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Riku Kärkkäinen

CLUSTERING AND INTERNATIONAL COMPETITIVENESS OF INFORMATION TECHNOLOGY INDUSTRY IN THE SAINT PETERSBURG AREA

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ABSTRACT

Riku Kärkkäinen
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The main objective of this study is to assess the potential of the information technology industry in the Saint Petersburg area to become one of the new key industries in the Russian economy. To achieve this objective, the study analyzes especially the international competitiveness of the industry and the conditions for clustering.

Russia is currently heavily dependent on its natural resources, which are the main source of its recent economic growth. In order to achieve good long-term economic performance, Russia needs diversification in its well-performing industries in addition to the ones operating in the field of natural resources. The Russian government has acknowledged this and started special initiatives to promote such other industries as information technology and nanotechnology.

An interesting industry that is basically less than 20 years old and fast growing in Russia, is information technology. Information technology activities and markets are mainly concentrated in Russia's two biggest cities, Moscow and Saint Petersburg, and areas around them. The information technology industry in the Saint Petersburg area, although smaller than Moscow, is especially dynamic and is gaining increasing foreign company presence. However, the industry is not yet internationally competitive as it lacks substantial and sustainable competitive advantages. The industry is also merely a potential global information technology cluster, as it lacks the competitive edge and a wide supplier and manufacturing base and other related parts of the whole information technology value system. Alone, the industry will not become a key industry in Russia, but it will, on the other hand, have an important supporting role for the development of other industries. The information technology market in the Saint Petersburg area is already large and if more tightly integrated to Moscow, they will together form a huge and still growing market sufficient for most companies operating in Russia currently and in the future. Therefore, the potential of information technology inside Russia is immense.

Keywords: clustering, international competitiveness, information technology, Saint Petersburg area

TIIVISTELMÄ

Riku Kärkkäinen
Pietarin alueen informaatioteknologiatoimialan klusteroituminen sekä kansainvälinen kilpailukyky
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Tämän työn päätavoite on arvioida Pietarin alueen informaatioteknologiateollisuuden potentiaalia tulla yhdeksi Venäjän uusista tärkeistä teollisuudenaloista. Päätavoitteen saavuttamiseksi tutkimuksessa analysoidaan erityisesti kyseisen teollisuuden kansainvälistä kilpailukykyä sekä klusteroitumista.

Venäjä on tällä hetkellä erittäin riippuvainen luonnonvaroistaan, jotka ovat olleet päälähteitä sen viimeaikaiselle taloudelliselle kehitykselle. Kestävän taloudellisen kasvun takaamiseksi Venäjä tarvitsee kuitenkin uusia toimialoja luonnonvarateollisuuksien lisäksi. Venäjän hallitus tiedostaa tämän tarpeen ja on aloittanut erikoishankkeita erilaisten teollisuudenalojen, kuten informaatio- sekä nanoteknologian, edistämiseksi.

Yksi mielenkiintoinen teollisuudenala Venäjällä on informaatioteknologia, joka on maassa alle 20 vuotta vanha ja hyvin nopeasti kasvava. Informaatioteknologian markkinat ja päätoiminnot ovat Venäjällä keskittyneet kahteen suurimpaan kaupunkiin, Pietariin ja Moskovaan, sekä niiden lähialueille. Pietarin alueen informaatioteknologiateollisuus on erittäin nopeasti kasvava ja kerää jatkuvasti lisää ulkomaisia yhtiöitä markkinoille. Kyseinen teollisuudenala ei ole kuitenkaan kansainvälisesti kilpailukykyinen, koska sieltä puuttuu merkittävät ja kestävät kilpailuedut. Teollisuudenala edustaa myös ainoastaan potentiaalista globaalia klusteria, koska sieltä puuttuu kestävän kilpailuedun lisäksi laaja toimittaja- ja valmistusteollisuuskanta sekä muita tärkeitä osia koko informaatioteknologian arvojärjestelmästä. Pietarin alueen informaatioteknologiateollisuudesta ei yksinään tule uutta avainteollisuutta Venäjällä, mutta sillä on tärkeä muiden teollisuudenalojen kehitystä tukeva rooli. Pietarin alueen informaatioteknologiamarkkinat ovat jo nyt suuret ja jos ne integroituvat yhä tiukemmin Moskovan markkinoihin, tulevat ne yhdessä muodostamaan riittävän suuret markkinat valtaosalle nykyisistä ja tulevista yrityksistä Venäjällä. Tämän pohjalta informaatioteknologian potentiaali Venäjällä on valtava.

Asiasanat: klusteroituminen, kansainvälinen kilpailukyky, informaatioteknologia, Pietarin alue

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Abbreviations

BN	Billion
BOFIT	Bank of Finland
CBR	Central Bank of Russia
CEO	Chief Executive Officer
CIS	Commonwealth of Independent States
CMM	Capability Maturity Model
CMMI	Capability Maturity Model Integration
COCOM	Coordinating Committee for Multilateral Export Controls
CPI	Consumer Price Index
EMS	Electronics Manufacturing Services
ER	Exchange Rate
ERDI	Exchange Rate Deviation Index
EU	European Union
EUR	Euro
GDP	Gross Domestic Product
GRP	Gross Regional Product
HEI	Higher Education Institutions
FDI	Foreign Direct Investment
IBA	International Business Activities
ICT	Information and Communications Technologies
IPR	Intellectual Property Rights
IT	Information Technology
LUT	Lappeenranta University of Technology
M	Million
MNE	Multinational Enterprise
M&A	Mergers and Acquisitions
NC	Necessary Conditions
NMS-10	10 New Member States of the European Union
NORDI	Northern Dimension Research Centre
NWFD	Northwest Federal District
OECD	Organization for Economic Co-operation and Development
PC	Personal Computer
PPP	Purchasing Power Parity
RF	Russian Federation (Russia)
Rosstat	Russian Federal State Statistics Service

RUB	Russian Ruble
R&D	Research and Development
SC	Sufficient Conditions
SEZ	Special Economic Zone
SPB	Saint Petersburg
TFP	Total Factor Productivity
ULC	Unit Labor Cost
USD	United States Dollar
USSR	Union of Soviet Socialist Republics
WIIW	Vienna Institute for International Economic Studies

1 Introduction

The recent phenomenon of globalization has changed the nature of competition in industries all around the world. Many industries, such as Information and Communications Technology (ICT), are these days considered to be global, and their markets are seen as borderless. Companies are no longer just competing for the domestic market or sourcing their inputs only nationally. Competition has become mostly international as companies have to serve customers over national borders, even on the other side of the world. Companies also tend to seek around the globe for localized sustainable advantages, which can today be exploited with less effort due to e.g. advances in communication technologies and reduction of multiple barriers, such as government interventions and investment restrictions. As globalization influences individual companies, it also consequently affects the industries and the nations in which they are located. Nations and their governments have now begun to understand that the international competitiveness of industries is important, and localized specialization and concentration together with increasing value-added activities is the key for good performance also national economy -wise.

The Russian economy has been growing rapidly, around six percent annually, after the economic crisis of 1998. Although the economy has grown, the sustainability of this performance is now under serious doubt. The Russian Federation (RF) has enjoyed good economic performance recently, but it is still fumbling in many aspects. For example, the productivity growth is struggling compared to the increase in wages, and the knowledge absorption capacity in terms of tapping into the international technology pool is considered poor. Also worker skills are inadequate to meet the requirements of modern standards, and the investment climate is still unstable and not attracting foreign investments in expected scales (Desai & Goldberg 2007). The Russian government has acknowledged the need to promote industries outside natural resources, such as oil and gas, which account at the moment for roughly two thirds of the total exports of the RF, and these exports are the main reason for the economic development in the last decade (Ollus 2007, p. 4). The natural resources of the RF are limited in quantity, and therefore nowadays sourced from harder and more expensive locations than before. In addition, these substances are considered to be low value-added and highly dependent of world market prices in terms of achieved profit. The world market prices for natural resources, especially oil, are volatile, which gives no guarantees for future levels of revenues.

Oil and gas exports have also caused problems for the RF. The country can be argued to suffer from a variant of Dutch disease, which refers to negative consequences arising from large

increases in Russia's income due to the dominance of natural resources in her foreign trade (Tiusanen 2007, p. 32). Foreign currency inflows to the country from natural resource exports and other sources, such as investments, have caused an increase in the country's currency volume. This increase has consequently caused excess inflation in comparison to e.g. the European Union (EU) and Organization for Economic Co-operation and Development (OECD) countries, which should be compensated with a decline in the nominal value of the domestic currency for the real exchange rate (ER) to stay unchanged. In the RF the ruble (RUB) has not declined sufficiently in its nominal value, which has caused real ER appreciation. This has had and will have two main effects for the country and its industries:

- A decrease in price competitiveness, and thus the exports, of its manufactured goods in other industries outside natural resources, such as Information Technology (IT).
- An increase in imports, which is a result of foreign goods becoming continuously relatively cheaper in comparison to domestic ones.

