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NÁZEV DIPLOMOVÉ PRÁCE
Innovation potential of Czech companies

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Rád/-a bych tímto poděkoval/-a vedoucímu diplomové práce, za metodické vedení a odborné konzultace, které mi poskytl/-a při zpracování mé diplomové práce.

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Innovation potential of Czech companies

Inovační potenciál českých firem

Autor: Bc. Štěpán Tůma

Summary

The main subject of this thesis is innovation and innovation potential of Czech small and medium companies. There is a thorough overview of the theoretical background on the innovation topic including current level of knowledge on this subject that is outlined in the beginning of the paper. Then currently used measures of innovation and innovative activity are described and their correlation with other relevant measures is analyzed to prove their explanatory power in describing reality of economic activity on the national level and their correlation with economic growth measures. The determinants and sources of innovation are analyzed and described. The aim is to provide modern, complex and interdisciplinary view (as innovation is influenced by wide range of factors including economic, management, cultural, educational, technical and other factors) on problematic of innovation. In the second part of the thesis the current innovative position of Czech small and medium companies is analyzed and the main barriers of better results in innovation are highlighted. The potential improvements leading to better position are proposed.

Souhrn

Hlavním tématem diplomové práce je problematika inovací a inovační potenciál českých středních a malých firem. Na úvod je popsán teoretický základ problematiky inovací, včetně stávající úrovně poznání a zkoumání této problematiky. V další části jsou popsány aktuálně používané ukazatele inovací a inovační aktivity, když je zkoumán jejich vztah k ostatním ukazatelům s cílem ukázat relativně malou vypovídací schopnost o inovacích a inovační aktivitě probíhající na úrovni národních ekonomik. V práci jsou analyzovány a popsány zdroje inovací v ekonomice a na úrovni individuálních firem. Cílem práce je poskytnou aktuální, moderní, komplexní a interdsciplinární pohled na problematiku inovací (jelikož inovace jsou ovlivněny faktory ekonomickými, řízením, kulturními faktory, vzděláním, technickou úrovni a dalšími faktory). V druhé části je zkoumána stávající úroveň inovativnosti českých středních a malých firem. Jsou popsány a zdůvodněny hlavní bariéry, následuje návrh opatření, jakým způsobem lze aktivitu a výsledky v této oblasti zlepšit.

Keywords:

Innovation, measures of innovation, innovation sources, SMB companies.

Klíčová slova:

Inovace, měření inovací, zdroje inovací, SME firmy.

JEL Classification:

O300 – Technological Change; Research and Development: General

M200 – Business Economics: General

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List of Abbreviations

GERD	Gross Expenditures on Research and Development
OECD	Organization for Economic Co-operation and Development
WB	World Bank
SME	Small and medium enterprise
ICT	Information and communication technology
CAPEX	Capital Expenditures
OPEX	Operational Expenditures
US	United States
ISIC	International Standard Industrial Classification
R&D	research and development
IP	Intellectual property
IPR	Intellectual property rights
EU	European Union
GDP	gross domestic product
CSU	Czech Statistical Office
MPO	Ministry of trade and industry
SWOT	strengths, weaknesses, opportunities and threats
KPI	key performance indicator
ISO	International Organization for Standardization
TQM	Total Quality Management

PDCA	Plan, Do, Check, Act

1 Introduction

The subject of diploma thesis is innovation potential of Czech companies. The target of the work is to provide modern, complex and interdisciplinary view (as innovation is influenced by wide range of factors including economic, management, cultural, educational, technical and other factors – most innovative breakthroughs now occur rather in spaces between disciplines (Toffler, 1980)) on problematic of innovation based on existing thoughts and views on innovation, including both classical (historic) thinking and modern contemporary thoughts. The second target of the theoretical part of the works is to evaluate current approaches towards measuring innovation and innovation activities on the level of national economy and also on the company level. The explanatory power of these measures and their description of reality are analyzed and evaluated. Last but not least the work is focusing on innovation potential of Czech SME[1] (small and medium enterprise) companies. The goal is to analyze current position of Czech small and medium companies regarding innovation, identify barriers for better results in innovation and propose potential changes that could lead to better results of innovation activities of Czech SME companies.

The reason for choosing such a topic is the generally accepted importance of innovation and invention for economy and also competitiveness of companies. It is due to the fact that the way of running business has changed significantly in the last years and decades (and the pace of changes is probably increasing and going to increase further) and depends nowadays heavily on the performance in generating and utilizing new knowledge, imagination, creativity, innovations and technologies (Kourtit et al, 2011). Creativity is changing the way how the business is executed, it is becoming an increasingly important factor and input into the production process of all goods and services – and therefore also critical for a business's sustainability – and an essential part of the current globalized economy (Glaeser, 2005). Another reason for choosing the topic of innovation is that it is very difficult subject as innovation (and also entrepreneurship and other related terms and factors) are indeed indefinable (Hampden-Turner, 2009) or sometimes confusingly described and categorized (Garcia et al, 2001).

[1] SME definition is according to European Commission Recommendation 2003/361/EC

The aim is to provide insights into the innovation and its sources and also the ways how to successfully execute it. It is due to the fact that it is said that 90% of all attempted innovations fail commercially (Hampden-Turner, 2009). The focus on sector of small and medium enterprises was chosen because of its importance for the national economies[2] and also due to the fact that innovation in SME's is very difficult to measure or quantify (it does not mean that for other companies or on the national level it is easy as it is explained later) as it shows some specific features and characteristics that cannot be captured by traditional indicators[3]. The importance of this business sector for the economy and its growth is widely accepted (and it is projected in various supporting policy measures of small and medium entrepreneurship across the world). Economic growth is now the world's focus and the way how to generate it is according to Hampden-Turner (2009) via increasing number of innovative entrepreneurs. This importance is opening the questions such as how to foster innovative entrepreneurs, whether innovation can be taught and entrepreneurs be trained.

The structure of the work is as follows - in its theoretical part it is outlining modern, complex and interdisciplinary view on problematic of innovation. The reason for interdisciplinary approach is clear – innovation lies on the crossroads of economy, management, education, technology, culture and lot of other disciplines. It is analyzing the sources of innovation and how it is measured. It is also describing the importance of innovation both on micro and macro-economic level.

The second part of the diploma thesis is covering the topic of innovation potential of Czech companies. It is providing an in-depth analysis of the potential within small and medium enterprises (SME) within current economic and social environment. The measures for improvement of the potential are proposed.

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[2] SMEs are significant part of the Czech economy – companies with more than 6 and less than 250 employees are representing almost the third of the business subjects (individual entrepreneurs not included) and are creating roughly one third of gross domestic product. Its significance is even more visible in the contribution to employment as SMEs are employing almost two thirds of the working population. (data according to CSU – Czech Statistical Office, www.czso.cz)

[3] Examples are GERD (gross expenditures on research and development), number of patents per capita

The methodology used in the work is resulting from the targets of the thesis – providing theoretical overview into the problematic of innovation, development of thoughts on innovation, types and sources of innovation etc. The methodology for achieving the target was review and research of existing literature on the topic. The next target was to analyze the currently used indicators of innovations and innovative activity and their mutual correlation and also correlation with growth indicators (to prove the widely accepted fact that innovation is the engine of growth and also whether the currently used innovation indicators are capturing the economic reality). The methodology used for achieving this target was based on collection of available data and execution of correlation analysis. Last main target of the thesis was Czech SMEs innovation potential analysis and identification of measures and areas for improvement. The methodology used for this target achievement was again collection of secondary available data and primary data from small qualitative research.

2 Innovation – theoretical background

2.1 Development of general thoughts on innovation

There are as many definitions of innovation as there are scholars writing about the issue. It needs to be also distinguished between innovation, invention and imitation. On the other hand there is broad agreement that innovation is widely seen as the key source of economic welfare and growth. The meaning of word innovation is very often not well understood and quite easy can misunderstanding happen when speaking about innovation, invention or imitation.. These words are very interrelated and edges or borders among them are sometime not very clear. Let's start in the beginning with explanation from dictionary[4]. Innovation can describe the action or process of innovating or a new method, idea, product etc. Invention can be describing the action of inventing something, typically process or device, or it can be something that has been invented. It can also mean creative ability or something fabricated or made up. Imitation on the contrary is describing the action of using someone or something as a model, or a

[4] Oxford Dictionary of English, Oxford University Press, 2003

thing intended to simulate or copy something else. The word innovation itself is coming from Latin word innovatus, which is the noun form of innovare and means to renew or change.

Innovation from economic perspective means to bring new ideas to market or to any other activity that has impact on goods and services production. It should have foster new markets and jobs creation so it is very important activity and is in focus of many scholars and policy makers.

It needs to be pointed out that innovations are not only product or present at good times (i.e. at the growth cycle of the economy) but they are also very frequently occurring during the recessions. Every major recession of the past has been followed by radical changes to the industrial structure, with the surging growth of new industries often supported by new infrastructures. Keynes's contemporary Schumpeter recognized that the destruction of old industries is both unavoidable and often necessary to the dynamics of growth.

It is important to stress in the beginning that innovation is not just about technological innovation (however general understanding is strongly biased towards this view), but there are different and equal meanings – innovation in processes, providing the service, communicating and selling products and services to the customers, production methods of goods and service etc. With this explanation is corresponding the generally accepted split of innovation into four categories: product, process, marketing and organizational. There should be added to these four basic categories as another and separate category business model innovation as it is occurring in reality and its relevance is growing. Examples of innovation in business model category can be low cost airlines, hosted ICT services[5], discount retailing, power tools leasing/subscription (Hilti) and many others.

[5] ICT hosting services means change in business model, when customer is not purchasing hardware and software that is then placed at his premises, but it is consumed as a service based on monthly fee. Benefit for the customer is switch from CAPEX to OPEX category of costs.

Traditional concepts of innovation, for example according to OECD Oslo manual[6], define innovation as new or improved products, services, processes, or improved organizational or marketing strategies. More modern approaches define innovation as the ability of individuals, companies and entire nations to continuously create their desired future (Kao, 2007). Innovation can be output of accident, byproduct of systematic search for something else or systematic search with clear goal from the beginning. As the first of the three mentioned can be considered as rather historical and not present nowadays, the other two are important to research further because approach to the process is somehow determining the outputs, results.

But let's starts from the beginning. Innovation (in both narrow or broader definition) was present in works and thoughts of all economists – starting with Smith (1904) who considered inventions (Smith did not distinguished between innovation and invention) and technological changes as important factor in wealth creation, however not the most important one. According to Smith inventions come from the division of labor what he considered as the main sources of wealth creation. Inventions were in his view the result of specialization as specialized workers gain the knowledge and experience over time leading to inventions solving actual problems.

Innovation is considered as one of the sources of economic growth, as it was proven by R. Solow (1956). Solow proved impact of technological development (it means innovation) based on data of increase in gross domestic product produced within 1 working hour in years from 1909 to 1949 – increase was twofold – and the increase was caused from 12,5 percent by increase in capital, the remaining 87,5 percent was caused by factors related to technical development (it means innovations). However there is a question how this observation for quite historical time from 2011 point of view is still relevant for contemporary thoughts of innovation. The era Solow was analyzing is called industrial era[7]. Main characters of the period were supply driven

[6] OECD Oslo manual was first published in 1992, currently there is 3rd edition from year 2005, and is providing guidelines for collecting and interpreting technological innovation data. The manual is product of OECD and Eurostat.

[7] Industrial era began with industrial revolution, the end of the first part could be dated to 1920s when focus switched from pure production view to the product view (that second part has finished in 1940s).

economy with focus on production. Key principle was to produce as big volume of goods or products as possible and the customers will come. It was era when mass production was introduced in large scale. This is not true anymore as there was shift from production centered logic to customer centric[8] logic where customers are better informed, rapid feedback cycles exists, and denser relations between all the participants in the value-chain exists too (Hall et al, 2010).

Every work that tries to draw up recent and up today overview of innovation theory ideas has to come to J, Schumpeter[9]. He identified innovation as the critical dimension of economic change. He argued that economic change revolves around innovation, entrepreneurial activities and market power and sought to prove that innovation-originated market powers could provide better results than the invisible hand and price competition. He argued that technological innovation often creates temporary monopolies, allowing abnormal profits that would soon be competed away by rivals and imitators. He said that these temporary monopolies were necessary to provide incentive for firms to develop new products and processes. From the current point of view it is interesting development in Schumpeter's thinking about source of innovation – at the beginning it was an entrepreneur-led innovation (characterized by strong leader with vision, idea etc.), later on he moved to the idea of big companies with enough funds for research, own labs etc. Current models with innovation largely driven by venture-capital funded, relatively small enterprises, seems to proving rather the first wave of Schumpeter's thinking (Hall et al, 2010).

According to Schumpeter, innovation is the result of a recombination of conceptual and physical materials that were previously in existence (Schumpeter, 1935). To achieve such reconfiguration or rather recombination it is necessary to explore and exploit the knowledge assets and resources by firm that is innovating (Cantner et al, 2009).

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[8] Customer centric approach means orientation of company to the needs and behaviors of its customers, rather than internal drivers (short-term profit, product preferences according to their internal profitability, preferences etc.).

[9] From Czech perspective there is interesting that this famous scholar within area of economy, political science and area of innovation was born in former Austro-Hungarian Empire, that is currently Moravia, part of the Czech Republic.

J.A. Schumpeter is no doubt the classic author within the theory of innovation. He was one of the first non-Marxist economists who focused on the dynamics of the economic[10]. Schumpeter analyzed not the dynamic process that are leading to quantitative change, but especially qualitative changes within the economy, that he called the innovations, These innovations are determining the economic development, contrary to the pure quantitative growth. Innovations are bringing sudden, discontinuous changes that are usually unpredictable. Not even static state was considered by Schumpeter as state of no changes because even without innovations the business life and life of the economy has to continue, goods are still produced, exchanged and consumed, money are circulating. Schumpeter's static is not paralyzed state, but constantly running process of business and economic life, but this life is happening within its old traditional borders or framework. The goods are produced and are disappearing and are again produced but with the same technological procedure or process and with same economical conditions. It is the cycle, repetition of what was already done. Schumpeter calls this situation circle flow. According to Schumpeter there are "new combinations" of production factors, such as use of new machines, introduction of mass production, use of cheaper sources of raw materials and more efficient ways of trade and also introduction of cheaper variants of current goods, entrance of the new market and finally production of completely new products, In the beginning Schumpeter used the term :new combination: as the sources of previously mentioned things, later on he had started to use the word innovation. As he was distinguishing between dynamic and static states he also distinguished between ordinary, common entrepreneurs and Entrepreneurs that are realizing new combinations i.e. innovations.

Schumpeter analyzed the progress of economy base on aggregate statistical data and he realized that the progress is not occurring continuously but in waves. He introduced the term of technological trajectory for describing the processes and aspect around

[10]The concept of economic static and dynamic was bring in by J.B. Clark – he considered static state as normal state of the economy when all the rules and laws are working in their purest essence whereas dynamic means faults, deviations and fluctuations.

innovation progress.[11] Schumpeter basically described a process of industrial and business mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one and incessantly creating a new one. This process he called creative destruction. He also saw innovation as the engine of business cycles and that disruption of the ongoing course of the economy, in turn, stimulates more innovation, then more disruption.

In work of Marshall (1920) can be found the first thoughts on clustering and learning organization that is leading to regional diversity between the results of companies from different regions. He introduced these thoughts in his work on "industrial districts" of England. These were based on the evidence of late nineteen century Britain in which companies within one industry (or at that time rather manufacturing same or similar products or goods) were geographically clustered. This geographical proximity was accompanied with two key parameters of this effect – high degree of vertical and horizontal specialization and strong dependence on exchange market mechanism. Firms tend to be small and to focus on a single function within the production chain. Firms located in industrial districts were highly competitive in the neoclassical sense, and in many cases there is little product differentiation (so relatively close to the idea of perfect competition). The major advantages of so called Marshallian industrial districts are coming from the above mentioned geographical clusters (i.e. simple proximity of companies), which consequently enables easier recruitment or in general supply of skilled labor and rapid sharing or exchanges of both commercial and technical information (caused by the proximity) through informal channels. They illustrate competitive capitalism at its most efficient form, with transaction costs reduced to a practical minimum; but they are feasible only when economies of scale are limited.

Very important progress in theory of innovation was made by Eric von Hippel who is specializing in the nature and economics of distributed and open innovation. Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to

[11] Technological trajectory is characterizing two aspects of innovation, first is application specifics and cumulative aspect of company development, when knowledge and experience are cumulated over time and then used in a way that is leading to innovation.

advance their technologies (Chesbrough, 2003) The concept of open innovation sees the boundaries between firm and its competitors, supplier, customers etc. so the ideas or or other sources of innovation can be easily interchanged between all subjects within given environment. The concept assumes a world of widely distributed knowledge where firms cannot afford to rely entirely on in-house research[12], but should instead buy or license processes or inventions (patents) from other subjects within given environment. The outputs of internal research that are not being used should be according to concept of open innovation should be distributed and utilized outside the company (it could happened via licensing, joint-ventures and spin-offs). Wall et al (2010) find out there are companies that are more successful in incremental innovation (outperforming in more established industries with more stable technological paradigms) and on the other hand companies more successful in radical innovations (outperforming in high-technology industries where technological paradigms are shifting).

Hippel (1994) also developed the concept of user innovation. The idea of user innovation is based on argument that end-users not producers are responsible for significant portion of new innovation. In this context Hippel introduced the term lead user.

