Periodica Polytechnica Social and Management Sciences

23(2), pp. 73-83, 2015
DOI: 10.3311/PPso.7737

RESEARCH ARTICLE

Factors Influencing Innovation in Small and Medium Enterprises in the Czech Republic

Marek Ehrenberger[1], Petra Koudelková[1*], Wadim Strielkowski[1]

Received 29 September 2014; accepted after revision 20 November 2014

Abstract

Our paper is focused on the factors that influence innovation in small and medium enterprises (SMEs) in the Czech Republic. The country that went through long economic transformation that resulted in the set-up of the new improved standards for entrepreneurship activities is currently dealing with the aftermath of world's economic and financial crisis. With regard to all that, Czech SMEs are facing tough competition on domestic and EU markets. This is when innovations might become one of the key factors of success that can help to differentiate the product, beat the competition and attract more customers.

Our study is based on the empirical model that employs the data from the survey questionnaire with 1144 Czech SMEs. We find several forms of innovations (e.g. own R&D, investment into technology, improvement of quality of a product or service, or presence on foreign (EU and world) markets) can become very significant in enhancing the growth and success of Czech SMEs, while the bureaucratic barriers for innovations and external factors with negative impact did not come through as obstacles. Based on our results, one can state thatthe most important policy implications are for the relevant stakeholders would be the support of investment activities of SMEs, creation of SMEs clusters within business parks, education of employees, expansions of Czech exports to the new markets, and intensive support of R&D. It would also make sense to increase the number of small SMEs (sole-traders and micro-enterprises) by making the registration process easier, or by offering subsidies or government support to the new companies and start-ups.

Keywords

innovations, SMEs, economic transition, Czech Republic, economic crisis

[1] Faculty of Social Sciences, Charles University in Prague, Smetanovo nábř. 6, 110 01, Praha 1, Prague, Czech Republic

[*] Corresponding author, e-mail: strielkowski@fsv.cuni.cz

1 Introduction: SMEs and innovations

It is often stated that small and medium enterprises (SME) are though to be best suited to take advantage of opportunities on the market, as far as they posses the capacity to survive, grow and retain a competitive advantage (see e.g. Nooteboom, 1994; Shane and Venkataraman, 2000; Hayton, 2005; Felício et al., 2012; Klyver et al., 2012; or Mamyrbayev, 2014).

It is obvious that innovations play an indispensable role in everyday activities of today's society, spanning across all areas of our lives. They are especially important in technical and economic disciplines (see e.g. Csáfor, 2006). Whereas they represent a key to progress in the former one, they are an essence of success or failure for the latter one. Innovations became an important aspect of every business activity due to the fact that they can create a new space for potential specialization and future growth. In addition, they allow pushing up the boundaries. Today's globalized and interconnected world makes innovations a necessity rather than an option for firms which want to survive on the market and develop further. Thanks to their creative nature they embody positive benefits both for their inventor and their user. The inventor usually earns a reward in a form of money or respect. The user then gets a result with improved quality, availability, diversity or increased quantity of goods and services.

The question is whether small or large firms are better suited to bring the desired goals of growth, employment and competitiveness and whether innovation is something that can significantly improve chances of firms to achieve success. This paper argues that with respect to the innovative activity SMEs are capable of and well-suited for pursuing such desirable goals. The capacity alone is not enough to bring favorable results. Since they play a vital role in any national economy, this potential should be well developed and constantly nurtured by means of direct and indirect state support (Lacina and Vavřina, 2013).

Moreover, it is often stressed that social, cultural and institutional dimensions of entrepreneurship play an important role with country specifics setting boundaries for the innovation and growth (see e.g. Urbanová et al., 2013).

Edwards and Gordon (1984) define innovation as *"a process that begins with an invention, proceeds with the development of the invention, and results in the introduction of a new product, process or service to the marketplace"*. This definition looks at innovation as a rather technological perspective. The issue is that not every innovation begins with an invention. Many innovations take a form of an improvement. Quite often, innovations are based on the results of new technological developments, or the new combinations of existing technology, or the utilization of other knowledge acquired by other enterprises. Innovations may be developed by the innovating enterprise or by another enterprise. However, just trading innovations produced and developed by other enterprises cannot be included as an innovation activity. Innovations should be new to the enterprise concerned. For product innovations they do not necessarily have to be new to the market and for process innovations the enterprise does not necessarily have to be the first one to have introduced the process (see e.g. Koudelková and Svobodová, 2011).

This definition is quite relevant for our later analysis of innovations in the context of Czech SMEs at least in two main aspects. The first one is that it was used for recognition of innovations in a survey among firms, which is exactly what we have done as well. The second one is that it extends the first definition to innovations with nature other than technological. It also involves improvements and innovations regarding processes that take place within the firm. It thus better covers the areas of our survey and enables the firm to easily identify its innovative activities (see e.g. Kokodey, 2013).

It is also relevant to mention that many scientific papers take patents as representatives of innovations. This is not an appropriate simplification, as Kuznets (1962) suggests, because not all innovations are patented. On the other hand, he also puts forward a supportive argument for patents as a measure of innovations. Patenting not only means technical readiness of an invention, but also manifests entrepreneur's belief in economic profitability of it. Even very slight modifications of already proven concepts which differentiate a particular product from its competitors and thus let it stand out can cause a huge difference in the market although not being patented. On the contrary, there are many patents that remain unused or serve for specific purposes. The strategic purpose of patents can be explained on the example of patent medicine (Muragundi and Naik, 2014).

Current times have brought a climate of "patent cold war" in which companies, e.g. in hi-tech consumer electronics, regularly file lawsuits one against another stating that the counterpart has breached one of their patents, and these count sometimes even in thousands, which was demonstrated above. Such patents can hardly represent genuine innovative activities. We see that the relationship between innovations and patents is at least complicated and current trends do not suggest any improvement in the near future.

There are also various levels of innovation that categorize innovations according to the amount of novelty incorporated. The strongest one and also the least frequent is "The innovation established an entirely new category of product". Only the top star companies reach this breakthrough moment. The second-best category is "The innovation is the first of its type on the market in a product category already in existence". We can see these innovations for example in high-tech consumer electronics. The other two categories encompass innovations that build-up on an already established technology or product. They are also the most frequent ones, defined as "The innovation represents a significant improvement in existing technology" and "The innovation is a modest improvement designed to update an existing product". Drucker (1986) offers four basic categories, listed according their significance: breakthrough, complementary, additive, incremental. Their frequency of occurrence follows an inverse sequence, but none of those ought to be neglected in order to achieve constant move forward and keep up with trends. These categories should be taken only as an example of innovation classification because there are plenty of classification schemes, as Coccia (2006) points out.

