functioning of the modelled system, and makes it possible to experiment with the model, in the form of simulation for example, during which the experimental conditions are changed and any change to the behaviour of the model is studied. Methods of network analysis for the production of time, resource and cost analysis of the project are now a traditional way of using the technique of modelling in project management.

The goal of this paper is to present a new expert decision-making fuzzy model for the evaluation of project success. The research in the field of evaluation of project success is based on empirical research. Secondary analysis was used to obtain and process relevant secondary data. General theoretical methods, based on principles of logic and logical thinking (analysis

– synthesis, induction – deduction, abstraction – concretisation) were used for processing, and in particular for the formulation of conclusions. Fuzzy modelling (fuzzy set theory and fuzzy logic) was used to create the decision-making fuzzy model, see below. The method of guided interviews with experts in project management was used for identification of the rules of the fuzzy model.

1. Literature Review

1.1 Use of Fuzzy Modelling in Project Management

Many authors have focused on the theory of fuzzy sets and applications of fuzzy logic in project management. The research by the authors Rodriguez et al. presents a method for the evaluation of risk in IT projects. The method is based in a combination of fuzzy analytic hierarchy process (FAHP) and fuzzy inference system (FIS). FIS is used for the integration of the groups of risk factors. These risk factors are the evaluation criteria of a modified FAHP which minimizes the disadvantages of the classic implementation of FAHP in order to obtain a more intuitive and easily adjustable model for multicriteria decision analysis with a lower computational need. The proposed model takes into consideration the different levels of uncertainty, the interrelationship among groups of risk factors, and the possibility of adding or suppressing options without losing the consistency with previous evaluations (Rodriguez et al., 2016). The research by the authors Rudnik and Deptula (2015) presents the properties, identification issues and utilisation of a new concept of probabilistic fuzzy system for the innovative project risk assessment. For this purpose, a group of risk factors, which influence risk variables, has been chosen. Linguistic risk variables are inputs to the innovation risk assessment system. The structure of fuzzy sets for linguistic values takes into account knowledge of a number of experts. Knowledge is presented as fuzzy rules (IF-THEN) together with probability measures of fuzzy events occurrence in the antecedent and conclusion of rules. The method uses parametric family of triangular t-norms, which facilitates inference parameters optimisation, enables flexible adjustment of a system to empirical data and makes the system more precise (Rudnik & Deptula, 2015). The research

by the authors Liu and Ye presented models for comprehensive evaluating modelling of investment project risk with trapezoid fuzzy linguistic information. A practical example for evaluating the investment project risk is used to verify the developed approach (Liu & Ye, 2015). The authors Nasirzadeh et al. (2014) present an integrated fuzzy system dynamic modelling for quantitative risk assessment. The values of the various factors, which are characterized by the nature of uncertainty, are defined by fuzzy numbers. The proposed model was simulated at different levels of risk; the optimum level of risk is determined by the point at which the minimum cost of the project (Nasirzadeh et al., 2014). The study of authors Yao-Chen Kuo and Shih-Lu Tong deals with a fuzzy multiple criteria decision-making (FMCDM) approach to systematically assess risk for a metropolitan construction project where twenty risk factors were identified. Triangular fuzzy sets are used for describing of identified factors. The overall risk level of the project depends on the individual impact of individual risk factors; the scheme was evaluated based on the relative impact and likelihood. They note that the suggested model for risk assessment is more reliable, more convenient than traditional statistical methods, and that this model can be used to efficiently identify risks metropolitan construction projects (Kuo & Lu, 2013). The article "Construction Project Risk Assessment Model" of the authors Zhang and Li (2011) presents the use of fuzzy mathematical theory and gray relational analysis method in the risk evaluation of construction project. The article by Nieto Morote and-Ruz-Vila (2011) is a methodology for risk assessment based on fuzzy set theory, which is an effective tool for dealing with subjective assessments. The proposed methodology is based on the knowledge and experience gained from many experts. Risk factors are evaluated by qualitative criteria in the form of trapezoidal fuzzy numbers. Fuzzy numbers describe the uncertainty variables at the language level (Nieto-Morote & Ruz-Vila, 2011). The authors Chanas and Zielinski (2001), Oliveros and Fayek (2005), Bushan and Ravi (2012), Kuchta (2001), Doskočil and Doubravský (2013) have presented fuzzy sets using fuzzy numbers to obtain critical paths of projects. The research by the authors Naeni, Shadrokh and Salehipour (2011) presents a fuzzy-based earned value model with the

advantage of developing and analyzing the earned value indices, and the time and the cost estimates at completion under uncertainty. An example illustrates how the fuzzy model can be implemented in reality. The same issues by the authors Naeni and Salehipour (2011) present an approach for dealing with fuzzy earned value indices including developing new indices under fuzzy circumstances and evaluating them using the alpha cut method. The proposed model (illustrated in the case study) improves the applicability of the earned value techniques under real-life and uncertain conditions.

1.2 Project Success

The issue of project success is also a scientific goal for some authors (Khan & Rasheed, 2015; Kemmeter, 2014; Schibi, 2013; etc.). The issue of project success is the subject of discussion among a number of experts both in project management and other areas (Joslin & Muller, 2015; 2013; Todorovic et al., 2015). There are a large number of metrics for the measurement of project success. A number of authors agree on some of these, while others are appearing as new. The studies by authors such as (Yang et al., 2011; Zwikael et al., 2014) consider research into new dimensions of project success. In the study „The Moderating effect of risk on the Relationship between planning and success“ the authors deal with examination the relationship between the project planning process and its success. They show the level of success (measured in the form of risk) associated with the project plan. They conclude the high risk projects must be carefully planned. See e.g. (Zwikael et al., 2014). In the opinion of the authors, the metrics differ according to the type of project, the phase in which the project is found, the method of expression: absolute or relative (Samset, 1998), and individual interest groups which often have their own way of perceiving project success (Davis, 2014). The traditional measure of project success is based on what is known as the triple imperative of a project and is associated with the fulfilment of the time period, costs and goals of the project (de Carvalho et al., 2015)cost, and margins. We adopt a contingency approach that evaluates the complexity of the project, according to 4 categories, the effect of industry sector and countries. The methodological approach involved a longitudinal field survey in 3 countries (Argentina, Brazil, and Chile.

In terms of the financial criteria applied, this generally involves the use of the indicators ROI – Return on Investment, NPV – Net Present Value, IRR – Internal Rate of Return (Yin-xiang, 2013) and perhaps CBA – Cost-Benefit Analysis (Jaradat et al., 2010). The research by the author Relich presented a computational intelligence approach to predicting the success of new product development projects (Relich, 2015). Data mining techniques, artificial neural networks and the fuzzy neural system are used to identify relationships between the duration of a project phase and other data stored in the information system of an enterprise (Relich & Muszyński, 2014). The article by McKay and Ellis presented a study which examined the relationship between knowledge sharing processes at the organisational level (organisational learning factors, the unit level, project learning practices) and the success of an IT project (McKay & Ellis, 2014). The research by the authors Chipulu et al. (2014) presented the impact of cultural values on the importance individuals assign to project success/failure factors. The research by the authors Kloppenborg et al. (2014) presented the role of the executive sponsor in achieving project success. The results provide knowledge that will help executive sponsors decide how to invest their limited time and resources. The authors Mazur et al. (2014) present a model of the associations between the major project managers' personal attributes and project success in the context of the Australian defence industry. In their model, emotional intelligence, cognitive flexibility and systemic thinking were hypothesised to relate to project success, mediated by internal and external stakeholder relationships. This model was tested in an online survey with 373 major project managers. Emotional intelligence and cognitive flexibility were found to be related to the development, quality and effectiveness of major project managers' relationships with both internal and external stakeholders, and these in turn were associated with their ratings of project success. The research by the authors Serra and Kunc (2015) presented the results of a survey of practitioners in Brazil, the United Kingdom and the United States evaluating the impact of Benefits Realisation Management (BRM) practices on the project success rate. Their results show BRM practices are positive predictors for project success in the creation of

strategic value for the business. BRM practices can be effective in supporting the successful execution of business strategies. In their papers, the authors Chan and Chan (2004) present an overview of criteria for the assessment of the success of construction projects according to previously conducted research. The criteria on which the majority of pieces of prior research have agreed are the indicators cost, time and quality. Other indicators to be considered are clients, architect, contractor and user (Chan, 2001).

1.3 Critical Discussion

A secondary research (literature review) and a primary empirical research (questionnaire survey in the form of structured and semi-structured interviews) shows, that the following metrics are generally considered measures of the success of a project:

- The project has conformed to the defined scope, goals and costs.
If the given criteria are fulfilled, the project can be considered successful.
- The customer was satisfied with the project.
The project can be considered a success even if a certain aspect of the preceding criterion is not met, though the customer is satisfied with the main aspects of the project. This criterion is becoming increasingly effective and a number of organisations now concentrate on assessing the satisfaction of customers with the project. The information obtained serves them as a basis for overall assessment of project success.
- The project output has fulfilled the principal purpose of the project.
If the main purpose of the project is met by the implementation of the project in spite of the fact that a certain criterion within the triple imperative has not been fulfilled, the project may be considered a success.

An input variable of the expert decision-making fuzzy model for the evaluation of project success (see chapter 3) was deduced from this information.

Currently analysed models of project success evaluation are based on an isolated application of selection criteria of project success. Those criteria are generally based on the triple imperative of the project – time, cost, quality. The indicators ROI (Return on Investment), NPV (Net Present Value), IRR (Internal Rate of Return) or CBA (Cost–Benefit Analysis) are used especially in terms of financial criteria. The customers and suppliers of the project are also used as criteria for project success evaluation. The project budget (cost of the project) only or time schedule are often used as criteria for project success evaluation. According to this assessment approach is generally not taken into account already achieved quality of the project. It is of course a problem, because the projects who are completed in time and within budget may not have defined outputs (quality of the project). Such a project can't be definitely evaluated as successful. Thoroughly conceived project risk analysis is a prerequisite for maintaining of basic parameters of triple imperative of the project. The projects rated high degree of risk have little potential to be successful in terms of triple imperative of the project. Overall it can be said that the weakness of the existing models for project success evaluation is reflected only selected criteria of project success often in the form of numerical values. The individual characteristics associated with the given process of project management are, it's true, relatively countable in project practice, though generally only with a wide scatter, i.e. they are more or less guesswork anyway. The approach to date, in the area of risk engineering for example, has either applied numerical values of probability and impact directly or worked with the classical strict membership of these values to certain sets which was unsuitable for a number of applications and failed to correspond to the true risk perception.

The proposed model (chapter 3) is primarily differed from the current approach thanks its summary evaluation of three key processes that affect the success of the project. It is a process of project risk management, process of elaboration of scheduling and resource analysis and process of quality assurance of the project. It is a process of project risk management, project scheduling and resource analysis and project quality evaluation. The proposed model evaluates these sub-

processes in three sub-models. The outputs of sub-models are used as inputs to the overall model of project success evaluation. The sub-models are possible to use in each life phase of the project also separately. The first sub-model evaluates the project status based on the Earned Value Management, specifically the indexes SPI (Schedule performance index) and CPI (Cost performance index). The second sub-model evaluates the total value of project risk on the RIPRAN method, specifically the indicators number of sub-risk and total value of sub-risks. The third sub-model evaluates project quality. Two qualitative indicators were defined to measure the quality of a project in practice (ČSN EN ISO 9000 (010300) 2005; ČSN ISO 10006 (010333) 2004): degree of compliance with the requirements and eligibility for use. The proposed fuzzy model for the assessment of project success is implemented by means of abstract modelling during which it models the structure of the system. The fuzzy approach was used to the modelling of the sub-processes of project success evaluation. This approach minimises a lack to practically application of exact calculation. The advantage of fuzzy sets is the ability to work with vague concepts. These concepts are widely used in everyday project management practice. Systematically, hierarchical and complexly (three key criteria) developed fuzzy model is its main advantage and differ from current project success evaluation models. This fact is confirmed by Assoc. Prof. Branislav Lacko, who is a certified project manager IPMA and long-time active member of Association for Project Management (Společnost pro projektové řízení, 2016) – International Project Management Association (IPMA) is the national organization, where from 2006-2010 he served as president.