Berkun (2010) is criticizing the use of word innovation as it is used in current world too often and it has lost any significance. He is proposing to use different explanation, significant positive change – if anything (product, service etc) is offering to whomever positive significant change than it is innovation. Based on that insight he is somehow criticizing the use of such statements as that someone is innovating every day or that he or she is in innovation business – if something is done regularly it cannot mean according to Berkun significant change (and then not fulfilling the condition to be called innovation). He also points out relative meaning of innovation for different customer groups (or basically recipients) of the significant change – for someone can be significant innovation shop with refrigerator, wifi access (wireless internet access) and plumbing as he states. The innovation as he is stressing out is not the output of one

[12] Contrary to the concept of open innovation is closed innovation that is based on paradigm that successful innovation has to be executed completely under control of one subject along the whole chain (i.e. generation of ideas, production, marketing, distribution etc.),

Eureka moment, but rather process of accretion (or growth by gradual addition). He is also coming back to the Schumpeter definition of sources of innovations, that it is based on a combination of things that existed before – any seemingly grand idea can be divided into an infinite series of smaller, previously known ideas. He also stresses out the importance of overcoming the cultural and technological barriers before significant innovation can be widely adopted (examples are dishwasher, laser and refrigerator) – so part of the challenge of innovation is coming up with the problem to solve, not just its solution. Berkun is also giving quite simplified (but maybe correct) view on innovation when he is defining innovation as something new, so to innovate according him means to introduce something new with emphasis on new. And he also explains that new does not mean something the universe has never seen before. He is supporting his argument with claim that any great innovator borrowed and reused ideas from the past. According to him the toolkit for every innovator are these three things: questions, experiments and self-reliance. Questions are as follows: Why is done this way? Who started it and why? What alternatives did they consider and what idea did their new idea replace? What are my or my friend's biggest complaints with how we do this thing, and what changes might make it better? How this is done in other towns, countries, cultures, or eras of time? What different assumptions did they make or constraints did they have? How can I apply and of the above to what I do? The experiments and self-reliance are self explainable – it is try, learn and try again. Berkun is also very freely citing Rogers what are five factors for successful innovation: 1. Relative advantage (what value does the new thing have compared to the old? It is important to point out that this is meant as perceived value how it is viewed by the potential consumer) 2. Compatibility (how much effort is required to transition from the current thing to the innovation – if this cost is greater than the relative advantage, most people won't try the innovation) 3. Complexity (how much learning is required to apply the innovation) 4. Trialability (how easy is to try the innovation?) and 5.observability (how visible are the results of the innovation – the more visible the perceived advantage, the faster the rate of adoption, especially within social groups).

In the context of development of inventions or innovations can be useful to use thoughts of T. Kuhn (1962). He has introduced the term paradigm shift- according to him the progress of scientific knowledge or changes in scientific fields undergo periodic

paradigm shifts[13] (or revolutions) rather than solely progressing in a linear and continuous way and also that these paradigm shifts open up new approaches to understanding that scientists would never have considered valid before. According to Kuhn science is broken up into three distinct stages. Prescience, which lacks a central paradigm, comes first. This is followed by normal science[14] when scientists attempt to enlarge the central paradigm by "puzzle solving". Guided by the paradigm, normal science is extremely productive.

In the area of how to learn (and also motivation to work) is important work of Howard Gardner. He is author of theory of multiple intelligences states not only do human beings have several different ways[15] of learning and processing information but these methods are independent of one another. Gardner is also very active in the area of motivation to work[16] and effective learning[17].

The more contemporary thoughts on innovation are also pointing out the fact that there is significant shift in the term "value proposition"[18] or how innovations (especially those from product area) are perceived – in the past the innovation usually meant delivery of better product that somehow naturally costs more, but nowadays in most cases it means to deliver better product and also cheaper product (Merrifield, 2009).

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[13] Paradigm shift according to T. Kuhn is a change in the basic assumptions, or paradigms, within the ruling theory of science and paradigm is what members of a scientific community and they alone share.

[14] Normal science according to T. Kuhn is a term that refers to the routine work of scientists experimenting within a paradigm,, slowly accumulating detail in accord with established broad theory, not actually challenging or attempting to test the underlying assumptions of that theory. Kuhn identifies this mode of science as being form of "puzzle-solving".

[15] According to H. Gardner there are seven intelligences: linguistic, logic/mathematical, musical, spatial, bodily/kinesthetic, interpersonal and intrapersonal. The eighth existential intelligence is still considered.

[16] GoodWork project, www.goodworkproject.org

[17] Project Zero, http://pzweb.harvard.edu/

[18] Value proposition is one of the core ideas of modern marketing, it is describing how much value the customer can expect from the goods or service (there are both views present, how much is producer promising and how much customer believes).

2.2 Sources of innovation

Very important question that has generated and is still generating lot of question that are answered with more or less accurate answers is what are the sources of innovation. What determines the level of innovation activity on firms' level and on national economy level? What determines the success of innovation activities (as innovation is not only about invention itself, but also important part is the execution- it means delivery of innovated product or service to the market, successful implementation of the changed processes or organizational structure etc.)

How the opportunity for the systematic innovation is rising? According to Drucker (2007) there are seven sources of innovation opportunities. These are unexpected events, the discrepancy between reality and plan, innovations from need for certain process, change in industry structure or market structure, demography, changes in perspective in view of world, frame of mind and substances and new scientific and non scientific events. The impact of market structure, changes in technology, global scope and vertical integration with their pervasive impact on the example of hard disk drive industry has been shown by Christensen (2003).

There are innovation opportunities coming from megatrends (even though those can be even negative) such as climate change, depletion of non-renewable resources, demographic change and emerging security needs, another megatrend can be future of the young as there is in many countries (e.g. Spain, Sweden and Ireland) youth unemployment above 20%. These megatrends can be turned into an opportunity for innovation. Another megatrend can be safety of future technologies (increasing digitization of personal information combined with international movement of people creates real risks of cyber security and other new technologies – from biotech to nanotech – create real and perceived risks and ethical concerns). Another example of megatrend in energetic sector can be so called smart grids of energetic networks, interconnected via borders. At the end of this chapter it would be good to highlight the main opportunities for innovation, that could be visible today and in next few years. What are the dynamics that are creating great opportunities for innovation? According to many scholars one of the very important factors is demographics (e.g. Merrifield,

2009), as consumer marketing will start focusing on the needs of the older generation, at least in the developed world.

From historical point of view there were three stages or phases and within each different source was bringing the productivity gains (and these gains can be attributed to certain level of innovations or inventions (Merrifield, 2009). The first historical phase (about end of the eighteen century) was represented by the worker. Later on it moved to the department or bigger group of the workers and finally at current time it has shifted to processes. As potentially next phase there is identified another shift from question how that is represented by the above mentioned three stages there should be even more dramatic change to the question what (Merrifield, 2009).

Education and human capital in general is widely seen as pre-condition for innovation. The main task of the education in order to fulfill its target in supporting innovation is to promote talent and creativity from an early stage. According to EU document[19] there are following key competencies such as entrepreneurial skills in the wider sense, as well as literacy, scientific and mathematical competence, languages, learning-to-learn skills and social and cultural competences, significant role in current digitalized world plays digital literacy. Importance of human capital as source of innovation (and also important factor leading to successful innovation) is growing over time. According to Hall et al (2010) there are different talent types needed, named as the literati[20], the numerati[21] and entrepreneurial managers. The first two are highly skilled and educated specialist, the later is entrepreneurial type, who puts things together, takes risks, decisions etc.

As human capital is very important source of innovation and as it was already mentioned its importance is growing over the time. When we are speaking about human capital, the key question is how to acquire such a talent and even more importantly how to retain (plus even further develop). The competition for such talents is very high and

[19] Proposal for a Recommendation of The European Parliament and of the Council on key competences for lifelong learning.2005/0221.

[20] Literati according to Oxford Dictionary means well educated people in literature, here in this meaning people good in humanistic studies, managerial skills etc.

[21] Numerati means people who are excellent in mathematical and analytical skills (S.Baker, author of The Numerati)

small startup companies have to be ready to use all different tools for acquiring and retaining those talents. (There could be numerous ways for acquiring, developing and retaining talent – motivation through stock options for example, active support of further development of employees etc.).

When we are speaking about human capital there is need to mention also aspect of labor mobility that is one of important factors contributing to regional differences in innovation activity. It can be exemplified on the case of United States, where immigrants are very important factor for US invention, representing 24% and 47% of the US small enterprise workforce with bachelors and doctorate educations in the 2000 Census of Population, respectively. This contribution was significantly higher than the 12% share of immigrants in the US working population (Kerr, 2009). To stress this argument even further is the result of a survey conducted in the year 1999 that found that one-third of Silicon Valley's total wealth, some 58 billion USD, had been created by Indians and Chinese migrating to the USA after 1970 (Saxenian, 1999). As for entrepreneurs, these are, to put it mildly, curious people. Historically the have been drawn from the marginal groups in society, the barely tolerated minorities (Hampden-Turner, 2009). Hence Nonconformists, about 7% of Britain's population produced 50 per cent of its entrepreneurs (Ashton, 1998).

When the sources of innovation on firm-level are discussed these factors are usually mentioned as key ones: supply of skilled workers, universities, financial institutions, the legal system, the supply base, the domestic market and the presence of other firms in the same or related industries (Hall et al, 2010). These are not the only drivers of the innovation capabilities of the company, but the main ones. There is clear geographic dependence of several factors that cannot be overcome (at least in the short to medium term). The reasoning behind above mentioned factors is clear – skilled workers are not entirely mobile internationally (it is determined by the relative attractiveness of the location, lifecycle of the worker and other), universities (they are on the one hand the source of skilled people, on the other hand the source of innovation itself as these are executing own research or participating on the research with commercial subjects). The other factor, financial institutions, is named not very accurately as it rather should represent the question of the financing of the innovations and it can be funded by

private sources (both intracompany sources or non company in form of risk venture capital) or public sources (any form of government finances). Next factor in innovation capabilities is legal system that should be understood as possibility to effectively protect the outputs of innovative activity within the country or wider region. (Effective protection should mean that the company is able to reach such financial conditions that enable payback of investment into innovation). Supply base and market structure are two remaining factors – market structure[22] means mainly the degree of concentration, number and relative strength of buyers and sellers and degree of collusion among them. The effect of supply base can be explained by the so called spill-over effect that is mentioned by several authors as very important effect (Mohnen, 1990, Griliches 1992 and Cameron, 1996). Spill-over effect means in the context of innovation direct knowledge gains of customers from research and development conducted by supplying industry.

Another source of innovation is considered to be market structure (it means basically the level of competition within given industry). At the aggregate level, the equilibrium relationship between market structure and aggregated innovation suggests that more competition is associated with less innovation. The raw data shows a negative relationship between the number of active firms and the total number of patents granted in the industry. Patenting was a lot more intense in the last years of the sample period, with thirteen active firms in automobile industry, than in earlier years, with 23 active firms, according to analysis of Hashmi et al (2010). (But the question is whether it is affected by change in market structure or the time effect, as the rate of the patenting according to Hall has increased over time in all industries, especially after 1984. Developing and producing automobiles is a highly research intensive activity: in 2006, more than 13% of all research and development expenditure spend in OECD countries was spent in ISIC industry 34 “Motor Vehicles”, more than in any other industry (for details see Table 1 in Annex 1).

[22] Four basic types of market structure are perfect competition (characterized by many buyers and sellers, none being able to influence prices), oligopoly (characterized by several large sellers who have some level of control over the prices), monopoly (characterized by single seller with considerable control over supply and prices) and monopsony (characterized by single buyer with considerable control over demand and prices).

Regarding the relationship between market structure and innovations Schumpeter advanced the argument that monopoly is more conducive to innovation than highly competitive markets. However to prove that fact is difficult due to the existence of "replacement" and "efficiency" effects. The former leads to lower innovation incentives for a monopolist that has existing profits at stake. The latter leads to lower innovation incentives in more competitive situation as competition lowers aggregated industry profit (Hashmi et al, 2010). Aghion et al (2005) demonstrate a non/linear inverted-U pattern between competition and innovation. At low levels of competition, more competition is associated with higher innovation, but the efficiency effect starts to dominate at higher levels of competition (Hashmi et al, 2010). Hashmi et al (2010) in their study conducted on case of correlation between market structure and innovation[23] and they took as example the highly competitive automobile industry (that is also very R&D intensive and has a lot of patents) on the other hand they are mentioning the microprocessor industry that is a duopoly of Intel and AMD and it is also quite innovative. In terms of the relationship between market structure and innovation, they find that 1) at the firm level, there is weakly positive relationship between a firm's price-cost margin and its innovation intensity (see the Appendix, Graph 1); 2) There is no relationship between competition and innovation at the industry level in the steady state. As the industry goes through a consolidation phase, the relationship is negative if competition is measured by the inverse of markups and positive if it is measured by the inverse of concentration 3) a key determinant of a firm's innovation intensity is its relative position in the industry in terms of knowledge stock (Hashmi et al, 2010).

If we look at sources of innovation on the organizational level there can be distinguished several vehicles or tools that company can use in achieving, realizing innovation. It can be innovation via acquisition, establishing of startup companies, own

[23] The idea of correlation between market structure and innovation can be viewed from two views. The first would be based on classic argument that Schumpeter advanced that monopoly is more conducive to innovation than highly competitive markets (which is also in line with the purely theoretical concept of perfect competition where there would be basically no innovation) and the second view is rather based on the evidence that the increased level of competition is rather fostering the innovation in reality.

resources or alliances with other companies (horizontal, vertical and lateral alliances are possible). These alliances are also playing significant role in knowledge spillovers.

Another important aspect of innovation or its source can be theory of geographical clusters. These ideas are very well exemplified by the well known success of Silicon Valley – a quintessential hub characterized by technology diversity and many small, entrepreneurial firms (in addition to high-performing large firms). That makes up a highly competitive market structure. However, other locations are also innovative, but are, relatively, neither technologically diverse nor particularly dispersed in terms of the local market structure (these other location are more concentrated and dominated by a single firm such as Kodak, Micron, Caterpillar (Agrawal et al, 2009). Entrepreneurial firms developing new products benefit from being located in diverse cities because they can more easily borrow from different activities but once they have settled on their "ideal process" they benefit from being in specialized cities where production costs are lower (Agrawal et al, 2009) Finally, theories focused on factors quite distinct from market structure and technological diversity, such as labor mobility and culture, have been advanced to explain regional variation in knowledge flow patterns (Agrawal et al, 2009).

For innovative activity within region, there is also important whether there a breakthrough innovation or invention occurred. If yes there is patenting growth significantly higher in such cities or regions where breakthrough inventions occur after 1984 relative to peer locations that do not experience breakthrough inventions. This growth differential in turns depends on the mobility of the technology labor force, which was modeled through the extent that technologies depend upon immigrant scientists and engineers. Spatial adjustments are faster for technologies that depend heavily on immigrant investors (Kerr, 2009). The analysis of Kerr (2009) compares the technology-level growth in patenting in cities where these breakthrough patents occurred relative to similar cities also innovating in the technology in question. They find evidence of localized patent growth after breakthrough inventions. For example, looking just among the ten largest patenting cities for a technology during 1975-1984, a one standard deviation increase in the relative presence of breakthrough patents results in a 20% greater patenting growth for 1990-2004.

Innovation is not any mystical inspiration of gifted humans (even though these can contribute significantly) but it is rather output of intentional and thought-out process of looking up for innovation opportunities (Drucker, 1985). There are according to Davila (2006) three basic and fundamental principles of innovation: 1) Innovation is managerial process, same as any other business function, and it needs for good execution specific tools, rules and discipline, 2) Innovation needs to be measured and it must be stimulated for assuring sustainable and great/good results, 3) company can use innovation for markets and industry redefinition through interconnection of technological innovations with business model innovations.

2.3 Factors leading to successful innovation

After the introduction of short overview of sources of innovation, in the following part there is description and discussion on factors that are leading to successful innovation. There can be found several key factors leading to successful innovation. One is management which is the playing role both as the factor that is contributing to successful innovation and also is subject to innovation itself. It is very difficult to argue the contribution of management practices however there are proves that are showing the strength of this factor. The research covering several homogenous industries like cement, block-ice, white pan bread and oak flooring are according to Bloom et al (2011) showing one hundred percent productivity spread between the 10^{th} and 90^{th} percentile – the explanation clearly must be the different approach in management techniques and their application. This research based on statistical data only was proven even more strongly by experiment that showed significant contribution of management practices to productivity gains. The experiment was concluded among randomly chosen large multi-plant Indian textile companies. Those companies were split into two groups (again randomly) where companies from one group received extensive management consulting services provided by well known international consulting firm and consequently the findings of the five months were implemented within next four month, again with support of the same consulting company. The companies from second group received only one month of basic support from the consultants. Results of this experiment were showing that improved management practices (the output of received consultancy

services) led to an increase in productivity by 11% and annual profitability increase of about 230 thousand USD. Even though the sample was not very big (twenty eight plants across seventeen companies) it shows the significant of management practices (Bloom et al, 2011).