Our paper studies the role of innovation as the main factor of growth and success in small and medium enterprises (SMEs) in the Czech Republic. We use the unique data from the field survey conducted with 1144 Czech SMEs from all regions of the Czech Republic in order to test our hypotheses using the econometric modelling. This paper is structured as follows: Section 2 provides a brief overview of SMEs in economic transition with a special focus on Czech SMEs and their development over time. Section 3 describes the data collection and reports on the profile and history of SMEs in our sample. Section 4 outlines the econometric model and reports its main findings. Finally, the last section summarizes and provides brief discussions and policy implications for the relevant policy-makers and stakeholders.

2 SMEs in the Czech Republic in economic transition

Even though the Czech Republic (and before that Czechoslovakia) has never been an SME economy as such, SMEs constitute its backbone both in microeconomic and macroeconomic realm (see e.g. Lendel and Varmus, 2013). Kočenda et al. (2004) notes that small firms in Czech transition were the main cause of low unemployment and accounted for the majority of newly created jobs. They conclude that the retained profit of small firms was a major determinant of new investments.

In order to provide an overview of the current state and the development of Czech SMEs since the EU accession in 2004, we present an overview of the structure of active economic subjects in the Czech Republic according to the employee categories (Table 1).

The numbers reported in Table 1 are not for all registered subjects (which are about twice as high but for all active entrepreneurial subjects due to the fact that these data are more

Table 1 Number of active economic subjects in the Czech Republic

				Categories according to the number of employees														
Year	**Total active subjects**	**Not specified**	**Without employees**	**< 5**	**< 9**	**< 19**	**< 24**	**< 49**	**< 99**	**< 199**	**< 249**	**< 499**	**< 999**	**< 1499**	**< 2999**	**< 3999**	**< 4999**	**>10000**
2005	1 266 336	277 271	733 249	169 922	28 137	26 129	6 356	12 015	7 211	3 394	639	1 163	540	119	19	33	8	29
2006	1 256 771	262 296	723 796	183 214	28 473	26 850	6 401	12 138	7 386	3 492	649	1 188	557	133	18	32	10	30
2007	1 224 863	302 601	647 818	185 007	29 346	27 267	6 579	12 393	7 473	3 545	691	1 227	579	142	21	31	13	27
2008	1 345 589	284 251	780 260	188 734	30 383	28 208	6 845	12 639	7 787	3 599	702	1 236	581	160	24	26	12	22
2009	1 346 185	253 963	817 540	183 855	30 316	27 903	6 433	12 454	7 519	3 477	662	1 188	523	163	23	27	14	31
2010	1 399 983	281 109	841 562	187 674	29 856	27 258	6 179	12 529	7 473	3 514	669	1 218	584	161	19	34	15	33
2011	1 461 201	319 639	862 087	191 302	29 064	26 686	5 991	12 664	7 421	3 506	621	1 242	612	166	21	29	19	35

Source: Czech Statistical Office (2011)

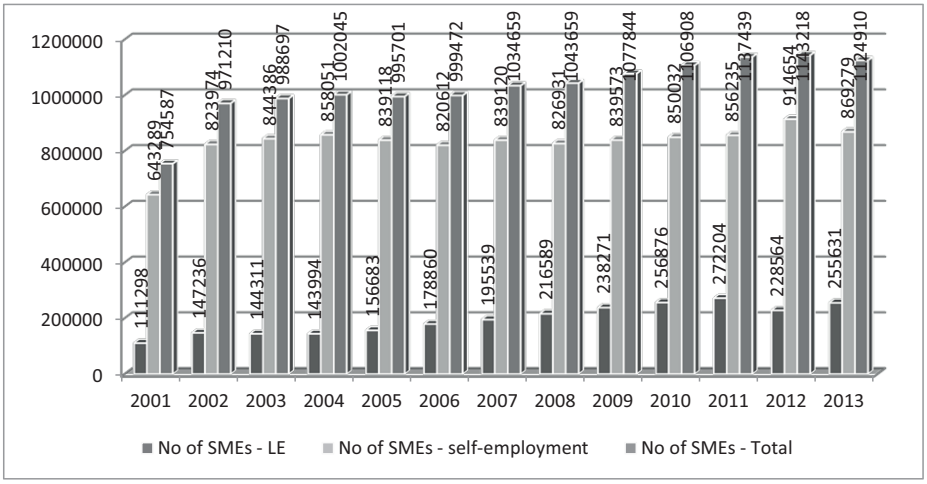

Fig. 1 Development of SME sector in the Czech Republic (2001-2013)
Note: LE stands for "large enterprises"; SMEs stands for "small and medium enterprises". Source: Own results

meaningful (Czech Statistical Office, 2007)). Active entrepreneurial subjects are classified according to the data obtained by statistical surveys, tax returns and payments for social insurance and thus give as least some lead of economic activity.

Figure 1 that follows provides a better overview on the state of SMEs in the Czech Republic and their development from 2001 until 2013.

The total number has been growing slightly, around 2.4% per year. Likewise, the birth and death rate of economic subjects, presented in Fig. 2, shows a relatively stable development.

Although it includes subjects of all sizes, we can assume, according to above mentioned proportionality that it represents mainly SMEs. The average birth rate between 2005 and 2011 was 110 101 subjects a year. The average death rate,

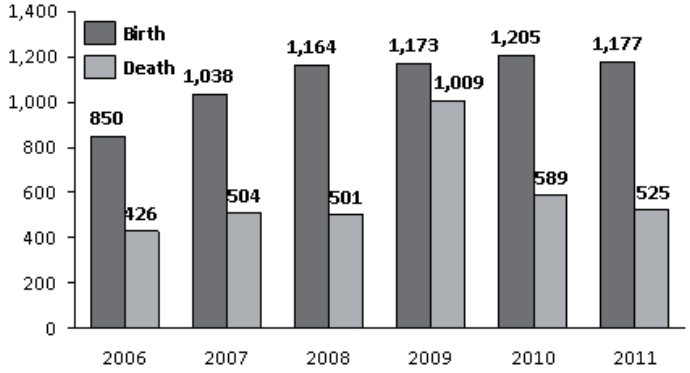

Fig. 2 Birth and death of economic subjects in the Czech Republic
Source: Authors' own results based on Czech Statistical Office (2011)