Due to the phenomenon of globalization and the facts presented above, economic diversification and transformation to a knowledge-based economy with the production of higher added value goods can be seen as the key to potential sustainable economic success for the RF. To promote this development process, the RF government has, for example, started the initiative of Special Economic Zones (SEZ) to promote specific industries in certain areas of Russia. One of the still developing and early-phase SEZ is located in the Saint Petersburg (SPB) area and is concentrating on the ICT sector, which readily has a strong basis and history in the area. The ultimate aim of the SEZ-initiative is to make the industry competitive both domestically and internationally.

This study concentrates on the IT industry of the SPB area, with target of finding out whether the local sector is capable of becoming one of Russia's new key industries, which are also internationally competitive and can balance the prevailing dependency on natural resources in the RF. This research gives valuable insight into the current state of development and competitiveness of the SPB area IT industry for both foreign investors and already functioning Russian companies, and Russian entrepreneurs considering establishing new operations in the area.

According to Porter (1990, p. 148), internationally competitive industries in a nation will not be evenly distributed across the economy, as his research shows. This is due to the national competitiveness factors promoting the phenomenon of clustering of the nation's competitive industries. Successful industries in specific nations are usually linked through horizontal (same customer, technology etc.) or vertical (buyer/supplier) relationships, which can be seen the basis

of clustering. Due to the above mentioned features, also the concept of clusters is an important part of this research.

1.1 Research objectives and questions

The main objective of the study is to assess with international competitiveness and clustering theories whether or not the SPB area IT industry is capable to become a key industry of Russia and attract foreign investors with technology and knowledge to the area. The research questions of this study, with their objectives, are presented in Table 1 below. The framework of this study, presented in Figure 1 below, has been constructed from the two main theoretical parts of this study, clustering and the international competitiveness of industry.

Table 1. The research questions, sub questions and objectives of this study

MAIN RESEARCH QUESTION	SUB QUESTIONS	OBJECTIVES
Does the IT industry in the St Petersburg area have the potential to become one of the key industries in the national economy of Russia?	a. How is the St Petersburg area IT industry structured and does it fulfill the initial conditions for industrial clustering?	To define the potential of the industry to cluster and offer insight into the existence of the cluster currently
	b. How internationally competitive is the St Petersburg IT industry currently?	Assessment of the international competitiveness of the industry and its strengths and weaknesses

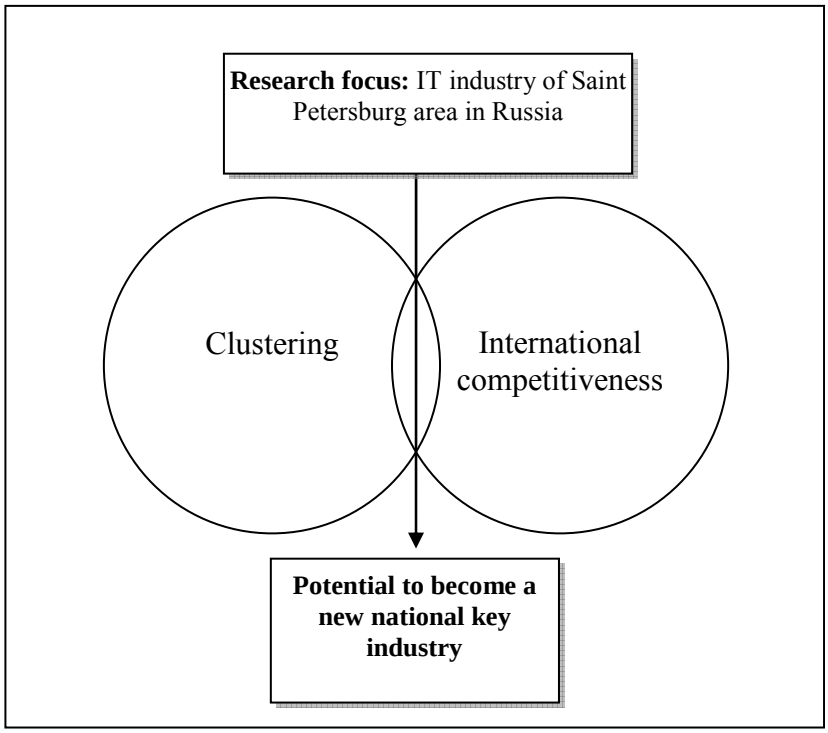

Figure 1. The framework of the study

1.2 Restrictions

The theory part of this study is restricted mainly to the definition and structure of a cluster, the initial conditions for clustering and the competitiveness diamond model. The definition and structure of a cluster and the competitiveness model are strongly interlinked and mainly based on Porter's theories. The competitiveness diamond model is extended with the behavior factors of Foreign Direct Investment (FDI) and Multinational Enterprises (MNE) location to correspond better with the research focus in the empirical part. The theories are mainly analyzed at the industry and cluster levels to achieve appropriate focus on the research area.

The main objective of the theory part is to build a theoretical background and tools of analysis, which are then applied in the empirical part and the research focus area. The empirical study is limited to the IT sector, without covering ICT, because telecommunications are considered to be more bulk-type of business with less innovative activities, it is less dynamic and more saturated market in comparison to IT, and it has also been studied more extensively. The focus is on the Saint Petersburg area, as the Russian Federation is such a vast country and Saint Petersburg, which is the second most dominant area of IT operations besides Moscow, represents one the most developed and competitive industries and market locations of whole Russian IT sector. The core of the SPB is considered to be the city of SPB and the Leningrad Region surrounding

it. The major locations of the IT industry of the Northwestern Federal District (NWFD) of Russia are situated there. Russia's national economic circumstances are also partly included in this research, due their strong linkage to the current situation and future potential of IT industry in the SPB area.

1.3 Research method

This study comprises a theory part and an empirical part. The theory part is a review of relevant literature and the empirical study is built on it. The main objective of the theory part is to gather information of initial cluster formation conditions and of international competitiveness factors. This knowledge is then used to analyze empirical data of the Saint Petersburg area IT industry. The empirical data has been gathered from multiple sources, as presented in section 1.4.

The contribution of this study is forming a picture of the current state of the IT industry in the Saint Petersburg area and analyzing its future potential. The mainly qualitative tools of the theories presented in this study are used and compared to the gathered empirical data. Due to inadequate quantitative hard data sources available in the research area, the whole study is mostly built on qualitative tools and research. The qualitative analysis is strengthened by expert interviews, which are semi-structured and therefore mainly targeted at bringing new perspectives and serving the generalization of the analyses and theories (Järvinen & Järvinen 2004, p. 145).

1.4 Data collection

An important part of this study are interviews considered as primary information sources, organized with Russian and Finnish experts from various fields of activities related to IT. Table 2 lists these experts by profession. These interviews have been done to assess the market environment, competitiveness, problems and strengths, as well as future trends of the SPB area IT industry. Also foreign and domestic investors' and experts' concerns about the SPB area IT industry were brought up in the interviews. Secondary sources, such as electronic newspapers, academic articles, research reports and various web pages, have been the other main data providers in this research. The statistical data has been collected from various sources. The Russian Federal State Statistics Service (Rosstat) provides the most up-to-date and extensive information on Russian industries and regions and FDI flowing to Russia. The World Bank, The Bank of Finland (BOFIT) and The Vienna Institute for International Economic Studies (WIIW) are valuable sources of information concerning the general economic situation in Russia. The

economic situation and general development of the RF influence the competitiveness and overall situation of the SPB area IT industry, as will be shown later on.

Table 2. Summary of conducted expert interviews

Profession	Current work responsibility	Number of interviewees
Director	Russian Business Activities, ICT Investments, Corporate Finance and Digital Innovations	4
Chief Executive Officer (CEO) and Chief Operation Officer	Higher management of Russia IT companies	2
General Manager	ICT Service Centre	1
Government official	Special Economic Zones	1
Former IT company owner	-	1

1.5 Structure

This study consists of six chapters, which are presented in the outline in Figure 2 below. Chapter 1 is an introduction to the study and its restrictions and objectives. Chapters 2-3 form one part offering the theoretic background of the study. Chapter 2 introduces the definition and structure of a cluster and the criteria for cluster formation. Chapter 3 is an introduction of the international diamond competitiveness model, which includes also the Russia-adjustments of FDI and MNE location behavior. Chapter 4 concentrates mainly on the economic development and current situation of Russia and the SPB area. The second main part of the study is the adaptation of theories to the empirical data of the research focus, Saint Petersburg area IT industry, analyzed in Chapter 5. The third main part of this study consists of Chapter 6, in which the overall results and findings of the study are presented and a summary of the whole study is given.