Another strong factor contributing to company's success in innovation is knowledge and its management within the company. Knowledge possesses certain properties which require special attention. It is often embedded in employees; it has features of public good and can hardly be bought at the market (Cantner et al, 2009). How can be the knowledge management characterized or even measured? There are following components within the company that should be present for good knowledge management: joint development of innovation strategies, open communication of ideas and concepts among departments, mutual support with innovation/related problems, regular meetings of department heads, temporary exchange of personnel and seminars and workshops involving several departments (Cantner et al, 2009). According to analysis made by Cantner et al (2009) firms which apply knowledge management perform better in terms of higher-than-average shares of turnover with innovative products compared to their twins (those that are not applying knowledge management) and in this study they also find that there is no significant effect of knowledge management on the share of costs reduction with process innovation.

According to different authors (Cantner et al, 2009) the knowledge, proxied by the firms' patent stock has positive impact on sales (the gross addition to a firm's knowledge is measured by the number of patents applied for by a firm in a calendar year and the knowledge of a firm is measured by its patent stock). Knowledge stocks can be also defined as cumulative result of past innovation. A one percent increase in relative knowledge stock is estimated to boost relative market share by 0,17 percent. Greater knowledge is estimated to have concave effects on marginal costs. The linear effect is positive. To incorporate the benefits of increased knowledge, it is often necessary to introduce new features into vehicles, which is costly. The negative coefficient on the squared knowledge term indicates that the marginal effect on costs decreases as knowledge grows larger. Patents for process innovations are one possible explanation for the negative coefficient, if they are more prevalent for highly innovative firms.

Another important aspect of turning inventions into significant drivers of the economic growth and welfare is apart from innovation itself the standardization – process that turns an existing high-tech product into a low-tech variety (Acemoglu et al, 2010). This process is output of usually costly adoption and standardization. The result is for example the cheaper version of the product, that is produced using high level of automatization or unskilled labor that are bringing cost benefits in case of large scale production (Acemoglu et al, 2010). The process can be detailed in a way that new technologies, when first conceived and implemented, are often complex and require skilled personnel to operate. At this stage, their use in the economy is limited by the patents of the innovator and the skills that these technologies require. Then to achieve higher volumes, margins, profits, or when IP rights are expiring, the process of standardization is coming as both an engine of economic growth and a potential discouragement to innovation. The computer business can be claimed as an example. In first thirty years of its existence computers could only be used and produced by skilled workers. At the same time the simplification of manufacturing process allowed mass production of electronic devices and low prices, competing among ICT firms intensified enormously, first among few industry leaders and then more broadly at a global scale. So to summarize, new products are invented via costly R&D and can first be produced only skilled workers. This innovation process is followed by a costly process of standardization. (Acemoglu et al, 2010). In this context there can play according to authors IPR protection significant role as lower IP protection minimizes wasteful entry costs, but this may lead to excessive standardization and weak incentives to innovate. To maximize growth of welfare, this latter effect needs to be counteracted by lower markups for standardized products. Authors also show that trade liberalization in less-developed countries may create negative effects on growth by changing the relative incentives to innovate and standardize. However, if increased trade openness is coupled by optimal IPR policy, it always increases welfare and growth. When too much of the resources of the economy are devoted to standardization, expected returns from innovation are lower and this limits the innovative activity. Expectation of lower innovation reduces interest rates and encourages further standardization (Acemoglu et al, 2010).In this context (- context of factors leading to successful innovation it is necessary to point out the shift, change that occurs during time, especially in the case of

product innovation. Innovative product were usually products with better parameters with higher costs for end customer, but nowadays it is rather (of course not in all cases, not in all industries but within significant majority of cases) in a way that better product is offered for less money (Merrifield, 2009).

2.4 Types of innovation

There are many different views that innovations can be viewed or sorted into categories. According to Garcia et al. (2001) there is a plethora of definitions for innovation types that has resulted in an ambiguity in the way the terms innovation and innovativeness are operationalized and utilized. There are terms such as radical, really new, incremental and discontinuous; among many others. The following part of the thesis should provide the basic categorization of innovations with the description of every kind of the innovation. There are altogether three basic views on categorizing innovations (the area where innovation is occurring, according to their impact or level of pioneering and also there are business and social innovations). The details on these categories of innovations are described below.

Probably the most important sorting is according to the area where the innovation is occurring. Within this category innovations are divided into four elementary types of innovation: product, process, marketing and organizational. The former two are representing so-called technical innovations, the latter nontechnical innovations.

Product innovations mean creation and later on introduction of a product (can be good or service) to the market, that is either new or improved on previous products of its kind. Product innovation can be represented by development of completely new product or improvement of existing product. New products are result of process that is called product development that is complex process of bringing a new product or service to the market. Within new product development there are following stages: idea generation, product design and detail engineering, market research and marketing analysis. Improvement of existing product means changes (positive) in functional characteristics, technical abilities, ease of use and others.

Process innovations is innovation within the internal processes of the company (can be processes of how the goods are manufactured, delivered to the customer, how the supply management chain is working etc.). The importance of process innovations is in fact that they increase bottom-line profitability, reduce costs, improve efficiency and productivity and has also positive contribution to employee job satisfaction.

The above mentioned product and process innovation are becoming into category of so-called technological innovations. According to OECD study on technological innovation[24] innovation is an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention.

The first of nontechnical innovations, innovations in marketing area is the implementation of a new marketing method (examples can be product placement, product promotion etc.). According to OECD Oslo manual marketing innovations are aimed at better addressing customer needs, opening new markets, or newly positioning a firm's product on the market, with the objective of increasing the firm's turnover (via increased sales volumes). The distinguishing feature of a marketing innovation is defined by manual as the implementation of marketing method not previously used by firm. It must be part of a new marketing concept or strategy that represents a significant departure from the firm's existing marketing methods. The new marketing method can either be developed by the innovating firm or adopted from other firms or organizations and it can be used for both new and existing products.

The last from this category are organizational innovations. These are represented by the implementation of a new organizational method in the firm's business practices, workplace organization or external relations. It can be according to OECD Oslo manual implementation of new methods for distributing responsibilities and decision making among employees for the division of work within and between firm activities (and organizational units), as well as new concepts for the structuring of the activities, such as the integration of different business activities. An example of an organizational

[24] OECD. The nature of innovation and the evolution of the productive system. technology and productivity-the challenge for economic policy. Paris: OECD, 1991. p. 303–14

innovation can be the first implementation of an organizational model that gives the firm's employees greater autonomy in decision making and encourages them to contribute their ideas. Another example of organizational innovation can be strong trend in change of the collaboration between employees and company units - from closed processes to the power of networks.

Another important categorization is according to their impact or rather level of pioneering, these can be divided into three basic categories (and each category is using knowledge in little bit different way see below) : incremental innovation, innovation that change consumers' behavior and innovations destroying existing firms' competencies (Cantner et al, 2009).

Innovations that are radical are sourced by recombination of knowledge assets that are then producing new ideas. The existing knowledge is used only to limited degree as these are output of the exploration or sought after new knowledge. On the other side there are incremental innovations that are based more intensely on existing knowledge. Process innovations occur continuously and are characterized by investment in new production techniques or reorganization of firm structures (Cantner et al, 2009).

Within this category of dividing innovations according to their impact or level of pioneering is also another approach than below mentioned. It is in recognizing incremental and disruptive innovations. The incremental innovations are those that improve existing product or service by upgrading performance, extending features, or adapting to different uses. Disruptive innovations, on the other hand, redefine a product or service and how it is used or understood (Hannaford, 2007). Incremental innovation is an ongoing process in most industries, necessary to hold on to (or expand) market share. Its nature is evolutionary in the sense that it involves generation after generation of adaptations – to competition, to changed market environments, to new political and economic conditions, and to improved technology (Hannaford, 2007). According to Hannaford (2007) there is scenario or certain pattern for disruptive innovation – the company dominates its market by dominance in manufacturing, marketing or service. It has achieved some form of equilibrium with its main competitors, which it resembles as they resemble it in turn. An individual or a small group makes an exciting industry breakthrough – if they go to the big company with the idea, they leave unheeded as the

process is unproven, the return is unlikely, and the demand is not there. Why should a multibillion dollar company look at some crazy outside ideas when they can make a few million through a new accounting maneuver, outsourcing manufacturing, or by releasing a new improved version of their product? Then the new company goes out and scrapes up the money to test the concepts. In the majority of cases, there's little or nothing there. Once in a while, there is something that not only works, but also has a profitable market and perhaps is even patentable. Even at this stage, the big company is pooh-poohing the idea. Then, in even rare cases, the product (or service) invented causes a real revolution, a tipping-point moment. Suddenly, everyone seems to start using the service or buying the product. The old company, to slow to turn, sees its revenue dropping, perhaps even its business going away (Hannaford, 2007).

According to Mohr (1977) there are following characteristics of incremental or continuous innovations: enhancement or improvement of current product or process, characteristics of products are well defined, competitive advantage is low production costs, high frequency of development reacting on specific market demand, demand side market and customer pull. On the other side, radical innovation has following characteristics: new technology is creating new market, use of laboratory research and development, better function than with the "old" technology, specific market opportunity, supply side market and technology is pushing.

Using different view (based on the area of innovation occurring whether it is business or social sphere) innovations can be divided in business ones and social innovations. Business innovations are all mentioned above, so only to give full picture lets describe shortly social innovations. These can be new strategies, concepts, ideas etc. that meet social needs of all kinds – from working conditions and education, to community development and health. The aim of such innovations is the extension and strengthening of civil society.

The above mentioned categorization of innovations into product, process, marketing and organizational is surprisingly omitting one important type of innovation that is growing in significance and importance. It is the innovation within business model. Christensen (2008) cites the need for business model innovation as one of the core elements of a successful market disruption. He proposes the sequence where first a

simplifying technology is needed to spark the disruption, then a new business model is needed to maximize the reach of the technology and finally there is a need for comprehensive value network[25] evolving to support previous two elements.

2.5 Policy support of innovation

As it was already described above there is agreement among policy makers that innovation is significant contributor to economic growth and welfare. Due to this reason there are various programs and policies supporting innovation.

European Union in its Lisbon Strategy for Growth and Jobs[26] that was launched in 2005 sets the objective of increasing research and development spending to 3% of GDP. The problems of the current EU innovation policy (according to EU business panel[27]) are leverage the power of networks and social innovation, implement Community level actions, invest strategically in the future, cope with the future societal challenges and open up innovation to people and creativity.

In connection with innovation there is often used the word knowledge based economy, or it is stated as the next generation of society – that after knowledge based society will come an innovation society.

Policy makers all over the world increasingly view high-tech SME's as key contributors to industrial creativity and innovation performance, technological change, social development and building and sustaining economic growth. (Jones-Evans et al, 2005).

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[25] Value network refers to business analysis perspective that describes social and technical resources within and between businesses. The nodes in a value network represent people or roles. The nodes are connected by interactions that represent tangible and intangible deliverables. These deliverables take the form of knowledge or other intangibles and/or financial value. Value network exhibits interdependence. They account for the overall worth of products and services. Companies have both internal and external value networks (source: openvaluenetworks.com).

[26] "Common Actions for Growth and Employment: The Community Lisbon Programme" - COM(2005) 330, 20.7.2005.

[27] http://ec.europa.eu/enterprise/policies/innovation/policy/index_en.htm

However the death rate of high-tech SME's is higher than that of large enterprises due to capital scarcity and their smaller scale (Kourtit et al, 2011). They operate and compete in continually changing business environment where innovation is continuous (Torraco et al, 19955) and the competition is often so intense that there is no breathing space for relaxation and strategy development (Sureshchandar et al, 2005). This sketched uncertainty, whether in terms of competition, technology advancements or business culture warrants the design of valid and tailor-made model for these firms that shows how they are performing and that offers the means to improve their creative and innovative performance and to support (control and manage) them better in challenging business environment (Kourtit et al, 2011).

When we are speaking about policy support of innovation, it is necessary to mention the institutional quality. According to CES VSEM (2010) there is evidence of tension between technological and economical resources of innovations and the nature of current institutions. The reason lies in magnitude and dynamics of innovation processes within contemporary organizations. The general assumption is that the solution is on the side of institutions, in their improved adaptability.

One of the popular and widely promoted tools of support is idea of incubators and clusters. Business incubators are seen as effective and useful tool helping companies to overcome some difficulties in the beginning of their career. Very interesting research on the effectiveness of incubators was made by Sonobe et al (2010) that find out positive relation between the outputs of business incubators in China and the infrastructure, and human and capital resources that are at business incubator's disposal, and also educational level of incubators' managers is contributing positively. On the other hand their research showed no relation with the scale and diversity of the cities they are located in. They also did not find the difference in performance between university-based and government-established incubators.

The reason for supporting SMEs and their innovative activities is that SMEs are contributor to the economic growth and employment. As Glaeser et al (2009) states economic growth is highly correlated with an abundance of small, entrepreneurial firms and they proved based on data that a 10% increase in the number of firms per worker in

1977 at the city level correlates with a 9% increase in employment growth between 1977 and 2000.

Another way of supporting the development of small and medium enterprises that is becoming popular is the idea of clusters. The term business cluster, also known as industry cluster, competitive cluster or Porterian cluster, was introduced and popularized by M. Porter[28]. The concept of cluster is based on cooperation (or interconnection or networking can be used) between geographically concentrated businesses, suppliers and associated institution in a particular industry. Clusters are considered to increase the productivity with which companies can compete, nationally and globally (Porter, 2000). The importance of economic geography, or more correctly geographical economies, was also brought to attention by P. Krugman[29]. The underlying concept, which economists have referred to as agglomeration economies, dates back to 1890, and the work of Alfred Marshall. According to Porter (1990) clusters have the potential to affect competition in three ways: by increasing the productivity of the companies in the cluster, by driving innovation in the field, and by stimulating new business in the field.

At the end of this part let look at the support of small and medium companies in the Czech Republic based on real numbers and activities. Innovation potential and entrepreneurship in the Czech Republic is supported also from the government level. Until 2010 from 2007 for example there were subsidies or financial support in the amount of 13,5 billion[30] CZK from the program "Operacni program podnikani a inovace". But there were also supports on the level of state budget with guarantees for almost 1500 small and medium enterprises that enabled them to get loans for operational and investment activities in the total amount of 9 billion CZK[31]. There are also other supporting programs that are more narrowly focused on technical and nontechnical innovations, for example programs "Trvala prosperita" or "TIP" that

[28] In his book The Competitive Advantage of Nations (1990)

[29] In Geography and Trade (1991)

[30] According to MPO (Ministry of Industry and Trade)

[31] According to MPO (Ministry of Industry and Trade)

supported in 2010 over 500 projects of small and medium companies in the area of industrial research and development with overall subsidy over 1,6 billion CZK[32].

”Ooperacni program podnikani a inovace” is reflecting Lisbon strategy of EU with focus on tools of direct and indirect support of entrepreneurship, especially its form of small and medium enterprises. In general the program is focused on removing the barriers in access to capital funds. The support is usually given to companies with higher innovation potential, and also to activities supporting establishment of new companies and on development of existing companies to improve their competitiveness within regions where structural problems and high unemployment are. The program is funded by EU structural funds (85%) and remaining part is funded by Czech state budget. There are six main areas of focus: establishment of the companies, development of the companies, effective energy[33], innovations, environment for entrepreneurship and innovations, supporting services for development of entrepreneurship.

Because of the nature of the Czech economy as the very open economy with high dependence on international markets, there is need for support of the small and medium companies in access to international markets where there is very often lack of finances and also know how. In this area are active state agencies such as Czech Trade and also MPO (Ministry of industry and trade).

According to MPO[34] there are following priorities for future. The establishment of seed fund or fund of risk capital by the MPO. Such fund should be support of innovational startup companies via direct investment into them or via other ways such as loans, guarantees etc. Such approach has certain advantages (providing the needed capital for startup companies with high innovation potential, multiplication effect of invested financials, relatively good experience with such approach form some very competitive countries in area of support of innovation environment and knowledge based

[32] According to MPO

[33] Focused on stimulation of activities leading to decreased energetic demand of production and on area of consumption of non-renewable, fossil energetic sources.

[34] MPO – Ministry of Industry and Trade, Report on small and medium enterprises, 2010

economy[35]). There are also negative effects that can be especially implicit risk (some projects will not be successful), no real experience. For years 2014 and later years MPO is considering following priorities in area of support of innovation: development of innovation entrepreneurship and of digital economy (the focus will be more on micro enterprises within chosen progressive industries, there should be also support of establishment of network of business angels and also cooperation with private sector). The second priority should be support of industrial research and innovations and entrepreneurship based on knowledge. The third priority is support of entrepreneurship and innovation infrastructure, another priority should be internationalization of companies and services for business and last priority is considered as sustainable energy, support of renewals and support of innovations in energetic sector.

2.6 Correlation among innovation indicators and with growth indicators

The last part of the theoretical part is aimed to analyze the correlation among different innovation indicators and also between innovation indicators and growth indicators. The reason for such analysis is to find out the relationship between different innovation indicators and mainly what is the relation between economic growth and the level of innovation activities – the aim is to prove whether generally accepted view that innovation is the main driver of the growth of developed countries (the growth in general cannot be applied as the highest growing economies such as China and India are rather growing due to the increased production – as the result of the fact that the most of the multinational companies are using production facilities in low workforce cost countries such as China and India).. As it is clear from the definition of innovation

[35] Knowledge based economy is a „buzzword“frequently used in connection with innovations and i tis also used by European Union officials and documents related to innovation and growth. The term was popularized by Peter Drucker. The key definitive or parameter of knowledge based economy is that knowledge is considered as product or tool for production of economic benefits or even for creation of jobs.

mentioned above, it is rather very complex activity, sometimes hard to describe, not mention the actual and precise measurement. For different purposes there was established the measurement of the innovation activities on the level of countries.