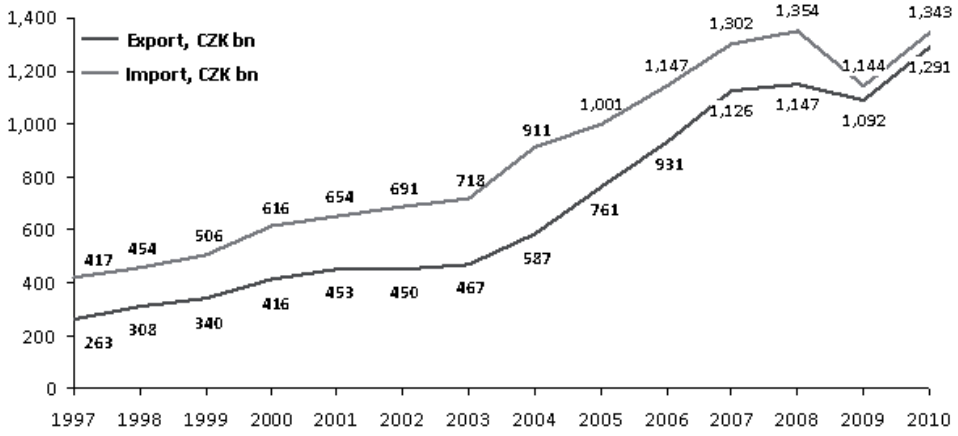

Fig. 3 Czech SMEs in international trade (1997-2010) Source: Own results based on Czech Statistical Office (2012)

influenced by a sharp increase in 2009, was 59 229. Without this peak year it is relatively stable 52,289. The increase in the death rate was caused by the economic crisis which caused the Czech GDP to decrease by 4.7% (Czech Statistical Office, 2012) and the unemployment to rise from 4.4% to 6.7%.

Czech SMEs provided employment for over 1.8 million people in 2010, a 60.88% share on total enterprises. Since 2007, when the number peaked at over 2 million, this is a 10% drop (Czech Statistical Office 2011). In 2009 and 2010 SMEs saw return of their revenues to 3.9 billion CZK and the total revenues were steadily growing since 2000 till 2008 when the economic crisis struck. The economic crisis and the recession brought a significant drop to all SMEs financial indicators.

One of the most important indicators of SMEs' economic activity is their role in international trade (see e.g. Arslan and Karan, 2009). It is good to know how SMEs are doing, especially in the context of the new export oriented strategy crafted by MIT (2012) which has increasing the number of exporters among SMEs by 50% as one of its priorities.

This strategy puts emphasis on exports to territories outside Europe, which means that SMEs will eventually be forced to compete globally. So far, their share on total Czech exports in 2010 was 51.3%, amounting to 1.29 billion CZK.

This number is steadily growing since 1997 (Fig. 3). The number has more than doubled between 2004 and 2001. The gap between exports and imports has been shrinking over time, from almost 35% to little above 4%. This is a clear sign that Czech SMEs are able to withstand competition on the foreign markets.

3 Data collection and analysis

In order to identify the determinants of innovations in Czech SMEs, we collected 1144 online questionnaires and obtained detailed firm-level data on firms' characteristics and innovations. Our complex dataset contains a wide range of indicators covering both SMEs' internal and external characteristics, such as a number of employees, structure of ownership, sources of innovations or their barriers, number of competitors, size of operated market and influence of the firm's environment on its actions. The outcomes thus bear valuable information about specific factors that may ultimately lead to innovations. Thanks to the extent of the dataset the right factors influencing innovative activities of firms can be identified and further evaluated in an econometric model.

The aim of our survey was to obtain as much reliable information from SMEs as possible. Two crucial problems emerge when trying to collect such data in reality. The first one is the difficulty to find someone who would be willing to provide such specific data; in case he actually had them. The second problem builds on the first one: even if a firm was willing to provide the data, it could be extremely difficult to extract them in sufficient quality, because no firm has a reason to spent resources on tracking specific aspects of innovations. This is especially true for SMEs, and so the questionnaire was designed to ask simple questions that can be answered quickly and without any research in firm's books.

Searching for contacts to firms was the first step towards having a sufficient amount of potential respondents of our online survey. The Magnus Web database (Čekia, 2011) was used to gain email addresses to approximately 49 thousand firms in employee categories from without employees to 200-249 employees.

The survey consisted of 21 questions and was designed with the help of a specialized online survey server. The questions in the survey were short and ready to be filled with just one click, making the answering process relatively easy and fast. The average time spent with answering our questions was around 11 minutes. Figure 4 shows the geographical distribution of the surveyed enterprises. Although the majority of them originated from Prague (25%), the rest were evenly distributed around the country.

Figure 5 reports the main areas of business of surveyed enterprises. The majority (20%) operated in manufacturing. This was followed by 17% and 16% of enterprises operating in construction and wholesale and trade respectively.

The majority of firms in the sample (48%) had less than 9 employees, 3% had in between 100 and 199 employees and 1% had between 200 and 299 employees. Figure 6 reports the turnovers in surveyed enterprises in the three consecutive years (2009-2011).

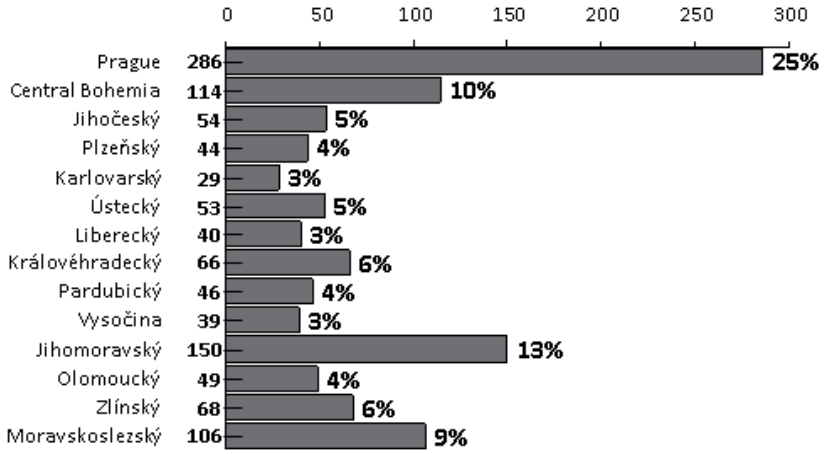

Fig. 4 Geographical distribution of surveyed enterprises (Source: Own results)