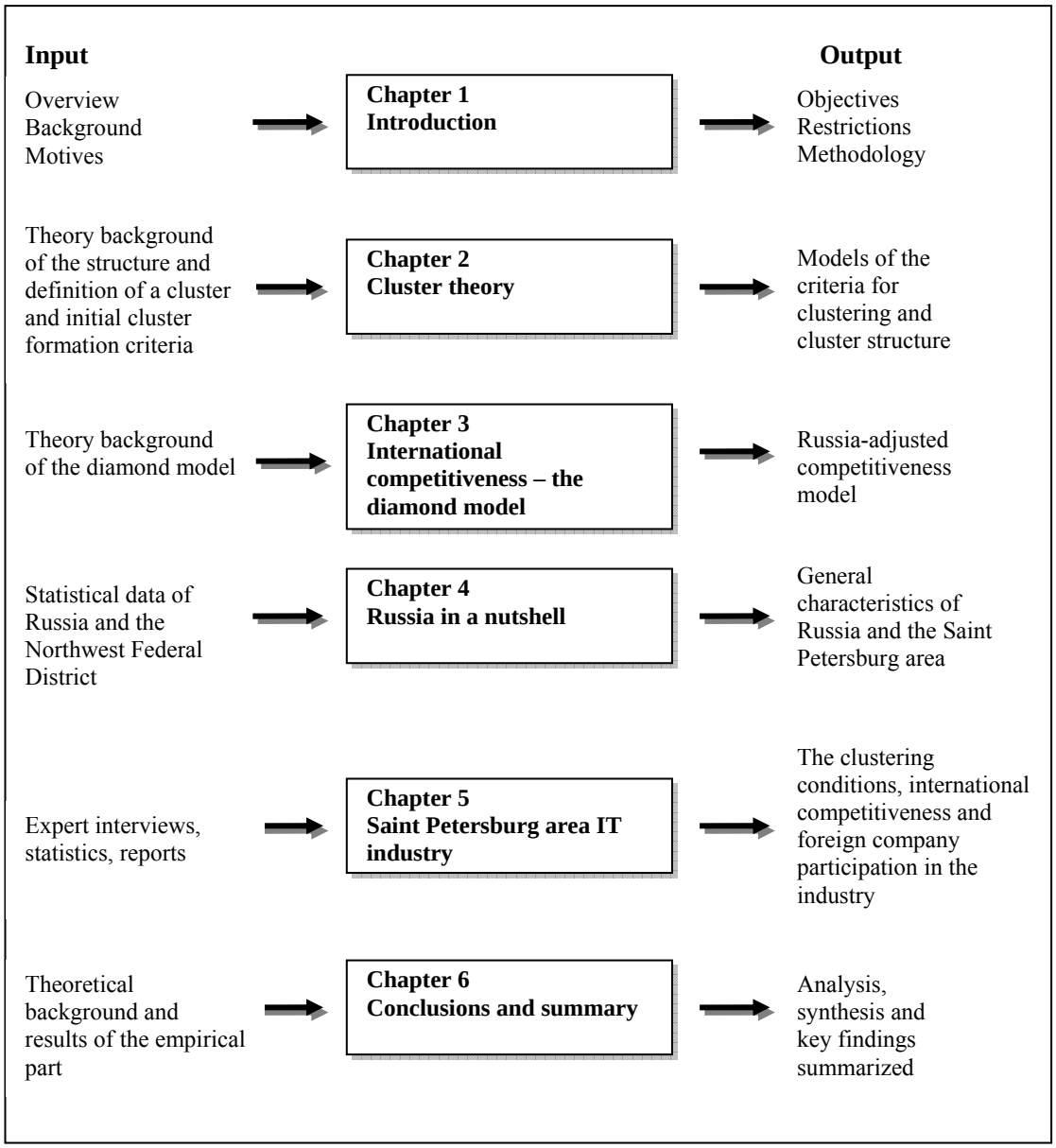

Figure 2. Outline of this study

2 Cluster theory

2.1 Definition of a cluster

Due to the phenomenon of globalization, the competitive environments in market economies have recently begun to change, with dramatic impacts especially on manufacturing, but also on other activities, such as software development in IT (Lin et al. 2006, p. 473). Globalization, made possible by advances in communication technologies and transports, and reduction in investment and trade barriers, has made it possible for companies to spread their operations all over the world in many forms, such as outsourcing activities and subsidiary firms (Dunning 1998, p. 47). While some have argued that location is losing its importance in economic activity (O'Brien 1992; Cairncross 1997; Gray 1998), others have the very opposite view, claiming that globalization is actually increasing the importance of location in business activities (Porter 1998a; Krugman 1996).

Porter (2000, p. 15) argues that the economic geography involves a paradox in the era of global competition and operation. According to him, changes in technology and competition have decreased many of the more traditional roles of location, as needed inputs of for example resources, capital and technology can now be sourced in global markets. Even immobile inputs can be reached and accessed through networks of firms and it is also no longer necessary to be located near the large markets in order to serve them. The global forces are also decreasing governmental influence over competition in the markets. Still, sustainable competitive advantages in the global economy are seen as strongly localized and highly influenced by the institutions, rivalry, sophisticated customers, related businesses and highly specialized set of skills and knowledge in these areas (Porter 1998b, p. 90). It has also been argued that the process of global economic integration itself leads to increased local and regional specialization, as decreasing transportation costs and trade barriers enable firms to agglomerate with other similar firms and, as a consequence, take advantage of the local external economies of scale (Krugman 1991; Fujita et al. 2000).

Porter put forward a microeconomics-based theory of national, state and local competitiveness in the global economy in his book Competitive Advantage of Nations (1990). This theory gives a very strong role for clusters in the competitiveness sphere. Clusters are presented, after further development of the original theory, as geographic concentrations of interconnected companies, specialized suppliers, firms in related industries, service providers and linked institutions, such as universities and trade associations, in a particular field, which compete but also cooperate and are linked by complementarities and commonalities (Porter 2000, p. 15). The advantages of

clusters are considered to be mainly based on external economies or spillovers across firms, institutions and industries. The whole of these interconnected participants in the cluster is considered to be more than the sum of its parts, which is also known as synergy in academic research. This synergy can be argued to be the root advantages of clusters for companies operating in them.

The geographic scope of clusters varies considerably between regions, states, a single cities or neighboring countries. This scope is largely related to the distance over which transactional, informational, incentive and other efficiencies occur. Clusters can rarely be put in the standard classification of industries, because they are often formed of several industries, both traditional and high-tech, and of linkages between them. However, clusters can be analyzed from the perspective of a single industry. Cluster boundaries can be seen as continuously evolving, due to the formation of new firms and industries, changes and developments in local institutions, and shrinkages of already established industries. (Porter 1998a, pp. 199-205)

According to Porter (1998a, p. 205) clusters can be defined in different ways in different locations, on the basis of the segments in which the firms compete and the strategies they use. Many examples of clusters with varying areas of production, size, breadth and state of development have been introduced in research including Silicon Valley in San Francisco Bay Area (Saxenian 1994), wine making in California (Porter 1990), and Finnish ICT (Steinbock 2004). Clusters exist and are formed both in developed and developing countries, though they tend to be more advanced in terms of breadth and depth in the first mentioned (Porter 1998c).

Although the term “cluster” is rather new in the economic landscape, the idea of a specialized industrial location is hardly innovative. The concentration of specialized industries in certain localities was already emphasized by Alfred Marshall in the Principles of Economics (1898), in which he explained these concentrations through three external economies: growth of ancillary trades, specialization of different companies in different branches, stages of production, and the availability of skilled labor. These ideas of Marshall have later been adjusted by various academic authors, such as Krugman (1991, p. 15), who argues that each manufacturer with reasonable economies of scale wants to serve the national market from a location with large demand, but also local demand can be seen to be large in the specific area, where the majority of manufacturers locate themselves. Although the general view of Krugman is different from that of Porter’s, they are both derived from the same Marshallian principles.

The definition of clusters has been strongly criticized by Martin and Sunley (2003, pp. 10-13) as chaotic concept, which lacks both industrial and geographical boundaries. However in this

research Porter's cluster concept offers the best basis, as the purpose is to assess the potential of the Saint Petersburg area IT industry to become a key and internationally competitive industry in Russia. This type of research is greatly supported by Porter's theories, which are mainly based on analyzing competition and competitiveness. It is also noted that despite some limitations and shortcomings of Porter's cluster concept and diamond model presented below, they are extremely good qualitative, analytical and constructive tools when studying potential clusters and their competitive advantage, and they have widely been used in research before.

The Soviet economic system was planned according to the concept of regional scientific and technical complexes, and these structures have left an industrial legacy and still influence business activities in the RF (Dudarev et al. 2004, p. 16). This also gives more reason to use Porter's cluster concept as the basis for most of the frameworks of this study. The theories of cluster formation and their criteria are presented next.

2.2 Cluster structure

The ICT industry has been going through radical transformation in the last decade or so, creating new opportunities and challenges for the infrastructure and actors in the industry. The established value chain has been increasingly deconstructed, with the emergence of powerful new players and the simultaneous radical restructuring of the industry. Technological developments and increasing changes in the market have added new dimensions to the already complicated situation. Therefore it is important to find tools to analyze the structure of the SPB area IT industry and the possible cluster. (Li & Whalley 2002)

As mentioned above, Porter defines a cluster as a geographically proximate group of interconnected firms and associated institutions, which are linked by both complementarities and commonalities, in a particular field. As cluster analysis presumes that no specific industry can be viewed separately from others, it should be examined with vertically and horizontally linked sectors (Porter 1998a). Therefore a cluster structure can be seen as a set of interrelated, but separate sectors in the analyzed field, as well as specialized inputs embedded and common to the region. The following elements based on Porter's theory, also presented in Figure 3, are therefore considered to be essential elements in the analysis of the cluster structure (Dudarev et al. 2004, p. 14):

- Primary goods, which are the list of goods or groups of goods competitive on the world market, and the companies manufacturing these products or services are therefore considered to form the core of the cluster.