2. Materials and Methods

2.1 Fuzzy Set

A fuzzy set is a set whose elements have degrees of membership. The fuzzy set was introduced by Lotfi A. Zadeh in 1965 as an extension of the classical notion of sets and can be applied in many fields of human activity (Zadeh, 1965). The degree of membership to fuzzy sets determines “how much” the element belongs to the set. This is the basic principle of fuzzy sets.

A fuzzy set can be defined as follows: Let X be a non-empty set and $\mu_{\tilde{A}}: X \rightarrow [0; 1]$.

Then fuzzy set \tilde{A} is a set of all ordered pairs $(x, \mu_{\tilde{A}}(x))$ therefore

$$\tilde{A} = \{(x, \mu_{\tilde{A}}(x)): x \in X, \mu_{\tilde{A}}(x) \in [0; 1]\}, \quad (1)$$

where X is a universe, $\mu_{\tilde{A}}$ is a membership function of fuzzy set \tilde{A} , (see Fig. 1), and $\mu_{\tilde{A}}(x)$ is a grade of membership of x . $\mu_{\tilde{A}}$ is defined for all $x \in X$ and $\mu_{\tilde{A}}(x) = 0$ for $x \notin \tilde{A}$.

A support of a fuzzy set \tilde{A} is the classical set

$$\text{supp } \tilde{A} = \{x \in X: \mu_{\tilde{A}}(x) > 0\}. \quad (2)$$

A kernel or core of a fuzzy set \tilde{A} is the classical set

$$\text{ker } \tilde{A} = \{x \in X: \mu_{\tilde{A}}(x) = 1\}. \quad (3)$$

A height of a fuzzy set \tilde{A} is the number

$$\text{hgt } \tilde{A} = \sup_x \mu_{\tilde{A}}(x). \quad (4)$$

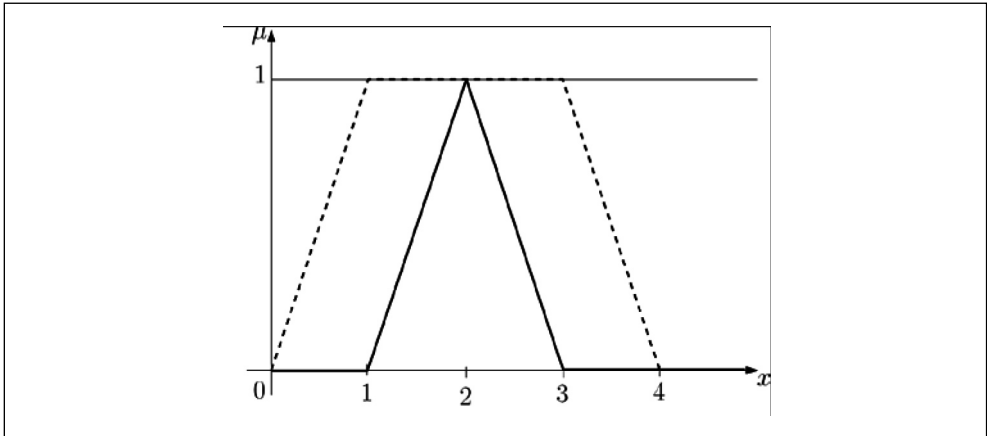
For example, when fuzzy set \tilde{A} is “about 2”, see triangular membership function in Figure 1, then $\text{supp } \tilde{A} = (1;3)$, $\text{ker } \tilde{A} = \{2\}$ and $\text{hgt } \tilde{A} = 1$.

2.2 Fuzzy Logic

The application of fuzzy logic is based on fuzzy set theory (Zadeh, 1965; Zimmermann, 2001; Klir & Yuan, 1995). Fuzzy logic measures the certainty or uncertainty of how much the element belongs to the set. By means of fuzzy logic (Zadeh, 2007) it is possible to find the solution to a given task from rules defined for analogous tasks. The calculation of fuzzy logics consists of three basic steps (Dostál, 2011):

1. Fuzzification – transforms real variables into linguistic variables using their attributes. The variable usually has from three to seven attributes. The attribute and membership functions are defined for input and output variables. The degree of membership of attributes is expressed by a mathematical function – membership function (Π, Z, S , etc.).
2. Fuzzy inference – defines the behaviour of a system by using rules of the type <When>, <Then> on a linguistic level. Conditional clauses typically have the following form:
 <When> [Input_a1 <And> Input_a2 <And> ... <And> Input_an] < And > [Input_b1 <And> Input_b2 <And> ... <And> Input_bm]
 <Then> Output_1.

Fig. 1: Triangular and trapezoidal type of membership function



Source: own

Each combination of attributes of input and output variables occurring in a condition <When>, <Then>, presents one rule. The rules are created by the user or expert himself.

3. Defuzzification – transfers the results of fuzzy inference (numerical values) on output variables by linguistic values. It describes results verbally.

A system with fuzzy logic works as an automatic system. The user need only enter input data. This can be represented by many variables and their attributes.

3. Results

The case study presents the use of fuzzy logic in the evaluation of project success. The Fuzzy Logic Toolbox in MATLAB software was used to create the decision-making model. The expert decision-making fuzzy model system for the evaluation of project success (EDMS_PSU) consists of three sub-models: a fuzzy model of project state evaluation (EDMS_PS), a fuzzy model of total project risk evaluation (EDMS_TVPR), and a fuzzy model of project quality evaluation (EDMS_PQ). There are six input variables, four rule blocks and one output variable in the fuzzy model. See Figure 2.

A membership function of type Π *trapmf* (trapezoidal-shaped) was used. The syntax of the function is the following: $y = trapmf(x,[a b c d])$. The description of the trapezoidal curve is a function of a vector x and depends on four scalar parameters a, b, c, d , as given by

$$f(x; a, b, c, d) = \begin{cases} 0; & x \leq a \\ \frac{x-a}{b-a}; & a \leq x \leq b \\ 1; & b \leq x \leq c \\ \frac{d-x}{d-c}; & c \leq x \leq d \\ 0; & d \leq x \end{cases} \quad (5)$$

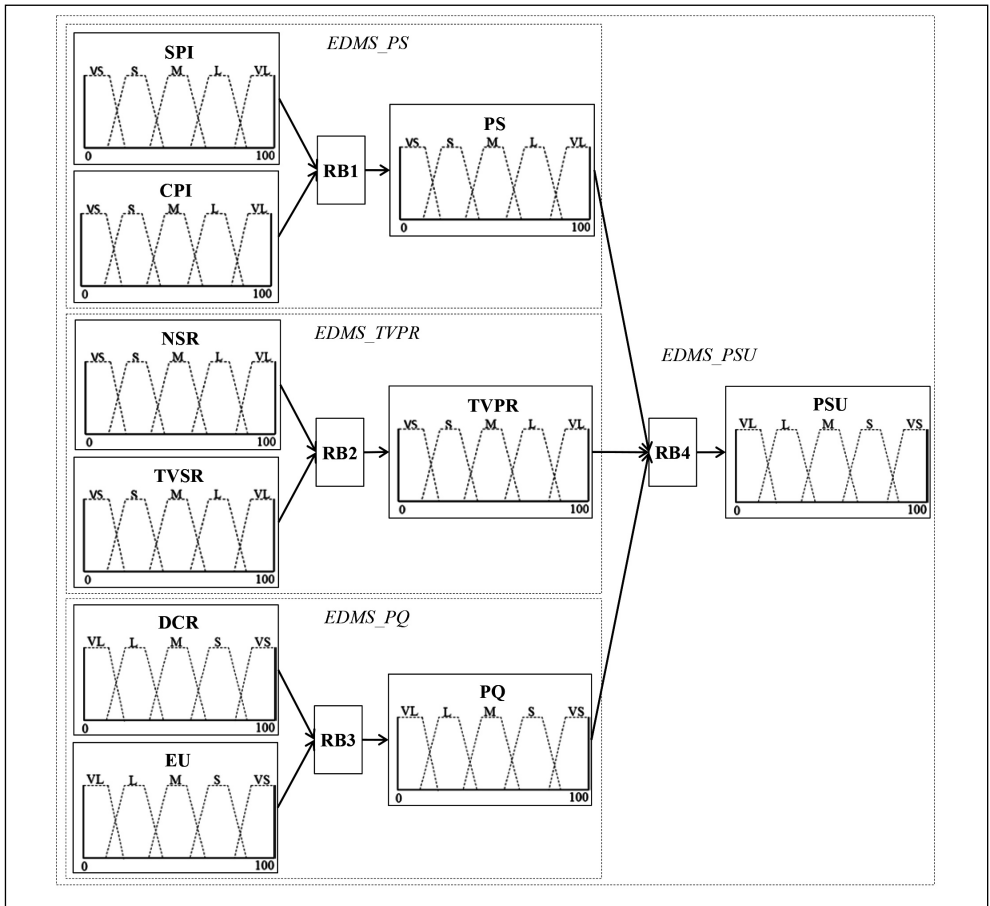
where the parameters a and d locate the “feet” of the trapezoid and the parameters b and c locate the “shoulders”.

Fuzzy Sub-Model of Project State Evaluation (EDMS_PS)

The rule block RB1 evaluates project status (PS) based on the Earned Value Management – EVM (Vanhoucke, 2014), specifically the indexes SPI and CPI. EVM method is based on the following indices:

- Planned value (PV) – Budgeted cost of work scheduled (BCWS). The total PV of a task = the task’s budget at completion (BAC).

Fig. 2: Scheme of project success evaluation



Source: own

- Earned value (EV) – Budgeted cost of work performed (BCWP).
 - Actual cost (AC) – Actual cost of work performed (ACWP).
- EVM uses for describing project schedule and cost performance following basic indices:
- Schedule variance (SV) – shows whether and by how much your work is ahead of or behind your approved schedule. Mathematically: $SV = EV - PV$.
 - Cost variance (CV) – shows whether and by how much you're under or over your approved budget. Mathematically: $SV = EV - AC$.
 - Schedule performance index (SPI) – shows the relative amount the project is ahead of or behind schedule. Mathematically: $SPI = EV / PV$. Interpretation:
 - SPI < 1: the project is behind schedule (finish later than expected),
 - SPI > 1: the project is ahead of schedule (finish sooner than expected),
 - SPI = 1: the project is on schedule (finish according to schedule).
 - Cost performance index (CPI) – shows the relative value of work done compared to the amount paid for it. Mathematically: $CPI = EV / AC$. Interpretation:
 - CPI < 1: the project is over budget,

CPI > 1: the project is under budget,
 CPI = 1: the project is within budget.

There is a graphical representation of PV, EV, AC, BAC, SV and CV in Figure 3.

The practical application of EVM is usually defined by certain tolerances which are represented in a graphic circle centred at point (1,1). These circles are the relevant size of the problem in which the project is located – problem of project status (PS). The closer to the centre (point (1,1)), the smaller the problems of project status are. The further away from the centre (point (1,1)), the greater the problems of project status. See Figure 4.