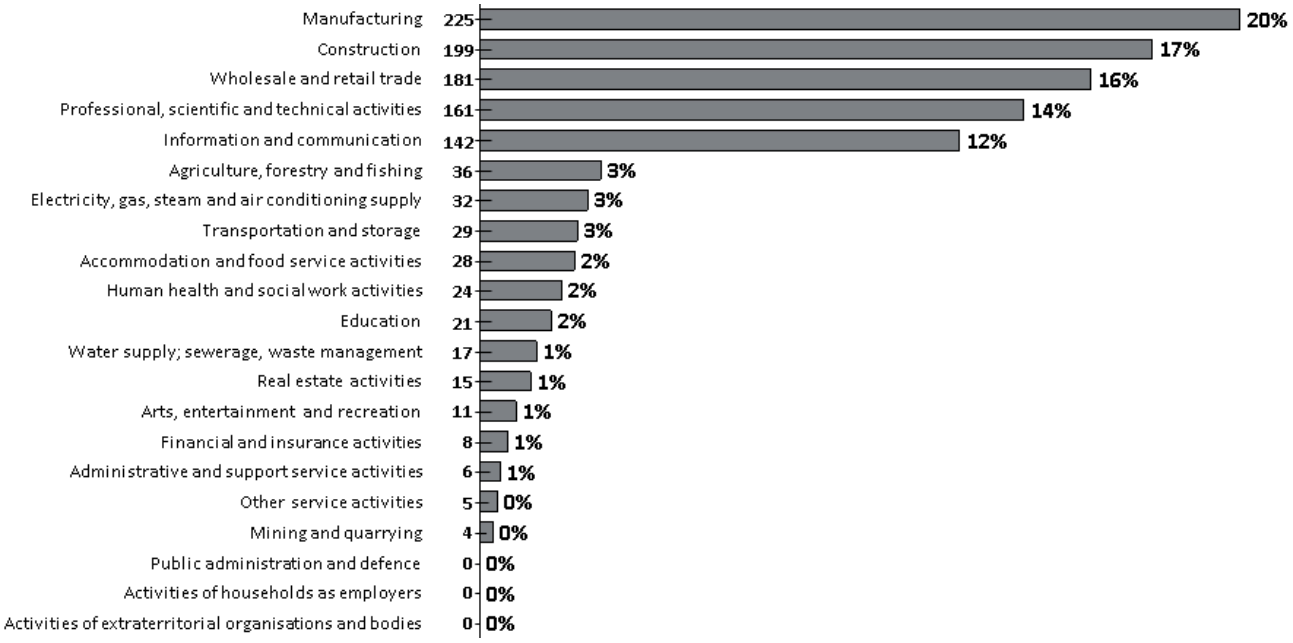

Fig. 5 Main areas of business of surveyed enterprises (Source: Own results)

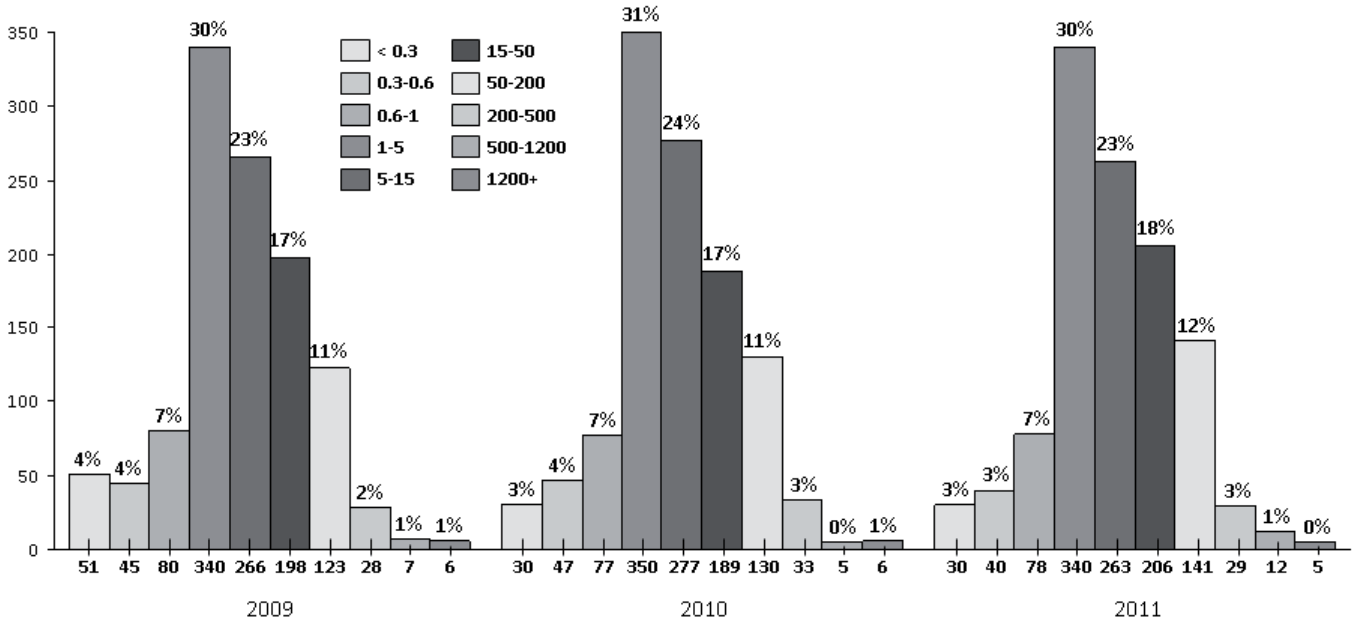

Fig. 6 Turnover of surveyed enterprises (2009-2011), millions CZK (Source: Own results)

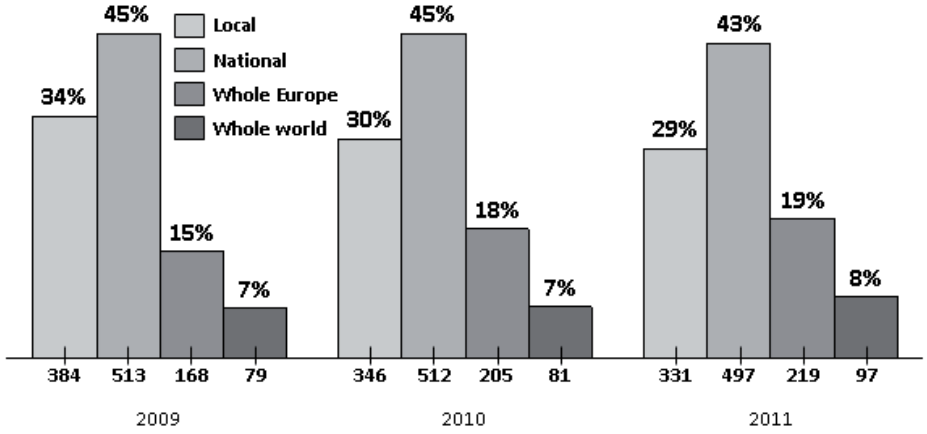

Fig. 7 Distribution of sales of surveyed enterprises (2009-2011) (Source: Own results)