The analysis was performed on data from Eurostat for group of 13 countries (Czech Republic, Denmark, Germany, Italy, Hungary, Austria, Poland, Slovenia, Slovakia, Finland, Sweden, United States and Japan). The reason for choosing such a group was as follows: Czech Republic was used as the main input as the later part is describing the innovation potential of Czech companies (from small and medium size enterprise segment) and others are used as benchmark – Denmark, Finland and Sweden were chosen as the examples of relatively small economies such as Czech Republic but with high expenditures on research and development (GERD indicator), Germany was chosen due to the fact that it is the biggest European economy with the highest number of patents per capita, United States and Japan as examples of one of the most innovative countries that are serving as general benchmark – together with South Korea – Poland, Slovenia and Slovakia were chosen due to the fact that are having similar historical background (both political and economical) due to the fact that all were part of former communist bloc, Italy was chosen as representing of big southern European economy and Austria was chosen as it is relatively similar in size - population wise -with the Czech Republic).

The first analysis performed was the analysis of correlation between indicator of economic growth (year-to-year changes of GDP) and expenditures on research and development (GERD). The data are in Table 2 and 3 in Appendix. The output of the analysis (-0,275) shows that there is no correlation between these two indicators.

The next analysis preformed was the analysis of correlation between expenditures on research and development (GERD) and number of patents per capita[36]. The data are in Table 2 and 4 in Appendix. The output of the analysis (0,877) shows that there is quite significant correlation so increased expenditures are leading to greater number of patents applied or granted.

[36] Patents per capita mean number of patents that were applied by EPO (European Patent Office).

Another analysis performed was the analysis of correlation between indicator of economic growth (year-to-year changes of GDP) and number of patents per capita. The data are in the Table 3 and 4 in Appendix. The output of the analysis (-0,286) shows that there is no correlation between these two indicators.

The last analysis performed on the Eurostat data was the analysis of correlation between indicator of economic growth (year-to-year changes of GDP) and growth in high-tech export[37]. The data are in Table 3 and 5. The result of correlation is -0,203, proving that there is no correlation between these two indicators.

The next set of analysis was performed on statistical data from World Bank, covering fourteen countries (to the former thirteen analyzed on Eurostat data was added South Korea, as the representative of dynamic, highly innovative economy).

The first analysis of this set was the analysis of correlation between expenditures for research and development (GERD) and year-to-year growth of gross domestic product. The output for the analysis was in interval -0,680 to 0,653 depending on respective country data. The details are shown in Table 6 in Appendix. Median of the results is -0,124 so it can be said that there is no correlation between two indicators (there are countries exceptional to this median – United States with result of -0,68 it means that there is negative correlation, similar is the results for Denmark, and on the opposite side of the spectrum is Czech Republic with the result 0,653 that is showing rather positive correlation – meaning that both indicators are growing at the same time). The data from World Bank are giving the same results as below mentioned analysis of data from Eurostat for same parameters.

The next analysis performed was the analysis of correlation between volume of high technology exports[38] and absolute volume of GDP (both indicators in current USD).

[37] High tech export is defined as share of high-tech export on total export. High Technology products are defined as the sum of the following products: Aerospace, Computers-office machines, Electronics-telecommunications, Pharmacy, Scientific instruments, Electrical machinery, Chemistry, Non-electrical machinery, Armament. The total exports for the EU do not include the intra-EU trade.

[38] According to World Bank high technology exports include products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments and electrical machinery.

This indicator is showing very high positive correlation (meaning that both indicators are growing at the same time), with results in interval from 0,790 to 0,991 and average result of 0,91. The highest correlation is in the case of Czech Republic. The details are shown in Table 7 in Appendix.

The next analysis performed was the analysis of correlation between expenditures for research and development (GERD) and number of researcher in R&D[39] per million people. Here the results are more vary, in the interval between -0,689 to 0,987, with average 0,585 and median 0,892. There are two countries showing rather negative correlation (Poland and Slovak Republic) the rest shows positive correlation so Poland and Slovakia can be taken as exceptions and as conclusion these indicators are also showing the correlation. The details are in Table 8 in Appendix.

The next analysis performed was the analysis of correlation between high-technology exports as share of total exports and year-to-year growth of gross domestic product. The results are not showing the correlation, with results in interval -0,390 to 0,687 and average and median roughly 0,12. The details are in Table 9 in Appendix.

The next analysis performed was the analysis of correlation between receipts from royalty fees and payments[40] and total volume of gross domestic product (GDP). The results are showing quite high correlation with results in interval from 0,568 to 0,970 and with median and average 0,898 , 0,871 respectively. The details are in Table 10 in Appendix.

[39] According to World Bank definition researchers in R&D are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned.

[40] According to World Bank royalty and license fees are payments and receipts between residents and nonresidents for the authorized use of intangible, nonproduced, nonfinancial assets and proprietary rights (such as patents, copyrights, trademarks, industrial processes, and franchises) and for the use, through licensing agreements, of produced originals of prototypes (such as films and manuscripts). Data are in current U.S. dollars.

The last analysis performed was the analysis of correlation between patent applications of residents[41] and expenditures for research and development (GERD). The results show that the correlation is not very strong, with results in interval from -0,517 to 0,923, with average 0,4 and median 0,469. The details are in Table 11 in Appendix.

One of the measures, R&D expenditures is considered as one of the most promoted and cited factors and key driver of innovation. It has definitely some relevance, but it is only one of several factors. It is description of the reality that is biased even on the macroeconomic level and these biases are growing when we are moving to micro level, on the level of individual firms, where there are also other significant drivers of innovation. The other reason why not to take R&D expenditures as mantra, is that on the firm level these expenditures on R&D are only one of several factors likely to determine the generation of new ideas (Hall et al, 2010). The first of the indicators, so called GERD (Gross Expenditures on Research and Development) is calculated as share of expenditures on research and development activities on GDP. This is the "holy grail" of the innovation statistics – country economics are compared by this ratio, there is EU policy for achieving of at least 3% etc. The development for this indicator for chosen countries and regions is in Table 2 in Appendix.

Another widely used indicator both on the level of national economy and company level is the number of patents (for national economy assessment there is used number of patents per capita, for companies there is used absolute number of patents). The link between the number of patents and economic growth was described as relatively low (Belenzon et al, 2009). It is due to the fact that the distribution of the patent quality is highly skewed, where a small portion of patents is generating significant value and significant majority of patents has limited or even zero value. This value of the patent in terms of many is not possible to measure; however several authors has found strong correlation between the value of patent and number of its subsequent citations.

[41] According to World Bank patent applications are worldwide patent applications filed through the Patent Cooperation Treaty procedure or with a national patent office for exclusive rights for an invention--a product or process that provides a new way of doing something or offers a new technical solution to a problem. A patent provides protection for the invention to the owner of the patent for a limited period, generally 20 years.

(Belenzon et al, 2009). It was found out that really breakthrough inventions can be defined by the number of citation each patent subsequently received as it was showed by Traitenberg (1990) and related studies that find that citations are a reasonable proxy for the value of a patent. Later studies find out that this proxy contains measurement error (Belenzon et al, 2009) so its value is rather limited.

It is well known however that the rate of patenting has increased over time in all industries, especially after 1984 (Hall, 1984). It is supporting the argument that the number of patents is not reflecting very well the level and success of innovation activities. The reason for that is that patenting has become the kind of industry itself, or rather significant source of income for law industry. Many companies are focusing on getting huge number of patents for future offensive use (to claim royalties later on from potential breaches of the patents) or from rather defensive factors to be protected from such attacks. The examples of this approach are for example mobile communication industry (producer of mobile phones such as Apple, Nokia, HTC, RIM who are suing basically each other) or cases in biotechnology industry (examples can be claims between Helicos BioScience, Illumnia, Pacific BioSciences).

As Zaby (2010) is showing, firms do not patent every invention and in many cases they are using other ways how to protect their intellectual property or wealth. These other ways can be trade secrecy or other non-legal means of protection of returns on the investment into research and development. The reason for not to patent can be for example the need to disclose the information within patenting process, lengthy and costly processes and also whether the patent will be legally enforceable in case of patent breaches etc. There is so called propensity to patent that should show how likely it is that the company will protect its invention by patenting. The reason for this is that a patent can transfer private information from the innovator the competitors, while at the same time patent protection is of limited coverage so that competitors can earn positive profits by imitating the patented invention without infringing the patent itself, i.e. inventing around (Zaby, 2010). Arundel et al (1998) proved that there is difference in propensity to patent depending on industry. The industries with very high propensity to patent are pharmaceuticals, chemicals, and machinery and precision instruments. On the other hand of the spectrum is textile industry. These differences among the industries

can explain (among other factors) the differences between the numbers of patents per capita. So it is rather about the structure of national economy (both industry wise and ownership wise) that is affecting this indicator.

3 Innovation potential of Czech SME companies

Third chapter of thesis is focused on innovation potential of the Czech small and medium companies. The definition of small and medium enterprise is based on criteria of number of employees, annual turnover and the volume of balance sheet (total volume of assets)[42]. The structure of the chapter is as follows: there are outlined general characteristic of small and medium companies and aspects of innovation in the beginning as the introduction, together with available commented data characterizing situation of small and medium businesses within Czech Republic. It is followed by analysis of current innovation performance of Czech SMEs and based on that the barriers that are limiting this potential are outlined. The final part of third sector is proposing potential improvement measures for increasing innovation potential of small and medium companies in Czech Republic.

This part of the thesis is about potential, respectively innovation potential. When speaking about potential the meaning of word potential should be defined. Potential means ability of the subject to react or perform relative to its status and capabilities. When describing the potential of company to innovate it is determined by the number of factors – technical, organizational, quality management, motivation of employees etc. According to Pittner et al (2004) there are following characteristics that are determining innovation potential: technical and technological view (use of high-tech tool relevant for given industry – ICT, automatization and robotization etc.), raw materials and use of progressive materials (again that are relevant for given industry – nanomaterials, biomaterials, polymers etc.), economical and financial sectors (such as volume of

[42] EU definition, with concrete parameters less than 250 employees, turnover less than 50 million EUR or assets are smaller than 43 million EUR. This category is split in small enterprises with less than 50 employees and annual turnover less than 10 million EUR and very small enterprises with less than 10 employees and turnover 2 million EUR (ES No. 800/2008).

disposable capital, volume of investment and its efficient spending, availability of loans, price level and level of profits, enforceable debts, level of production costs, productivity etc.). Sales activities and marketing is characterized by quality of marketing mix execution, sales activity such as identification of potential customers and ability to acquire and retain customers. Then there is an aspect of research and development that is characterized by volume of resources that are used (not only financial resources). Social factors are including relationships among employees, managers and other aspects of human resources. These are sometimes underestimated but can be real booster or barrier of innovation activities.

There is a generally accepted view that small companies will outsmart giant corporations on global scale (Gibson et al, 1998). According to Gibson, customers will have infinite access to products, services and information. And also networks will be more important than nations. And where (in the business world) you'll either be doing business in real time, or you'll be dead (Gibson et al, 1998). And all these parameters are able to fulfill in better way small and medium companies.

The trend in the high technology sector[43] especially (that is very rich with innovations) is that next to the presence of large multinational corporations small and medium sized enterprises emerge and grow continuously, thus increasing their employment, while large firms tend to decline in number (down-size and focus on their core activities) and to cut their employment (Tether et al, 1998). The decline in the manufacturing employment in large firms in the West corresponds with the industrialization of China and India and reallocation of many large firms to these and other nations which acts as a magnet for manufacturing (Kourtit et al 2011).

Another important aspect of innovation is its contribution to increased productivity. As Hall et al (2009) show on the example of the research among Italian SMEs, especially process innovations has positive impact on firm's productivity. They also find the correlation between the size and age of the company and their productivity levels, with

[43] High technology sector – Eurostat is defining high technology products as the sum of the following products: Aerospace, Computers-office machines, Electronics-telecommunications, Pharmacy, Scientific instruments, Electrical machinery, Chemistry, Non-electrical machinery, Armament.

larger and older firms being less productive. Another outputs of their research are that firm size, R&D intensity and investment in equipment enhances the likelihood of having both product and process innovation. They also proved the level of international competition fosters R&D intensity, especially for high-tech firms. So the conclusion is that the innovation in small and medium enterprises cannot be sufficiently and precisely measured by the metrics such as number of patents (as the patenting process can be very costly for these companies and there are no human resources for realization of such process) and also the expenses on research and development are not giving the real picture as these small and medium companies are not distinguishing such expenses in their accounting, balance sheet).

It can be assumed that innovation activity realized by the SME companies is pursuing the same objectives as in the case of bigger companies (large enterprises). These objectives can be defined as follows: get significant competitive advantage over the competitors, that is sustainable in the long time and via this advantage realize good or improved financial performance (regardless it is measured as revenues, profit, company value etc.). Each company has to innovate even though the reasons for that can be different – it can be the strategic objective on the one hand or simple reaction to the pressure of the competition. It was proved that frequency of innovation is corresponding with the firms' performance (Banbury et al, 1995) so the reason or motivation for innovation is quite clear. This statement can be applied to companies of all sizes, both small and big. The same applies also to the management of concrete innovation process in reality, that is very demanding and success of the activity cannot be predicted.

Innovation within small and medium enterprises is showing significant differences compare to the big companies (Rothwell, 1994), It is not very surprising as also the parameters of both types(or rather size types) of companies are different (organization structure, access to capital, size of the accessible capital, human resources to be named as few examples). Among advantages in innovation in the case of small company is definitely its flexibility of decision process and small time to action (both are given by the small size of the company and clear decision power). Big companies should realize the advantage in their access to resources, both financial and human. There is also important difference in the category structure of the innovation activities – whereas

small companies are clearly focused on product innovation (Acs,1990), big companies have probably more distributed innovations among all the types, not only product, but also process, organization and marketing innovations. However it seems to change over time as it will be shown on case of Czech small and medium companies in following sections of thesis (the shares of all four types of innovation – product, process, marketing and organizational - are more or less balanced with decreasing share of product innovation).

The product development or innovation in small companies is rather accidental character and is result of "good luck" when the innovation is occurring as an output of ad hoc process (that is influenced by time and environment conditions) according to Vermeulen (2003). The innovation process is not formalized and structured in the case of small and medium companies. This argument can be accepted only partially, it is relevant for rather smaller companies and also it heavily depends on the industry.

The reason for focusing in this part of the study on SME companies is quite simple as these are majority of the economy and important source of economic growth. Czech Republic has share of SMEs on overall number of economic subjects 99,84%[44] which is overwhelming majority. Details on the development of number of small and medium enterprises are in Graph 2 in Annex. From the employment point of view, small and medium enterprises are employing two thirds[45] from the Czech Republic workforce. The number of people employed by SME in Czech republic has grown from 1,830 million in 2000 to 1,855 in 2010 (with highest number in 2007 reaching 2,033 million employees) – details in Graph 3 in Annex. This segment of the economy has similar shares as in other European countries such as Italy and other. The high share on employment especially is showing the significance those companies have for the national economies. The importance of small and medium sectors is also significant in case of contribution to the gross domestic product by one third[46] (for details see Graph 4 in Annex). The significance of the small and medium enterprises for the national

[44] According to CSU there was 1 031 557 economic subjects active at the end of the 2010, thereof 1 029 871 small and medium enterprises.

[45] According to CSU

[46] According to CSU data

economy is further stressed by their share on the overall output of the economy that is slightly over fifty percent in case of the Czech Republic. For details see the Graph 5 in Appendix.

Very interesting characteristic of the small and medium enterprises is development of average labor costs that are lower than overall average for all companies by 10% that is showing that small and medium enterprises has certain limits in attracting the workforce. However there is necessary to take into consideration also industry structure that can biased the numbers. For details see Graph 6 and Table 12 in Appendix.

Investing activity of the small and medium enterprises showed significantly growing trend since year 2000, the volume more than doubled in 2008 with decrease in following years 2009 and 2010 as the result of worsened economic conditions. For details see Graph 7 in Appendix.

The connection of the Czech small and medium enterprises with international economy is growing as it can be seen in Graph 8 in Appendix, with positive trend of closing the gap between imports and exports.

Very interesting number showing the trends and developments within the small and medium enterprises is their structure, namely the shares of four basic categories on produced output of SMEs. These categories are industry, construction, trade and services. The shares of industry and construction are declining, trade is relatively stable and the growing category is services (details Graph 9 in Appendix).This produced output can be compared with share of the different sizes of the companies within given industry as it is shown in Appendix Table 12.

It is interesting to look at the number of employees that are according to statistic working on research and development and expenditures on the research and development- see Table 13 and Table 14 in Appendix.

Another important aspect for the innovation potential is the level of international cooperation, export and import. As the size of the Czech market is very limited there is necessary for companies that are seriously thinking about innovations to go to the international foreign markets. The research made by European Commission among

small and medium enterprises showed that only 25% of SMEs is exporting on foreign markets, 7% is in role of supplier or customer of foreign company and only 2% is realizing foreign direct investment, This average numbers for whole EU are in case of Czech companies higher that is reflecting the openness of the Czech economy. There is relation between size of the company and the degree of international cooperation or international activities. The bigger company the more active on foreign markets is. The same applies for the size of the domestic market when companies from countries such as CR are more active on international markets due to relatively small size of their internal markets (the same can be said about companies form Estonia, Denmark, Sweden, and Slovenia etc.). There is also relation between the age of the company and their international activities – older companies are more likely to be active on international markets.

