



## FACTORS THAT INFLUENCE THE SUCCESS OF SMALL AND MEDIUM ENTERPRISES IN ICT: A CASE STUDY FROM THE CZECH REPUBLIC

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**Abstract.** Small and medium enterprises (SMEs) occupy a large niche in the information and technology sector (ICT) and play an important role in the functioning of any state's economy. This paper focuses on a specific local market and uses the Czech Republic as a case study in order to establish the success factors crucial for achieving economic success. It aims at determining those factors with the help of econometric success rate models based on the own data collected via the means of questionnaire survey among ICT enterprise. Our results show that the earnings-employee ratio, average revenues and the investment in own R&D play the most important role in the success of Czech SMEs in question. Both, financial and non-financial indicators perform significantly in the predictions of success.

**Keywords:** SMEs, firm performance, entrepreneurs, economic success, ICT, Czech Republic.

**JEL Classification:** L25, L63, L69, O31, O32.

### Introduction

Small and medium enterprises (SME) represent a relevant field of research because of their significant role in every economy (see e.g. Lukács 2005; Kočenda 2008; or Tech, Latha 2012). Based on a study conducted by the Ministry of Industry and Trade of the Czech Republic (MPO), on December 31<sup>st</sup> 2011 there was 1,066,787 SMEs that formed 99.84 percent of all registered and active enterprises in the Czech Republic. Their significance underscores the fact that more than 60 percent (1,856 thousand employees) of Czechs are employees of SME, their performance ratio in 2011 created 49.5 percent of the ICT sector (CZK 4,064,795 million), and performance value added represented 54.43 percent with a value of CZK 1,342,297 million (MPO 2011).

The Czech Statistical Office (CSO 2012) declares the ICT sector on the basis of CZ-NACE and OKEČ classification; for the purpose of this work we use CZ-NACE. The ICT sector comprises all economic entities (legal persons, natural persons) whose principal activities include the following

sections, groups and classes of CZ-NACE. Firstly, production of ICT and manufacturing industries (group 26 and some of its subclasses), trade in ICT (61 group and its subclasses), and ICT services (62, 58, 95 groups, and some of its subclasses). Basically, one can imagine this class as a group of enterprises whose business activities intervene with the production, sale or services of electronic components, computers, telecommunication technologies, consulting in a field of information technology or internet services.

The latest available data for general analysis of the ICT sector are for 2011, when CSO published that, in the Czech Republic, there are 32,443 active enterprises. In addition to this, based on the CSO study, the ICT sector accounted for approximately 3 percent of total employment in 2011 (CSO 2012). Concerning the employment rate, the number of legal personalities in the ICT sector rose slightly.

Over the years of 1995 and 2011, job positions rose by approximately 60,000. Figure 1 below highlights continuous growth and the importance of the ICT sector. One can

compare the development of employment in ICT with the whole Czech labor market (CSO 2012). It is noticeable that during the observed years, except for the deepest period of “financial crisis” (2008–2009), there was moderate growth in job position creation. Moreover, the share of ICT job places on the whole market rose as well. The slopes in Figure 1 denote number of people employed in ICT sector (thousands of people). Lin (1998) denotes the number of employees in ICT sector as percentage of employees in all the sectors (CSO 2012).

It is obvious that the emerging importance of ICT could not be described by just the growth of employment in the sector alone. The World Bank has developed a separate unit to coordinate investments in the ICT sector. The rationale behind this is that technological progress is a considerable driving force behind economic growth. ICT infrastructure in particular has attracted much investment, and generated significant fiscal revenues and employment opportunities in developing countries (see e.g. Zálešák, Kocourková 2009). The number of mobile phone subscriptions in developing countries has increased from 200 million in 2000 to 3.7 billion in 2010, and the number of Internet users has grown more than tenfold (CSO 2012).

More specific details for local conditions are given in research encompassing 50 ICT companies in 2009. A survey showed that 80 percent of companies consider the recession to have run its course by the end of 2009 (Zálešák, Kocourková 2009). To extend this idea, Voříšek and Novotný (2010) state that the Czech Republic’s ICT sector is still developing and we could consider it as the most progressive among with the financial and energy sectors in the past decade. To support this statement, Figure 2 below shows the production value of the ICT sector and its comparison with the entire business enterprise sector. As we can see, the production grew from CZK 73 billion over the past 18 years to CZK 522 billion, and even the proportion in production of every business enterprise nearly tripled, from 2.3 percent to 6.1 percent.

Overall, SME in the Czech ICT sector plays one key role. They definitively form the organizational structure related to the amount of companies in this sector. Furthermore, more than 60 percent of legal personalities were employed during the past 8 years (around 1.6 percent of total employment) in this sector. The financial crisis had a strong impact on ICT SME, with the number of enterprises trending downward as of 2009, while the rest of them started to invest more in R&D to implement new technologies and products. However, ICT shows signs of competitiveness and it is still possible for new enterprises to enter the market. This is because of the fact that over the period of 2005 to 2011, the number of SME grew while their revenues rose, but the profit margins were trimmed back. In the case of the Czech Republic, ICT sector will perform as a prosperous

and absolute core of business. The number of workers in information technology is slowly approaching 200 thousand, which is almost equivalent to the automotive industry (Voříšek, Novotný 2010). Moreover, it is believed that most new investment will come to ICT. Therefore, supporting development of the bio and nanotechnology fields is crucial.