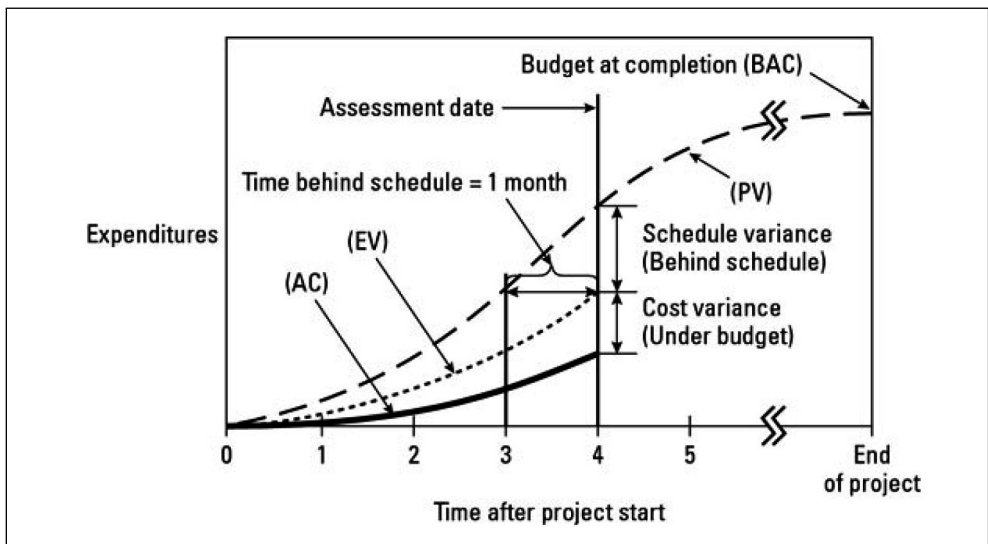
The inputs (into RB1) are represented by two variables: SPI_deviation (SPI) and CPI_deviation (CPI). The output from rule block RB1 and the output variable is the problem of project status (PS). The input variable SPI has five attributes: VS – very small, S – small, M – medium, L – large, VL – very large. The input variable CPI has five attributes: VS – very small, S – small, M – medium, L – large, VL – very large. The output variable PS has five attributes: VS – very small, S – small, M – medium, L – large, VL – very large (Doskočil, 2015).

Figure 5 shows the rule block (RB1) with 25 rules and degrees of support that set up the relation between input and output variables. The list and combination of rules for the project state evaluation system is based on empirical research in the given subject carried out by the controlled interview technique.

Fuzzy Sub-Model of Total Project Risk Evaluation (EDMS_TVPR)

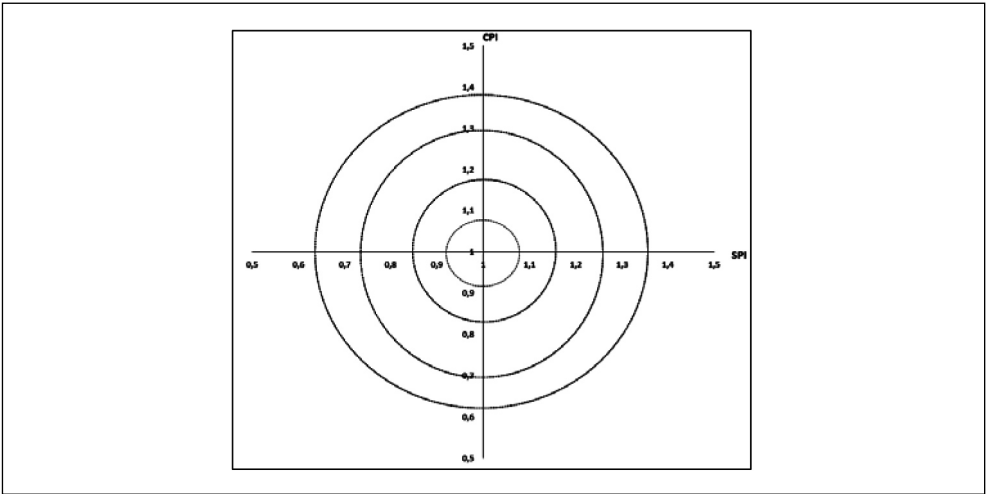
The rule block RB2 evaluates the total value of project risk (TVPR) on the RIPRAN (Risk PProject ANALysis) method – specifically the indicators: Number of Sub-Risk and Total Value of Sub-Risks. Both indicators are extremely important inputs in the evaluation of the total risk of the project based on the RIPRAN method. The RIPRAN method is an empirical method for the analysis of project risks. The author of the RIPRAN method is Associate Professor Branislav Lacko. The RIPRAN method can be used in all phases of the project (Cooper et al., 2014). The method was originally created for risk analysis automation projects within the framework of a research project at the Technical University in Brno. Experience has shown that, after certain adjustments, it is possible to apply the method in the risk analysis of a wide range

Fig. 3: Graphical representation of basic EVM indices



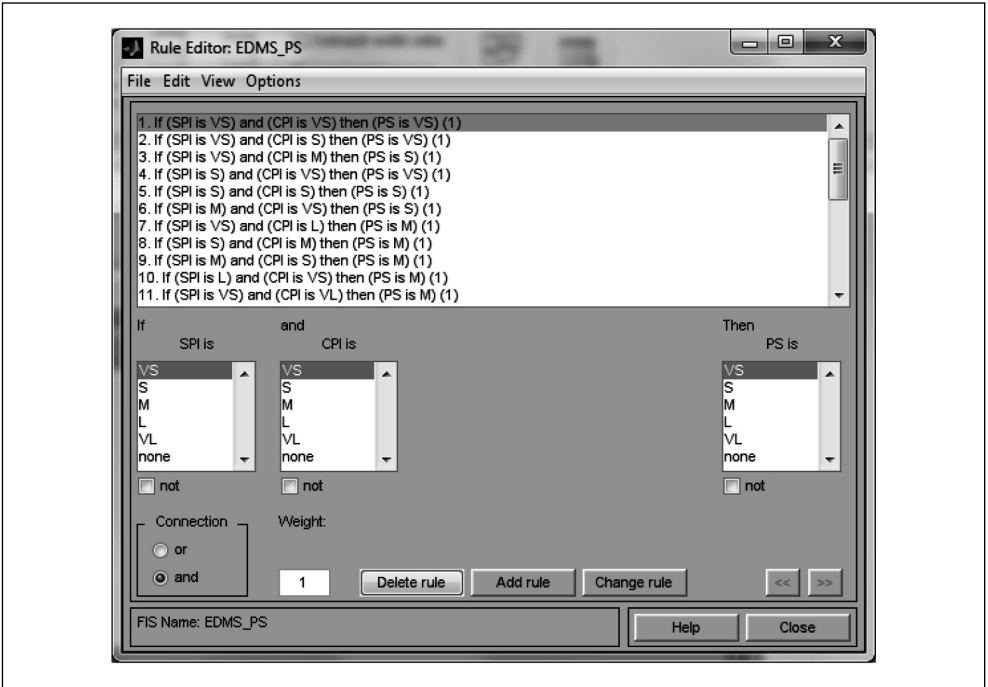
Source: Earned Value Management Terms and Formulas for Project Managers

Fig. 4: Status chart SPI, CPI



Source: own

Fig. 5: Rule block (RB1) and some rules – EDMS_PS



Source: own

of various projects and, in some cases, for the analysis of other types of risks than project risks. The RIPRAN method is a trademark, registered author of the Industrial Property Office in Prague under reg. no. 283536 (Lacko, 2015).

The inputs (into RB2) are represented by two variables: Number of sub-risk (NSR) and total value of sub-risks (TVSR). The output variable is total value of project risk (TVPR). The input variable NSR has five attributes: VS – very small, S – small, M – medium, L – large, VL – very large. The input variable TVSR has five attributes: VS – very small, S – small, M – medium, L – large, VL – very large. The output variable TVPR has five attributes: VS – very small, S – small, M – medium, L – large, VL – very large.

Figure 6 shows the rule block (RB2) with 25 rules and degrees of support that set up the relation between input and output variables. The list and combination of rules for the total project risk evaluation system is based on empirical research into the given subject carried out by the controlled interview method.

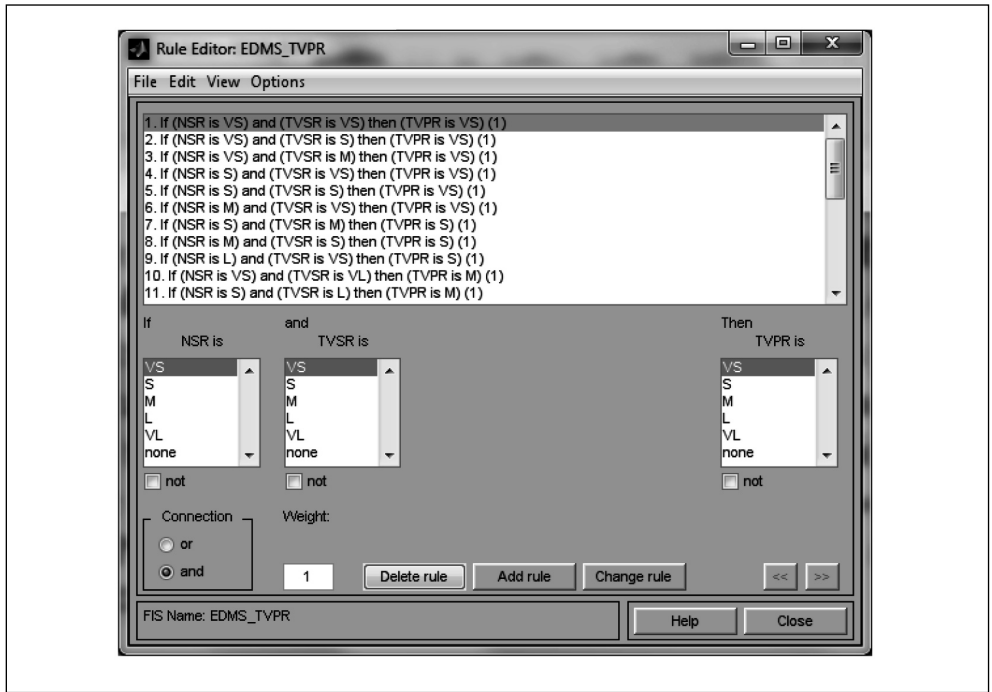
Fuzzy Sub-Model of Project Quality Evaluation (EDMS_PQ)

Rule block RB3 evaluates project quality (PQ). Two qualitative indicators were defined to measure the quality of a project in practice (ČSN EN ISO 9000 (010300) 2005; ČSN ISO 10006 (010333) 2004):

1. Degree of compliance with the requirements – processes and products of the project correspond to predetermined specifications (declaration of the project).
2. Eligibility for use – the products of the project can be used in the manner for which they were intended.

The inputs (into RB3) are represented by two variables: Degree of compliance with the requirements (DCR) and eligibility for use (EU). The output variable is project quality (PQ). The input variable DCR has five attributes: VL – very large, L – large, M – medium, S – small, VS – very small. The input variable EU has five attributes: VL – very large, L – large, M – medium,

Fig. 6: Rule block (RB2) and some rules – EDMS_TVPR



Source: own

S – small, VS – very small. The output variable PQ has five attributes: VL – very large, L – large, M – medium, S – small, VS – very small.

Figure 7 shows the rule block (RB3) with 25 rules and degrees of support that set up the relation between input and output variables. The list and combination of rules for the project quality evaluation system is based on empirical research into the given subject carried out by the controlled interview method.

The scheme of the fuzzy model evaluating project success (only the sub-model related to rule block RB4) is displayed in Figure 8.

Fuzzy Model of Project Success Evaluation (EDMS_PSU)

Rule block RB4 evaluates project success (PSU). Partial outputs from the blocks (RB1, RB2, RB3) are simultaneously inputs into rule block RB4 (see Fig. 7). The output variable is project success (PSU). The output variable PSU

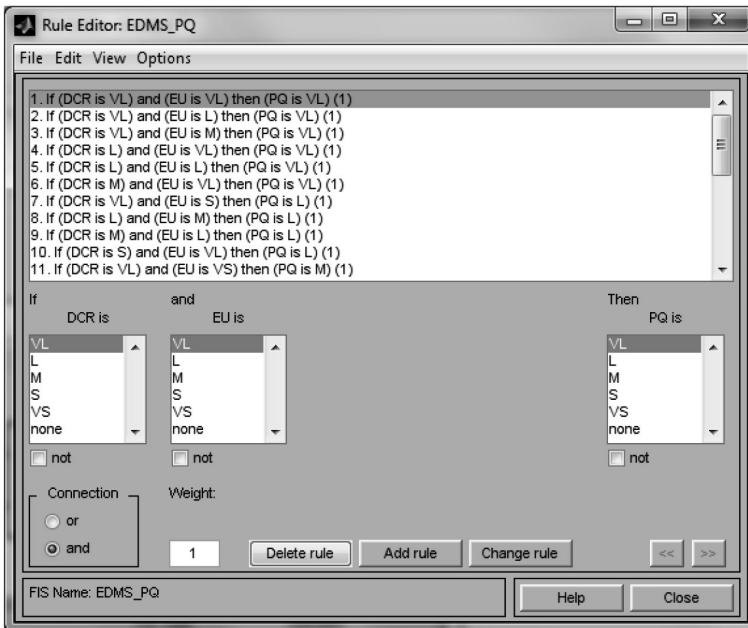
has five attributes: VL – very large, L – large, M – medium, S – small, VS – very small.