For the innovation of the small company are important factors of quality of the business environment. According to Viturka (2010) there are six categories of factors that are influencing the innovation potential of the company in. These categories are: business factors (that are split in markets proximity, important companies, foreign companies presence and support services), infrastructure factors (that are split in quality of roads and railroads, proximity of airports and information and communication technology development), workforce factors (that are split in availability of the workforce, quality of the workforce and flexibility of the workforce), local factors (consisting of knowledge base and financial assistance), cost factors (workforce costs, costs of rents) and environmental factors (urbanism and natural attractiveness of territory and environmental quality of territory). The importance of the factors is almost 30% for business factors, 8% for infrastructural factors, 26% for workforce factors, 15% local factors, 13% costs factors and remaining 9% for environmental factors. The research was based on the data from Czech regions to show the differences in innovation potential based on territorial difference. The factors were selected based on the preferences of business active in the area of industry and selected services (banking, insurance, telecommunications, informatics, scientific research and other business services). Relative strengths of the factors were identified based on analysis of opinion researches of potential investors. The details are in Table 15 in Appendix.

Let's look in the definition of the factors, starting with the most important category, business factors. Factor of markets proximity is describing economic potential of accessible markets for given industry/product or services. Factor of important companies is describing the benefits resulting from presence of big and strong industrial companies, which are stimulating spread of innovations within their networks of suppliers and distributors. Factor of foreign companies' presence is reflecting general positive influence of international companies – this positive influence is especially for the situation when there is no sufficient volume of domestic capital. Very important factor is support services meaning services for companies including scientific and research services, information services and also financial services that are provided by specialized small companies. There are significant differences in Czech regions when these business factors are synthesized – on one side of the spectrum is Prague where the concentration of demand is very strong, on the other side of the spectrum is Zlin and Moravskoslezky kraj. However even though Prague is considered as region with relatively strong demand it is necessary to point out that in general for any innovation (that should be produced with significant costs) is Czech market very small and every serious innovation attempt should take into consideration wider markets (depends on the given product, service or industry but at least all the neighboring countries should be considered).

The infrastructural factors are stated with relatively low importance. Factor of railroads and roads is interpreting the connection of local regional centers to the most important segments of railroads and roads. From the regional point of view there is correlation between size of the regional center and their position or connection to the network of railroads and roads. Factor of proximity of airports has positive influence especially on service industry. The information and communication technologies factor is representing the potential of savings generated by equipment of certain region with communication infrastructure. This factor is correlated with level of education when there are above average local centers such as Prague, Brno and Zlin and below average centers represented by Ostrava and Usti nad Labem (Viturka, 2010).

The workforce factors are second important category that is together with business factor constituting more than fifty percent. Factor of availability of workforce is

reflecting total regional supply of workforce. Factor of quality of workforce is reflecting the education level within region. Factor of flexibility of the workforce is representing the entrepreneurial activity within given region that is given by number of entrepreneurs per inhabitants. Within this category is according to Viturka (2010) performing Prague, Plzen, Brno and Zlin very well, the worst are Moravskoslezky, Karlovarsky, Pardubicky, Ustecky kraj.

Local factors are constituted by factor of knowledge base that is given by localization of universities (with accent on technical and natural science disciplines) and by factor of financial assistance which is determined by the level of tax income within given region.

Cost factors are represented by factors costs of work and rents. The least significant factors are environmental ones that are created by the factors that are influencing the quality of life and though attracting people with high potential. All these factors were evaluated and synthesized by Viturka (2010) into evaluation of Czech regions. The results of the regions are stated in Table 16 in Appendix.

3.1 Analysis of current innovation performance

Current innovation performance of the Czech small and medium companies is starting with the SWOT analysis of the Czech small and medium companies. SWOT is based on analysis of Ministry of industry and trade and also on own analysis and estimations, based on six in-depth interviews with representatives of this sector (the questionnaire for the interview is in Table 17 in Appendix and results of SWOT are in Table 18). To comment or enhance above mentioned SWOT analysis following strengths, weakness, opportunities and threats can be added. Strengths : definitely the tradition of industry production (famous entrepreneurs and inventors in Czech history such as F. Krizik and others), traditional innovation potential of employees and also increased number of small and medium enterprise that are interested in innovation processes, also increased use of progressive technologies and innovative products into the production. Among weakness there are also stated by the representative of small and medium enterprises and also by several authors (Holoubek, 2009) lack of funding for innovation. The

relevance of this factor is at least disputable. Among other weakness can be stated low support of ideas realization and not sufficient support of entrepreneurial education.

The survey among small and medium enterprises made by Holoubek (2009) shows following data: small and medium enterprise are relatively strong in innovation of currently offered product or service, the same can be applied for introduction of new product to the market. Lower activity was documented in application of new technologies and very low percentage is realizing the innovation in marketing area (design, customer relations, sales and after sales services etc.) The reason for this can be caused that majority of the companies within sample are from B2B segment (producing goods that serve not for final consumption but as the input for other companies) and within this sector the role and importance of marketing is sometimes underestimated. According to companies that took part in research they perceive as the most important innovation benefit in enhancement of portfolio of product and services, followed by implementation of new technologies and also in increased market share. In the contrast with these statements only half of the companies are implementing new technology even though it was perceived as second most important innovation activity. Very poor results were obtained in the area of human resources. Improvement of qualification of employees is realized via one-off trainings (and those are forced usually by legislation changes). In this context the companies' included in research also stated classic argument that there is no supply of enough employees with qualification (and they do not see that they are basically contributing to this status). Surprisingly high and good results were obtained in the area of research and development that was by the owners and managers of the small and medium companies cited as strengths. Companies according to their responses are having own units dedicated to research and development, they are actively using the results of research and development of universities. Very interesting results were obtained in the area of preferred variant of financing of innovation that strong majority of companies prefers own resources, followed by bank loans and leasing, only very small percentage of companies is thinking or using venture capital funds. This observation is showing major contradiction or conflict with the nature of innovation. As majority of small and medium companies are rather undercapitalized with limited own resources, how they can prefer as the best option for funding of innovation own resources?

Holoubek (2009) in his work came with analysis of innovation potential on the level of individual company, measured by so called Index of company's innovation potential, where he used scoring of performance of individual company and compared its results with average for Czech republic. The index is consisting of categories human resources, connections and non-final products used as the input for further production, company investments, financing and support and access to information.

3.2 Analysis of barriers

Let's look at the barriers for innovation, starting with barriers for entrepreneurship in general. These can be divided into two categories – endogenous (no wish to do the business due to the fact that there is no motivation, fears, not sufficient knowledge or abilities for entrepreneurship, no resources, no ideas etc.) The exogenous barriers are legislation (especially conditions for company establishment and its functioning) economic environment, tax conditions etc.).

According to Sebestova (2007) there is relatively low level of information and ability to work with information among representatives of SME. It has as a consequence impact in low knowledge and use of marketing and managerial methods in company management (planning, creation of strategy, project management, marketing research and marketing tools in general etc.). SMEs are also very isolated and not willing to cooperate with other subject in greater socioeconomical environment. Cooperation activities are happening usually later on in the phase of the development of the company, not in the start up phase. There are also several negative factors in the area of knowledge and innovations. These are especially not sufficient activities of employers in the area of education of employees when SMEs do not have usually any plans for further improvement in qualification of employees. Another negative factor is quality and structure of the supply of the workforce on the local labor market.

The negative factors that are influencing performance or lifetime of small and medium enterprise are as follows: not sufficient level of capital, not sufficient planning,

competitive advantage[47], not sufficient knowledge of marketing[48] (Sebestova, 2007). Another deadly factor is tendency to do everything by own resources, not using outsourcing and specialized knowledge where is needed in general. Last factors should be mentioned are level of connection and participation of employees to the business and also not controlled expansion. The statistical data on barriers hampering the introduction of innovation are in Table 19 and 20 in Appendix (data are for companies that are innovating and also for non-innovating companies so the difference can be observed and analyzed).

According to Sebestova (2007) there are two types of small and medium enterprises – the first category are innovation companies that were established to achieve already defined innovation and the second category where innovation is pushed by external factors, as a pressure from competitors.

According to Sebestova (2007) there is also important factor in the fact who has the decisive role or responsibility in terms of defining the strategy of business subject, or company (the statistical data on this parameter are in Table 21 in Appendix). The numbers in the table are showing that owners of the companies are having their strategic plan "in their head", not officially written or communicated to the employees. That is causing troubles with information towards employees and also not written plan is very difficult to follow. Very important in the context of creation of strategic plans is the source of information (the data on sources are in Table 22 in Appendix).

Another interesting source mapping innovation abilities and capabilities of SME companies in Czech Republic is questionnaire (Vacek et al, 2001) that is producing so called map of readiness of company for innovation. There are several categories that are mapping the activities that are relevant for innovation. The examples are in category Strategy and planning – vision about company future, vision communicated to employees, details on existence of innovation plan, changes of plans, financial KPI's of

[47] Majority of small and medium companies are either local imitation of others, there are no specifics that could lead to the competitive advantage. And that can be obtained via differentiation in the offering or focus on certain niche market that is not occupied yet

[48] The need for creation of marketing strategy or at least thinking about it, is due to the fact that is necessary to determine not only who will be purchasing the product or service but also why.

plans, project management. The other researched areas are in category Marketing where are following : monitoring of actual trends on market, evaluation of market competition position, orientation of company on customers, monitoring of preferences of customers towards company's product, the way how the market information is distributed within the company and marketing and financial management aspects. The next category is covering technological process that means future competitiveness of the company within its industry, changes in used technologies, collection of impulses for execution of changes within technological processes, evaluation of investment rentability for planned changes within the company, calculation of production costs and their monitoring and management within the company and creation of resources to be spent on development. Then there is category covering quality and environment (with detailed questions on monitoring the quality management within the company, scoring of individual contribution of employees to quality ensuring and external audit of quality, from the environment are there are question on impact of firm's activities on environment, impact of quality monitoring on change processes within the company and creation of resources for costs induced by changes of norms, rules and legislation within areas of quality and environment). The category of logistics is covering issues of ensuring purchasing and distribution, logistic optimalization, information distribution and communication with business partners, flexibility of logistics processes, and implementation of innovation within logistics and logistics management and finance. Then there is category of organizational and human resources issues that is covering aspects of employee satisfaction, motivation of employees, management and communication, internal conflicts solution, information system and company culture.

Now let's look at the statistical data on innovation from the CSU. The data that are covering all sizes of companies are showing important relation between the size of the company and their innovation ability (or activity). The classic Schumpeter conception was promoting big companies (it was in past empirically proved). According to CES VSEM (2010) the reason was that the key connection to sources of modern knowledge (that is enabler of innovation activities) cannot be ensured without companies' research capacities (that can be built in industrial era only by big companies). But the post-industrial era and developed public infrastructure of research and education significantly strengthen the role of small and medium companies in innovation activities (CES

VSEM, 2010). This trend also has been enforced in policy of many countries. The policies are changing in a way that is not based on the assumption that the best invested resources are those into growth resources of innovations (i.e. large companies) and also leaving the assumption that public support should be orientated into small and medium companies (CES VSEM 2010). New approaches are assuming specific role of both big and SME companies in innovation activities and are supporting the development of environment (infrastructure) that should encourage the interaction between small and big firms. Statistical data are not reflecting this yet however (CES VSEM 2010).

According to Table 23 in Appendix there was in total 6184 companies within small enterprises that were realizing in years 2006/2008 technical innovation – it is representing almost the third of total number of small companies within the economy and this share is continuously growing by 2-3% per two years. Medium enterprises are showing even more significant growth in the area of technological innovation when percentage of medium enterprises grown from 38% in years 200/2001 to 47% in years 2006/2008. (The big enterprises on contrary are showing only small increase, from sixty five to sixty seven). It would be interesting to see whether the improved results in categories of small and medium enterprises are caused by birth of new companies (that is more likely to happen in those industries where innovation are more likely to happen) or whether the share are increasing when the amount of the companies in the sample (total number of small and medium enterprises remains the same).

When we look at the split of technological innovations (split into product and process innovation – details in Table 24 in Appendix) there is interesting trend in stagnation of product innovation (that is relatively stable for all small, medium and big companies) and quite significant growth in area of process innovation – small enterprises increased share of companies with process innovations when between periods 1999/2001 and 2006/2008 it has increased two folds, in the case of medium enterprises it increase from 20% to 35% (the similar trend can be observed in the case of big companies). This is quite surprising results as process innovations are thought to be especially relevant for big companies and here the small and medium showed significant increases. It could be caused by growing share of companies that are providing services, where processes are playing significant role.

With this development the growth is in expenditures related to technological innovations is corresponding. In the period between years 2001 and 2008, the expenditures growth almost 3fold, for medium enterprises there was growth more than 2 fold (big companies grown in similar share as medium companies) – for details see Table 25 in Appendix.

When we look at non-technological innovation (it means marketing and organizational innovations) the growth rates are significantly lower for period between 2003 and 2008. The only growth was in the case of small companies that grew from 35% to almost 42%, in the case of medium enterprises these remains relatively stable – the details can be seen in Table 26 in Appendix.

The split of non-technological innovations shows increase in marketing innovations, whereas the share of the companies that are realizing organizational innovations is decreasing over time. The growth in marketing innovations is very significant for small companies where between 2003 and 2005 it has increased from 17% to more than 32%, the share of marketing innovations within category of medium enterprises grew from 24 to more than 37%.

3.3 Proposal of potential boosters

Potential boosters – the first potential booster for Czech small and medium enterprises is in area of education. There is potential for increasing the reach of educational system from classic one based on several degrees (basic, secondary, university) behind the university – in to the area of long life continuous education of workforce so the people are still up to date. It would also generate significant opportunity for SMEs to consume this service and externalize and improve the knowledge of their own employees. The second important aspect in education can be change of the model of the providing education – increased use of ICT that would make it more effective, cost effective and also would bring the digital knowledge in it.

So as the summary of potential boosters can be stated that is necessary that company has to have positive approach towards strategic planning and implementation of changes

and innovations. It means to realistically think about company's future, strengthen its competitiveness and look for causality between knowledge and innovation (that is complementing the traditional innovation ways and opens new ways leading to entrepreneurial successes. It is important to bear in mind that there is no direct link between innovation project initiation and it economic results as even well defined projects that are not well suited into innovation orientated and supporting company culture are not successful.

The first area where are definitely gaps a space for improvement is area of strategy and planning. Small and medium companies are relatively skeptic about usage of any tools or techniques from this category, claiming that this is bureaucratic ballast that is maybe good for big companies. This is not very healthy approach as without planning and strategic targets definition there is no target(s) that should be achieved and there is not possibility of checking and controlling the progress and to adopt corrective measures. It is not proposal for the same strategic and planning approach for small and medium companies as it is in the case of big companies. There is no need for sometimes very detailed and complicated planning process that is adopted by big companies, but the basics of framework should be the same. Company should have define its mission (that is relatively stable during longer period of time), vision (the view of future state of the company must be clear, the targets must be clear and quantifiable and also well communicated through the company) and strategic plans should be aligned with these targets and updated according to changing conditions that are having influence on target fulfillment). Well defined mission has the importance for the company as an anchor in uncertainty. Business activities and entrepreneurship is inherently having risks and uncertainty included. Vision and mission is helping to decrease this level of uncertainty on the acceptable level and is increasing the probability of success. Both are also giving evidence about overall quality or standard of the company and its readiness for action (that is important both for consumers but especially for suppliers and cooperating companies as it is showing that company has perspective in future, is not only short time focused, it is possible to count with it, orientated on it and trust it). What the successful strategy should be based on? Customer oriented focus, strategic thinking, ability to view things from different points of view, entrepreneurship, proactivity, ability to see details, fair evaluation and assessment of strengths and weaknesses a their

intentional management/improvement, focus on knowledge, people and simple solutions. What could influence this execution negatively is that mission, shared values and vision are not declared or defined in a way that is not possible to transform them into ready for action form. Strategy is not well connected with targets for different levels of management, resources allocation is not linked to strategy from long term priorities point of view. Additional negative factors are no feedback between outputs of business activities and performance needed for strategic targets achievement and also if there is focus primarily on short term financial KPI's. There is also big mistake in focusing on financial KPI's only as these are delayed and giving picture about the past – it is though necessary to enhance them with the indicators of future performance.

With the issues of mission, strategy and other things that are very often perceived by the representatives of small and medium companies as not useful for them and as bureaucratic ballast, there is also the issue of the governance and management and organizational structure.

The importance of this rather strategic and long-term, but the long-term vision has to be linked to the day-to-day operations via a performance management system (the performance management system can be defined as the formal, information-based routines, procedures and process of collecting and tracking data used in performance management by managers to maintain or alter pattern in organizational activities (Simons, 2000)).

Assumptions for successful innovations are as follows. It must defined in the beginning: needed resources and cash flows that are needed for design and launch of product (or any other innovation) in long term horizon and also the business systems and processes must be set so the innovation activity can be performed effectively. It is also important to ensure that resources (both financial and non-financial are available at correct time).