The main objective of this paper is to discover and describe the most significant factors, and indicators, or rather even methods, that influence the success of SME in the Information and Communication technologies sector (ICT) in the Czech Republic. This sector was selected because it is currently undergoing a revolution in its development with public demand and business opportunities for adaptation of new products and ideas enabling companies to achieve rapid market penetration. However, for their stable development there is a further added value needed. This work focuses on the factors that companies consider to be important.

### 1. Definitions of SMEs success

Motivation for describing the success or growth of SME comes from various sources all around the world. The main reason represents the research dedicated to improvements and advice to the government. As was mentioned above,

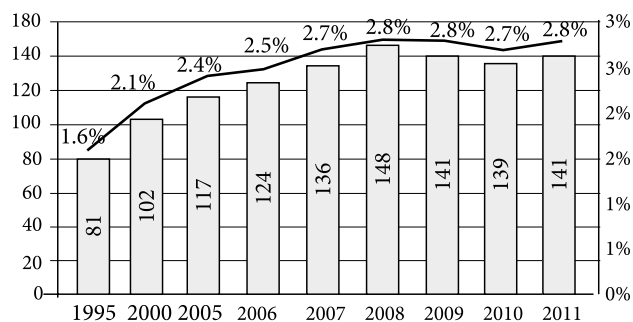


Fig. 1. ICT sector employment development. Number of people employed in ICT sector in thousands of people and employment in ICT as percentage of total employment in all sectors.

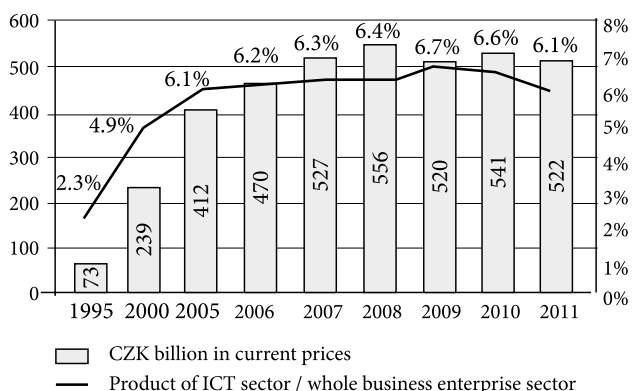


Fig. 2. Production value in ICT sector (CSO 2012)

SME creates the majority of the companies established in the given state, thus the implementation of governmental policies should not be harmful to the environment for wealthy enterprise growth. Kaibori (2001) emphasizes the importance of such positive national conditions, especially among transition countries. Meanwhile, the entrepreneurs have come to establish enterprises on their own and with their own capital in order to secure adequate income and stable working conditions for employees. Government usually faces a strong decline in working conditions and economy. It is crucial for them to set appropriate rules that would create smooth and stable growth conditions.

In this kind of environment, it is necessary for owners to establish their companies with individual resources like quality of service or goods, capital, sales, management, know-how, technology, information, business connections, and then accumulate them and expand into business opportunities. This usually creates a very important environment for national competitiveness and economic growth.

One could argue that these indicators, which need to be researched for policy setting reasons, are not common and that the diversity in culture, social conditions, historical background or stage of economic development among the individual states in the world (see e.g. Kadocsa, Fransovics 2011). Kaibori (2001) oppose with the suggestion that "there are many things in common in market mechanisms such as economy conditions, management principles, and economic units" (Laki, Szalai 2006). In the following lines, some of the research papers presenting general success factors are described.

A plethora of research is oriented on the transitory countries, in which the entrepreneurs faced to the completely new conditions and opportunities for the successful enterprise establishment on their own.

Laki and Szalai (2006) examined key success skills of the post-socialistic Hungarian entrepreneurs. From his interview-based research, the socio-demographic characteristics dominated the success in the transiting Hungary. "Age, gender, schooling, and residence mattered: in the entrepreneurial arena of the 1990s, it was a group of highly educated middle-aged urban dwellers that possessed a definite advantage ahead of all others" (Kaibori 2001). In addition to this, the employment history and general "luck" played the significant role as well. Kadocsa, Fransovics (2011) conducted similar research among SME in Hungary, which was pointed to the impact of the EU accession on them. Main finding of this work was that "small businesses do not capitalize on the opportunities offered by the European Union, and do not make efforts to apply for EU grants and funds, or attempt to penetrate new markets" (Kaibori 2001). However, Kadocsa and Fransovics note that there are different factors that influence SME success such as cost management,

trade and marketing, production, technical development and finances.

Aidis, Mickiewicz (2006) conclude their research within the Lithuanian SME with the similar results as Laki and Szalai (2006) that the education of the entrepreneur plays important role in the success, but they find one more variable, which turned to be more significant. They add the role of the export orientation as a key growth factor. Moreover, as a quite surprising fact could be that the "learning-by-doing" concept seemed to be not important factor of the transition growing companies. We must note that the negative influences, which might have impact on the company's success, are also required to complete the whole analysis. This paper was enriched for analysis of the negative influences like corruption factor which pointed up as one of the most influential. Among the negative effects, surprisingly, the Lithuanian enterprises did not comprise the taxes payments (Aidis, Mickiewicz 2006). Authors based this study on the concept of the multinomial logit estimator.

Jasra, Khan (2010) recognize the financial and technological resources, government support, marketing strategies, and entrepreneur skills to have a significant and positive impact on business success among the 520 Pakistani SME (Jasra, Khan 2010). Within the researched companies, the study finds out that the financial resources are the key factor, which the enterprises selected as the most important. With regard to this, Jasra and Khan (2010) point out that this could be due to the poor governmental and banking support into the SME industry. The whole study was based on the responses from the questionnaire which were processed via basic multiple regression in IBM SPSS software.