- Specialty inputs, which are the main factors of production embedded in the region and country in question, mentioned in the factor conditions of the diamond model presented in the competitiveness chapter of this research. These inputs are for example raw materials, infrastructure and educational system.
- Technologies, which is a description of the equipment, technologies and machines used by the core sector of the cluster and its producers.
- Related and supporting industries, which are the sectors of the economy and specific companies, whose products and services are directly or indirectly consumed or may be consumed by the core sector of the cluster.
- Consumers, who are the main customers and consumers of the primary goods manufactured by the companies in the cluster.

The analysis of the cluster and its structure helps especially in identifying the sources of competition in specific regions and the development strategies, with focus on the companies operating in them (Dudarev et al. 2004, p. 15). Due to these features, cluster structure analysis is considered an important part of this research.

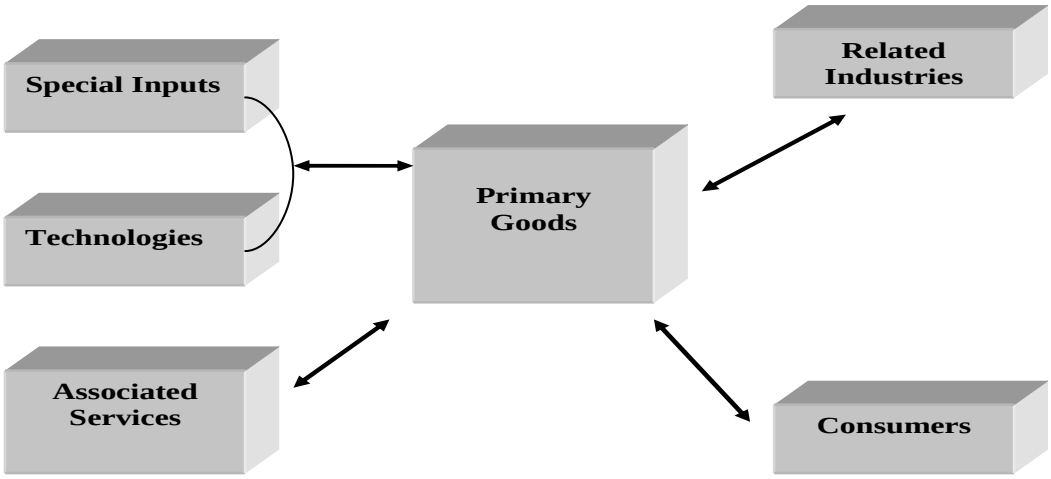

Figure 3. Cluster Chart (Dudarev et al. 2004, p. 14)

2.3 Cluster Formation

Although clusters have recently received much interest, especially among policymakers' and a lot of studies have been conducted from various points of view, the initial conditions of clustering have been the focus in academic research. The father of the cluster concept, Michael Porter, casts very little light to the conditions of clustering and has therefore been criticized (Yetton et al. 1992). Porter (1990) explains national specialization as the result of coincidence of favorable conditions of factor conditions, demand, supporting and related industries, and

steady rivalry among companies in a specific location. This cluster approach has been criticized especially because the concept does not fit well to industries based on raw materials or considered to be domestic or producing so called non-tradable goods (Penttinen 1994). It can be argued that not all industries are equally affected by the process of clustering, and therefore some initial conditions for clustering can be found. Moreover, it has also been concluded that within the industries affected by the process of clustering, an innovative cluster is not likely to be formed automatically. (Steinle & Schiele 2002, p. 850)

According to Bresnahan et al. (2001), starting a cluster, which is defined as simply a spatial and sectoral concentration of firms, is based on building the economic fundamentals for an industry or technology, and finding the spark of entrepreneurship to get going. The initial spark for clustering is seen to be hard to obtain and risky to pursue, and it is considered important to be linked to a sizable and growing demand as well as proper supply of key factors, such as skilled labor in the IT sector. Other critical factors are for example the capabilities of the firm and market building, which require systematic efforts to promote organizational and technological capabilities and foster new business and institution formation. All these factors are in line with the attributes in the cluster structure presented below and the diamond model by Porter, which analyzes the competitiveness of a location, industry or cluster. Bresnahan et al. (2001, p. 842) also argue in their research, which is strongly linked to the cluster of the Silicon Valley, that external effects, such as benefit for specific technology firms that are formed from the presence of other firms or of support structures, do not play a significant role in the early phases of clustering. As most of the factors mentioned above come up in the other analyses used in this research, another framework to analyze the potential of an industry to cluster is used in this research and presented below in more detail.

A framework for assessing the potential of an industry to cluster has been represented in a research by Steinle and Schiele (2002). They conclude that under certain conditions, which are divided into Necessary Conditions (NC) and Sufficient Conditions (SC), industries are most probable to cluster. These condition steps are illustrated in Figure 4 below. The NC for clustering are the foundations on which the whole structure of clustering stairs rely, and they have to be present always. Each of the SC is considered an optional step. Because of the additivity of the SC, it is also possible to skip over specific steps. The SC for clustering add to each other: a long value chain does not necessarily lead to the presence of multiple competencies, but increases their probability. Also value chains with multiple competencies do not always lead to a more rapid speed of innovation, but are more likely characterized by network innovations. Last, innovations may lead to market volatility, which, independent, from the whole production process, can be also demand-induced. Since the IT industry in general is

considered globalized, the clustering conditions are presented and later on assessed from the global cluster perspective with additional remarks on the SPB area IT industry. The clustering-stairs are examined one-by-one next.

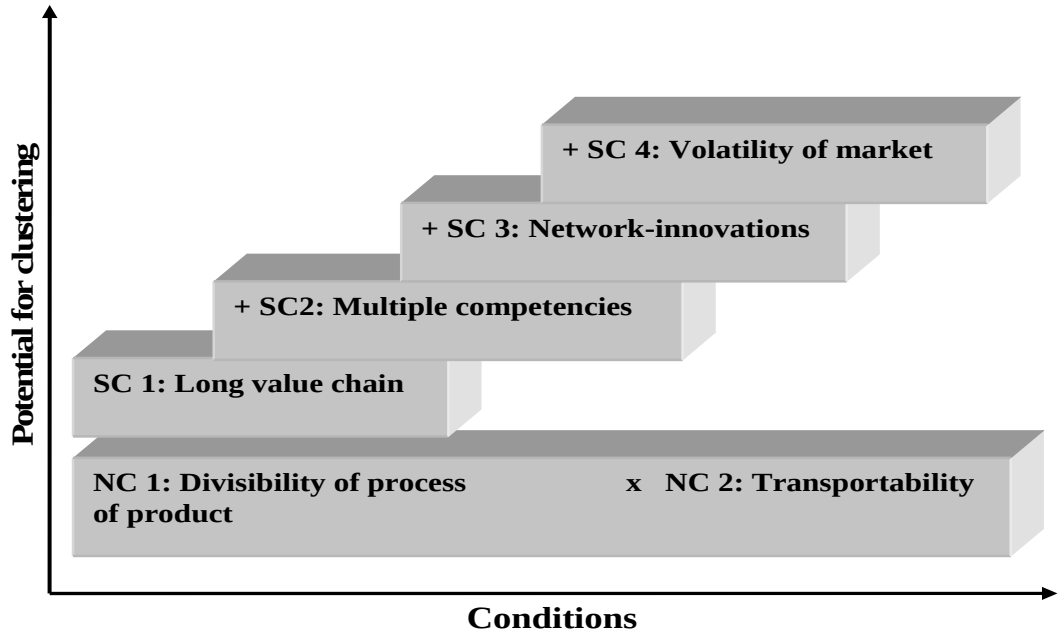

Figure 4. Clustering stairs indicating potential for clustering in an industry (Steinle & Schiele 2002, p. 856)

2.3.1 Divisibility of the process

The possibility to divide the whole production process in a specific industry into many separate steps is considered the first NC for clustering. This allows companies to specialize in certain activities, so that alternative forms of coordination can be considered. According to Jarillo (1995, p. 4) this specialization phenomenon is also behind the success of many companies as they control, in terms of quality, prices etc., the whole production process, but do not necessarily own all the units which add value to the product on different levels of the value chain. As mentioned above this kind of outsourcing activities and fragmentation are very common in this time of globalization, especially in the IT sector. It is also considered that a critical mass of both actors and business volume has to be present in an industry to be influenced by the process of fragmentation. Fragmentation, which is according to Rosenkopf and Tushman (1994) largely determined by the technical divisibility of products in general, enables the formation of several specialized organizations, which ultimately both compete and learn from each other on different levels of the value chain. (Steinle & Schiele 2002, pp. 851-852)