Another are for improvement is marketing. It is needed that companies are thinking about their markets, relevant customers and with focus on profit. Marketing category is also covering activities that are supporting, facilitating and realization of exchange transaction. There are also functions within the company in this category, which are related to sales of goods or services. When we are speaking bout marketing it is

necessary to distinguish between market pull and technology push. Market pull is leading to impulses for incremental, continuous innovation (examples are reactions to changed preferences and wishes of customers and subsequent company response to changed customer preferences). Technology push is source for substantial or breakthrough innovations that is related to creation of new demands from customers and also proactive estimation of assumed inception of demand that not become known to customers yet and to the new markets creation.

When we are speaking about innovations there can be described to edge approaches how the innovation can be prepared regarding good timing for the market. One approach is identification of products that could be developed and then wait until the technology for producing those products is available. Second approach can be to identify any used or under development technology and try to figure out, how these can be applicable by the company. There can be used researches such as Gartner hype cycle for emerging technologies[49].

Product innovations can be incremental or radical. Radical means usually introduction of new product, incremental means change of parameters, design or other conditions and characteristics of current product. Incremental innovations are less financially demanding and less risky compare to the radical ones. Improvement of product's characteristics has usually faster adoption on market, when introducing new product there is necessary to overcome certain barriers. The advantage of radical innovation is creation of competitive advantage or creation of non-competitive environment (or monopoly) – by the length of this status the economical effect of innovation is determined. When there are economic barriers on the entry it is lengthening the payback of the investment. As the environment is highly competitive it is needed to introduced

[49] Gartner Hype Cycle for emerging technologies is covering and analyzing the maturity of 1,800 technologies and trends from the ICT area and is categorizing the technologies into several categories or rather phases of adoption such as Technology Trigger, Peak of Inflated Expectations, Trough of Disillusionment and Slope of Enlightenment. For 2010 the most inflated expectations are for example with products and technologies such as media tablets, private cloud computing and 3D flat/panel TVs and displays

product improvements as quickly as possible. The product innovations are the most profitable or beneficial for companies with big volumes of production.

Process innovations are including changes of current machines and tools used within production process, increase of speed of production process, greater flexibility of production, decrease of time needed to translation of concept into final product and increase of quality when at the same time the costs are decreased.

Another category that is offering space for improvement is definitely are of quality and environment. These are including gaining of ISO certification[50], TQM (Total Quality Management)[51] and other concepts such as Kaizen[52], PDCA[53], and Six Sigma[54] etc. The importance of quality is very high as based on previous negative experience customer will hardly purchase again. Potential defect can be negative, very easy to remember character of the product and it can cause negative attitude towards not only current product or service but also towards the producer in general. Especially important are those parameters that are highly perceived by the customer and are representing the value for the customer. Very important aspect of this is also the stability – to achieve the same quality for all products and also for services where it is extremely difficult as with human factor included every service providing can be viewed as unique form this point of view. Use of control mechanisms including external independent audit are also potentially very useful for improving quality. It is also necessary to analyze and monitor current process and situations and identify areas for improvement (that can lead to

[50] For quality there is relevant ISO 9000, for environmental issues there is relevant ISO 14000

[51] TQM is concept of integrated management philosophy leading to continuous improvement of the quality of products and services. According to Cua et al (2001) there are nine common practices of TQM: cross-functional product design, process management, supplier quality management, customer involvement, information and feedback, committed leadership, strategic planning, cross/functional training and employee involvement.

[52] Kaizen is Japanese word for improvement and is based on similar principles as TQM, it means continuous improvement of processes in manufacturing, engineering and business management.

[53] PDCA (also known as Deming circle) is acronym for plan-do-check-act. It is iterative four step management process that should lead to quality improvements.

[54] Six Sigma is a business management strategy originally developed in Motorola, in 1986. It aims to prove the quality of processes outputs by identifying and removing the causes of defects (errors) and minimizing variability in manufacturing and business processes.

innovation itself). It is also important to reflect the environmental issues in the processes of the company namely decrease energy consumption in production process, decrease potential consumption of produced goods, reduced waste and reduce negative impact on environment in general.

Another area for improvement is logistics, it means organization, planning, management of flow of goods, starting with development, purchasing and ending with production and distribution according to orders of final customer, so all the requests are fulfilled with least possible costs. Logistic as a system is part of strategy and it is managing distribution of resources over time (resources means people, production capacity, information etc.) with target to achieve higher competitiveness of the company. Logistic system is also interconnecting the producer with its suppliers and customers and also all the parts of the distribution or supply chain within those. Logistic has to react and follow also trends such as quicker reaction on changes in demand, permanent decrease of costs and continuous improvement of logistic processes. Another huge opportunity is in outsourcing that was also stated in several researches as a barrier for Czech SME companies.

The last but not least is category of human resources and organizational issues. Intellectual wealth of company is created by workers who are contributing to creation and management of common knowledge base with aim to improve the results of research and development and it is leading in the final effect to the improvement in business performance itself. There is even in smaller companies' significant role of personal management or human resources. It includes activities such as choosing and allocation of employees (description of work, planning of needed personnel, organizational setup, improvement in qualification and also compensation and benefits issues).

Another area that is showing the potential for improvement for Czech SMEs is are of marketing innovations. The strength of this factor is showed by Askenazy et al (2010) who claim that advertising and innovation are two engines for firms to escape competition through a better attraction power towards consumers or quality advantage.

4 Conclusion and summary

The main focus of this thesis was to investigate the innovation, what are driving forces behind innovations, how the innovation was viewed by different scholars starting with classic economists and including also modern contemporary views on problematic of innovation. The target of the work was fulfilled in this area. In the following part of the thesis the sources of innovation are described – such as seven sources of innovation opportunities defined by P. Drucker or the opportunities coming from megatrends such as demographic changes, climate changes, technological changes etc. Also in the part that is covering the sources of innovation is described the role of education or human capital in more general, broader view. These aspects are covering educational system, motivation for lifetime education (not finishing with learning after last school etc.), and aspects of labor mobility. Another important source of potential innovations is seen in market structure – that means level of competition within given industry. The idea of geographical differences in level of innovation activities is also described in part dedicated to theory of geographical clusters and related issues.

The following part of the work is briefly covering what are the preconditions or factors leading to successful innovation. It is showing on example of using modern management techniques that these can lead to significant gains in profitability and productivity, so these can be viewed as another area for realization of innovative activities, together with knowledge base and its management within the company. The relationship between innovation and its later standardization is discussed as important source for economic growth and growth of the welfare.

The following part is describing and analyzing types of innovation according to different views. It outlines three elementary views for distinguishing different types of innovation: 1) business or entrepreneurial area where innovations are occurring (with four basic types – product, process, marketing and organizational and with fifth type to be added – business model innovations), 2) according to impact of innovations or level of pioneering (with recognizing three types such as incremental, changing consumers' behavior and destroying existing firms' competencies (Cantner et al, 2009) or more simple view distinguishing incremental and disruptive innovations) and to give a full

picture also more broader and global view represented by distinguishing between business and social innovations as 3rd type or category.

There is also briefly discussed the support of innovation on the state level, showing the European Union ambitions and also real activities done in Czech Republic.. The last part of the theoretical chapter is dedicated to brief analysis of currently used indicators of innovation, such as GERD and number of patents per capita. The analysis shows their limit when describing the level of innovative activities.

The part dedicated to the innovation potential of Czech SME companies is describing the actual situation within this segment of economy including the actual available data. The data shows increasing share of small and medium enterprises introducing both technological and non technological innovations. What is also positive (and it is contrary to some previous thoughts on innovations within SMEs) the relatively high numbers of companies innovating not only in product area but also in other three categories). Within the area of barriers of innovation there was found discrepancy or contradiction within the mostly cited barrier the financial resources and on the other hand preferring by overwhelming majority of SMEs own resources (that is on one side commendable as conservative and prudent approach, on the other side it is showing that the owners are not willing to give up their control over the company due to dilution of shares in case of entrance of investors, or it could mean that entrepreneurs itself or their ideas are not ready for fight for these financial resources). So the area of financing respectively change of approach seems to be needed. Another area is aspect of quality of human resources that is showing similar pattern – by SME representatives cited as important barrier on the other hand their activity in it is rather very limited.

Further research in this area can be made in analysis of indicators correlation to try explain in more detail and analyze the behavior, relationship and levels of correlation between the indicators. Also new measure could be proposed to better measure especially SMEs and include their innovation outputs in statistics. Within the area of innovation potential of Czech SME there would be good to propose next steps how the proposal can be executed.

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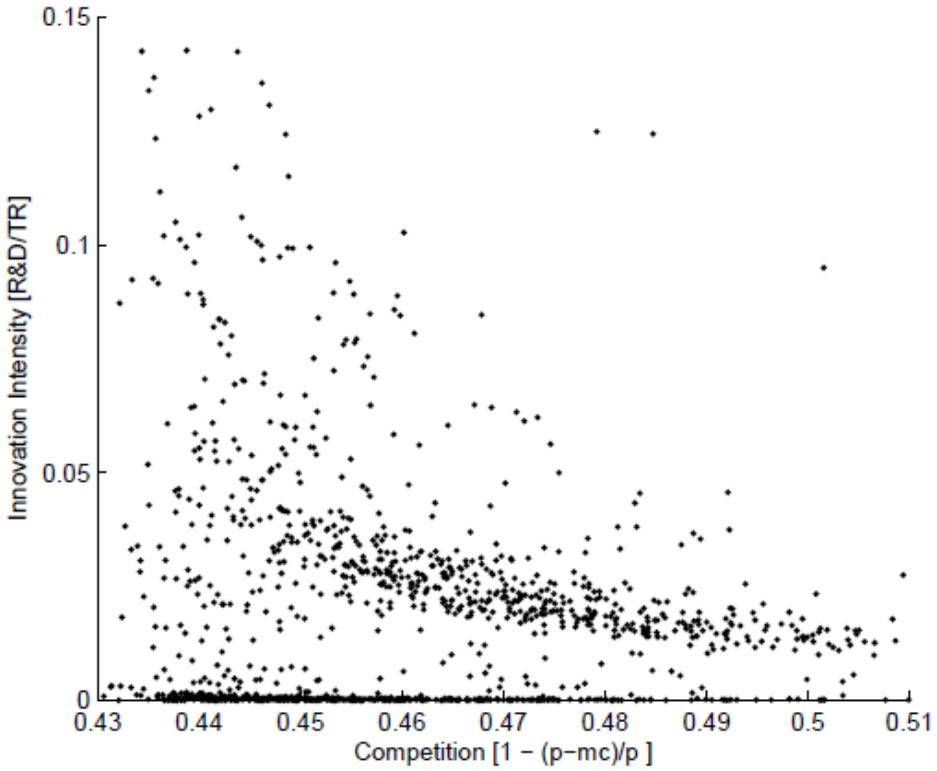
Appendix

Table 1- R&D expenditure by industry in the most innovative countries (data for 2006, in bil. PPP), Source: OECD ANBERD database, edition 2009 (online).

Industry (ISIC Rev. 3)	USA	Japan	Germany	Korea	France
Chemicals (24)	46,3	16,4	8,2	2,1	5,0
Radio, TV, telecommunications equipment (32)	31,2	12,2	4,1	13,3	2,8
Motor vehicles (34)	16,6	17,9	14,4	4,2	4,6
Medical, precision, optical instruments (33)	22,4	4,6	3,5	0,4	1,6
Office, accounting, computing machines (30)	7,4	14,1	0,6	0,4	0,2

Note: All sectors which are in the top three by total R&D expenditure in any of the five countries are included; industries are sorted by total R&D expenditure across the five countries.



Graph 1 - Equilibrium Dynamics: Relationship between Competition and Innovation at the Firm Level, source Hashmi et al (2010).

Table 2 - Expenditures on research and development as percentage of GDP (GERD), source: Eurostat.

Country/year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Czech Rep.	1,14	1,21	1,20	1,20	1,25	1,25	1,41	1,55	1,54	1,47	1,53
Denmark	2,18	2,24	2,39	2,51	2,58	2,48	2,46	2,48	2,58	2,87	3,02
Germany	2,40	2,45	2,46	2,49	2,52	2,49	2,49	2,53	2,53	2,68	2,82
Italy	1,02	1,05	1,09	1,13	1,11	1,10	1,09	1,13	1,18	1,23	1,27
Hungary	0,67	0,79	0,92	1,00	0,93	0,87	0,95	1,00	0,97	1,00	1,15
Austria	1,90	1,94	2,07	2,14	2,26	2,26	2,45	2,46	2,52	2,67	2,75
Poland	0,69	0,64	0,62	0,56	0,54	0,56	0,57	0,56	0,57	0,60	0,68
Slovenia	1,37	1,39	1,50	1,47	1,27	1,40	1,44	1,56	1,45	1,65	1,86
Slovakia	0,66	0,65	0,63	0,57	0,57	0,51	0,51	0,49	0,46	0,47	0,48
Finland	3,17	3,35	3,32	3,37	3,44	3,45	3,48	3,48	3,47	3,72	3,96
Sweden	3,58	3,86	4,13	3,97	3,80	3,58	3,56	3,68	3,40	3,70	3,62
United States	2,63	2,69	2,71	2,60	2,60	2,53	2,56	2,59	2,65	2,77	2,77
Japan	3,02	3,04	3,12	3,17	3,20	3,17	3,32	3,40	3,44	3,44	3,44

Table 3 - Year-to-year change of GDP (gross domestic product) in % , source : Eurostat

Country/year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Czech Rep.	1,30	3,60	2,50	1,90	3,60	4,50	6,30	6,80	6,10	2,50	-4,10
Denmark	2,60	3,50	0,70	0,50	0,40	2,30	2,40	3,40	1,60	-1,10	-5,20
Germany	2,00	3,20	1,20	0,00	-0,20	1,20	0,80	3,40	2,70	1,00	-4,70
Italy	1,50	3,70	1,80	0,50	0,00	1,50	0,70	2,00	1,50	-1,30	-5,20
Hungary	4,10	4,90	3,80	4,10	4,00	4,50	3,20	3,60	0,80	0,80	-6,70
Austria	3,30	3,70	0,50	1,60	0,80	2,50	2,50	3,60	3,70	2,20	-3,90
Poland	4,50	4,30	1,20	1,40	3,90	5,30	3,60	6,20	6,80	5,10	1,70
Slovenia	5,40	4,40	2,80	4,00	2,80	4,30	4,50	5,90	6,90	3,70	-8,10
Slovakia	0,00	1,40	3,50	4,60	4,80	5,10	6,70	8,50	10,50	5,80	-4,80
Finland	3,90	5,30	2,30	1,80	2,00	4,10	2,90	4,40	5,30	0,90	-8,20
Sweden	4,70	4,50	1,30	2,50	2,30	4,20	3,20	4,30	3,30	-0,60	-5,30
United States	4,80	4,10	1,10	1,80	2,50	3,60	3,10	2,70	1,90	0,00	-2,60
Japan	-0,10	2,90	0,20	0,30	1,40	2,70	1,90	2,00	2,40	-1,20	-6,30

Table 4 - Number of patents per capita (per million inhabitants), source Eurostat

Country/year	1999	2000	2001	2002	2003	2004	2005	2006	2007
Czech Rep.	5,83	6,48	6,99	8,61	11,16	11,05	10,41	14,65	15,78
Denmark	160,98	177,07	168,74	174,14	192,21	191,83	202,12	193,73	194,05
Germany	254,94	267,82	264,44	260,84	263,34	276,19	283,74	283,61	290,70
Italy	65,32	70,08	69,37	73,13	75,28	79,43	82,31	83,56	86,37
Hungary	11,32	11,80	9,69	11,81	12,59	15,43	13,38	16,02	17,15
Austria	133,66	147,10	149,37	157,35	164,08	175,52	179,96	203,54	216,97
Poland	0,94	1,12	1,52	2,12	3,00	3,15	3,20	3,61	3,82
Slovenia	15,86	25,47	25,12	38,18	37,91	57,54	53,35	48,17	51,47
Slovakia	2,86	2,08	2,26	4,51	5,85	3,83	5,70	7,34	7,83
Finland	275,74	274,57	266,31	241,90	241,32	263,99	247,07	248,60	250,76
Sweden	248,52	257,95	236,21	224,68	221,19	246,21	260,07	280,04	298,36
USA	109,16	110,33	105,95	108,21	109,02	114,91	115,90	106,60	105,75
Japan	148,33	171,28	156,91	158,59	166,54	174,50	164,91	162,86	161,67

Table 5 - Share of high-tech export on total export (in %), source Eurostat

Country/year	1999	2000	2001	2002	2003	2004	2005	2006
Czech Rep.	7,85	7,78	9,10	12,32	12,37	13,66	11,67	12,74
Denmark	13,88	14,43	13,99	15,02	13,45	13,32	14,86	12,75
Germany	14,19	16,08	15,80	15,15	14,76	15,36	14,79	14,06
Italy	7,51	8,54	8,58	8,22	7,10	7,08	6,94	6,35
Hungary	19,45	23,11	20,61	21,45	22,33	21,92	19,69	20,33
Austria	11,89	14,05	14,66	15,74	15,33	14,76	12,81	11,17
Poland	2,26	2,84	2,71	2,45	2,71	2,73	3,20	3,11
Slovenia	3,75	4,46	4,83	4,86	5,80	5,20	4,26	4,66
Slovakia	3,50	2,87	3,17	2,63	3,43	4,68	6,40	5,82
Finland	20,69	23,48	21,14	20,90	20,58	17,77	21,34	18,12
Sweden	17,83	18,71	14,23	13,71	13,12	14,14	14,23	13,40
United States	30,08	29,95	28,71	27,99	27,00	26,82	26,15	26,13
Japan	25,13	27,00	24,73	23,09	22,75	22,37	21,15	20,04