The success factors of African SME are discussed in Monibo (2003), Harabi (2005), and Govindasamy (2010). First of all, Monibo (2003) introduces his work with a story of successful bakery in Nigeria which terminated its business after the death of the entrepreneur. He states the main question if behind the whole success of a company lays only the founder's contribution. To accomplish this aim, the dynamic model techniques are used. In more detail, the survival function is depicted as the most suitable. To conclude this work, Monibo (2003) noted that succession problem of owner leave influenced almost 54 percent of companies significantly that they had to close within the next year. (Approximately, half of them, closed at once). Only 37 percent of the sample survived the "succession experience" (Monibo 2003). Harabi (2005), on the other side, explore the success factors of Macedonian companies as omitted variables from the growth equation of a company. This paper describes which of the factors contributes to the future size of an enterprise the most significantly. According to Harabi (2005), the important ones with positive effect are following: company location, diversification effect, legal status, price competition, strong demand for product,

governmental positive regulations. Negative factors, he recognizes the qualification of workers, small population centers, and governmental negative policies. As we can notice, the government appears on both sides. Last of the above-mentioned papers is devoted to the South African minorities – Indians. In this work, mainly the causalities of differences between the successful enterprises were measured (managerial skills, personal factors, financing factor and ownership structure). These causalities were compared with the basic statistic values such as the mean, standard deviation, frequency and range. From the research, the education factor and family involvement seemed to be as only the significant factors of influence. Number of years since the establishment appeared in the statistics but author rejected this variable because of lack of observations.

Chittithaworn *et al.* (2011) suggests the factors which could help the entrepreneurs in Thailand to set up such a beginning standards or more likely investments into the company to get the growing and wealthy SME.

Collected 146 statistical responses showed that company's characteristics, customer and market demand, cooperation, marketing, external environment, and financial with other kinds of resources are significant enough to describe almost 60 percent of the model variations. Again, the multiple regression analysis is being used. Chittithaworn *et al.* (2011) find out that the Porter's Generic Strategies developed by Michael Porter generates conditions for successful start-up SME growth in Thailand (cost leadership, market differentiation, product focus characteristics).

Research across the Taiwanese companies (Lin 1998) shows that on the first place, the entrepreneurs indicate the success in the progress in company's structure, technology, and development. After that, the managerial skills author deemed as much more significant than technical skills. However, the study concerned only 43 observations; it is one of the quite different approaches so far.

From the western background, a study on American family-owned companies by Motwani, Levenburg, Schwarz (2006), confirmed that most of family member's issues strictly relate to the enterprise performance, also "selecting a successor who possesses strong sales and marketing skills" is crucial for their success. One of the last conclusions was that the formal plan of succession and communication with the successor represents important role. The process of data collection author developed on the questionnaire survey among almost 4000 SME with 368 responses (which represents 9.2-percentage response rate). Several limitations of their model arise in the conclusion part, Motwani, Levenburg, Schwarz (2006) state that expect the lack of the available data their hypothesis could suffer from the subjective bias. It is because their analysis was based only on answers of CIOs and top managers. Moreover, the fact that this research was based on cross-sectional industries

could cause significant mistakes in final values for concrete industry study.

Yusof, Aspinwall (2000) represent one of the industry specialized analysis, which was conducted on SME from the automotive sector in the United Kingdom. Their aim was to discover main success factors and total quality management implementation. Response rate from the questionnaires was over 20 percent and the data analysis was done with IBM SPSS software. To verify the results, some of the tests on reliability were presented (consistency test, construct and criterion-related validity test). Concerning the results, among the English enterprises, the most significant factor seemed to be the management leadership abilities, results and performance reports, employee training, adopting a quality assurance system. On the other hand, the areas that actually need more attention from these companies are those having low practice levels, like continuous improvements of system, technical improvements, supplier quality assurance. Terminating remarks are devoted to the recommendation. We could perform similar analysis on other industries to compare the cross-sectional differences in SME or as well to introduce the extension of time-based performance of the companies.

Most recent research on the SME success factor analysis is based on the enterprises at the time of EU Accession (see Kadocsa, Fransovics 2011). Rural enterprises did not find the benefits coming from the possibility of applying for grants or funds in the EU, but on the other side, they surprisingly evaluate as an important factor the age (probably the experience) of the manager – founder of the SME. In addition, there appears to be a correlation of the micro and macro-economic conditions between the poor and rich areas.

Overall, it can be stated that the analysis of SME success is crucial from various reasons, starting with the fact that government policies have the substantial influence on them (Harabi 2002), and from other reasons like banking success scoring, consultancy services analysis (Peacock 2000). Researchers are usually consistent in their comments on indicators, or more rather factors that influence the SME success rate positively or also negatively. Most of them agree on the education factor, employee training (Laki, Szalai 2006; Aidis, Mickiewicz 2006; Peacock 2000). But other influences are obvious from the researches: age of manager – owner (Laki, Szalai 2006); market skills and experience of the selected manager (Laki, Szalai 2006; Yusof, Aspinwall 2000; Monibo 2003; Motwani *et al.* 2006); ownership structure (Hanousek *et al.* 2005; Hanousek *et al.* 2012; Estrin *et al.* 2009); product orientation and trade (Aidis, Mickiewicz 2006; Jasra, Khan 2010; Chittithaworn *et al.* 2011; Porter 1980); government influence (Kaibori 2001; Aidis, Mickiewicz 2006; Jasra, Khan 2010); and many others.