2.3.2 Transportability of the final product

The transportability of the final product is considered as the second NC for clustering. Here the definition of product includes both industrial products and services. Services are also transportable, if for example the service provider moves with their equipment to a customer. The product has to be transportable or the location of its providers is determined by the site of their consumers and customers. Also a cluster without competition cannot define an identity or form any boundaries. This would lead to a point, where membership in the cluster would not bring any business benefits for its participants. In a summary, the products of a cluster have to be transportable. (Steinle & Schiele 2002, p. 852)

2.3.3 Long value chain

In addition to the two above-mentioned NCs, there are also a couple of SCs which foster the process of clustering. The first two, the long value-chain and diversity of competencies, are mainly based on Richadson's (1972) differentiation between complementary activities, which are consecutive in the value-chain, and similar activities, which require the same kind of competencies. These factors lead to increasing profits in clusters or reduced costs of coordination, if there is an increasing need to coordinate complementary, but not similar activities. (Steinle & Schiele 2002, p. 852)

Firms create value to their customers through series of activities, such as technicians performing repairs, researchers designing and developing new and existing products, and processes and manufacturing operations. These activities can be grouped into categories, which linked together as a whole are called the value chain presented in Figure 5. (Porter 1990, p. 40)

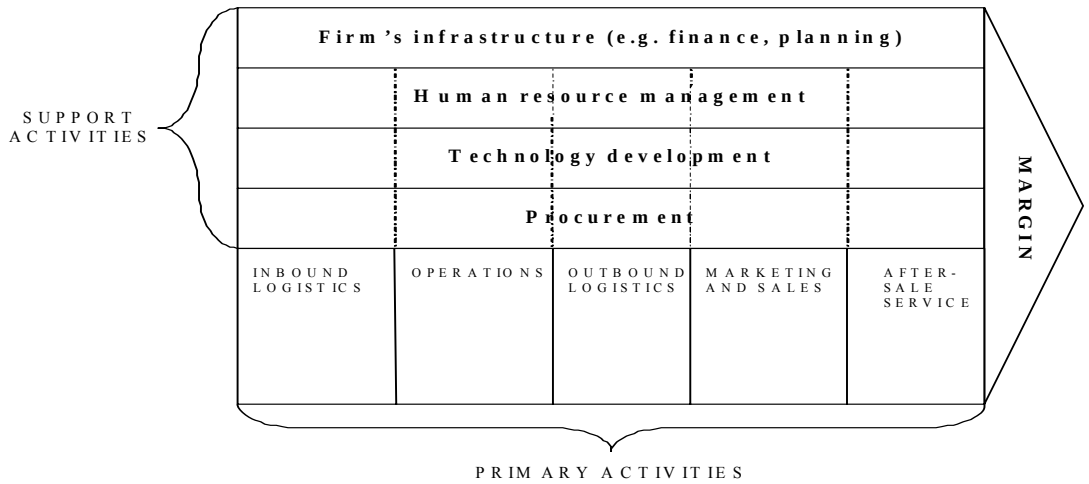

Figure 5. The Value Chain (Porter 1990, p. 41)

Value chains, as most academic research sees them, were introduced by Michael Porter (1990), whose view of value chains is presented in this research as the main basis for analysis. According to Porter (1990, p. 40) activities in the value chain are broadly divided into two groups. First, primary activities are the ones involved in the ongoing production, delivery, marketing, and services related to the product. The second group are support activities, which consist of technology, human resources, firm's infrastructure, including general management and finance, and procurement (input purchase), supporting the other activities. Each primary activity is considered to make use of the above mentioned supporting activities in some combination. Firms, especially in developing economies, seek to gain competitive advantage by developing new ways to conduct all activities more efficiently, which is also called upgrading the value chain (Kaplinsky 2004). A firm is considered to be more than the sum of its activities, as its value chain is an interdependent system of different activities affecting each other and connected by linkages. This view is very close to the cluster concept, which is considered to be based on linkages between different parts of the cluster.

According to Porter (1990, pp. 42-43), a company's value chain in a specific industry is a part of much larger stream of activities, which he calls the value system, presented in Figure 6. The value system includes suppliers, who provide inputs, such as components, purchased service and machinery to the firm's value chain. A product moving towards the final buyer often also goes through several value chains of distribution channels. Finally products become purchased goods or inputs to the value chains of their buyers, who use them in their own activities.

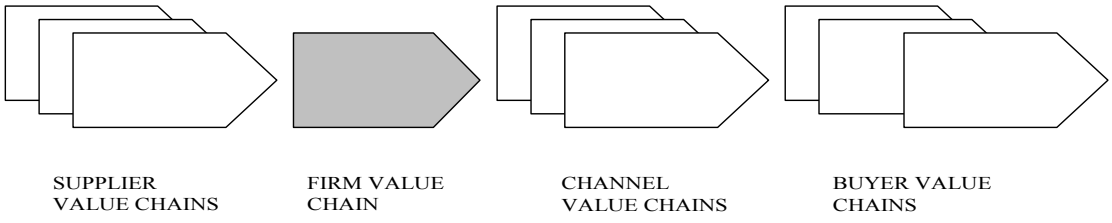

Figure 6. The Value System (Porter 1990, p. 43)

According to Steinle and Schiele (2002, p. 852), when an industry includes several specialized organizations, their competitiveness is highly dependent on other companies or actors operating in complementary activities along the value chain. The importance of the surrounding environment and its structure grows as the number of linkages between the actors increases. Coordination between the actors becomes even more challenging when supplies have to be tailor-made instead of being standard intermediate inputs. In many industries, like IT, the end

products develop in rapid cycles and therefore also the suppliers have to be flexible with their production and coordinate and cooperate closely with their main customers (Yeung et al. 2006, p. 534).

The length of value chains is considered to be mainly technically determined, and the final product is dependent on multiple actors with different components coordinating to form it (Steinle & Schiele 2002, p. 852). Specialized organizations, especially component manufacturers, in value chains are generally more likely to succeed when their output is spread to several industries and actors instead of just one big player (Yeung et al. 2006, pp. 535-536). The different segments of value chains are characterized by varying profitabilities, which is partly the initial reason for company specialization, as especially big MNEs tend to get rid of (outsourcing etc.) business activities, which are not part of their core activities or generating good profit (Jarillo 1995, p. 49).

2.3.4 Diversity of competencies

The second SC, diversity of competencies, is based on Richardson's (1972) argumentation on similarity between activities. If the competencies in a value chain are considered to be distinct, it is very challenging for one company to master them all. This leads to challenges in coordination between very diverse actors specialized in different competencies. The presence of such dissimilar, but complementary knowledge and competency is considered to be another sufficient condition for clustering. (Steinle & Schiele 2002, p. 852)

2.3.5 Importance of innovation

The efficiency of cooperation between complementary actors becomes a success factor the more they contribute to the process of innovation and the shorter the time available for this coordination is. Of course, if an industry does not give credit to innovation, the advantages arising from the coordination of these innovation actors will not provide any benefit. The importance of innovation can be considered as another SC for clustering, but though innovation power is usually linked to clusters (Baptista & Swann 1998), there is no consensus on which type of innovation would actually promote clustering. (Steinle & Schiele 2002, p. 852)

According to Steinle and Schiele (2002, pp. 852-853), some scholars argue that radical innovations need a few complementary innovations to develop their potential, which indicates that the structure of the proximate environment of an innovator is very important in these innovations due to the large number of companies which may be involved in the process. In this

sort of process, which is common in the beginning of the life cycle of a product or industry, the exchange of implicit knowledge is considered important between several actors. Clusters, or industrial systems, are not made up by only physical flows of inputs and outputs, but by massive and intensive exchange of technological expertise, business information and know-how in both traded and untraded form (Scott 1995, pp. 51-66). According to Malmberg and Maskell (1997, pp. 25-31), the presence of implicit knowledge as such fosters clustering and the interactive process of innovating, which normally occurs through problem solving and contains both codified and tacit elements.

According to Steinle and Schiele (2002, p. 853), a second academic group argues for rather incremental innovations to foster clustering, and for such kind of product-based learning to occur, a continuing and direct exchange of knowledge between different and very diverse actors is required. Implicit knowledge would be exchanged through face-to-face interaction between these incrementally innovating actors. The clustering would be expected to continue more rapidly when the industry comes to a more mature phase and radical innovations are replaced by more incremental ones. Malmberg and Maskell (1997, p. 29) argue that tacit and spatially more sticky forms of knowledge are becoming more important over time for sustaining long-term competitive advantage. If the knowledge involved is more tacit, also spatial proximity is more important in enabling face-to-face contacts between the actors, as in incremental innovations.