Table 6 - Output of correlation analysis between expenidtures on research and development (in % share on GDP) and year-to-year change of GDP (in %), data for period 1996-2008, source World Bank

Country	Country code	Correlation
Austria	AUT	0,0202
Czech Republic	CZE	0,6532
Denmark	DNK	-0,6170
Finland	FIN	-0,3893
Germany	DEU	-0,0319
Hungary	HUN	-0,1645
Italy	ITA	-0,4518
Japan	JPN	-0,0241
Korea, Rep.	KOR	-0,0939
Poland	POL	0,1514
Slovak Republic	SVK	-0,1534
Slovenia	SVN	0,1184
Sweden	SWE	-0,2715
United States	USA	-0,6800
LOW		-0,6800
HIGH		0,6532
AVG		-0,1382
MEDIAN		-0,1237

Table 7 - Correlation between high technology exports and GDP total, data for period 1988-2009, source World Bank

Country	Country code	Correlation
Austria	AUT	0,8822
Czech Republic	CZE	0,9911
Denmark	DNK	0,9235
Finland	FIN	0,8010
Germany	DEU	0,8717
Hungary	HUN	0,9782
Italy	ITA	0,9040
Japan	JPN	0,7904
Korea, Rep.	KOR	0,9600
Poland	POL	0,9730
Slovak Republic	SVK	0,9843
Slovenia	SVN	0,9866
Sweden	SWE	0,8497
United States	USA	0,8521
LOW		0,7904
HIGH		0,9911
AVG		0,9106
MEDI		0,9138

Table 8 - Correlation between GERD and number of researchers, based on data from period 1996-2008, source World Bank

Country	Country code	Correlation
Austria	AUT	0,987
Czech Republic	CZE	0,933
Denmark	DNK	0,875
Finland	FIN	0,949
Germany	DEU	0,954
Hungary	HUN	0,909
Italy	ITA	0,709
Japan	JPN	0,939
Korea, Rep.	KOR	0,934
Poland	POL	-0,689
Slovak Republic	SVK	-0,483
Slovenia	SVN	0,819
Sweden	SWE	0,233
United States	USA	0,119
LOW		-0,689
HIGH		0,987
AVG		0,585
MED		0,892

Table 9 - correlation between high technology exports (as share of total exports) and year-to-year change of GDP, based on data from period 1988-2009, source World Bank

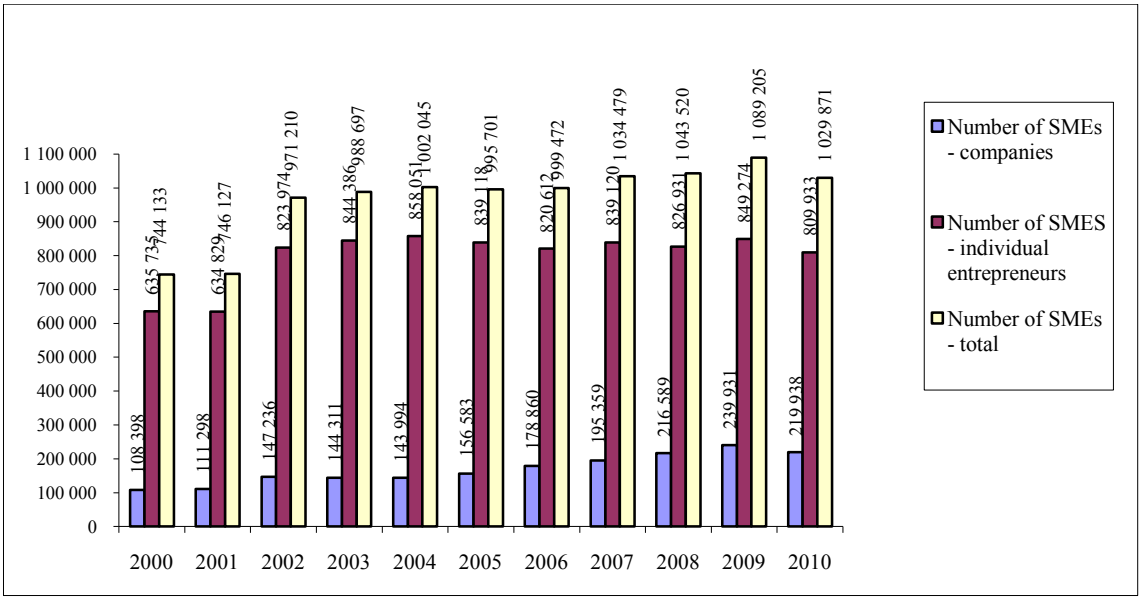
Country	Country code	Correlation
Austria	AUT	-0,195
Czech Republic	CZE	0,123
Denmark	DNK	0,121
Finland	FIN	0,314
Germany	DEU	-0,391
Hungary	HUN	0,366
Italy	ITA	0,025
Japan	JPN	0,225
Korea, Rep.	KOR	-0,366
Poland	POL	-0,012
Slovak Republic	SVK	0,407
Slovenia	SVN	-0,071
Sweden	SWE	0,387
United States	USA	0,687
LOW		-0,391
HIGH		0,687
AVG		0,116
MEDIAN		0,122

Table 10 - correlation between high tech exports total and gdp total, based on data from period 1967-2009, source World Bank

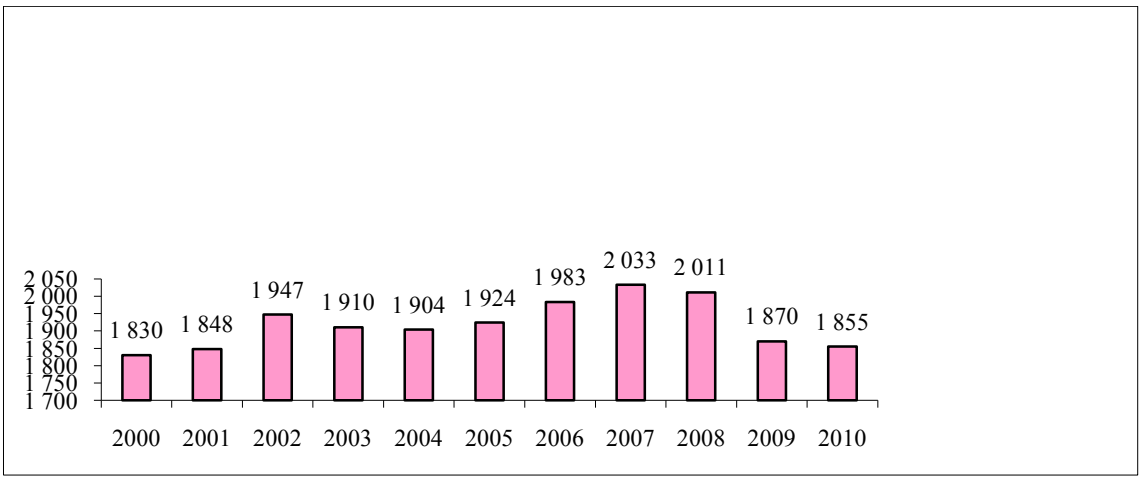
Country	Country code	Correlation
Austria	AUT	0,891
Czech Republic	CZE	0,568
Denmark	DNK	N/A
Finland	FIN	0,863
Germany	DEU	0,884
Hungary	HUN	0,970
Italy	ITA	0,901
Japan	JPN	0,714
Korea, Rep.	KOR	0,868
Poland	POL	0,925
Slovak Republic	SVK	0,963
Slovenia	SVN	0,898
Sweden	SWE	0,914
United States	USA	0,963
LOW		0,568
HIGH		0,970
AVG		0,871
MEDIAN		0,898

Table 11 - correlation between patent applications and GERD, based on data from period 1996-2009, source World Bank

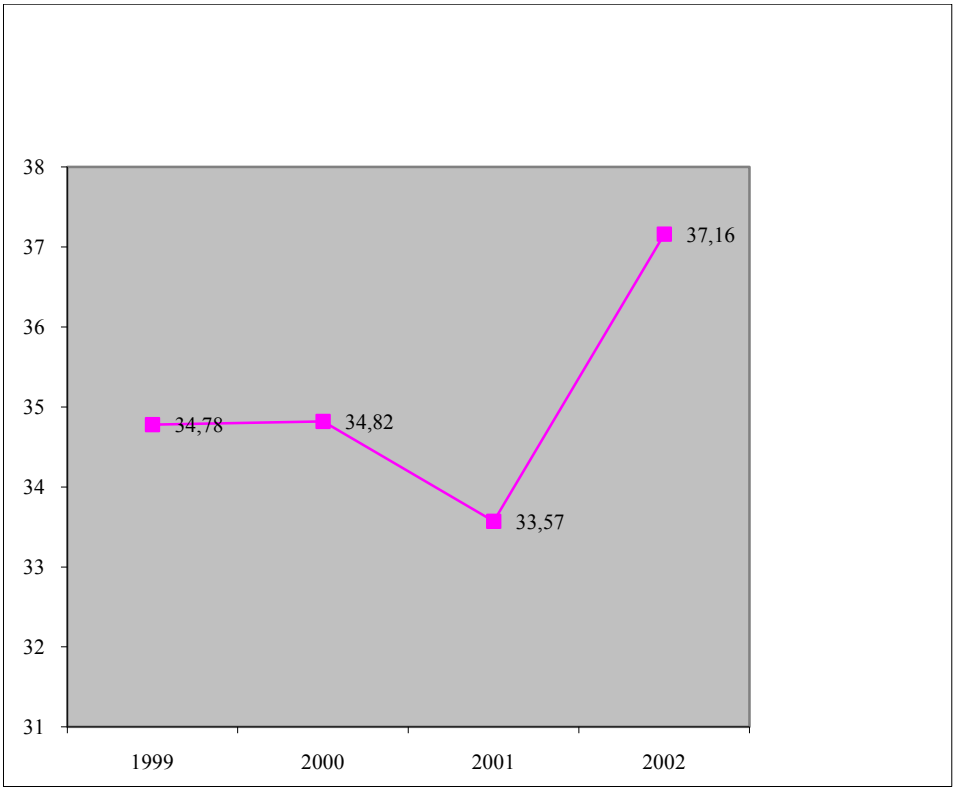
Country	Country code	Correlation
Austria	AUT	0,822
Czech Republic	CZE	0,590
Denmark	DNK	0,740
Finland	FIN	-0,517
Germany	DEU	0,695
Hungary	HUN	0,113
Italy	ITA	0,882
Japan	JPN	-0,060
Korea, Rep.	KOR	0,923
Poland	POL	0,373
Slovak Republic	SVK	0,160
Slovenia	SVN	0,200
Sweden	SWE	0,108
United States	USA	0,566
LOW		-0,517
HIGH		0,923
AVG		0,400
MED		0,469



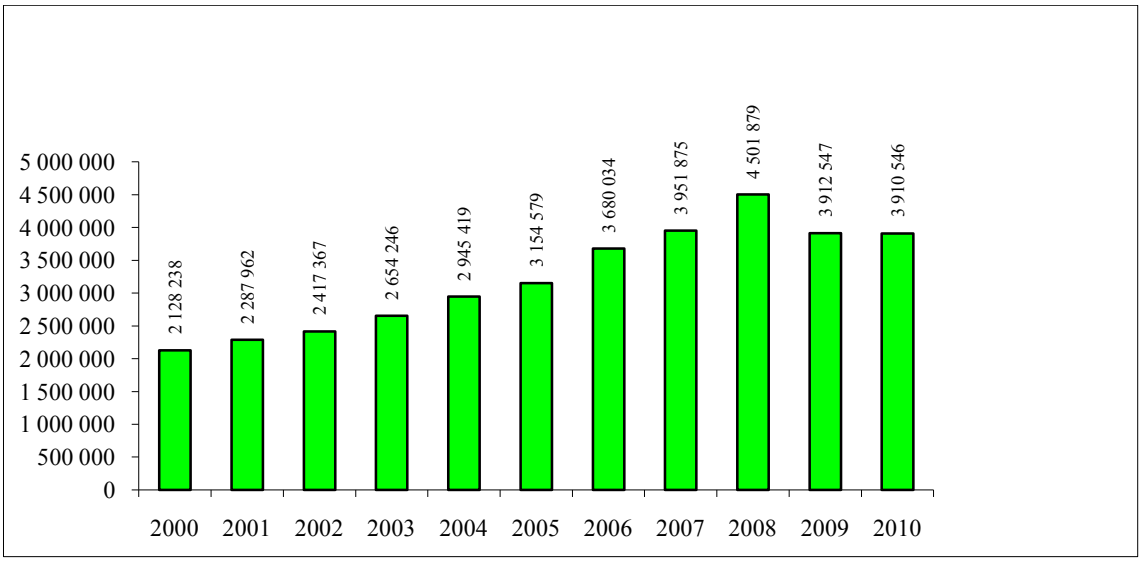
Graph 2 - Development of number of SMEs within Czech economy in years 2000-2010 (thousands of employees), source CSU



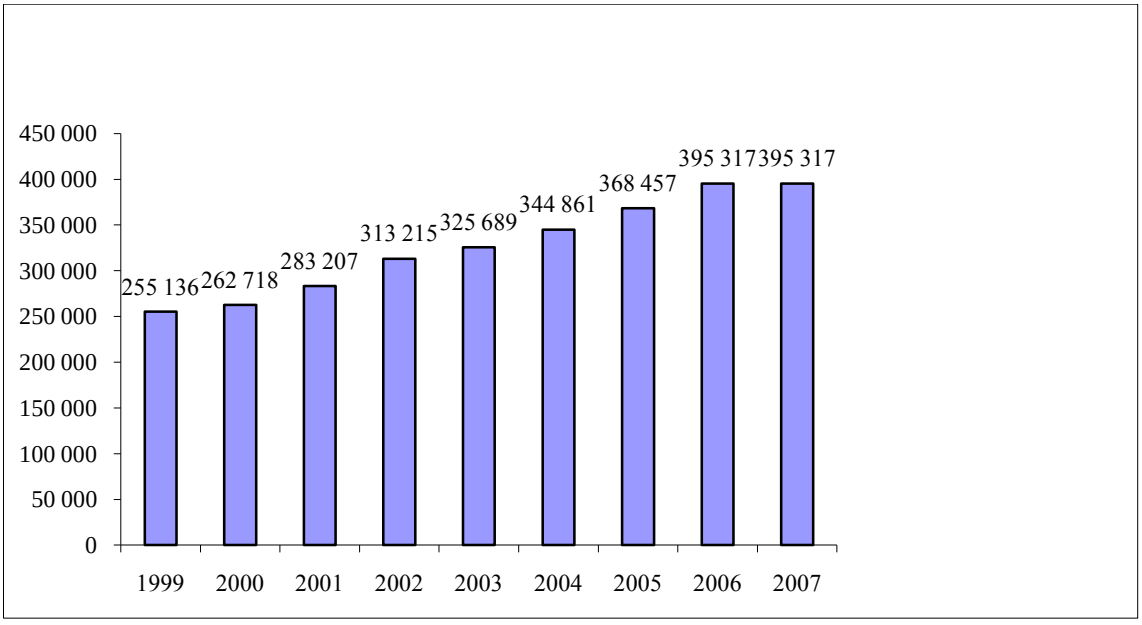
Graph 3- Development of employees employed by small and medium enterprises in Czech republic in years 2000-2010, number of employees in thousands, source CSU



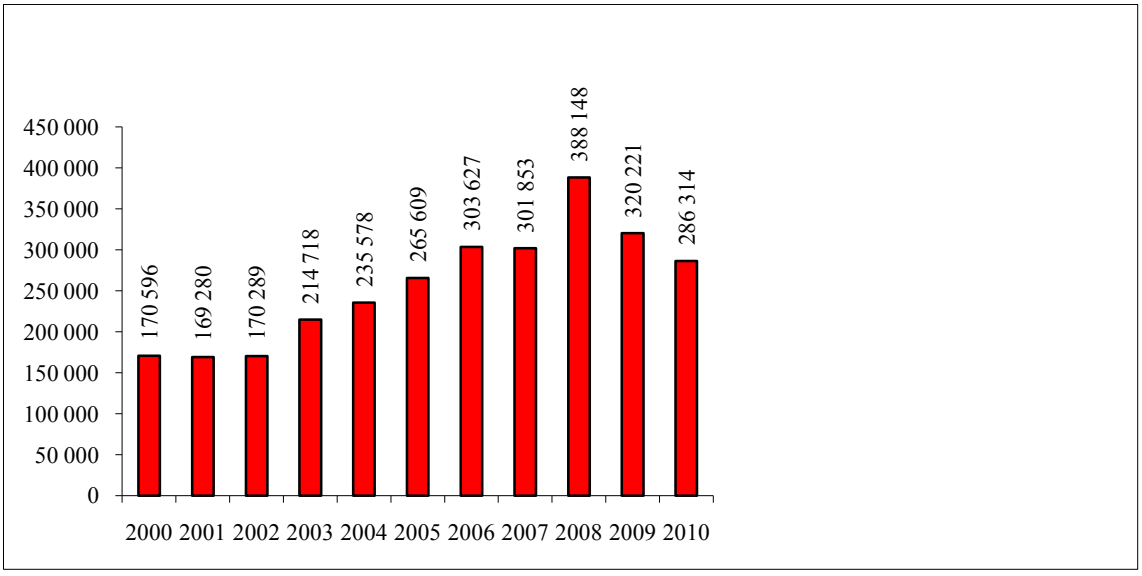
Graph 4 - Share of SMEs on GDP in %, source CSU