Importance of ICT sector analysis is underlined by Kaibori (2001) with high-tech companies in the Silicon Valley in the U.S. Czech ICT sector has gone through a “revolutionary” period in last two decades, and yet, it still has a potential to develop. Thus, we should consider the analysis of different factors influencing their success as important and value-adding topic of research.

## 2. Data and methodology

Our analytical part is heavily based on the questionnaire survey distributed among the Czech ICT companies. Information about individual enterprises including contact e-mails was obtained from ČEKIA Magnusweb database. Our selection of SMEs corresponds to the CSO selection of the ICT sector with 39,463 records in total. All companies are selected with regards to filled e-mail contact address from the ICT sphere which represented 7,979 potential respondents. E-mail was messaged to all contacts with a request to fill the survey.

The survey was active for approximately one month, during April, and the respondents were asked in one wave overall. After this round, only 47 answers were collected, which could not be considered as a sufficient or reliable sample. Second round followed after, increased the number of completed questionnaires to 131.

Questionnaire distributed among the ICT companies consisted of three parts including thirty direct questions and three optional supplement questions to provide an opportunity for respondents to express their ideas and opinions. Various types of questions were posed – multiple choices, yes/no, pick one and rating, and description questions.

Most of the respondents were companies from the software development field (56.19 percent), into this category belongs enterprises, which offers products of the non-material character – website, software development. Second largest group represent enterprises that distribute the software solutions. These are the resellers of software and companies, which implement the software solutions (20.95 percent). Two smallest groups are analogically the hardware distributors (17.14 percent) and hardware developers (5.71 percent).

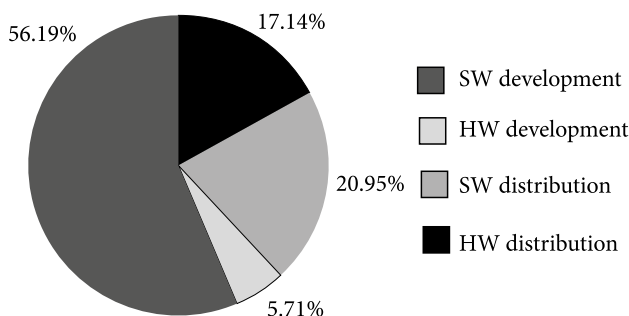


Fig. 3. Field of activities distribution of ICT SME (created by the authors)

Companies, whose fields of activity extend more than one category, were added into more categories at once.

Figure 3 above hence denotes that most of the companies in Czech are oriented in the field of software development. This might be logically caused by the fact that it is still easier to create small business company, which develops mobile applications or internet pages than to establish a factory developing new components or devices, moreover in the time of cheap and easy supply from Asian countries. According to some of the commentaries, this hypothesis is confirmed later in this chapter.

These companies are in the most cases owned by one native legal personality (38.1 percent of observations) or one legal entity (25.71 percent). Third largest group represents the group of Czech owners (19.05 percent) followed by the groups of Czech legal entities (15.24 percent), which demonstrate that the ICT sector in Czech Republic still does not attract foreign small investors. Logically, than the smallest group of proprietors are the foreign owners. From the general structure of the sector, it could be assumed that companies, which have foreign owners background, do not come under the group of SME. On average, companies employ 11.94 employees, where 2.05 are on the managerial post. According to Gupta (2010) span of control range is generally quite wide. It represents the 4–22 employees under the managers lead, when the number depends mainly on the nature of the work. Moreover, companies with more traditional orientation believe that 5–6 subordinates per supervisor would be ideal, and more innovatively based companies prefer the rate of 15–20. Nevertheless, if the nature of work cannot be precisely determined from this research (mainly hierarchy of the individual enterprises), we could state that the result mostly fits for this division.

Common ICT SME in Czech Republic operates for nearly 13 years and there is 40 percent change that it has a headquarters in the capital city. This statement is based on the fact that average age of a company in the sample is 12.96 years and exactly 40 percent of them operate in the city with more than 1,000,000 of inhabitants, which corresponds only to one city in Czech. From the company age distribution (*Appendix 5*) is noticeable that there were two periods of establishment that could be quite obvious. Older group of enterprises are around the 20 years old. This means that they were settled just at the beginning of 90', when the market was opened to any new companies and it offered many opportunities of focus. Second group represents younger SME than 10 years. This wave might be supported by the increasing trend information technologies in Czech Republic. Amount of internet users increased, web pages presentations boosted, mobile devices started to be more used with wider possibilities of usage, and the new drift of data analysis occurred. All these are the trends, which became popular around 10 years ago and they created the

new spot on the ICT market. This statement is supported by the fact that 52.54 percent of analyzed enterprises from software development industry begun their activities after 2003 and Voříšek (2010) states that the ICT services sector tend to be more progressive than the manufacturing sector.

Concerning the geographical distribution, the largest group of respondents actively operates in the capital city (40 percent). Second were surprisingly the cities with less than 50,000 inhabitants (the smallest offered category) with the share of 32.38 percent. Next two categories includes cities with 50,000 to 500,000 inhabitants where jointly operates 23.81 percent of companies. Smallest group belongs to 500,000–1,000,000, where only 3.81 percent of enterprises operate.

Frequently discussed topic that influences the company success is the age and the educational level of the CEO of the firm. From the available sample, managing directors are most often between 35–45 years old with finished first-degree academic education, which could be expected based on the empirical studies of employee productivity. Joint distribution showed that the most common situation is when the CEO is between 31–45 years with finished high education or CEO between 36–55 years with finished first-degree academic education. Separate percentage distributions of age and education are listed in the tables below. This analysis has just the informative character, closer description of connection of CEO age and education and understanding of success is mentioned in following paragraphs.