The common ground in the characterization of the differing views presented above is the probability of clustering in industries that have the presence of implicit knowledge, rapid speed of transformation and involvement of several actors with distinct competencies in the innovation processes. According to Freeman and Soete (1997), network-innovation is defined by neither a radically new invention like in inventor-entrepreneur, which normally includes self-commercialization, nor by improvement of one already existing, like a laboratory or large in-house research and development (R&D) type with a number of specialists in distinct departments. Network innovation is enabled by different actors with distinct competencies and their cooperation through combining their skills, thus improving an existing product or process or even creating a completely new one. These innovations can occur without planning, but require cooperation of several actors. In network innovations constitution of the whole value-creating system and the sum of all actors involved in the innovation process is of significant importance, and thus the advantages of clustering become most relevant. The probability of complementary actors to exist or to form and to know each other becomes higher and the need for well working coordination becomes vital. Therefore an industry, in which the innovation process is commonly characterized by network innovations, is most likely to cluster in comparison to the other types. (Steinle & Schiele 2002, p. 853)

2.3.6 Volatility of the market

According to Steinle and Schiele (2002, p. 854), the volatility of the market, which awards flexible adaptation, is considered the last SC for clustering. This is due to advantages from coordination, which arise from proximity of actors in a value chain, transforming into competitive advantages, if the reaction speed is considered of high importance, as in volatile markets. In other words, the spatial location is less arbitrary as the control over timing of demand decreases. Market-determined time-sensitivity, which in practice means reduction of the producers' control over demand, is considered to foster clustering. According to Scott (1988, p. 26) "…flow of economic activity through a system of input suppliers and subcontractors will always be more constant and regular on average than the flow through one specific vertically integrated channel". This leads to faster adoption and lower switching costs in case of market changes in multi organizational systems in comparison to an integrated company. This means that dynamics and volatility foster clustering.

The time sensitivity mentioned above is not equally common in all industries. Speed is not considered an imperative only in high-tech industries or in those whose process of production is considered to be characterized by just-in-time deliveries or lean production, like in automobile sector, in which just-in-time deliveries are adopted to cut down production costs and to respond quickly to market changes (Womack 1990). If the final product is subject to fashion or the phenomenon of cyclicity in demand, time based competition is also very likely to be present. Similarly, according to Yeung et al. (2006, pp. 534-536) market characterized by heterogeneity of demand, which requires individualization of the components or products, such as the ICT cluster in Beijing China, honor very much flexibility of producers. Modular production, which revolves around the concept of one factory containing several production lines, each serving specific customers in a certain period of time, is one good example of the flexibility and time-sensitivity of the ICT industry among producers. On the other hand, standardized products allow better control over time and therefore for space, which reduces the likelihood of clustering. (Steinle & Schiele 2002, p. 854)

2.3.7 Effective conditions for clusters formation

To sum up the conditions presented above, it can be argued that clustering would be most expected to arise in the following situations (Steinle & Schiele 2002, pp. 855-856):

- Products or services can be divided into separate steps of production.
- Products are globally applicable and have comparatively low transportation costs.

- Components of the products are produced in different processes with distinct competencies.
- Customer demand is continuously satisfied with new modifications of the products manufactured with improved methods through innovations, especially network-type.
- The market requires rapid reactions to unpredictable changes in customer demand and preferences.

If all or most of the above mentioned conditions apply, it can be analyzed next what the competitiveness of a specific potential cluster is in the global scale, or the stage of its development. A framework for assessing the international competitiveness of an industry or a potential cluster is presented in the next chapter.

3 International competitiveness – the diamond model

Competitiveness has received increasing interest and discussion in the last decade, especially among political leaders and decision makers. Some strongly criticize the adoption of the business term "competitiveness" in explaining all problems facing modern nations (Krugman 1994). International competitive advantages are often on the firm-level related to companies' potential to survive and gain long term growth in a competitive multinational environment (Söllvell et al. 1991, p. 15). In general, the availability of competitive resources is not enough, they have to be organized and managed properly to create international competitiveness (Ojainmaa 1994, p. 11).

Most discussion on national competitiveness still remains on the macroeconomic level and on legal, political and social factors and circumstances, which underpin a successful economy. Improvement in these areas is necessary, but still inadequate. According to Porter et al. (2006, pp. 51-53) in the Global Competitiveness Report 2006-2007 of the World Economic Forum, a stable macroeconomic context increases the chance to create wealth, but does not create it by itself. Wealth is created by productivity, in which a nation uses its resources such as human, capital and natural, like oil and gas in Russia, to produce both services and goods. Microeconomic capability of the economy is the most influential factor in productivity, embedded in the quality of the national business environment and sophistication of companies. Unless a nation's microeconomic capabilities improve, long lasting improvements in general prosperity will not occur (Porter et al. 2006, p. 51).

Due to most research focusing on the basic company level of competition, there is a need for a convincing explanation of the influence of nations in international competition and their success in it. There are several theories explaining the patterns of countries' trade, based on the classical comparative advantage. Comparative advantage was defined first as market forces allocating a nation's resources to specific industries where they are relatively most productive, and later as nations having equivalent technology but different basis in factors of production like natural resources, land, labor force and capital. (Porter 1990, p. 11)

The classical comparative advantage theories are no longer sufficient or consistent to explain many factors of competition, as transformation towards internationalization and globalization have already started to change the rules of the game. Due to the conditions explained above, Porter (1990) views competition dynamic in the sense that a firm's competitive advantage not only corresponds to the environment, but it also tries to shape the environment according to the

company's own needs. In the time of globalization this means in practice that a company can avoid poor conditions by relocating its production, or through innovation activities.

A nation's competitiveness depends on the capacity of industry to upgrade and innovate. On the other hand, the influence of nation has become more important in the increasing global competition. Companies achieve competitive advantage against top competitors in the international sphere due to pressure and challenge from strong domestic competitors, demanding local customers, and aggressively operating home-based suppliers. Malmberg and Maskell (1997) argue that that the only enduring basis for competitive advantage in the globalizing economy will be localized and based on tacit knowledge. Due to the increasing role of knowledge, also the role of the nation has grown. Overall competitive advantage is formed through highly localized processes where differences in such factors as history, values, culture and institutions of nations all contribute to it and sustain it. (Porter 1998a, pp. 155-269)

The need to explain influence of a nation on competition and the increasing evidence on the clustering of industries and advantages rising from it led Porter (1990) to the creation of the "diamond model". This framework is especially suitable for analyzing possible cluster competitiveness, although it may be used to examine the competitiveness of nations and firms as well. According to Penttinen (1994, p. 67), who has presented critique against the diamond model, with a few adjustments and additions to the original model, it can be used in competitiveness analysis of a specific industry or a potential cluster in a specific country. Even without modifications, the extensive nature of the model in its original form can be used to give good information on the current state of competitiveness of the research area.

The diamond model is based on four broad attributes, which determine the foundations for a location to succeed or fail in enabling creation of competitive advantages for companies located inside the area. These interdependent attributes are the following: factor conditions, demand conditions, related and supporting industries, and context for firm strategy, structure and rivalry. In the original model of Porter (1990, p. 127) there were also two additional external sources of competitive advantage, the role of chance and the role of the government. These four determinants together with the two external factors are considered to be an interactive system. Competitive advantage rises from the dynamic interaction of these parts, and they also reinforce each other. The government factor in this research is divided into federal and local governments as presented by Dudarev et al. (2000, p. 9). Actually, also the International Business Activity (IBA) created by Dunning (1991) can be added to the model and is presented here as a third external force (Penttinen 1994, p. 58). According to Dunning, the original model lacked activities of modern MNE. IBA, with its features FDI and MNE locating to the area, is such an

important factor of competitiveness in the SPB area IT industry that it is included in the diamond presented in Figure 7 below, and is discussed also separately in chapter 3.6. Also, the technological development, which was added in the competitiveness model by Ojainmaa (1994, p. 27), and productivity in Russia have had and are expected to have in the future, such significant influence that they are added to the diamond in this research as the fourth external factor. Next, all the attributes requiring further explanation to understand the role of clusters in competition are discussed more thoroughly.

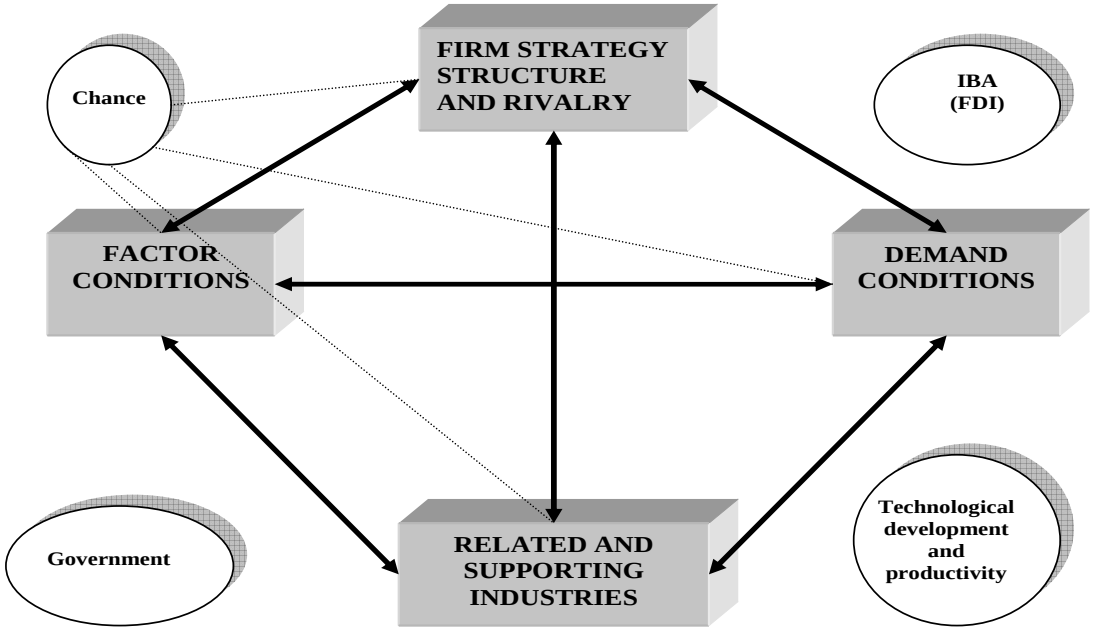

Figure 7. Russia-adjusted diamond model[1] (Dudarev et al. 2000, p. 9; Ojainmaa 1994, p. 27; Penttinen 1994, p. 58)