Figure 9 shows the rule block (RB4) with 125 rules and degrees of support that set up the relation between input and output variables. The list and combination of rules for the project success rate evaluation system is based on empirical research into the given subject carried out by the controlled interview technique.

Figure 10 shows the correlation between input and output. Specifically, this image shows graphically the correlation between two output variables PSU and input variables PS and TVPR. It is a function dependence $PSU = f(PS, TVPR, PQ)$, where the input variable PQ in this three-dimensional graph is a constant. The user can change this variable for presentation in graphs. In this graph, you can see extremely important information about the fuzzy model.

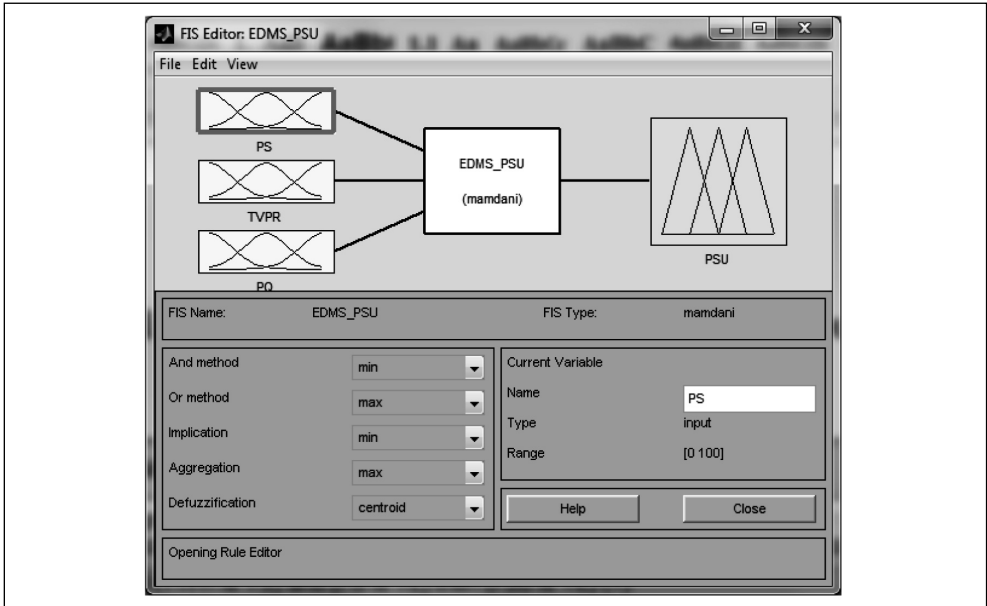
The graphic representation of the dependence of the input and output variables

Fig. 7: Rule block (RB3) and some rules – EDMS_PQ



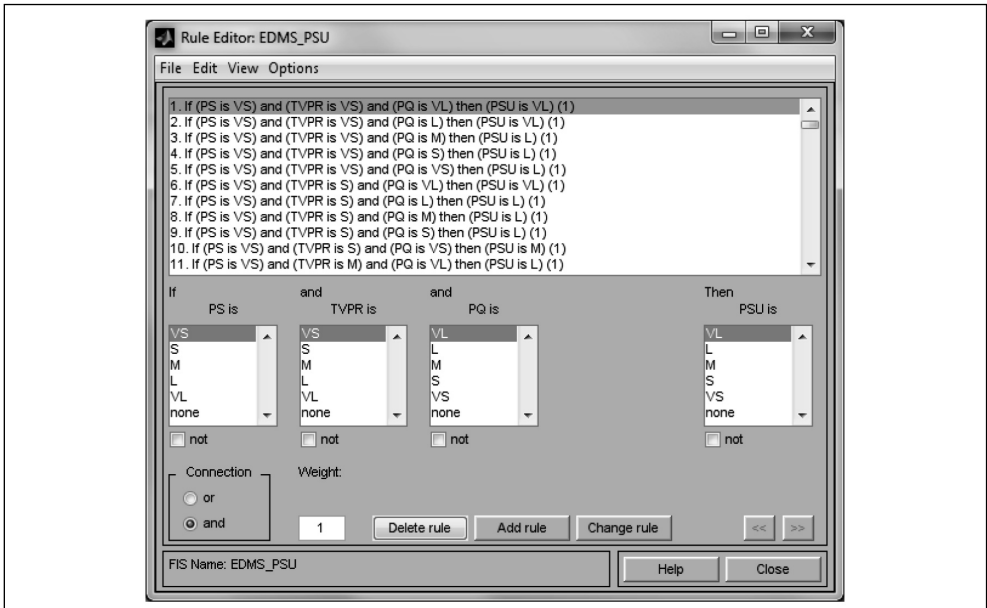
Source: own

Fig. 8: Build up model – RB4



Source: own

Fig. 9: Rule block (RB4) and some rules – EDMS_PSU



Source: own

makes it possible to control the set parameters of the fuzzy model. In general, one may say that the display area of the given model is satisfactory since the defined rules and selected membership functions generalise the model sufficiently.

Taking into account the monitoring of four variables (four-dimensional problem), which is our idea difficult to imagine, Figure 10 shows a cut of the four-dimensional problem; the result is three dimensions surface. This is achieved by fixing one of the input variables, e.g. the third input variable $PQ = 50$, see Figure 10. The value of output variable (PSU) reaches the maximum only in the value 75 on this level of the cut, see Figure 10.

The display of four-dimensional problem is reduced into three dimensions for a fixed selected input variable $PQ = 50$. The changing variables are PS, TVPR, PSU. The points in the graph (see Fig. 10) have therefore coordinates [PS, TVPR, PSU]. It is possible to deduct for variables $PS = 0$ and $TVPR = 0$ the value of $PSU = 0$. For variables $PS = 100$, $TVPR = 100$ can be deduct the value of $PSU = 75$. See Figure 10.

Figure 11 shows the evaluation of project success for a concrete project. The input variables are set up as $PS = 0$, $TVPR = 0$, $PQ = 0$. This leads to the result (output) $PSU = 7.29$ which means that project success is evaluated as very large (the value 7.29 is close to zero). Using the first rule is expressed by the output variable PSU coloration (see Fig. 11). It was used the first rule: *If (PS is VS) and (TVPR is VS) and (PQ is VL) then (PSU is VL)*. See Figure 9. This rule means: If project status (PS) is evaluated as very small (VS), total value of project risk (TVPR) is evaluated as very small (VS) and project quality (PQ) is evaluated as very large (VL) then project success (PSU) is evaluated as very large (VL).

The input variables in value $PS = 100$, $TVPR = 100$, $PQ = 100$ leads to the result (output) $PSU = 92.7$ which means that project success is evaluated as very small. It was used the last rule: *If (PS is VL) and (TVPR is VL) and (PQ is VS) then (PSU is VS)*. This rule means: If project status (PS) is evaluated as very large (VL), total value of project risk (TVPR) is evaluated as very large (VL) and project quality (PQ) is evaluated as very small (VS) then project success (PSU) is evaluated as very small (VS).

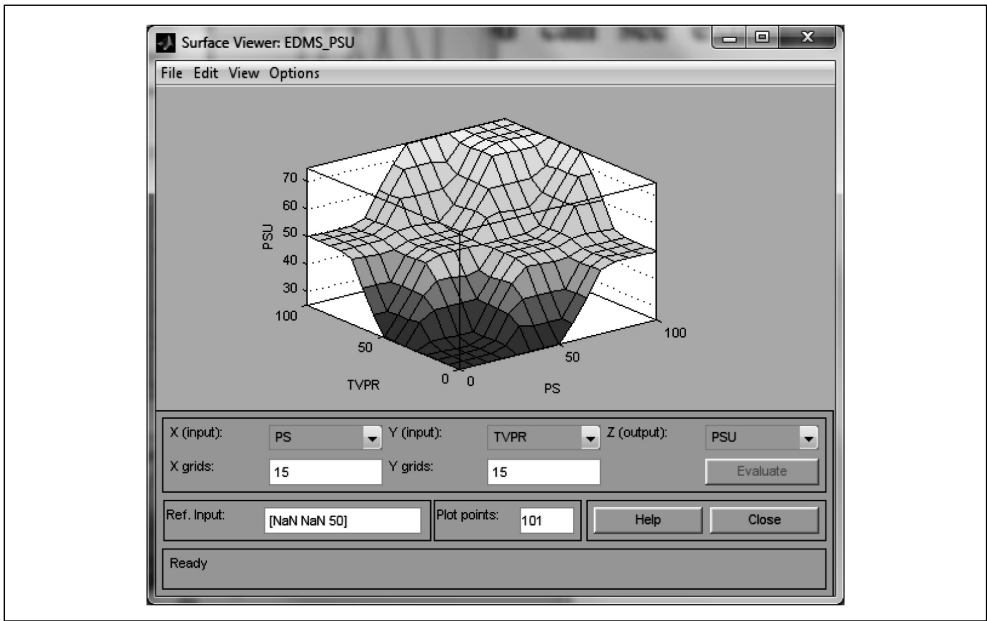
4. Discussion

The proposed fuzzy model for the assessment of project success is implemented by means of abstract modelling during which it models the structure of the system. All figures created in the Fuzzy Logic Toolbox in MATLAB software are illustrative. The fuzzy modelling of selected project processes (the project status evaluation, the project risk evaluation and the project quality evaluation) was applied, first and foremost, in view of the ability of fuzzy sets to work with inexact (vague) concepts. These concepts are widely used in everyday project practice. Definition of exact mathematical relationships that would model the given reality sufficiently faithfully would be highly complicated in this situation.

The success of the proposed model and its limitations depend, first and foremost, on the extent and quality of the input data. The proposed model is set to expert data. This data served as a point of departure for the description of the modelled system from the viewpoint of its purpose and goals. The model contains basic input variables that have long been considered in project practice as criteria for the assessment of pertinent project processes. If other facts or additional new data is identified, additional or other possible dependences may be determined or the given dependences exactified, with the rules and shapes of functions of model membership thereby being exactified as well. The structure rules of the fuzzy model depend also on life phase of the project. Priorities of the project (thanks to the environment in which the projects underway) are changing. Experts can therefore define different rules for each life phase of the project. For these reasons, the proposed model cannot be considered final. The viability of the model, which falls over time, must always be respected. The model must be upgraded, i.e. corrections with regard to the real state must be made or the model drawn up entirely from scratch. Only a model drawn up to a high standard and subjected to verification can be applied in live operations and used as a tool supporting decision-making.

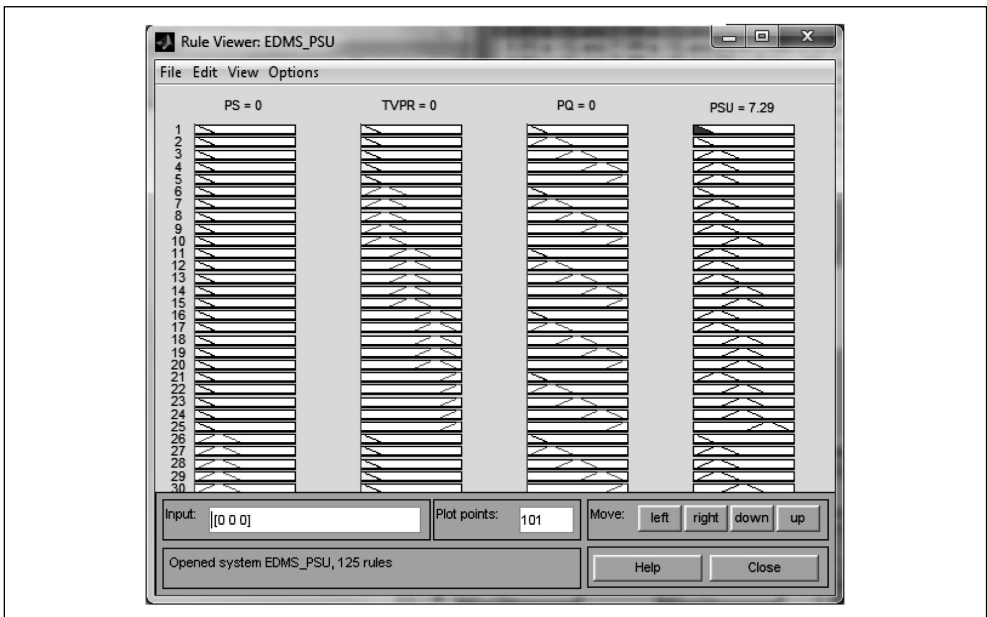
The model must be tuned and verified after its creation. The success of the model depends primarily on the quality of the fuzzy rules. If the model does not give correct output, the rules or shapes of the membership functions must be corrected or changed. The results meet the requirements, for which reason the model can be considered generally functional. The model

Fig. 10: Correlation between variables – RB4



Source: own

Fig. 11: Output (PSU) – project success is very large



Source: own

can be used in practice. An executable file called M-File can be created to implement the fuzzy model in MATLAB. M-file is used to enter the input values and automatically evaluate project success.