Next point of view is focused on the markets that the ICT firms operate on. The largest portion belongs to the domestic market (46.96 percent), followed by the regional domestic market (38.46 percent). Unexpectedly, the smallest parts represent the foreign markets. EU market is impacted by 11.72 percent of analyzed enterprises and there are only 2.86 percent of globally active companies. Thus, it could be implied, that enterprises do not tend penetrate to foreign markets, which might limit their possibilities and capital inflow from non-domestic markets. Moreover, this finding looks surprisingly, because of the fact that in previous paragraphs it was mentioned that the largest representation in the sample is by the software distributing companies, which do not usually have physical boundaries of sale.

Furthermore, one the finding about most frequent the channels of sales underlines the missing possibility of spreading into foreign markets. Enterprises from 53.33 percent offer their services and products via internet that could possibly open the barriers of their expansion.

Nevertheless, second most popular method is by direct contact with clients (36.97 percent) and remaining share belongs to retail and wholesale distribution. Comparison that is more detailed is stated in the figure above. In addition to this, one of the companies had a commentary on different way of sale and that is the foreign sales distributor.

Another topic concerns the company’s clients and direct competition on the market. Because there is quite large

variation between the collected amounts, the exact numbers would not have any explanatory value. However, the first differences marks of the observed years would reveal the trends in growth or loss of the clients. From this point of view, majority of the analyzed companies in 2011 registered increase in the quantity of clients (45.71 percent). Last year, even 49.52 percent of enterprises noticed growth of their customers. This was projected to the companies, whose customers stayed the same between 2010 and 2011 (31.43 percent). For 2012, it dropped to 22.86 percent of firms. The amount of enterprises, which lose customers, is increasing during the observed period. (The growth was from 22.86 percent between 2010 and 2011 to 27.62 percent between 2011 and 2012.) For the current situation in 2013, alternatively, most of the companies expect increase of their customers by more than 5 percent (35.24 percent). The same numbers as last year expect 32.38 percent of enterprises and 19.05 percent expect slight growth. The rest of them (13.33 percent) do expect diminution.

Financial resources represents quite important component of the success of an enterprise. Several questions arise with this topic. Can the company finance all its expenses by the revenues from previous years? Does it need bank loans or the insufficient funds comes from the owners investments? Do enterprises use available financial subsidies for example like EU grants? This paragraph analyzes collected answers about the financial resource differentiation between the ICT SME. Generally, most of the firms are independent from others subsidies than their previous earnings from sales. All of the categories are around 40 percent self-reliant. Secondly, domestic investments represent alternative way of supporting the operations. They are used to support mostly in case of HW distribution enterprises. Hardware developing firms more likely support their operations banks loans compared to other ICT SME categories. This might be due to the fact that it is quite difficult to establish stable hardware developing company on the Czech market, maybe because

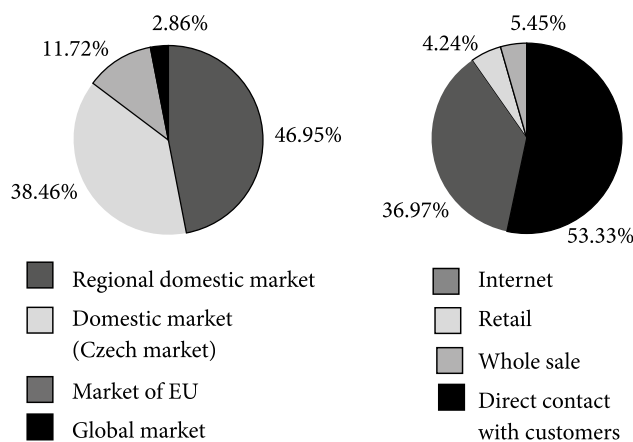


Fig. 4. ICT SME market orientation and channels of sale distribution (created by the authors)



of the competition of large corporations, as some of the respondents noted in the commentaries part.

Software companies are only users of financial subsidies and grants. Distributors use them in 13.79 percent of cases. Still they are able to cover their expenses in most cases by sales earnings. Summary of this analysis is stated in the Table 1.

To conclude the success identification of companies, the analyzed companies choose as the most informative unit of success measurement the financial factor earnings where the yearly revenues and amount of customers play important role. Moreover, they identify the key factor the originality and accessibility of their services and products as crucial to have competitive advantage. The predictive value of above-mentioned indicators is discussed in the following chapter.

### 3. Empirical model and its testing

By determining the predictive value of different variables for success rate factors, companies will be able to enhance their internal operations to gain better performance and results. Several other reasons why these processes are appropriate to analyze are summarized in the final parts of this paper. Econometric models could perform such an analysis.

Process of identification of individual success factors determinants includes all variables into statistic software that stipulate their significance in separate cases. Then, by removing less significant ones, which do not have any predictive value, the final model of given dependent variable is constructed. Results are then discussed and controlled. The outcome should be that they have overall meaning for the purposes of the paper and that they explain some rational effect. Even though, most of the responses are complete, some of the observations are missing in the data set because of the fact that the financial values question was optional and some respondents skipped it. These are usually continuous variables. Other type of responses, discrete ones, are ordinarily complete, thus if the explanatory variables are compounded only by them, amount of observations is complete for this case. The most common methodology of this research is generally usage of linear regression. Thereafter, the models

are based on the linear relationship between variables  $Y_i$  and  $X_i$  in the form:

$$Y_i = \alpha + \beta X_i + \varepsilon_i, \quad i = 1, 2, \dots, n, \quad (1)$$

where  $Y_i$  denotes the  $i$ -th observation on the dependent variable  $Y$  which represent success rate indicator,  $X_i$  represents  $i$ -th observation on the vector of independent, explanatory variables,  $n$  is number of collected observations, and  $\alpha$  and  $\beta$  are intercept and slope of the simple linear relationship between  $Y$  and  $X$ .