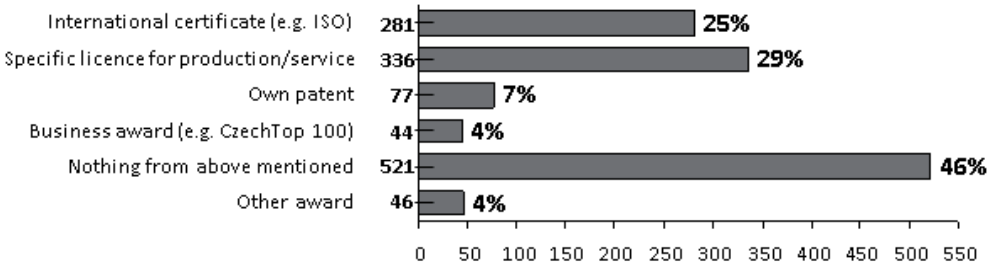

Fig. 8 Ownership of certificates, licenses, patents and awards (Source: Own results)

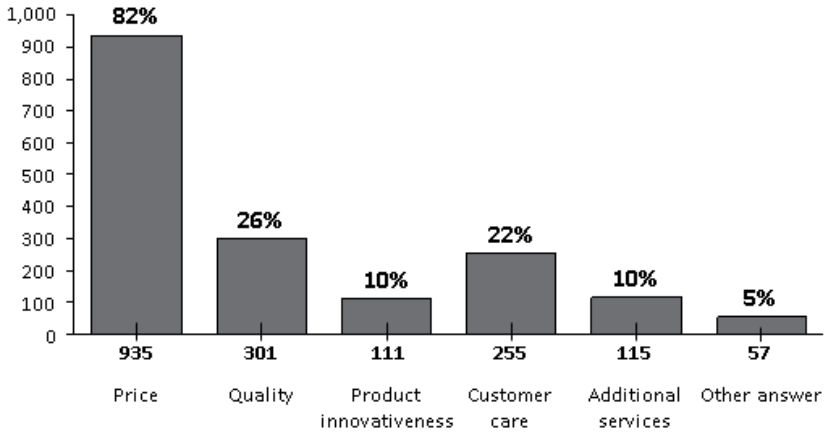

Fig. 9 Main areas of competition of surveyed enterprises
Source: Own results

Figure 7 depicts the dynamics of distribution of sales for surveyed enterprises in our sample with respect to local, national, EU and world markets in the three consecutive years. This information is of a special interest, since it reflects the link between innovations and sales spread.

Figure 8 reports licenses, patents or awards. Other answers included plenty of specific certificates, prizes, trademarks or industrial patterns. A few firms are in preparation phase for ISO certificate.

Some firms expressed their mixed or negative experience with ISO certificates. This may be caused by the fact that obtaining a certificate can a bureaucratic burden for a small firm or that it is of no use for the entrepreneur. Only a small number of firms belong to a cluster and 13% of them do not know whether they belong to such a structure.

The majority of firms compete in price (for the majority of firms (44%), there are between 5 and 25 main competitors in their area of business) (Fig. 9).

Many firms noted that there was often unreasonable pressure on price at the expense of quality. Proportion of firms competing in quality and product innovativeness also confirms that finding. However, competition in prices pushes margins down and inhibits so much needed investment into development of new and better products or services.

4 Empirical model construction and testing

The aim of our empirical model described in this section was to identify innovations as determinant of growth and success in selected Czech SMEs. After thorough evaluation of the theory behind innovations, intensive collection of a large amount of data and careful finalization of the dataset, we proceed to description of the model and later to its estimation. The linear econometric model used in our paper is a multivariate statistical model of the form:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} ... + \beta_k X_{ki} + \varepsilon_i \quad (1)$$

where Y_i is the dependent variable defined as the measure of innovations in an SME (number of patents, licences, certificates), and $X_{1,i},\ldots, X_{1,i}$ are the explanatory variables and $\boldsymbol{\varepsilon}_i$ is the error term.

In a multiple linear regression model there are k variables and $k + 1$ regressors (one can regard β_0 as a parameter attached to the variable X_0 which assumes a constant value of "1"). It is implied that the variation in Y is systematically explained by the part of Y that is represented as (x' β) and that the part of Y not explained by it is represented by ε (Fabozzi et al., 2014). The assumptions of the multivariate model are the following (Pindyck and Rubinfeld, 1991): (i) The x_i are stochastic variables whose values are fixed; (ii) No two or more than two of the x_i variables are perfect linear combinations of one another; (iii) The disturbances $\boldsymbol{\varepsilon}_i$ have an identical normal distribution with mean $E(\boldsymbol{\varepsilon}_i) = 0$ and variance $E(\varepsilon_i^2) = \sigma^2$ and, among them, zero covariances.

In the standard case $\boldsymbol{\varepsilon}_i$ is assumed to be independent and identically distributed over individuals and time with zero mean and variance σ_ε^2. If the β_i are treated as N fixed unknown parameters, the model presented above becomes the "fixed effects model".

An alternative approach assumes that the intercepts of the individuals are different but that they can be treated as drawings from a distribution with mean μ and variance σ_ε^2.

In our case, due to the specifics of the research and the properties of the collected data, the use of one-way error model expressed either by the fixed effects (*FE*) model or the random effect (RE) model is justified. The error term in this model consists of two components: a time-invariant component α_i and a remainder component that is assumed to be uncorrelated over time. To account for the problem of individual location effects in the econometric model, location variables (location dummies) are to be used (see e.g. Lógó, 2007). Due to the fact that we are using exogenous variables (*X's*), *m* objective variables (*Z's*) and *l* subjective variables (*W's*), and if *r* is the number of locations of the *i*th SME, and $i_1, i_2, \ldots, i_r$ are these locations, then most fully unrestricted model can be presented in the following form:

$$\begin{aligned} Y_{ri} = &\sum_{p=1}^{r} \sum_{j=1}^{k} \beta_{ji_P} X_{ji_P} + \sum_{p=1}^{r} \sum_{j=k+1}^{k+m} \beta_{ji_P} Z_{ji_P} \\ &+ \sum_{p=1}^{r} \sum_{j=k+m+1}^{k+m+l} \beta_{ji_P} W_{ji_P} + u_{rc} + e_{ri}, \end{aligned} \quad (2)$$

where X_{ji_P}, Z_{ji_P}, and W_{ji_P} are the th truly exogenous, objective, and subjective variables for the $Z_{ji_P} i_P$ location of the *i* SME, respectively, $\beta's$ are the corresponding coefficients, and e_{ri} is the error term, that is the sum of the error terms $e_{i_1}, e_{i_2}, \ldots, e_{i_r}$.