The proposed fuzzy model is recommended for use primarily in the implementation phase of the project cycle and then repeatedly after each project milestone is reached (structured, for example, according to WBS – Work Breakdown Structure). Project managers obtain a tool for “measuring” selected project processes with this model. They also get the opportunity of using the model for experimentation, for example by means of simulations. This provides additional information about possible project development and, in some cases, alarm signals to support future decision-making.

Conclusion

This paper presents an expert decision-making fuzzy model for evaluating project success. The proposed model (including sub-models) is implemented in the MATLAB software environment with the use of the Fuzzy Logic Toolbox application where it is also verified and further specified. MATLAB software was chosen for the construction of models in view of the fact that it is not necessary to perform a detailed examination of the essence of the principle of fuzzy sets (with which fuzzy logic works) which is an indisputable advantage in view of the varying standard of mathematics in the intercultural environment of project teams today.

In view of today's multidisciplinary and international project environment, characterised by a large number of parties with an interest in the project, the fuzzy approach is one way of incorporating uncertainty into project practice. The advantage of fuzzy sets over classical set theory lies in their ability to record inexact (vague) concepts that project managers use in their natural language in the design and implementation of projects. The individual characteristics associated with the given process of project management are, it's true, relatively countable in project practice, though generally only with a wide scatter, i.e. they are more or less guesswork anyway. The approach to date, in the area of risk engineering for example, has either applied numerical values of probability and impact directly or worked with the classical strict membership of these values to certain

sets which was unsuitable for a number of applications and failed to correspond to the true risk perception. The fuzzy approach to the modelling of these processes minimises this shortcoming. The application of fuzzy approaches in the modelling of controversial (in relation to the possibility and practical usability of exact calculation) selected project processes is one of the principal contributions of this paper.

The proposed model provides project managers and others with a tool for the “measurement” of selected project processes (assessment of the state of the project, assessment of project risks, assessment of project quality, assessment of project success). The fuzzy approach including knowledge base of expert rules and its ability to systematically, hierarchical and comprehensively evaluate three key criteria of project success is the main asset and simultaneously differ from current models. A significant general advantage of the application of the technique of modelling in project management is the possibility of subsequent experimentation with the model, in the form of simulation for example. This makes further information about the possible variant development of projects available and can provide warning signals to support future decision-making.

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Abstract

SUCCESS EVALUATION MODEL FOR PROJECT MANAGEMENT**Radek Doskočil, Stanislav Škapa, Petra Olšová**

The article presents an expert fuzzy model for evaluation of the project success rate. The model is implemented with the use of fuzzy logic. First, fundamental theoretical principles related to the problems of project success rate, fuzzy sets and fuzzy logic are introduced, after which a fuzzy model for project success rate evaluation, including partial sub-models, is presented in the form of a case study which represents the main goal of the article.

The fuzzy model is implemented in the MATLAB software environment with the use of the Fuzzy Logic Toolbox application, where it is also verified and further specified. The fuzzy model consists of six input variables which are divided according to their character into three categories in each block (RB1, RB2, RB3) and are separately evaluated. Partial outputs from the blocks (RB1, RB2, RB3) are simultaneously inputs for block RB4, from which there is a single output variable – project success (PS). The RB1 rule block evaluates the situation from the point of view of the state of the project. The RB2 rule block evaluates the total value of project risk. The RB3 rule block evaluates project quality. The RB4 rule block evaluates the total project success rate.

Experimenting with the fuzzy model allows simulation of the uncertainty that is always involved in projects. The case study introduces an overall diagram of the fuzzy model, the input and output variables, including their attributes, and the evaluation rules of the four rule blocks.

The proposed fuzzy model is used to evaluate project success primarily in the implementation phase, then repeatedly after each phase of the project is completed. This provides project managers with a tool that allows relatively rapid evaluation of the success of the project and the opportunity of applying appropriate measures in good time if necessary.

Key Words: *Project management, project success, evaluation model, fuzzy logic, decision-making.*

JEL Classification: C44, M11, M21.

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DESIGNING MODERN INFORMATICS EDUCATION FOR FUTURE MANAGERS AND ADVANCED USERS ACCORDING TO THEIR KNOWLEDGE BASE

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Introduction

Knowledge, the implementation of information and communication technologies (ICT) and innovations are considered to be the key factors of success that can ensure economic growth for individuals, companies even for whole countries. It is not different in the school environment. As well as in the economic sphere also in the school environment it is necessary to count with a minimal stability and certainty. The only thing that is certain in today's world is permanent change. For successful existence in this turbulent environment it is very important to learn how to cope with changes and the quickly transforming world.

The development of economy and a rise of living standards directly depend on knowledge of a generation and the proper usage of information which help with educating society, creating new scientific products and improving technologies. Dynamic changes in society and labor market require modern, flexible, innovative and creative possibilities of education. New skills for knowledge society are not only classical literacy (reading, writing, counting), but also digital literacy and good creative, logical and critical thinking.

It is necessary, especially for higher education institutions, to search for the new possibilities of improving the skills of future specialists and professionals, developing individual abilities and acquiring high level professional competences. The system of university education is one of the basic parts of education, culture, teaching, social welfare and economic development in every country. University education has been accepted as the foundation for public priority, economic prosperity and life quality. The institutions of

university education are capable of training an educated, intelligent and knowledgeable society and raising national intellectual and creative potential (Lamanuskas, Augiene, & Makarskaite-Petkeviciene, 2012).

1. Theoretical Background and Current Issues

1.1 Informatics and ICT in Business Environment

Changes of economic environment were commenced by scientific and technical progress of the first half of the 20th century. Construction and massive spread and extent of computer and its use as well as extensive conglomerate of technical means and technologies, often referred to as to information or information-communication technologies. Now Information society starts to transform into a different, more organized form, so called knowledge society (Kelemen et al., 2007; Soltes & Gavurova, 2014). These changes cause significant social impacts. Institutions, organizations, enterprises focus more on getting employees who excel in their knowledge. It is also needed to be able to change knowledge into effective work. That is linked to a way of „system thinking” which makes us see things in relations. Education and learning become the key interest of people and organizations. Investment into immaterial capital is nowadays an important sum in most companies (Bureš, 2007).

The current business environment is characterized as highly turbulent, influenced by modern ICT, globalization, short innovation, production cycles and employee mobility. Progressive advanced companies show it is necessary to possess data, information, and knowledge and to value the experience of their

employees. The need for new knowledge and skills requires that employees improve their competencies, skills and knowledge continually.

The economics literature emphasizes the importance of human capital, seen as the result of education and training (Lucas, 1998), and innovativeness, as reflected in R&D efforts (Aghion & Howitt, 1992) as determinants of growth at the economy-wide level. At the firm level, educated and trained employees and R&D activities are seen as inputs to the production process which directly affects output (Barron & Kreps, 1999).

Human resource systems can contribute to sustained competitive advantage through facilitating the development of competencies that are firm specific, produce complex social relationships, are embedded in a firm's history and culture, and generate tacit organizational knowledge (Lado & Wilson, 1994). Moreover, competencies are fundamentally information based invisible assets that can be accumulated by careful planning and executed practice of organizational learning (Pucik, 1988).

Current business entities are forced to consistently improve their products and services. They have to utilize information systems, ICT and modern management methods. This is the only way they can succeed in such competitive environments. The information aspects of the management at all levels have a very important function in increasing competitiveness and management quality of all economic systems. Nowadays many managers in a higher position are expected to be information managers as well (Earl, 2000). They have to be involved in analysis, modeling and building of the effective IS of the companies and organizations.

1.2 Informatics and ICT in Slovak Education System

The success of Europe 2020 (European Commission, 2011) (the competitiveness and the innovation capability of European industry and social cohesion) depends on the strategic and effective use of ICT and the knowledge, skills, competences and inventiveness of the European workforce and citizens. The role of ICT on productivity and standards of living seems to be critical, because e-skills shortages, gaps and mismatches as well as a persistent digital divide will affect negatively productivity growth, competitiveness, innovation, employment and social cohesion in Europe, as we can

read in (European Commission, 2007) – ICT, e-Skills for the 21st Century. With developing technology, it is necessary to widen e-skills by demand of creativity, innovation and higher-level conceptual skills and competencies.

Our educational system should be able to react appropriately to the development and trends in the upcoming knowledge society. The most recent National reform programme in the Slovak Republic from 2014 (Národný program reforiem Slovenskej republiky, 2014), presents actions to fulfill targets contained in the strategy Europe 2020 (European Commission, 2011).

An Action plan (Akčný plán Národného programu reforiem Slovenskej republiky, 2014), following the National reform programme of SR, defines tasks in particular fields. Activities of the Action plan demands from civil service employees, lawyers, medical workers, businessmen but even from ordinary citizens knowledge of IS, abilities to analyze processes as well as specify functionality requests on the IS being built and on IS management.

The first step towards informatization of schools in Slovakia was launching the project Infovek in 1999 (Sýkora, 2000). The document accepted by the Slovak government in 2008 Strategy of informatization of regional education (Stratégia informatizácie regionálneho školstva, 2008), defined a key government target – in four years to bring Slovak educational system closer to European schools preparing students for information society.

Another government document released in 2013 is Dikipedia – a concept of informatization of the educational resort with an outlook till 2020. The concept presents digitization as one of the most effective tools for Slovak teachers and scientists how to achieve better results in education and research (MINEDU, 2013).

Determined targets and priorities should be imported into the basic curricular documents as well as into the Educational framework which adjusts lessons allocation so that the declared efforts could be transformed into educational process. However if we have a look at the for example Educational framework for secondary schools (MINEDU, 2011), the real situation does not testify to the proclaimed interests and efforts. The subject Informatics has the second lowest lessons allocation which is only 3 lessons in the 1st up to the 4th (5th to 8th) year in the higher secondary educational stage. Insufficient is the ICT integration into

the tuition of other subjects, acute is also lack of competent qualified teachers in the field of informatics and ICT use.

While building a research tool we analyzed the basic curriculum document which is binding for the secondary stage of education in secondary schools State educational program for the subject Informatics ISCED 3A (National Institute for Education, 2012) especially targets, content and performance standard.

In recent years, several advanced countries have declared the intention to transform their ICT school subject into a new Computer Science, Informatics, or Computing education, with the emphasis on developing computational thinking, programming, designing computational systems and other basic concepts of Informatics. In Slovakia the theoretical conception of the school Informatics at the primary and secondary stages can be approximately characterized by the following principles:

- It is not the ICT in education, but Informatics. Both components are necessary in modern education: integration of ICT into learning processes, and also a separate subject focused on the concepts of Informatics or Computing.
- Informatics is a general (opposed to vocational) subject, for every student, without regard to his or her future professional profile and the degree of achieved education.
- Programming is considered an inseparable and core constituent of the school Informatics. There were controversial and not very successful attempts of the 80s and the 90s to implement the concept of 'programming for everybody' in every secondary school. Today we believe that educational programming can flourish only if we manage to adopt original ideas e.g. of Papert or Resnick about programming as a tool for thinking, exploring, and socializing, as an opportunity to create new playful learning contexts (Kalaš & Gujberová, 2013).