In order to get the predictive value of this model, it is important to estimate the intercept and all included coefficients. This step is done through ordinary least square method, where the sum of squares of error terms in the regression is being minimized.

All the calculations are processed in the IBM SPSS Modeler software, which works on the basis analyzing and performing individual series of nod steps that comes into the final model outcome.

Results of individual regression model are applied in order to identify the factors that are most significant for enterprises success. Opening part of each interpretation starts with the model notation, where the bold numbers state for coefficients values followed by the robust standard errors value in the parenthesis and \*, \*\*, \*\*\* denoting the significance level less than 1 percent, 5 percent and 10 percent. The results of the stepwise regression estimates are presented in Table 2.

It appears that *zisk\_zam\_SL* on which the *Q7-2010-vysledek\_hospodareni\_SL*, logarithm of earnings in 2010 has positive influence with the dummy variable if the company's main financial resources are from domestic investments (*Q9-moznost1=1*) or from earnings from previous years (*Q9-moznost1=3*). Dummy variable is recognizable by the "=" character behind the variable name and it stated on which of the possibilities it is applied. On the other side, negative influence has an expected growth (*Q8-2013-zamestnanci=2*) or stay (*Q8-2013-zamestnanci=3*) in the costs on employee training in actual year. In addition to this, negatively appear also if company finances its operations from the bank loans (*Q9-moznost1=4*). Insignificant value, also proving problems with colinearity, is devoted

Table 1. Financial structure of Czech SMEs in ICT sector

	Domestic investments	Foreign investments	Earnings from previous years	Bank loans	Financial subsidies, grants
Total	35.61%	2.27%	42.42%	11.36%	8.33%
SW development	36.99%	2.74%	43.84%	6.85%	9.59%
HW development	25.00%	0.00%	37.50%	37.50%	0.00%
SW Distribution	31.03%	0.00%	41.38%	13.79%	13.79%
HW Distribution	40.91%	4.55%	40.91%	13.64%	0.00%

to the number of customers in years 2010 (Q24-2010) and 2011 (Q24-2011).

Overall accuracy of the model represents 55.7 percent, where the information criterion 0.599 labels this model as quite stable, but with possible irregularities.

The next model indicates company's success based on the average revenues performance in past three years (2010–2012). This variable was reported as the most important for the respondents in the previous data analysis. Model selection method was performed by the best subsets procedure. In addition to the data set, the automatic data preparation technique was applied. By performing this technique, either

the non-suitable and outperforming observations are omitted or the categories of some discrete variables are merged to maximize association with the target (predicted) variable. The results of the stepwise regression estimates are presented in Table 3.

Here, *trzby\_SL\_prumer* are computed as average logarithms of total revenues for last three years. *Q7-2012-naklady\_transformed* represents the positive added value of the total costs in last observed year. The intercept of this variable is too small because the logarithm transformation was not applied on it. Other variables with positive value are not such significant in this model, these are the

Table 2. Results of the earnings per employee model.

Notation	Variable	Coefficient	Standard error	Sig.
Intercept	Intercept	0.123	0.832	0.883
Q7-2010-vysledek_hospodareni_SL	Logarithm of earnings in 2010	0.282*	0.062	0.000
Q8-2013-zamestnanci=2 dummy	Expected growth in 2013 dummy	-1.257**	0.567	0.031
Q8-2013-zamestnanci=3 dummy	Expected stay in 2013 dummy	-0.039	0.518	0.940
Q9-moznost1=1 dummy	Company's main financial resources are from domestic investments	0.87	0.672	0.202
Q9-moznost1=3 dummy	Company's main financial resources are from earnings from previous years	1.326***	0.673	0.054
Q9-moznost1=4 dummy	Company's main financial resources are bank loans	-0.278	0.980	0.778
Q24-2011	Number of customers in 2011	-0.002***	0.001	0.064
Q24-2010	Number of customers in 2010	0.002	0.001	0.102

Note: \*, \*\*, \*\*\* denotes the significance level less than 1 percent, 5 percent and 10 percent.; Dependent variable is logarithm of earnings per employee in 2012.

Table 3. Results of the stepwise regression estimates (best subsets method of selection). Company's success model. Dependent variable is average logarithms of total revenues for 2010–2012

Notation	Variable	Coefficient	Standard error	Sig.
Intercept	Intercept	2.926*	0.233	0.000
Q7-2012-naklady_transformed	Positive added value of the total costs in 2012	0.0001*	0.0001	0.000
Q12-obrat_transformed=0	Turnover per year as relevant financial indicator of success is <i>not at all</i> considered to be significant	-1.332*	0.349	0.000
Q12-obrat_transformed=1	Turnover per year as relevant financial indicator of success is <i>not</i> considered to be important	0.174	0.263	0.511
Q12-obrat_transformed=2	Turnover per year as relevant financial indicator of success is <i>rather not</i> important	-0.866**	0.353	0.017
Q8-2014-marketing_transformed=0	The company expect considerable growth in marketing costs in 2014	-0.907**	0.363	0.015
Q16_transformed=0	Age category of the CEO 18–25	-0.92**	0.397	0.024
Q16_transformed=1	Age category of the CEO 26–30	-0.208	0.165	0.214
Q29-naklady-na-zamestnance_transformed	Employee expenses as the main barrier for company development	0.045**	0.021	0.034
Q13_transformed	Age of a company	0.019	0.011	0.100

Note: \*, \*\*, \*\*\* denoting the significance level accordingly less than 1 percent, 5 percent, and 10 percent.