The community level errors in each province are given by u_{rc}. The Breusch and Pagan tests are run in order to test the null hypothesis that these are equal to zero. In addition, the general model (without regional interactions) can be used here for the estimation of the effects of innovations (Y_i):

$$\begin{aligned} Y_i = &\beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_k X_{ki} + \beta_{k+1} Z_{1i} + \beta_{k+2} Z_{2i} + \ldots \\ &+ \beta_{k+m} Z_{mi} + \beta_{k+m+1} W_{1i} + \beta_{k+m+2} W_{2i} + \ldots + \beta_{k+m+l} W_{li} + u_c + e_i, \end{aligned} \quad (3)$$

Or, in shortened form, Eq. (3) can be written as follows:

$$Y_i = \sum_{j=1}^{k} \beta_j X_{ji} + \sum_{j=k+1}^{k+m} \beta_j Z_{ji} + \sum_{j=k+m+1}^{k+m+l} \beta_j W_{ji} + u_c + e_i, \quad (4)$$

The results of our estimations are conditional on a set of specification and diagnostic tests. First, heteroscedasticity test was run and heteroscedasticity was detected. Therefore, robust standard errors (RSE) were used in three out of four cases. Robust standard errors is an econometric technique that allows the researchers to rule out the heteroskedasticity which invalidates statistical tests of significance that are based on the assumption that the modelling errors are uncorrelated and normally distributed, and that their variances do not vary with the effects being modelled (Verbeek, 2008).

Number of innovations according to categories was selected naturally as explained dependent variable. Dependent variables for the final model have been carefully chosen during the process of crafting a solid model reliably identifying the key determinants of innovations. Just eight observations had to be taken out of the model, because they did not contain information on number of innovations the firm has achieved.

Overall, four models (innovation model, ownership model and impact factor model with robust standard errors and barriers model using OLS) were estimated using Gretl statistical software. They used 1136 observations, consisting of seventeen variables, three of which were categories, and the rest were defined as binary variables. Each model has the same list of "core" variables but differed in the additional binary variables that coded for instance the existence of barriers to business, the structure of ownership, or the impact of the external factors such as competition, or the rule of law (hence the names of the models such as "innovative", or "barriers" model).

Table 2 Complete results for model estimations

	Innovation model	Barriers model	Ownership model	Impact factors model
	RSE	OLS	RSE	RSE
Small enterprise	0.1659***	0.1523**	0.1598 ***	0.1673***
	(0.0596)	(0.061)	(0.0596)	(0.0599)
Medium enterprise	0.237**	0.230**	0.2459**	0.2443**
	(0.1013)	(0.1023)	(0.1012)	(0.1029)
Turnover in 2011	0.0873***	0.0838***	0.0922***	0.08903***
	(0.0311)	(0.0306)	(0.032)	(0.0312)
Cluster	0.2103*	0.2056*	0.2085*	0.208*
	(0.1113)	(0.1115)	(0.1127)	(0.1115)
Equipment age	-0.0583**	-0.0597**	-0.0585**	-0.0613**
	(0.0282)	(0.0284)	(0.0285)	(0.0285)
Competitors	0.0417**	0.0380**	0.043**	0.0412**
	(0.017)	(0.0173)	(0.0172)	(0.0171)
New technologies	0.195795***	0.2003***	0.1936***	0.198***
	(0.0511415)	(0.0519)	(0.051)	(0.052)
Diversification	0.1707**	0.1706**	0.1745**	0.1746**
	(0.0711)	(0.0715)	(0.0726)	(0.071)
Quality	0.2247***	0.2201***	0.2211***	0.2211***
	(0.0484)	(0.0490)	(0.0487)	(0.0487)
Marketing	0.1864***	0.1866***	0.1925***	0.1857***
	(0.0626)	(0.0626)	(0.0620)	(0.0626)
Education	0.1195**	0.1154**	0.1206**	0.1202**
	(0.0544)	(0.0557)	(0.0543)	(0.0557)
Optimization	0.1868***	0.1877***	0.1918***	0.1875***
	(0.0562)	(0.0559)	(0.056)	(0.0566)
Customers	0.1689***	0.1725***	0.1632***	0.1672***
	(0.04912)	(0.0492)	(0.0491)	(0.049)
Own R&D	0.420***	0.4126***	0.4211***	0.420***
	(0.0592)	(0.0599)	(0.0596)	(0.0598)
Market barriers	-0.1064**	-0.1001**	-0.1007**	-0.103**
	(0.0471)	(0.0481)	(0.0471)	(0.047)
Scientific cooperation	-0.1402**	-0.150010*	-0.1529**	-0.1464**
	(0.0692)	(0.0779)	(0.071)	(0.0703)
Limited company	0.1474*	0.1441	0.1538*	0.1377
	(0.0891)	(0.090)	(0.0909)	(0.0904)
Financial sources		0.227		
		(0.0596)		
Regulation		-0.0724		
		(0.0597)		
Rule of law		-0.0724		0.027
		(0.0597)		(0.136)
Qualified workforce		0.0166		
		(0.0578)		
Support of state		0.0711		
		(0.0536)		
Ownership			0.123	
			(0.101)	
Competition				0.0502
				(0.101)
Constant	1.47266***	1.4918***	1.435***	1.48087***
	(0.1592)	(0.1570)	(0.1629)	(0.1634)
Observations		1136		
R-squared	0.47	0.46	0.46	0.45

Note: RSE stands for „robust standard errors", and OLS stands for "ordinary least squares". Source: Own results

Table 2 depicted above reports the results of all four models in question. We check the value and the sign of the coefficients, as well as the significance of the coefficients to make predictions of their impact on the innovations in SMEs (dependent variable).

Overall, it appears from our analysis that enterprises classified as small or medium ones tend to be more innovative than micro enterprises. This can be explained by their relative abundance of financial and human resources. Some of them can be specifically devoted to developing new products or service, while micro enterprises (often represented by sole traders) do not have this option.

Moreover, it becomes apparent that larger target markets induce more innovations. This relationship could be also viewed from the other direction, namely that innovation causes the firm to expand territorially. These two links cannot be simply separated because they occur simultaneously. Innovations enable the firm to compete internationally and at the same time international market puts more pressure on innovativeness of the offered good.

Quite surprisingly, in the case of Czech SMEs, licenses did not come through as significant determinant of innovation. This might be explained by their diversity and real impact on firms. This finding supports the argument that patents may not be a good representation of innovations which was discussed in Section 3. On the other hand, belonging to the cluster plays a positive role (which is in accord to similar findings from other countries – see e.g. Van Zyl and Mathur-Helm, 2007; Navickas and Malakauskaite 2010; Hovelja et al., 2010; Stephens and Onofrei 2012; or Conway 2012). Small firms in the clusters dominated over those that were not aware of the advantages that clusters provide, especially in terms of synergy.