In general, we can see development and output of our educational system in the field of Informatics and using ICT we can see in general at national level in e.g. (Veštic, 2013; Pudto & Gavurova, 2012; 2013). We also can compare us with other countries via results of international surveys, for example OECD PIAAC Survey of Adult Skills – Problem solving in technology rich environments (OECD, 2013).

The Survey of Adult Skills defines Problem solving in technology-rich environments in (OECD, 2012) as using digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks. It focuses on the abilities to solve problems for personal, work and civic purposes by setting up appropriate goals and plans, and accessing and making use of information through computers and computer networks.

1.3 Current Trends in Business Informatics and Using ICT

Informatics, ICT and computer networks penetrated into all aspects of activities where they enable us to work by brand new ways and create new values. Computer and the Internet have brought to companies unprecedented opportunities of mutual connection and partnerships building (Kelemen et al., 2007).

Much different prognosis deals with the trends of Informatics and ICT field, while the one which is most commonly used by ICT professionals is a prediction designed by Gartner Company called Hype cycle that tracks the different available technologies in their phase of growth, phase of decline of interest till their stabilization position. Gartner's 2015 Hype Cycle for Emerging Technologies (Gartner, 2015), identifies the computing innovations that companies and organizations should monitor. Now it mostly supports digital marketing, digital business and autonomous. In the field of the digital marketing enterprises focus on new and more sophisticated ways (e.g. via mobile, social, cloud and information) to reach consumers, who are more willing to participate in marketing efforts to gain greater social connection, or product and service value. Digital business is on higher level and focuses on the convergence of people, business and things. The Internet of Things (IoT) and the concept of blurring the physical and virtual worlds are strong concepts. Physical assets become digitalized and become equal actors in the business value chain alongside already-digital entities, such as systems and apps. Autonomous is defined by an enterprise's ability to leverage technologies that provide humanlike or human-replacing capabilities. Using autonomous vehicles to move people or products and using cognitive systems to recommend a potential structure for an answer to an email, write texts or answer

customer questions are all examples that mark the autonomous stage (Gartner, 2015).

As enterprises continue the journey to becoming digital businesses, identifying and employing the right technologies at the right time will be critical.

Other expected trends in the field of using ICT, which can be found e.g. in (Gartner, 2014a; 2014b; 2014c) are:

- any function on any device, anywhere and anytime; BYOD (Bring Your Own Device – bring your own equipment to working environment);
- smarter things – as mobile robots, the IoT, the wireless device power, machine-to-machine communication services, mesh networks sensors, home health monitoring;
- Big data, global computing power at low prices – the world presented by almost endless analytical understanding, computational power and continuously and effectively improving cost of it, businesses can better understand their customers and effectively prevent fraud;
- human communication technologies – technologies, which communicate with people and vice versa by much more human, more natural;
- future of payment – no cash, all transactions are electronic, which helps companies to trace and increase efficiency of payments, and customers increase comfort and safety;
- 3D printing; cloud computing, process modeling, analysis of social networks, etc.

2. Research Problems Formulation

The requirements of the all school levels graduates' informational competences as well as the requirements of their creativity, their ability to solve problems, which don't have algorithmic methods for solving, are increasing in the knowledge economy environment.

It is obvious that support and development of information competences, skills and computer literacy of all users should be the main interest. It is obvious as well, that the system of education has to be customized according to these social requirements. The required state and the reality do not have to meet though. However despite growing interest and investment in the area of ICT, important gaps remain in the current knowledge base and abilities of all type ICT users (see e.g. OECD (2012), OECD (2013), Vešić (2013)).

That is why we focused on real ICT skills and knowledge of our students – future advanced users and managers in our research. The important queries of our questionnaire survey are:

- What is the students' knowledge base gained during their past education in the field of computer science/informatics?
- What are their ICT competences?
- How can they use their knowledge, skills and competences?

These are the questions we have been dealing with since academic year 2003/2004. Using a questionnaire administrated on first seminars of Informatics I Course we search for extent and content of compulsory education in the field of informatics/computer science and ICT at secondary schools. In close connection with result of questionnaire evaluation we investigate what are currently the competence requirements concerning the informatics and using ICT of non-professional in computer science?

Our effort is focused on designing a modern education system for future advanced users/managers at an area of "understanding and using business informatics and ICT". This means to provide education in accordance with practice demands, on current knowledge basis of our students – graduates of secondary schools.

3. Data Collection, Methods, and Results of Questionnaire Survey

We created the questionnaire entries based on current legislation, pedagogical documentation and standards, currently they are e.g. (ECDL Foundation, 2013), (National Institute for Education, 2012), (MINEDU, 2011). The aim was to compare results, developments and improvements in a longer time period. For this reason we did not modify the questionnaire entries during the research and we provided some formal modifications in a minimal possible way. Annually we have been monitoring the extent and the content of the education in the field of Informatics. On the first seminar of Informatics I Course in 90 minutes students answer questions focused on number of obligatory lessons and the content these lessons comprised. The questionnaire contains apart from the closed items also open items concerning information systems, type of IS, life cycle of IS, modeling and the work with them.

We also assess the students' abilities to use their knowledge and skills to specify users' requirements using analysis and evaluation of developed tasks at the end of the questionnaire. The students are asked to specify a requirement on simple IS (by text and graphically). The task is to build an IS in small rental (e.g. DVD), where we want to install new electronic IS based on modern ICT instead of "old-styled paper" one. Their formulation of user requirements should be understood by professional systems analysts and software engineers, who farther analyze these requirements and consequently design IS according to these requirements. In this task students have to demonstrate their ability to use informatics knowledge, ICT competences, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks.

We use methods of quantitative and qualitative analysis to assess these students' projects. To compare the level of ICT skills and information competences of secondary school graduates and development in the education system we present and compare evaluation of student responses from the year 2003 to 2014.

3.1 Characteristics of the Respondents

The sample of our research consists of all secondary school graduates, who entered first year at Faculty of Economics Technical University of Košice in years 2003-2014. We only have the possibility to influence and adjust parameters of informatics education for these students; we did not extent our research to the other faculties. Students in the studied sample are secondary school graduates from Eastern Slovakian Region in more than 95% of cases.

Basic information about the sample of respondents are as follows:

- total number of respondents over the presented period: 1,921 graduates of secondary schools, mainly from the region of Eastern Slovakia and Košice;
- Grammar school (GS) graduates: 1,669 students (87%);
- Business school (BS) graduates: 234 students (12%);
- Other school (OS) graduates: 18 students (1%).

Numbers of respondents in searched period and type of graduates' secondary school presents Tab. 1 in details.

Tab. 1: Number of respondents and types of secondary schools

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
GS	113	144	140	136	141	149	166	140	149	125	129	137
BS	32	25	17	18	20	16	11	22	9	17	22	25
OS	2	2	1	0	2	1	0	3	0	2	1	4
Total	147	171	158	154	163	166	177	165	158	144	152	166

Source: own

Within the first part of questionnaire we asked our students the question: How many obligatory informatics lessons did you get over at secondary school in particular school years? As we can see in the Fig. 1, despite the increasing importance of Informatics and ICT competences the number of lessons devoted to this subject in secondary schools is very low.

3.2 Results of Questionnaires Evaluation

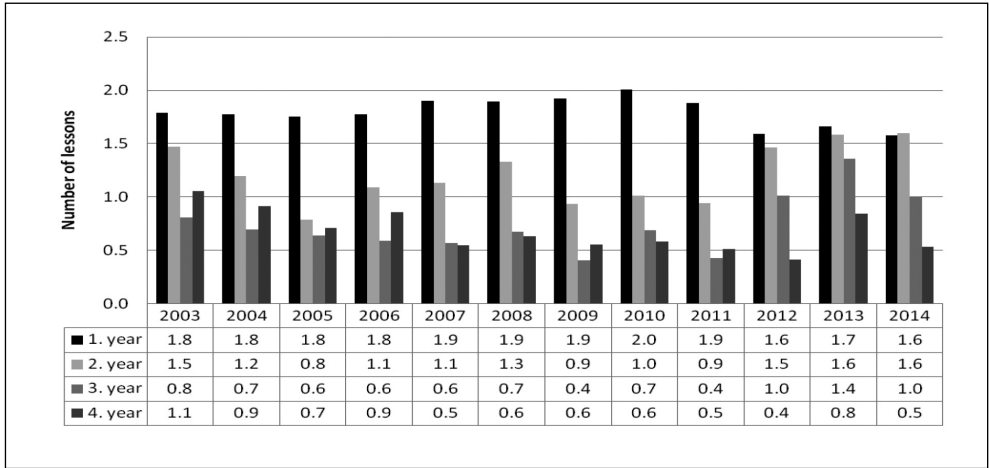
Current standard of European Computer Driving Licence version 5.0 (ECDL, 2013) and basic pedagogical documents were the base

for designing the part of the questionnaire concerned on finding out the level of students' informatics knowledge and competences. We focused on:

1. Basics of Informatics and ICT;
2. Working with computer and administration of files;
3. Text processing;
4. Spread sheet programs;
5. Usage of databases;
6. Presentation;
7. Web browsing and network communication.

Questions in this part of the questionnaire were formulated as following: Did you deal

Fig. 1: The average number of obligatory informatics lessons at secondary schools

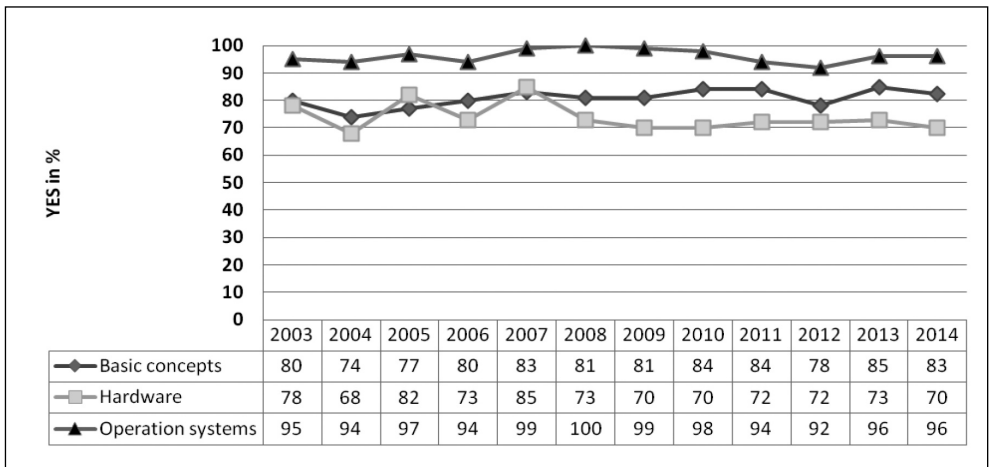


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or work with the next terms, programs and applications “ * ”? The sign * in the question means following terms/fields: informatics elementary concepts (data, information, history, etc.), hardware (computer and its components, von Neumann architecture, etc.), operation system. The respondents had an option to

choose only from answers “yes” or “no”. In the Fig. 2, 3 and 4 with tables we present results of this part of the questionnaire, shifts and advancement in students’ knowledge basis in monitored fields. We show an evaluation of the students’ answers expressed as a percentage number of response, “yes”.