3.1 Factor conditions

The factor (input) conditions or factors of production are something that all nations, and consequently locations, possess. These are nothing more than the required inputs to compete in any industry. Factor conditions include also intangible assets (such as physical infrastructure), information, the legal system, and university research institutes. To increase productivity, the main indicator of competitiveness, these factor inputs must improve in efficiency, quality, and finally specialization to specific cluster areas. The latter specializing factors, especially the ones integrated to upgrading and innovation, not only result in higher levels of production, but tend to be less tradable and not available outside the cluster. (Porter 1998a, p. 211)

[1] Every external factor, such as "chance" in the picture, affects and is linked to the original determinants (boxes)

To explore the role of factors in the competitive advantage sphere of a nation, Porter (1990, p. 74) conceptualizes them as more meaningful for industry competition. Therefore they are divided into several broad categories:

- **Human resources**: quantity, skills, cost of personnel, taking also into account standard working hours in a country and location and work ethic.
- **Physical resources**: amount, accessibility, quality and cost of a nation's natural resources. Climate conditions and also location and geographical size can be viewed as a part of physical resources.
- **Knowledge resources**: stock of scientific, technical and market knowledge on goods and services, and knowledge residing in universities, research institutes, statistical agencies, literature, market research reports and databases etc.
- **Capital resources**: capital in its various forms and its available amount and cost to finance industry. Globalization is slowly bringing countries closer in the capital sphere, but substantial differences still remain and are likely to do so in the future as well.
- **Infrastructure**: type, quality, and user cost of infrastructure available that affects competition. Includes attributes like transportation and communication systems, health care, and also such things as housing stock and cultural institutions, which affect the quality of life and the attractiveness of the living area.

Every nation and area has its own strengths and weaknesses in factor conditions, but the most relevant question is the efficiency of deploying the factors. These factors can be basic or advanced, and generalized or specialized. Many factors can also be created or can be inherited, like in Russia, where the legacy of communism has left its mark. (Porter 1990, pp. 76-81)

3.2 Firm strategy structure and rivalry

The context for firm strategy and rivalry refers to the rules, norms and incentives affecting the type and intensity of local rivalry. It also includes creating, organizing and managing characteristics of firms, which are to some extent inherited and differ from nation to nation. Domestic rivalry is one of the main aspects in describing the competitiveness of an industry, as it causes continuing improvement and innovation (Porter 1990, pp. 107-124). Generally economies with low productivity lack local rivalry, as most competition comes from imports and, if competition occurs at all, local rivalry involves imitation. In these economies price is the main competitive variable and firms keep the wages down to lower costs. Typically this type of competition is characterized by a low level of investments. On the other hand, the move to a more advanced economy requires development of a strong local rivalry. The rivalry must shift

from low wages to low total cost through efficiency enhancing in manufacturing and service delivery. Ultimately competition shifts from imitation, through differentiation, to innovation and from low investment to high investment, not only in physical assets but in intangibles, such as technology and skills. Clusters play a huge role in these transitions and this is the main reason for this research to be based on the cluster concept. (Porter 1998a, p. 212)

The character of rivalry is strongly influenced by aspects of the business environment, such as available factors and local demand conditions. The context for strategy and rivalry can be divided into two primary dimensions (Porter 1998a, p. 212):

1. Climate for investment in its many forms, which supports a more sophisticated method of competition and higher levels of productivity. Macroeconomic and political stability set the context for investment, but microeconomic policies such as the structure of the tax system, Intellectual Property Rights (IPR) rules and the corporate governance system, are also important.
2. Local policies affecting the intensity of rivalry, which includes such factors as antitrust policy, openness to foreign investment, licensing rules and influence of corruption.

3.3 Demand conditions

Demand conditions at the home location include the nature of domestic demand formed by local and export demand. Demand conditions are usually divided to three broad attributes (Porter 1990, pp. 86-99):

1. Composition of home demand, which can be divided into segment structure and demand, sophisticated and demanding buyers, and anticipatory needs.
2. Size and pattern of growth of home demand, which includes several characteristics: (a) many smaller buyers instead of few larger ones boost the dynamics of the market better, (b) rapid growth is important due to consequently increasing investments, (c) large demand in the home market may create economics of scale, but might also diminish willingness to export, (d) the sooner the new demand arises, the better the domestic industry can be prepared for it, and consequently, gain advantage against the foreign rivals, and last, (e) market saturation increases innovation and therefore competitive advantage is gained as well.
3. Internationalization of domestic demand, which includes mobile or multinational buyers bringing international characteristics to the domestic markets. Especially in the case when foreigners come to the nation to be trained and thus learn domestic markets and their supply.

Demand conditions in general have great influence on firms' chances to move from producing imitative, low quality products and services to compete in differentiation and innovation. Advancement requires increasing the local demand, as the presence or emergence of demanding and sophisticated home customers gives pressure for firms to improve their performance, and in addition gives insight into existing and future needs. Foreign markets alone do not offer these advantages as easily, and local demand can also reveal market segments that allow firms to differentiate. In the global economy, the quality of local demand matters far more than its size, and clusters in linked industries influence setting of demand conditions heavily. (Porter 1998a, pp. 212-213)

3.4 Related and supporting industries

The related and supporting industries must also be competitive to be able to offer the required level of quality to the main industry. The specialized supplier industries must be effective to provide more value to their customers. Coordination, and therefore the linkages between industries must be strong to enable innovation possibilities and upgrading in general. This also applies to the relating industries, with which the sharing of activities gives boost to the involved industries and might even create new competitive ones. Clusters constitute one facet of the diamond, but they are best seen as manifestation of the interactions among all four facets (Porter 1998a, p. 213). The most positive influence is gained from relating and supporting industries, if they act internationally by themselves. (Porter 1990, pp. 100-107)

3.5 External factors

External factors have in this research been added to the diamond model to adjust it so that it can be used in the analysis of the SPB area IT industry in Russia. These factors have had and will remain to have an influence on the whole Russian nation and its industries.

The role of chance reflects unexpected changes in the economy. These may be financial issues, political decisions, currency changes, technological discontinuities, and even wars. These may be positive or negative in terms of creating or losing competitive advantage. (Porter 1990, p. 124)

The role of government is to influence all the four main parts of the diamond. The government may have a positive or negative effect on each determinant or it can itself be influenced by some of the determinants (Porter 1990, p. 127). The government in Russia should be divided into

federal, which creates the institutional and legal framework, and local, which can improve the competitiveness of locally important industries like IT in SPB (Dudarev et al. 2000, p. 10).

International business activity may allow competitive advantage for MNEs through their internationalization process and operations. The creation of international competitive advantage depends of the ability to compete globally, which nowadays involves e.g. international trade, agreements with foreign partners, or FDI. The companies with IBA are in a position to choose to locate their production or other facilities in a specific area, where most competitive advantage is available, and may benefit from several national diamonds at the same time. Foreign activities of companies have consequences on each four facets of the competitive advantage diamond, as IBA may have direct or indirect impact e.g. on domestic demand conditions, as the foreign demand conditions in other countries may influence the quality of products sold in the domestic markets. IBA may also increase competition, or increase the value of existing networks of economic activity by granting access to foreign clusters (Dunning 1991, pp. 18-37). The IBA-related feature, FDI is presented more thoroughly in chapter 3.6. (Penttinen 1994, pp. 57-60; Ojainmaa 1994, pp. 15-19)

Technological development has a central role in influencing the structure of industrial production and consumption, and international competition in general. Improving the absorptive capacity, which includes the ability to tap into the international technology pool, is considered a major driver of increased productivity (Goldberg et al. 2007, p. 37). Therefore, it is important to analyze productivity development in the same context. The advance of technology can refer to the stock of knowledge used in production or new production methods, which include new forms of distribution, new products with new features, new approaches to marketing, new production machinery etc. Technological development may result especially from R&D activities. Technological development influences competitive advantage especially through the effects on companies' strategy of differentiation and cost position. (Ojainmaa 1994, p. 20)

According to Hoekmann and Javorcik (2007), there are two main foreign sources of knowledge and technology absorption for Russian industries. These two factors, of which FDI is also presented below, are:

1. **Trade**. Companies absorb knowledge through imports and technological inputs. Exporters learn from the trade with suppliers and clients in more advanced markets.
2. **FDI**. Technology and knowledge spillovers from foreign investors are beneficial for the destination country/industry and its companies.