*Q29-naklady-na-zamestnance\_transformed* (companies for which the costs on employees present a barrier in their development) and *Q13\_transformed* (age of a company).

The fact that contributes negatively is the companies which do not adapt their revenues as important part of operations (they do not gain much gravity to them – *Q12-obrat\_transformed=0*, *Q12-obrat\_transformed=2*). The positive value of the middle variable might be caused by lack of available observations, but in this model, it implicate opposite effect than its border dummy variables. In addition, one of the significant elements is the age of company CEO. Those enterprises, whose managing director's age is between 18–30 years, perform with lower average returns. Surprisingly, if enterprise is planning to invest more into marketing in following year (*Q8-2014-marketing\_transformed=0*), it also indicates worse results on returns.

Summary statistics of this econometric model demonstrate better results than the previous one. Total accuracy as it is illustrated below reaches 72.5 percent and the information criterion –70.129 indicates well fitting model.

Moreover, the normal distribution of residuals seems fitting except a small rigidity on the left tail of the distribution and the colinearity test did not showed any problems with the variables.

In order to enlarge the idea of using revenues as a predictive function of success of individual companies, if the revenues from last observed period are taken, some significant explanatory variables are found as well. The results of stepwise regression (method of best subsets selection) are presented in Table 4.

In this case, the logarithm revenues in observed period (*Q7-2012-trzby\_SL*) are logically positively and most significantly dependent on logarithm of total costs in the same period (*Q7-2012-naklady\_SL*), on the logarithm of marketing costs in 2010 (*Q7-2010-marketing\_SL*) and the amount of employees (*Q5*). Questionable could be that the marketing costs from previous or observed year did not occurred as significant. This might be due to lack of collected data. Alternatively, only negative coefficient are proved for logarithm of total costs in previous year variable (*Q7-2011-naklady\_SL*).

Overall, this model perform better than the previous again. Almost the same effect is explained by less variables which have obvious influence on its value. Thus, the most important predictor in this is represented by the total costs of actual year. Others do not reflect so much importance. Even though the information criterion reaches –81.779, normality distribution comparison with the residuals do not show much comparable course. Colinearity test confirm above mentioned hypotheses for both total costs. Thus the previous model which predicted revenues should be preferred for these conditions.

Testing R&D values showed that for both possible approaches (graveness approach and continuous values model) are possible some significant predictors. This is the reason why in this part are discussed both of them. The results of estimations for R&D importance model (forward stepwise regression model best subsets selection method) are presented in Table 5.

Here the importance (success) value of the research and development (*Q22-rad*) is characterized by positive affiliation to various types of ICT companies. The most importantly the companies from hardware development sphere (*Q3=2*). Other specifications contribute to this success factor with smaller proportion software developing (*Q3=1*) and software distributing (*Q3=3*) companies. Hardware distribution does not show any significance important for this model. Positively contribute also if the company considers the earnings as an important part of company performance (*Q12-rozdelitelny-zisk*) and logically most important is how much they spend on R&D (*Q7-2012-RaD-SL*) and if they consider the active investments into development as a comparative advantage (*Q12-rad*). Negative coefficient represents the logarithm of investments into R&D in 2010 (*Q7-2010-RaD\_SL*).

Total accuracy test shows 58.5 percent accuracy. where the information criterion is heavily high valued by rank 104.688. which indicates that the model does not need to fill well. Distribution of residuals on other side quietly well describe the normal distribution and in addition the importance of individual predictors is equally divided. And the colinearity problem is not spotted among these indicators.

Table 4. Results of the stepwise regression estimates (best subsets method of selection). Company's success model. Dependent variable is logarithm revenues 2012

Notation	Variable	Coefficient	Standard error	Sig.
Intercept	Intercept	1.227*	0.224	0.000
<i>Q7-2012-naklady_SL</i>	Logarithm of total costs 2012	0.941*	0.104	0.000
<i>Q7-2011-naklady_SL</i>	Logarithm of total costs 2011	–0.331*	0.12	0.008
<i>Q7-2010-marketing_SL</i>	Logarithm of marketing costs 2010	0.122***	0.072	0.098
<i>Q5</i>	Number of employees	0.007***	0.004	0.100

Note: \*, \*\*, \*\*\* denoting the significance level less than 1 percent, 5 percent and 10 percent.

Secondly, seemingly better model represents the R&D investment in observed year 2012. By using the best subset method of estimating the regression, the results are presented in Table 6.

The amount of R&D investments (logarithm) in observed year (*Q7-2012-RaD\_SL*) depends mainly on positive financial indicators of logarithm of R&D investments in previous year (*Q7-2011-RaD\_SL*), and logarithm of total costs in actual (*Q7-2012-naklady\_SL*). Neglectible positive contributor is also the barrier of lack of employee qualification (*Q29-kvalifikace*). *Q7-2011-naklady\_SL*, previous year total costs are represents strong negative influence on the model in combination with the less significant predictor of investments into R&D in 2010 (*Q7-2010-RaD\_SL*). Logarithm of investments into marketing in 2010 (*Q7-2010-marketing\_SL*) also negatively influence R&D investments this year.

Although the overall statistics predicts a very stable model with information criterion being very low (−259.324)

and the distribution of residuals quite normal, colinearity in this case is quite high almost for all financial variables that it might lead to inaccurate numerical results.