Fig. 2: Comparison of achieved percentage of students who previously deal/worked with basic concepts, hardware and operation systems



Source: own

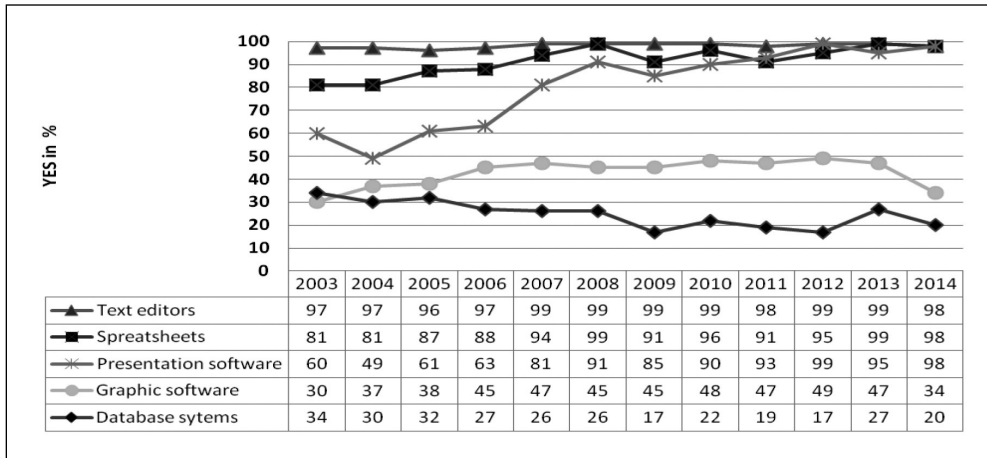
The situation in the field of basic concepts is changing only slightly, in spite of the fact that this field is a part of compulsory informatics curriculum. The surprising fact is that gradually fewer students are familiar with basic knowledge of computer hardware basics. As we expected the results in the field of understanding and working with operation systems have growing tendency.

Other areas of information competences we examined using similar tasks: "Did you deal with or work with next types of applications?" Students could answer following: text editor (MS Word, TEX, etc.), spread sheet program (MS Excel, Calc, etc.), software for presentation, graphic software and database system. Within

the Fig. 3 with the table we present achieved percentage of students who had some experience with the mentioned applications.

Graph in the Fig. 3 illustrates high ratio of students who worked with text editor at their secondary school. It also shows an increase in working with spread sheet programs. As we can see the ratio of students who worked with software designed to make presentation has grown significantly. On the other hand, the number of students who had the opportunity to meet with database systems is slightly decreasing. In all the mentioned fields according to our survey applications of The Microsoft dominate in education.

Fig. 3: Comparison of achieved percentage of students who worked with the text editor, spread sheet program, presentation and graphic software and database systems



Source: own

The ability to communicate via computer network also belongs to basic computer competences. In detail it means using internet services and understanding the basic rules of network communication, security issues. These are needed for solving the next problems and tasks in the questionnaire. As we can see in the Fig. 4, in the last years almost all secondary school students worked with and used internet services (email, www, ICQ, Skype, etc.), especially the application for web browsing. Despite that fact, it is surprising that the number of students who are familiar with basic rules of computer networking e.g. basic of topology,

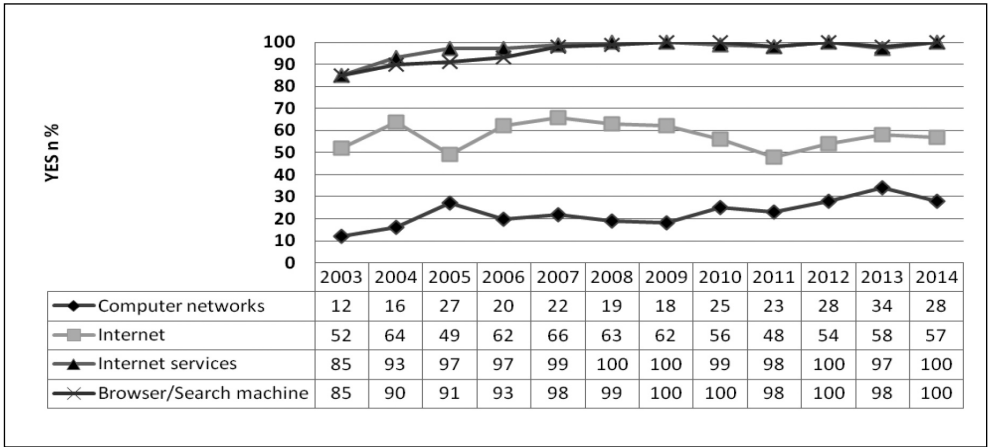
how the Internet works, internet protocols, is stagnating. We expected that the low number of students familiar with basic knowledge of computer networks and Internet would start to increase, because of significant expansion of the Internet. As we can see the results prove different.

The surprising facts are presented in the Fig. 5. In the last three years gradually fewer students are familiar with programming, algorithms, web page creation and coding.

In the next part of the questionnaire there was the question: "Have you met the following terms: information system, types of information

Fig. 4:

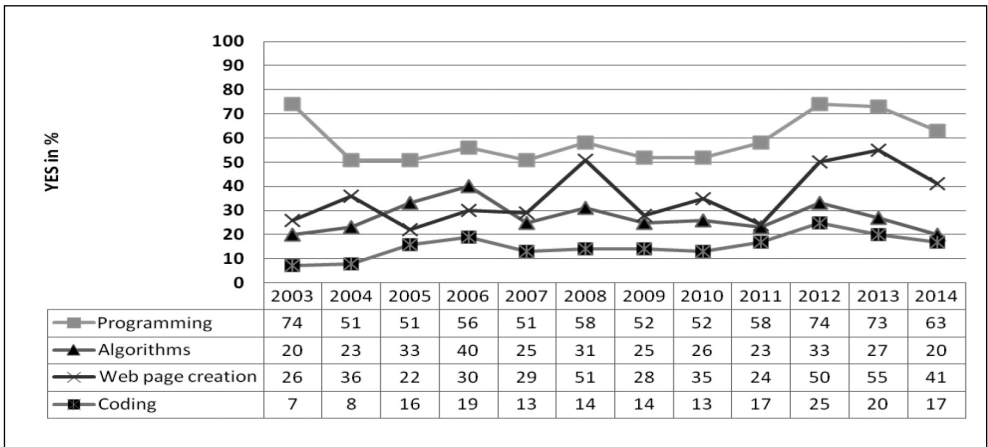
Comparison of achieved percentage of students who deal/worked with the terms in the field of computer networks, the Internet, internet services and browser/search machine



Source: own

Fig. 5:

Comparison of achieved percentage of students who deal/worked with the terms in the field of programming, algorithms, web page creation and coding



Source: own

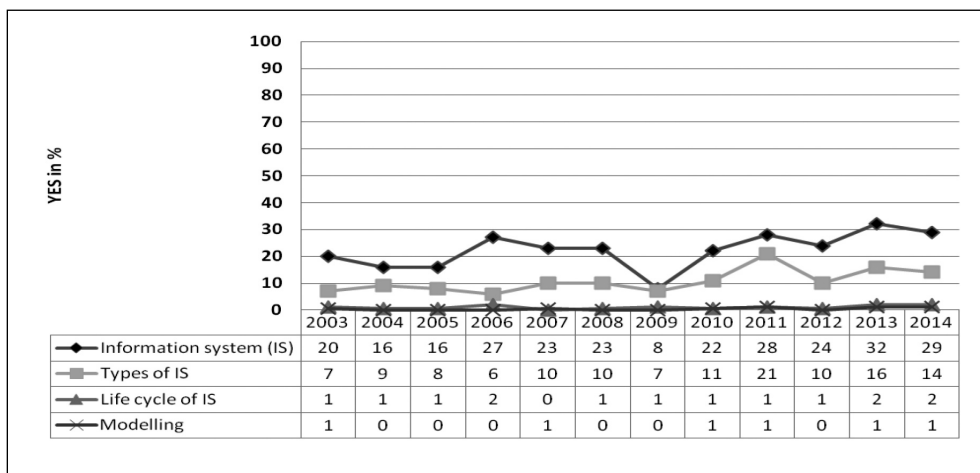
systems, life cycle of information system and modeling of information system on the informatics/computer science lessons? Fig. 6 with the table presents obtained results.

In the average less than 20% of the students have had experience with IS and recognize

the types of IS. Less than 1% specified dealing/working with modeling as a method of simplifying and recognition of real objects.

We also asked students to submit examples of information system from practical life with which they had met/worked so far. For the

Fig. 6: Comparison of achieved percentage of students who deal/worked with the terms in the field of IS, types of IS, life cycle of IS and modeling



Source: own

watched time period in average 70% of students were not able to provide any example of used information system.

3.3 The Real State of Higher Level Students' Information Competences

In the last part of the questionnaire we asked students to describe a simple example of using IS in practical life and to write user requirements. The task was: Define/describe user requirements for a simple information system in a DVD rental where we want to install new and effective electronic IS based on modern ICT instead of "old-styled paper" IS.

Solving this task as well as Problem solving in technology-rich environments OECD PIAAC (OECD, 2012) represents the intersection of what are sometimes described as "computer literacy" skills (i.e. the capacity to use ICT tools and applications) and the cognitive skills required to solve problems. The objective is not to test proficiency in the use of ICT tools and applications in isolation, but rather to assess the capacity of students to use these tools, their knowledge and information competences to access, process, evaluate and analyze information effectively in a goal-oriented way.

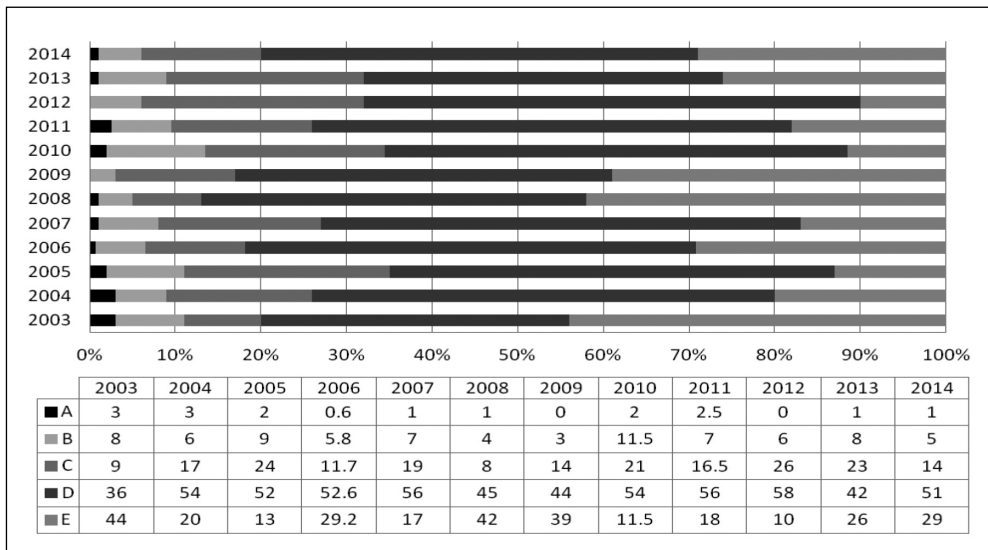
We divided the students' user requirement formulations – projects according to the quality into following five levels:

- **A** – acceptable, it was possible to recognize functions and requirements of IS, there were structure and hierarchy between requirements, there were some graphical expressions.
- **B** – mostly continuous text with effort to design database tables, content and scope was partly incomplete.
- **C** – extensive continuous text with typical lack of exactness, structure, relationships, extent from ½ sheets to 2 sheets.
- **D** – text in extent from few lines to ½ of sheet, totally unsatisfactory.
- **E** – no elaboration, most of these students said: "I don't know what to write."

The results of the evaluation of "user requirements" formulation projects are shown in the Fig. 7.

The provided graphs present shifts which occurred or did not occur during estimated time periods in particular fields – extent of informatics teaching at secondary schools, and content of secondary school informatics. As we can see nearly 100% respondents are familiar with working with text editor, operating systems, using internet services and search machines, spreadsheet program and software for presentation. Relatively high percentage of students was familiar with informatics elementary terms, basics of hardware and

Fig. 7: Percentage evaluation of the user requirements formulation



Source: own

architecture of computer, internet protocols programming languages. Also more than 20% of the students had already encountered with the term IS and more than 10% with IS typology. However when we look at the evaluation of user requirements at Fig. 7 only a small ratio of students was able to formulate in an acceptable way a simple IS assignment. Even level B showed inadequacies at solving these types of tasks. The other levels C, D and E cannot be considered acceptable.

We derived from the questionnaire evaluation that the education of Informatics at secondary schools is focused on handling with different packages of applications' programs. There is a lack of understanding of basic terms of modeling and IS, regardless of the fact, that students work with IS and modeling in some form "every day" in school and in the common life. Algorithmic approach, the using of knowledge for creating "something new" and interdisciplinary relations are often missing.