Our findings show that increasing age of equipment is negatively related to innovations. This is quite understandable, as far as the newer equipment allows more innovative usage and implementation. On the contrary, competition had a positive effect (especially higher competition categories). It might be that more competitive environment forces firms to innovate more. However, a top innovative firm with a unique business proposition can have very few competitors. There are also firms that specialize on serving the public sector and if selected in often dubious public procurements, these firms no longer have motivation for improvements in the absence of any competitors.

A number of investing activities of firms show significant impact on innovations. Investments into technologies and quality show a strong impact, also when compared to other variables. Although investment is just a precondition to a potential discovery and its successful realization, it is a necessary step towards achieving innovation. Unfortunately, our survey revealed that many firms could not afford to invest because their main concern was survival on the market. This creates a vicious circle because without investment innovations have a harder way to come and nobody can expect high profits for mediocre goods or services.

By far and large, the greatest determinant of innovations is own R&D which was indicated as a main source of innovations by 31% of firms. Although own R&D facilities may be a costly investment, it is definitely worth to have it. It is important to emphasize that not only medium firms exploit its benefits. About 30% of micro and small enterprises engage in this activity, followed by 41% of medium enterprises. Customers also represent an important source of innovations. This stems from the fact that they may come to the firm with new and more difficult requests and thus motivate it to higher originality.

On the other hand, barriers to innovation did not prove to constitute a real obstacle for innovations to a large extent, although two actual barriers emerged nevertheless. Market barriers, e.g. competition or insufficient demand, and cooperation with scientific institutions thus had a negative effect on those firms who encounter them. The legal form of the enterprise is also a factor crucial for innovations, as far as limited companies tend to innovate more than the other legal forms. This finding generally means that the limited company is the right form of enterprise for Czech SMEs nowadays.

5 Conclusions and policy implications

Our paper provides an overview of innovations as the factors of growth and success in Czech small and medium enterprises. Our results take into account the recent development of Czech SMEs in the times of economic crisis. Results based on ore empirical analysis tend to be valid for reasonable understanding of firms on a sectorial or regional level. However, when it comes to the micro level of individual firms, it turns out that every case is unique and no common inference can be easily drawn.

It appears that the majority of the factors leading to innovations can be influenced by the firm itself, it is therefore desirable for the SME to focus on these factors. At first glance, some of them may look unsuitable for a particular SME, probably because the terms are used mainly in different context, i.e. R&D for non-technical SMEs providing services However, it is important for every firm to translate these variables into its own language and find ways how to exploit the available opportunities.

One of the crucial factors for innovations proved to be the legal form of the enterprise which translates that limited companies tend to innovate more than other legal forms. There are two possible explanations to this: First, limited companies are often represented by sole-traders (one-person firms) and micro-enterprises that seek to establish a strong position on the market. These small companies tend to innovate and invest into new technologies and processes in order to beat the competition. Second, small companies are less cumbersome and more creative than large enterprises and can spend less time dealing with tax forms and employment and health ensurance agenda, and more time innovating their products or services.

What might mean a new factory for one SME might be a better software in case of another enterprise. Investments of

different kinds have proven to work and deliver innovations. Firms should always search for ways how to invest, even if it will not be large sums of capital. Even optimization of processes within the SME will be a good step forwards. Firms should not put too much weight on barriers or external environment as these have not emerged as real inhibitors to innovations.

From our analysis, it becomes apparent that the Czech government should focus on specific aspects of support for SMEs in the areas, where its guiding hand is really needed. In the Czech context, it might be the support of investment activities of SMEs, education of employees, expansions of Czech exports to the new markets and intensive support of R&D in firms that are the right subjects for that. Those firms have the potential to bring fruits in the future in the forms of productive innovations. General governmental support should create a progressive environment which would enable micro enterprises to grow faster to become small and medium enterprises that tend to be more innovative.

As for the implications and suggestions for further research, it would be interesting to measure the impact of the use of ICT and e-commerce on the innovation and success of SMEs. The wide use of Internet in reaching the potential customers and selling the products and services across national borders and thus expanding the firms' markets, is becoming crucial nowadays. It might be interesting to see whether more ICT-knowledgeable companies tend to be more innovative. In addition, it might be interesting to see whether more innovation lead to more success (which might be measured by the profit per employee, or the net annual profit). With regard to these two alleys of future research suggested above, it would also be interesting to make an international comparison of SMEs from different countries or regions (e.g. SMEs from Visegrad countries, or SMEs from Eastern, Western and Southern Europe) due to the location-specific effects and possible country differences embedded in the structure of economy (e.g. in South Europe, SMEs constitute up to the 70% of all enterprises). Finally, it seems interesting and timely to make a cross-country comparison of SMEs in the EU in order to determine the factors of competitiveness and to make suggestions that might be relevant for European policies of supporting small and medium enterprises in the long horizon.

References

Arslan, O., Karan, M. B. (2009) Credit risks and internationalization of SMEs. *Journal of Business Economics and Management*. 10 (4). pp. 361-368. DOI: 10.3846/1611-1699.2009.10.361-368

CEKIA (2011) Magnus Web Database. [online] Available from: <www.magnus.cz/cz/magnusweb> [Accessed: 20th July 2014].

Coccia, M. (2006) Classifications of Innovations: Survey and Future Directions. [online] Consiglio Nazionale delle Ricerche. Available from: <http://www.ceris.cnr.it/ceris/workingpaper/2006/WP_2_06_COCCIA_NEW.pdf> [Accessed: 15th July 2014].

Conway, C. (2012) Supporting business start-ups through incubator and business support. *The International Journal of Entrepreneurship and Innovation*. 13 (4). pp. 311-311. DOI: 10.5367/ijei.2012.0099

Csáfor, H. (2006) Corporate social responsibility in the Countries of the Carpathian Euroregion. *Periodica Polytechnica Social and Management Sciences*. 14 (2). pp. 45-52. DOI: 10.3311/pp.so.2006-2.01

Czech Statistical Office (2007) Male a stredni podniky (jejich misto a role v ceske ekonomice. Available from: www.czso.cz/csu/csu.nsf/informace/ckta090307.doc [Accessed: 20th July 2014] (in Czech).

Czech Statistical Office (2011) Charakteristika vyberoveho a zakladniho souboru zpravodajskych jednotek. Available from: www.czso.cz/csu [Accessed: 6th December 2012] (in Czech).

Czech Statistical Office (2012) Ekonomicke subjekty podle poctu zamestnancu a kraju. Available from: http://vdb.czso.cz [Accessed: 24th April 2012] (in Czech).