As it was mentioned above, several problems arose during the construction of individual models that cannot be enhanced with available data set. The crucial represents insufficient amount of observations among ICT SME. This could be corrected by using more extensive long lasting research. In addition to this, with wider possibilities of research would be connected a collection of more variables, which were marked by companies as important ones in previous chapter. Thus, more appropriate and quantifiable results would be achieved. Finally, if there would be such a variables, complex econometric model would be possible to apply to gain better described individual effects that would not indicate any statistical problems.

The constructed models above suggested that there is a negative correlation between company performance and the

Table 5. Results of the forward stepwise regression estimates (best subsets method of selection). R&D importance model. Dependent variable is importance of active R&D for success

Notation	Variable	Coefficient	Standard error	Sig.
Intercept	Intercept	−1.032	0.816	0.212
Q3=1	Software development as main subject of business of the company	3.122*	0.836	0.000
Q3=2	Hardware development as main subject of business of the company	6.518*	1.505	0.000
Q3=3	Software distribution as main subject of business of the company	2.448**	1.002	0.018
Q12-rozdelitelny-zisk	Divisible profit from business as relevant financial indicator of success	0.307*	0.095	0.002
Q7-2012-RaD_SL	Logarithm of R&D investments 2012	2.435*	0.812	0.004
Q12-rad	Comparative advantage gained from R&D investment as financial indicator of success	0.306*	0.112	0.009
Q7-2010-RaD_SL	Logarithm of R&D investments in 2010	−1.7**	0.819	0.043

Note: \*, \*\*, \*\*\* denoting the significance level accordingly less than 1 percent, 5 percent, and 10 percent.

Table 6. Results of the stepwise regression estimates (best subset method). R&D model. Dependent variable is the amount of R&D investments (logarithm) in 2012

Notation	Variable	Coefficient	Standard error	Sig.
Intercept	Intercept	0.014	0.043	0.741
Q7-2011-RaD_SL	Logarithm of R&D investments in 2011	1.102*	0.049	0.000
Q7-2012-naklady_SL	Logarithm of total costs in 2012	0.472*	0.021	0.000
Q7-2011-naklady_SL	Logarithm of total costs in 2011	−0.474*	0.025	0.000
Q7-2010-RaD_SL	Logarithm of R&D investments in 2010	−0.108**	0.049	0.032
Q29-kvalifikace	Insufficient education of employees or their qualification as the main barrier of company development	0.011**	0.005	0.032
Q7-2010-marketing_SL	Logarithm of marketing costs in 2010	0.025	0.016	0.121

Note: \*, \*\*, \*\*\* denoting the significance level accordingly less than 1 percent, 5 percent, and 10 percent.

lack of skilled employees. From this fact, it can be implied that freshly educated students who have the most up-to-date knowledge of modern trends are one of the factors that positively influence a company's success. In addition to this, young people without long-term experience in the labour market represent one of the cheaper working forces available, thus their employment and induction into enterprise processes might include lower costs on the side of wage expenditures and, simultaneously, motivate employees who are willing to grow in knowledge and performance. Unfortunately, this paper did not contain statistics about the movement of this labour force.

Neither the political situation, nor fees or taxes occur in any of the models significantly. Even from the descriptive statistics section, companies do not place much importance in the effect of political situations on the success ratio.

It can be gathered from the statistics illustration in the ICT sphere development description that the financial crisis of the previous years has hit this sector markedly. This effect probably carried over into the modeling part and also can be seen through the lagged influence of several types of investments (a frequently used variable was the marketing costs from the previous two years).

### Conclusions and policy implications

Overall it becomes obvious that Czech SMEs, similar to other SMEs in small open economies, face difficulties in achieving success within their respective markets. Some of them demonstrate more sufficient results than others; others are satisfied with their profitability at a specific return level. Conversely, there are some that need organizational help to cope with their position. These variations are based on the indicators and factors that have a connection with their success rate.

Our research indicated both financial and non-financial indicators such as earnings and revenue value, divisible profits, number of customers, company publicity, active R&D, and participation on large projects. This identification led to the possibility of modeling the success rate among the sample of answers. The ratio of earnings per employee as the first indicators of a company's success was chosen from the studied literature. Secondly, based on results from the descriptive section, the average returns value is quite significant. Finally, the gravity of R&D is the last model to have been constructed.

The first model logically depends, for the most part, on the historical value of earnings and expected decline in employee expenditures. The upside for this success rate is that the company is able to cover its expenditures on operations from either previous sales or from domestic investments. On the downside, bank loans discriminate against the success valuation.

The second model is based on the total costs in an observed period. If an enterprise does not regard revenues as important, it has a negative influence on the model. If not,

it is considered to be an unintended effect. Similarly, young directing managers do not contribute to revenue performance positively.

The last prediction concerning the magnitude of research and development in a company is determined by which ICT sphere said company operates in. The most favored companies are from the hardware-development sphere. It is also dependent on historical R&D investments and divisible earnings.

The rationale of individual models is than discussed in the result interpreting section, where the proper specifications of answers on the stated hypotheses are presented. Overall, our results from this analysis could be used in consultancy as well as in banking. Those institutions would then be able to identify enterprises which tend to perform better on the Czech market. Via such analysis they would be able to maintain a rationale-supported attitude in different situations. In addition to this, models on the success rate of ICT companies would be appropriate to be used by the government because these processes might enhance possibilities of financing individual projects and spheres. All the above-mentioned models could then serve as starting points for wider research among ICT companies to be enhanced by a wider range of observations and thus help this recently stagnating sector to show its real importance.

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