4. Essential Characteristics of Informatics Course New Design

In this section we will at first describe the reasons why we consider it important to educate users

and non-professionals in business informatics, especially in the field of information systems. Afterwards we will describe teaching methods created on the basis of assessment of the current knowledge state on secondary school students and modern trends.

4.1 Importance of Education in the Field of Business Informatics and IS

Why it is necessary to provide all students – future managers and advanced users with proper education in the field of business informatics, IS and ICT competences? The answer can be found in the following sources.

Information systems are a scientific discipline with a global reach that investigates a development, use, and impact of ICT (Bašl et al., 2011; Vymětal, 2009). Business Informatics as such constitutes a major scientific community within the IS discipline according to (Gála, Pour, & Šedivá, 2009; Heinrich & Riedl, 2013). In the articles of Voříšek, Pour and Buchalcevcová (2015) and Soltes and Gavurova (2014) we can furthermore read that the required qualification of users and IT practitioners should be developed systematically. Management of

business informatics has been in the spotlight of researchers and IT practitioners from all over the world for a number of decades. However, a rising complexity and heterogeneity of technological infrastructure and enterprise applications together with the growing possibilities of information service provision have contributed to a demanding management of business informatics. In particular, diverse options of IT service provision, i.e. apart from standard outsourcing of selected applications and services also various cloud computing models such as Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS), significantly increase the number of stakeholders and business relationships a company may have. Nowadays, company management expects an improved effectiveness and reduced costs associated with IT services provision forcing IT executives to seek better methods for business informatics management (Voříšek, Pour, & Buchalcevo^vá, 2015).

According to the findings in (Werber, Rajkovič, Urh, & Žnidaršič, 2015) in order to take full advantage of the existing technology current owners and managers of small and micro-enterprises are aware that they should increase the level of their computer skills and knowledge, stay informed about new trends, developments in the ICT and acquire technical and managerial competences needed to effectively manage the IS. Training in using of PC based end-user tools, and their use for data analyses may also help owners, managers and employees to gain self-confidence in using ICT, and better exploit the available technology.

As we can read in (Gála, Pour, & Šedivá, 2009), a current trend in business informatics is to strengthen the use of strategic applications i.e., enterprise applications that have a potential to deliver a competitive advantage. Such strategic applications include Business Intelligence, Competitive Intelligence, Customer Relationship Management, and various forms of electronic and mobile business applications.

4.2 New Design of Informatics II Course

Although computer science has been a regular subject in all levels of schools for a long time, there is still more and more discussion on how to teach computer science and what to teach: Should computer science education be oriented more towards its applications or more

towards its fundamentals or more towards its social effects? How can we cope with the rapid developments of computer science and ICT with respect to curriculum development? (Schwill, 1998)

Many new different learning environments, tools, communities and pedagogies, supported by ICT, are currently available for every single learner instead of textbooks, blackboards and classical classroom teaching. For students it is more motivating, if they have to solve practical problems, a variety of used media can support students' learning and provide a deeper understanding of the content and concepts.

As university teachers, as researchers and as participants of project teams we have found out that the knowledge and abilities of everybody must possess in order to work effectively and succeed in knowledge economy and have been dramatically redefined. We consider changes in economic environment, development in computer science, development in the area of business informatics, enterprise modeling, using simulation, and extensive application of new knowledge in all areas of life. We decided to modernize and innovate the informatics education at our faculty based on the following:

- Analysis and assessment of the real state of students' knowledge and their abilities. We consider it a very important step in determining the content and methods of our effective teaching.
- Studying programs and curricula of advanced foreign universities in the field of Informatics, business informatics and ICT integration.
- Collection/gathering of educational requirements from the practice, labor market, employers, development and using ICT and changes in the economic environment.

Based on studying the accessible sources of literature e.g. (Basl et al., 2011), (Bureš, 2007), (Dale, 1969), (Drucker, 2001), (Eckstein, Manns, & Voelter, 2001), (Hubweiser, Broy, & Brauer, 1997), (Schwill, 1998), (Strawman, 2004), (Voříšek, Pour, & Buchalcevo^vá, 2015) the latest knowledge and trends in the field of ICT mentioned above, implementation and integration of IS, published experience of experts from the area of development, contents of foreign universities curriculums, contents for educating experts in the field of "business informatics" and software engineering, our

own knowledge and skills we have decided for a concept of education in two parallel lines. The new structure of the Informatics II Course, used and adjusted during last ten years presents Tab. 2.

Firstly, considering big differences in ICT knowledge and skills of secondary school graduates oblige us to keep the classic procedure in teaching the Informatics subjects. In structure very similar to ECDL standard students can learn basic terms, how to work in text editor environment, spread sheets,

presentation software, database systems, and various web-services, which we consider vital for further correct understanding of possible work in business informatics.

The second, parallel line, where the business informatics and management of IS are the key themes, seems to be in the relation with modeling of the business processes. As a dominant method in this area we use problem-oriented project teaching, while we are using the functionality of LMS Moodle environment.

Tab. 2: New structure of the Informatics II Course

Informatics II Course – second term – 13 weeks					
First line – classical way of teaching - lectures and exercises					
MS Excel		MS Access		Test	
Second parallel line – teaching/learning with application new attitude					
The main aim is – Development of Project – User Requirements of Information System					
Face to face teaching, 3 lectures	Project proposal via Moodle	Project first draft via Moodle	e-learning, learning-by doing, providing feedback via Moodle	Project final version via Moodle	Evaluation Face to face at the exam

Source: own

All our students find themselves at a position of a manager of a virtual company – in the role of IT executive such as Chief Information Officer (CIO) in ensuring continuous development and innovation of both IT applications and IT infrastructure. At project of specifying users' requirements they have to think about how to differ from the others, what kind of innovations they should bring into the model of the main process of a chosen company. They have to have by the method of learning-by-doing get knowledge of IS and its management.

The recommended structure of the user requirements project consists of four parts. In the first one, a student specifies the core business process by text and a graphic model. On this basis they create requirements on the IS in the second part of the task. They describe the functionality of the project in the third part using UML – use case diagram and the basis for the data model is a proposal of classes and their attributes using UML class diagram. The last part is a proposal of tables of relation database in MS Access environment.

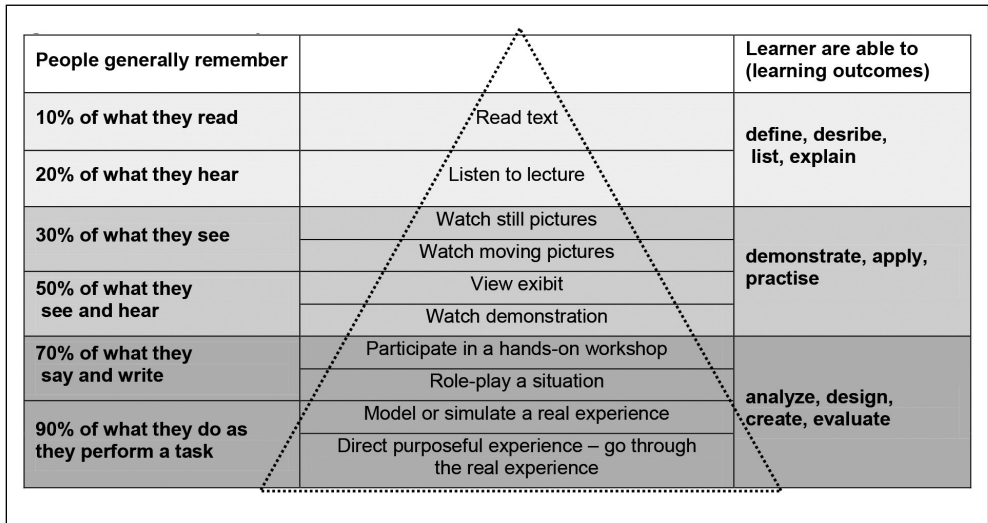
In our course preparation we came out from well known facts that are concisely described

by Fig. 8 – Dale's Cone of Experience (Dale, 1969). It is a model that incorporates several theories related to instructional design and learning processes and it is also a tool to help teachers and instructors make decisions about resources and activities.

Teachers/instructors should design instructional activities that build upon more real-life experiences. The most effective methods at the bottom, involves direct, purposeful learning experiences, such as hands-on or field experience. Today, this "learning by doing" has become known as "experiential learning" or "action learning".

The difficulty of the implemented problem-oriented project education is related to both (as we can read e.g. in (OECD, 2012)) the cognitive demands and complexity of the tasks, and the range and nature of the tools and applications that the student is required to use to arrive at a solution. This difficult problem solving tasks tended to involve transferring information from one application to another, and then transforming that information in addition to requiring the student to follow a relatively complex sequence of actions. Students have to demonstrate

Fig. 8: Dale's cone of experience



Source: Dale (1969)

sufficient familiarity with computers to use them to perform information-processing tasks and their ICT competences/skills in solving the problems commonly encountered in their roles as workers, citizens and consumers.

Conclusions

In the paper we presented new design of Informatics II Course based on evaluation of current students' knowledge base and level of their ICT competences. Those were evaluated based on annually realized questionnaire. Conclusions formulated in the previous sections are directly relevant for teaching realized on the Faculty of Economics, Technical University Kosice. In the process of questionnaire creation we drew from generally valid documents for secondary schools in Slovakia. In the sample of respondents there were mostly graduates from Eastern Slovakia Region therefore this allows us to assume that knowledge base and ICT competences on the other faculties especially in our region with non informatics focus would copy the described trends.

In order to prepare future managers with taking into account labor market requirements, students must be challenged with innovative tasks that focus on understanding and not only on memorization.

Benefits of better ICT skilled user and employee for all company and organizations can be observed in the following areas:

- Higher productivity and performance of the company/organization.
- Possibility of implementation new organizational forms, e.g. development of business nets, participation in supply chains.
- Increased added value of the product or services.
- Entry to new markets. Utilization of new business channels.
- New products or services, changing business processes.
- Responding to new business activities of competitors.

We developed an environment in which students solved a sequence of small assignments leading to one target task, which is similar to a programming (Schwill, 1998). Our experience shows that after taking the whole gradation of the assignments we had designed, students achieved better results when solving the target task. In spite of that, we believe that our approach gradually contributes to the development of systematic approach, logical and critical thinking and creativity.

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Abstract

DESIGNING MODERN INFORMATICS EDUCATION FOR FUTURE MANAGERS AND ADVANCED USERS ACCORDING TO THEIR KNOWLEDGE BASE**Libuša Révészová**

The main question we are dealing with is how to teach/educate the future managers – advanced users of business informatics, ICT and information systems. As a very important step in determining the content and method of teaching we consider an evaluation of the knowledge base of students who enter the first year at the Faculty of Economics Technical University of Košice. In the first seminar in subject called Informatics I students fill in questionnaires which are focused on their general knowledge of informatics/computer science and basic terms of IS. In the paper we present evaluation of our questionnaire survey in the period 2003-2014. Conclusions formulated in the paper are directly relevant for teaching realized on the Faculty of Economics, Technical University Kosice. In the process of questionnaire creation we drew from generally valid documents for secondary schools in Slovakia. In the sample of respondents there were mostly graduates from Eastern Slovakia Region therefore this allows us to assume that knowledge base and ICT competences on the other faculties especially in our region with non informatics focus would copy the described trends. We also present our innovative manner of informatics education based on modeling, simulation and on a well known opinion that “no kind of teaching can replace the personal experience”. As a dominant form we use problem-oriented project teaching. Students find themselves in a position of a manager of a virtual company, at project of specifying users’ requirements The paper deals with the experience in teaching, we present recommended structure of the user requirements project and we also discuss the body of knowledge and methods which have been implemented into the subject Informatics II. In the proposed innovative way of teaching we are trying to transform solving problem process into an active process of cognition.

Key Words: Education, informatics, ICT competences, student’s evaluation, business informatics.

JEL Classification: A20, I21, I23, O34.

DOI: 10.15240/tul/001/2016-4-013

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