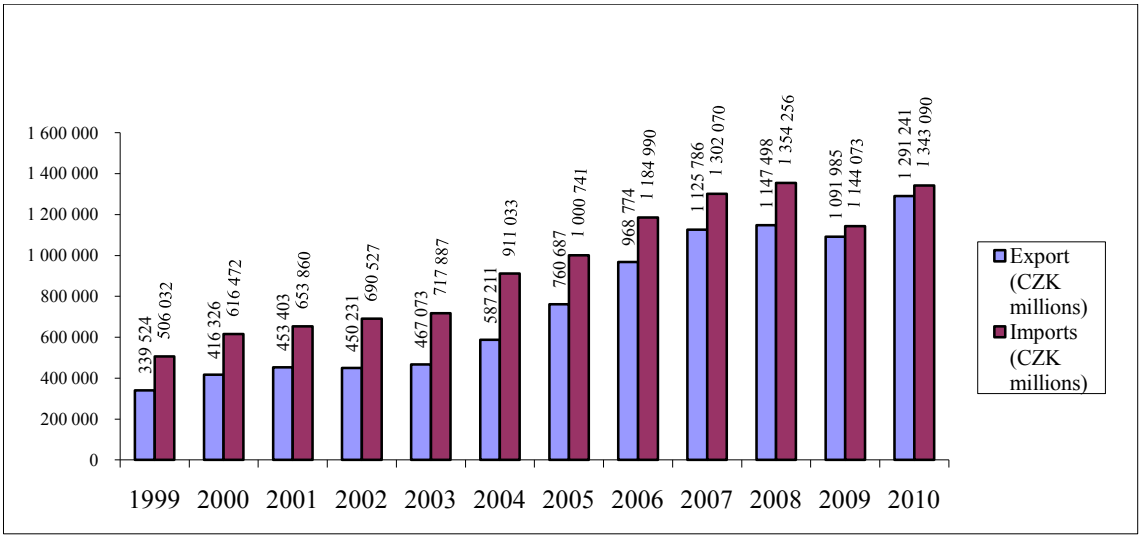
Graph 5 - Overall output of SMEs in Czech economy, in CZK millions, source CSU



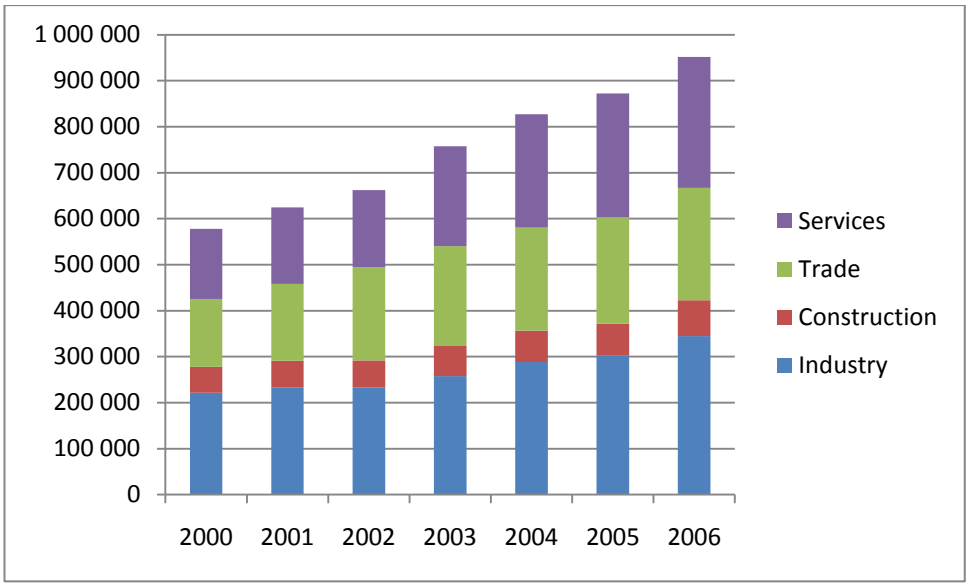
Graph 6 - development of payroll costs within czech SMEs (in CZK millions) , source CSU



Graph 7 - Investment activity by Czech SMEs in CZK millions, source CSU



Graph 8 - Foreign trade activities of Czech SMEs in CZK millions, source CSU



Graph 9 Shares of catgeorie of industries on SME output - units in millions CZK, source CSU

Table 12 - organizational structure of the Czech economy, according to industry, source CSU vyrocni zprava za 2010, data k 31.12.2009

CZ-NACE section	2009					
		Size of business (no. of employees)				
	Registered businesses, total	0[1)]	1–5	6–19	20–249	250+
Total	**2 570 611**	**2 288 148**	**189 588**	**59 378**	**31 434**	**2 063**
Agriculture, forestry and fishing	91 014	82 946	4 700	1 789	1 558	21
Mining and quarrying	605	358	71	83	72	21
Manufacturing	305 074	267 556	19 416	9 418	7 866	818
Electricity, gas, steam and air conditioning supply	2 704	2 150	181	170	183	20
Water supply; sewerage, waste management and remediation activities	10 564	8 799	910	392	424	39
Construction	313 358	288 338	15 525	6 772	2 650	73
Wholesale and retail trade; repair of motor vehicles and motorcycles	666 180	598 652	48 962	14 121	4 276	169
Transportation and storage	73 882	60 584	8 967	2 927	1 296	108
Accommodation and food service activities	132 207	108 609	17 418	5 049	1 102	29
Information and communication	54 549	48 650	3 983	1 239	623	54
Financial and insurance activities	52 419	50 027	1 828	328	201	35
Real estate activities	137 865	125 795	9 855	1 645	550	20
Professional, scientific and technical activities	321 242	294 341	21 195	4 366	1 287	53
Administrative and support service activities	49 261	42 974	3 562	1 399	1 175	151
Public administration and defence; compulsory social security	15 468	9 227	3 068	2 017	985	171
Education	40 751	29 870	2 460	3 812	4 566	43
Human health and social work activities	32 510	12 949	16 636	1 347	1 393	185
Arts, entertainment and recreation	58 693	53 895	3 257	907	598	36
Other service activities	170 484	161 778	6 620	1 450	619	17
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	5	5	-	-	-	-
Activities of extraterritorial organisations and bodies	140	120	10	10	-	-
Unclassified	41 636	40 525	964	137	10	-

Table 13 - R&D personnel : business enterprise sector (BES), by size group of enterprises and activity, source CSU

Indicator	*R&D employees (31 December; headcount)*				
	2005	2006	2007	2008	2009
Total	**27 278**	**29 740**	**31 847**	**32 745**	**33 480**
In foreign-controlled enterprises	8 467	10 289	11 757	14 713	14 577
By size group of enterprises:					
0 employees (natural persons)	270	189	160	132	157
1–9 employees	597	614	702	547	931
10–49 employees	3 233	3 951	4 196	4 639	4 999
50–249 employees	9 152	9 757	10 366	11 200	12 074
250–499 employees	3 695	3 418	3 447	3 090	3 343
500 and more employees	10 331	11 810	12 975	13 136	11 976

Table 14 - R&D expenditure: business enterprise sector (BES), by size group of enterprises and activity, source CSU

Indicator	*R&D expenditure, BERD (CZK mil.)*				
	2005	2006	2007	2008	2009
Total	**26 657**	**32 470**	**33 620**	**33 486**	**33 218**
In foreign-controlled enterprises	14 007	19 351	18 960	20 909	20 340
By size group of enterprises:					
0 employees (natural persons)	90	85	71	69	107
1–9 employees	376	417	579	396	589
10–49 employees	2 187	2 493	2 677	3 105	3 361
50–249 employees	6 355	6 635	7 762	8 607	9 004
250–499 employees	3 204	2 701	2 728	2 791	2 970
500 and more employees	14 444	20 138	19 803	18 517	17 187

Table 15 – Factors of quality of business conditions and thein relative strenghts, source Viturka (2010)

Factors	Industry A	Industry B	Industry C
Business factors	31	27	29
Markets proximity	14	10	12
Important companies	9	11	10
Foreign companies presence	5	3	4
Support services	3	3	3
Infrastructure factors	8	9	8
Quality of roads and railroads	3	3	3
Proximity of airports	1	1	1
ICT development	4	5	4
Workforce factors	28	24	26
Availability of workforce	10	10	10
Quality of workforce	15	11	13
Flexibility of workforce	3	3	3
Local factors	14	17	15
Knowledge base	13	15	14
Financial assistance	1	2	1
Cost factors	12	13	13
Workforce costs	6	6	6
Costs of rents	6	7	7
Environmental factors	7	10	9
Urbanistic and natural attractivity of territory	4	5	5
Environmental quality of territiory	3	5	4

Table 16 - quality of business conditions supporting innovation in Czech regions, source Viturka (2010)

Region	Popullation in thousands	KPPI of region	KPPI of regional centre
Prague	1316,9	1,3	1,3
Stredocesky	974,7	3,01	2,26
Jihocesky	625,3	2,97	2,08
Plzensky	550,7	2,85	1,73
Karlovarsky	304,3	3,28	2,51
Ustecky	820,2	3,39	2,70
Liberecky	428,2	3,05	2,35
Kralovehradecky	550,7	2,97	2,04
Pardubicky	508,3	3,01	1,83
Vysocina	519,2	3,12	2,23
Jihomoravsky	1127,7	2,72	1,58
Olomoucky	639,4	3,15	2,32
Zlinsky	595,0	3,28	2,51
Moravskoslezky	1269,5	3,37	2,23
Czech Republic	10230,1	2,96	1,3

Table 17 - Questions for own qualitative research among SMEs owners/managers

Area	Questions
1.	What are the main parameters of the company: number of employees, industry, company age, company turnover (if more details can be shared please do so) What was the reason or motivation for establishing the company?
2.	How do you understand word innovation? Have your company introduced any new product/service, process, marketing approach or organizational change? If yes please describe the substance of such innovation and also the process leading to introduction of such innovation? What was business impact of such innovation?
3.	How does your company executing innovation process? What are the barriers in bringing more innovations to market or to internal functions of your company?

Table 18 - SWOT analysis output of Czech SMEs, source MPO and own resarch

Strenghts	Weakness
▪ Flexibility in reaction to the market development ▪ Knowledge of local markets and customer needs ▪ Workforce adaptability ▪ High performance focus of SME's owners ▪ Products' quality ▪ Innovation potential ▪ Jobs creation ▪	▪ Not sufficient capital sources (especially in case of small and very small companies) ▪ Very low focus on marketing activities due to the limited financial resources ▪ Limited funds for technology equipment and tools ▪ Intellectual property rights ▪ Prevalence of production with low value added ▪ Further development of human resources not in focus ▪ Not sufficient cooperation between SMEs.
Opportunities	**Threats**
▪ Foreign markets expansion ▪ Increased cooperation of companies in areas of common interests ▪ Introduction and use of shared brands and trademarks ▪ Subsidies available to SME's ▪ Cooperation with universities and other research institutions ▪ Bigger participation on public orders/tenders	▪ Lack of qualified workforce in technical professions ▪ High competition; ▪ Bureaucratic obstacles in everyday business; ▪ Legislation restrictions ▪ Technical and technological lagging behind

Table 19 - Effect of factors hampering innovation activities for innovating enterprises, source CSU, 2005

Indciator	Hampering factor marked as high important (innovating enterprises - %)										
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
CR total	23,4	12,3	18,5	8,4	1,9	3,3	5,4	17,6	11,7	5,5	8,7
small enterprises (10-49 empl.)	24,8	12,6	18,8	7,2	1,9	3,4	5,7	17,6	11,2	6,0	9,6
medium enter. (50-249 empl.)	21,6	12,5	18,3	11,6	1,8	3,1	5,0	17,7	13,0	4,3	6,6
large enterprises (above 250 empl.)	15,9	8,5	16,0	9,0	2,6	3,4	2,9	16,3	11,7	3,8	7,3

Legend:
[1] Lack of funds within enterprise
[2] Lack of finance from sources outside enterprise
[3] Innovation costs too high
[4] Lack of qualified personnel
[5] Lack of information on technology
[6] Lack of information on markets
[7] Difficulty in finding cooperation partner
[8] Market dominated by established enterprises
[9] Uncertain demand for innovation goods or services
[10] No need due to prior innovations
[11] No need because of no demand for innovations

Table 20 - Effect of factors hampering innovation activity for non- innovating companies, source CSU 2005

Indciator	Hampering factor marked as high important (noninnovating enterprises - %)										
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
CR total	20,6	7,7	15,1	6,1	1,5	1,7	4,2	12,8	9,4	7,0	21,4
small enterprises (10-49 empl.)	21,5	8,1	15,7	5,8	1,5	1,7	4,3	13,3	9,8	7,1	21,0
medium enter. (50-249 empl.)	16,6	5,5	11,8	7,9	2,1	1,6	4,0	10,3	7,0	6,3	23,6
large enterprises (above 250 empl.)	11,7	3,9	11,1	2,6	0,5	0,8	1,8	7,5	8,6	6,7	20,8

Legend:
[1] Lack of funds within enterprise
[2] Lack of finance from sources outside enterprise
[3] Innovation costs too high
[4] Lack of qualified personnel
[5] Lack of information on technology
[6] Lack of information on markets
[7] Difficulty in finding cooperation partner
[8] Market dominated by established enterprises
[9] Uncertain demand for innovation goods or services
[10] No need due to prior innovations
[11] No need because of no demand for innovations

Table 21 - Split of responsibilities in strategy preparation, source Sebestova (2007)

Company size	Manager	Owner	External consultant	Specialized internal unit
Micro (0-10 empl.)	12,6%	75,6%	1,8%	10%
Small (11-49 empl.)	35,8%	45,7%	2,8%	15,7%
Medium (50-249 empl.)	72,5%	5%	0%	22,5%
% share of total	40,30%	42,10%	1,53%	16,07%

Table 22 - Sources used in process of strategy preparation, source Sebestova (2007)

Company size	Official statistics	Purchased analysis	Own resources	Informal sources	Number of sources
Micro (0-10	21,8%	12,8%	47,6%	17,8%	1,51
Small (11-49	27,3%	16,6%	35,6%	20,5%	1,73
Medium (50-	28,4%	13,5%	41,9%	16,2%	1,85
% share of	25,83%	14,30%	41,70%	18,17%	1,7

Table 23 - Number of companies realizing in given period technological innovation, source CSU

	Number of business				%			
	99-01	**02-03**	**04-06**	**06-08**	**99-01**	**02-03**	**04-06**	**06-08**
Total	**5 885**	**5 451**	**8 217**	**9 515**	**29,4**	**31,1**	**35,1**	**37,0**
small (10 - 49 empl.)	3 493	3 367	5 042	6 184	24,0	26,3	29,0	32,2
medium (50 - 249 empl.)	1 654	1 436	2 380	2 456	38,3	39,0	48,7	47,0
large (above 250 empl.)	738	649	794	875	65,2	62,3	70,5	67,5

Table 24 - Share of companies realizing product and process innovation in given period, source CSU

	Product innovation				Process innovation			
	99-01	**02-03**	**04-06**	**06-08**	**99-01**	**02-03**	**04-06**	**06-08**
Total	**23,6**	**23,3**	**24,3**	**22,8**	**16,7**	**12,5**	**27,3**	**29,0**
small (10 - 49 empl.)	19,0	19,3	18,5	18,2	13,6	8,8	21,6	25,4
medium (50 - 249 empl.)	30,6	29,9	37,2	32,2	20,3	17,9	39,7	35,2
large (above 250 empl.)	55,5	49,6	57,9	54,1	42,5	37,8	61,3	57,1

Table 25 - Expenditures for technological innovations in given year according to company size, source CSU

	2001	2003	2005	2006	2008
Total	**49 192**	**50 019**	**94 864**	**97 146**	**116 892**
small (10 - 49 empl.)	8 202	11 218	11 747	11 769	21 452
medium (50 - 249 empl.)	11 052	8 742	29 584	24 885	25 715
large (above 250 empl.)	29 938	30 059	53 534	60 492	69 725

Table 26 - Companies with nontechnological innovation in given period, source CSU

	Number of businesses			%		
	03-05	**04-06**	**06-08**	**03-05**	**04-06**	**06-08**
Total	**8 532**	**8 864**	**11 664**	**40,7**	**37,9**	**45,4**
small (10 - 49 empl.)	5 319	5 632	8 040	35,3	32,4	41,9
medium (50 - 249 empl.)	2 441	2 454	2 755	51,3	50,3	52,7
large (above 250 empl.)	771	778	869	70,2	69,1	66,9

Table 27 - Companies with non technological - marketing or organizational - innovation, within given period, share on total, source CSU

	Marketing innovation			Organizational innovation		
	03-05	**04-06**	**06-08**	**03-05**	**04-06**	**06-08**
Total	**20,2**	**19,1**	**34,0**	**36,7**	**33,1**	**32,9**
small (10 - 49 empl.)	17,8	16,7	32,4	30,8	27,3	28,6
medium (50 - 249 empl.)	24,5	24,1	37,5	48,4	46,6	42,3
large (above 250 empl.)	35,2	34,9	44,0	66,8	65,3	58,7