Dodd, S. D., Anderson, A. R. (2007) Mumpsimus and the mything of the individual entrepreneur. *International Small Business Journal*. 25 (4). pp. 341-360. DOI: 10.1177/0266242607078561

Drucker, P. F. (1986) *Innovation and Entrepreneurship: Practice and Principles*. New York: Harper & Row.

Dubini, P. (1988) The Inuence of Motivations and Environment on Business Start Ups: Some Hints for Public Policies. *Journal of Business Venturing*. 4 (1). pp. 11-26. DOI: 10.1016/0883-9026(89)90031-1

Earle, J., Frydman, R., Rapaczynski, A., Turkewitz, J. (1994) *Small Privatization: The Transformation of Retail Trade and Consumer Services in the Czech Republic, Hungary, and Poland.* Budapest: Central European University Press.

Edwards, K. L., Gordon, T. J. (1984) Characterization of Innovations Introduced on the US Market in 1982: Final Report.

Fabozzi, F. J., Focardi, S. M., Rachev, S. T., Arshanapalli, B. G. (2014) Building and Testing a Multiple Linear Regression Model. *The Basics of Financial Econometrics: Tools, Concepts, and Asset Management Applications*. pp. 81-102. DOI: 10.1002/9781118856406.ch4

Feldman, M. P., Audretsch, D. B. (1999) Innovation in Cities: Science-based Diversity, Specialization and Localized Competition. *European Economic Review*. 43 (2). pp. 409-429.

Felício, J.A., Couto, E., Caiado, J. (2012) Human capital and social capital in entrepreneurs and managers of small and medium enterprises. *Journal of Business Economics and Management*. 13 (3). pp. 395-420. DOI: 10.3846/16111699.2011.620139

Hanousek, J., Kočenda, E. (2004) *Tale of the Czech Transition: Understanding the Challenges Ahead*. Prague: Charles University in Prague, CERGE and the Economics Institute of The Academy of Sciences of the Czech Republic.

Hayton, J. C. (2005) Promoting corporate entrepreneurship through human resource management practices: a review of empirical research. *Human Resource Management Review.* 15. pp. 21-41. DOI: 10.1016/j.hrmr.2005.01.003

Hovelja, T., Rožanec, A., Rupnik, R. (2010) Measuring the success of the strategic information systems planning in enterprises in Slovenia. Management. *Journal of Contemporary Management*. 15 (2). pp. 25-46.

Hughes, A. (1992) *The Problem of Finance for Smaller Businesses*. Working Paper No. 15. Small Business Research Centre. University of Cambridge

Klyver, K., Hunter, E., Watne, T. (2012) Entrepreneurial ties and innovativeness in the start-up decision. *The International Journal of Entrepreneurship and Innovation*. 13 (3). pp. 153-163. DOI: 10.5367/ijei.2012.0084

Kokodey, T. A. (2013) A Three-Dimensional Matrix Model for Determining the Optimal Strategic Choice for a Company. *Periodica Polytechnica Social and Management Sciences*. 21 (2). pp. 59-65. DOI: 10.3311/PPso.7089

Koudelková, P., Svobodová, A. (2011) Přístupy k řízení inovací ve středních a velkých podnicích. *Trendy ekonomiky a managementu.* 5 (9). pp. 84-89. (in Czech).

Lacina, L., Vavřina, J. (2013) The impact of financial and economic crisis on SME's in Greece and Ireland. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*. 61 (4). pp. 1005-1016. DOI: 10.11118/actaun201361041005

Lendel, V., Varmus, M. (2013) The level of utilization of innovative activities of transport businesses in the Slovak Republic. *Periodica Polytechnica Social and Management Sciences*. 21 (2). pp. 83-90. DOI: 10.3311/PPso.7090

Lógó, E. (2007) Usability test with non-conventional goals-success and expenditure indicators. *Periodica Polytechnica Social and Management Sciences*. 17 (2). pp. 67-72. DOI: 10.3311/pp.so.2009-2.02

Mamyrbayev, A. (2014) Competetivness and Development of Kazakhstani SMEs. *Periodica Polytechnica Social and Management Sciences*. 22 (1). pp. 57-64. DOI: 10.3311/PPso.7214

Muragundi, P. M., Naik, A. N. (2014) Patent or patient? The challenges in pricing policy of patent medicine. *The Pharma Review*. 1. pp. 46-48.

MIT CZ (2010) Zpráva o vývoji malého a středního podnikání a jeho podpoření v roce 2010. Available from: http://download.mpo.cz [Accessed: 20th July 2014] (in Czech).

MIT CZ (2012a) Exportni Strategie CR 2012-2020. Available from: http://www.mpo.cz [Accessed: 20th July 2014] (in Czech).

Navickas, V., Malakauskaite, A. (2010) The impact of clusterization on the development of small and medium-sized enterprise (SME) sector. *Journal of Business Economics and Management.* 10 (3). pp. 255-259. DOI: 10.3846/1611-1699.2009.10.255-259

Nooteboom, B. (1994) Innovation and diffusion in small firms: theory and evidence. *Small Business Economics*. 6 (5). pp. 327-347. DOI: 10.1007/bf01065137

Pindyck, R., Rubinfeld, D. (1991) *Econometric models and Economic forecasts*. London: McGraw-Hill.

Shane, S., Venkataraman, S. (2000) The promise of entrepreneurship as a field of research. *Academy of Management Review*. 25 (1). pp. 217-226. DOI: 10.1007/3-540-48543-0_8

Sorensen, M. (2007) How Smart Is Smart Money? A Two-Sided Matching Model of Venture Capital. *The Journal of Finance*. 62 (6). pp. 2725-2762. DOI: 10.1111/j.1540-6261.2007.01291.x

Stephens, S., Onofrei, G. (2012) Measuring business incubation outcomes. An Irish case study. *The International Journal of Entrepreneurship and Innovation*. 13 (4). pp. 277-285. DOI: 10.5367/ijei.2012.0094

Storey, D. (1994) *Understanding the Small Business Sector*. London: Routledge.

Thornton, P., Ribeiro, D., Urbano, D. (2011) Socio-Cultural Factors and Entrepreneurial Activity: An Overview. *International Small Business Journal.* 29 (2). pp. 105-118. DOI: 10.1177/0266242610391930

Urbanová, M., Dundelová, J., Dvořáková, D. (2013) Values and Entrepreneurship. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*. 61 (4). pp. 1175-1181.

Van Zyl, H. J., Mathur-Helm, B. (2007) Exploring a conceptual model, based on the combined effects of entrepreneurial leadership, market orientation and relationship marketing orientation on South Africa's small tourism business performance. *South African Journal of Business Management*. 38 (2). pp. 17-24.

Verbeek, M. (2008). *A guide to modern econometrics*. John Wiley & Sons.