3.6 FDI

Clustering or agglomeration increases the potential for technology transfer, and therefore improvements in domestic technological capabilities (De Propris & Driffield 2006, p. 279). In addition, the presence of MNEs considered leaders in technological and capital accumulation, foster further the possibility of clustering and agglomeration in this specific location (Cantwell 1991). Therefore, the development of a modern and high technology Russia and its industries in specific locations, such as IT in SPB area, are considered to be highly influenced by FDI and, consequently, by MNEs locating in potential cluster areas. The Russian government is not necessarily able to finance all the needed investment to infrastructure, and foreign companies may bring new knowledge and technology with them, enabling positive spillovers and therefore development and improved competitiveness of the industry (Dudarev et al. 2000, pp.10-12; Tan 2006; Maskell & Malmberg 1999).

Many studies have sought for a link between inward FDI and agglomeration (see Head et al. 1995; Driffield & Munday 2000), but there is very little evidence that inward FDI forms by itself a sustainable and well functioning cluster. The governance structure, which is considered asymmetric, of this type of agglomeration is such that the strategic decision making power is in the hands of the MNE, which is typically a purchaser and exploiter of local inputs. Often in these cases very little technology transfer occurs between the foreign and domestic sector (De Propris 2001). Therefore, FDI-based MNE concentration to specific areas requires thorough analysis of underneath linkages and processes. (De Propris & Driffield 2006)

Very often the FDI-initiated geographic concentration of activities is not a “cluster” in its real meaning, but rather a couple of domestic companies giving low value added services to large foreign subsidiary firms having high import intensity. Thus, in addition to technology transfer, inward investment generating productivity growth in the domestic sector is considered limited. It is important is whether the investor has entered an already existing and functioning cluster or whether the concentrated activities are just a collection of suppliers to the foreign firm. In summary, FDI does not by itself usually generate well working and sustainable clusters. On the basis of these arguments, FDI is mainly considered as an important external factor of competitiveness analysis in this research. (De Propris & Driffield 2006, p. 281)

FDI is considered an important channel for the introduction of new ideas, technologies and standards in transition economies. Technology transfer through FDI is likely to have an important role in the transformation of the formerly centrally planned economies, such as Russia and Central and Eastern European countries. A necessary condition for a long-term positive

impact of inward FDI is the existence of location-specific factors constituting the intangible assets of the cluster, such as local tacit or uncodified knowledge and information not available elsewhere, which encourage the MNE to commit itself to the specific locality (De Propris & Driffield 2006, p. 281). FDI can also in practice provide a vital source of investment for modernizing the industrial structure of these countries and act as a channel for the introduction of new ideas and working practices. (Holland & Pain 1998)

According to Aitken and Harrison (1999), FDI might have negative externality effects also as an MNE entering the host country might take a market share from the original domestic players and force them to produce in lower quantities with higher costs than before the entry. If this occurs, it may diminish the positive spillover effect from the MNE and cause the foreign entry to have net negative effect on domestic productivity. Still, FDI-increased competition is considered to improve domestic productivity in the long run. In practice, it encourages local firms to be more efficient, or eventually drives poorly performing and not improving companies out of business. (De Propris & Driffield 2006, p. 279)

3.7 Critique of the diamond model

Porter's diamond model is well known and widely used, and therefore it has received some critique (Davies and Ellis 2000; Penttinen 1994). According to Penttinen (1994, pp. 21-56), who has made a summary of the critique of the model, the criticism can be divided into several categories. These categories are presented below and their relevance to this study is assessed:

1. **Geographical location of created competitive advantage,** which implies that competitive advantages can also be sourced globally instead of just nationally. In this study this has been taken into account by keeping in focus the global nature of IT and by adding IBA to the model.
2. **FDI,** which points that inward foreign direct investments are important for the creation of competitive advantage, and foreign-owned subsidiaries can contribute to the development of a country's industry. FDI has also been added to the diamond model as a part of IBA in this research to overcome the problem.
3. **Small open economies,** which refers to the diamond model being only applicable to big countries. In this research this is not relevant, as Russia can be considered a big country in many terms, and the competitiveness diamond is used in this research to analyze the specific SPB area IT industry.
4. **Resource-based industries,** which implies that also this kind of industries with e.g. strong natural resource dependency, may have substantial competitive advantage. For

this study this is not highly relevant, since IT is not considered to fit the group. Therefore, this critique is not considered in this research.

5. **National culture,** which refers to culture having significant importance in the formation of competitive advantage. This was partly refuted by Porter (1992) when he stated that culture has an influence, at least indirectly, to all components of the diamond. This statement has been taken into account also in this research.
6. **Methodology,** which points out the issues of competitive advantage in quantitative measures, such as those related to the selection of industries, the generalization and comparability of the results, and the predictive power of the study. In this study this is not significant, since the model is used mainly as a qualitative tool for analysis.
7. **Macro variables,** which implies that these multiple variables have an effect on competitive advantage. This is taken into account in this study by taking macro variables into consideration in the general presentation of Russia.
8. **Dynamism,** which refers to the fact that past and future are somewhat hard to describe with the model as it emphasizes only existing clusters. In this research the past is taken into consideration in the discussion of the legacy of communism. Future forecasts are not done in detail, since they lack reliability, but some views and speculations for the future are made on the basis of the collected data and the analyses.
9. **Rigor,** which implies that Porter's research is not specific and lacks precision. This is taken into consideration in this research by adjusting the model and by acknowledging the possible shortcomings and trying to fix them. It is also noted that the diamond model is used mainly as a qualitative tool of analysis.

4 Russia in a nutshell

The Russian Federation with its total territory of approximately 17 million (M) square kilometers is the largest country in the world in terms of area. The RF is located in Northern Asia and partly in Europe (the area west of the Urals is considered part of Europe). Russia's geographic size is actually around 1.8 times the size of the United States and around 4.0 times the size of the EU, in comparison. The RF borders the Arctic Ocean in the north, the North Pacific Ocean in the east, Asia in the south, and Europe in the west. The RF has 14 borders common with other nations, such as Finland, China, Ukraine, Mongolia and Estonia. Figure 8 below shows a map of the RF.

Figure 8. Map of RF (CIA 2007)

The population of the RF is according to the estimate of July 2007 around 141.4 M, which ranks Russia as the 8th biggest in the world. Russia's two biggest cities by population are Moscow, which has roughly 10.4 M people, and SPB, which has 4.7 M people (Spiridovitsh 2007, p. 4). There are also 11 other cities with more than million inhabitants in Russia and in general 73 percent of the population live in urban areas (Rosstat 2007a). The Russian population has been declining quite rapidly, in 1993 the population was still 148.3 M (Rosstat 2007a). Explanations for the decline are for example the overall higher death rate (16.04 deaths/1,000 population) in comparison to the birth rate (10.92 births/1,000 population) and the low life expectancy at birth of men, which is 59.12 years in comparison to e.g. Finland's 75.15 years. The net migration in Russia is 0.28 migrant(s)/1,000 population (CIA 2007).

4.1 Basic macroeconomic indicators of Russia and their development

The year 1997 was the first year of economic growth in post-Soviet Russia. After six years of reforms and adaptation to the market economy, the country was still under serious economic turbulence. As a result of this turbulence, the year 1998 brought a financial crisis, with a combined currency, banking and debt crisis. The main economic achievements, low inflation and stable ER, of Russia's stabilization policies since 1995 vanished. The ruble (RUR) collapsed from about RUR 6 for United States Dollar (USD) 1 to RUR 20-25 for USD 1, the excess capital of banking system shrunk to almost zero and the payment system came almost completely to a halt. Industrial production declined steeply (over 5 percent) and wages dropped heavily. As one result of the ER collapse, import substitution increased, since imports to the country became more expensive comparatively. Despite the initial negative effect of devaluation, the inflation soon came down and the ER started to stabilize. The economy started to revive and the future started to look brighter for the Russians. (Sutela 1999, p. 5)

The Russian economy has been growing at a rapid speed ever since the 1998 crisis. Between the years 1999-2006, the average annual growth rate of the Gross Domestic Product (GDP) was over 6 percent, as illustrated in Table 3 below. This economic growth was largely based on the export of oil and gas with high world market prices. The oil and gas production and refining still account for approximately 25 percent of the total GDP and their share of total exports is roughly two thirds in Russia. The rest of the exports are mainly other low-value-added raw materials, such as metals and wood, and high-value-added products account for only few percentages of total exports. The rapid economic growth of RF since 1998 has been boosted especially by the increase of oil price over sixfold in the world market. The RF is actually the world's second largest producer of oil and the largest producer of gas. The Russian GDP growth and its correlation to international oil price increases are presented in Figure 9 below. It is worth mentioning that in the beginning of the year 2008 the oil price reached the level of around 110 USD/barrel. In summary, the RF can still be considered a natural resource economy in terms of its production structure. (Lainela et al. 2007, p. 4)

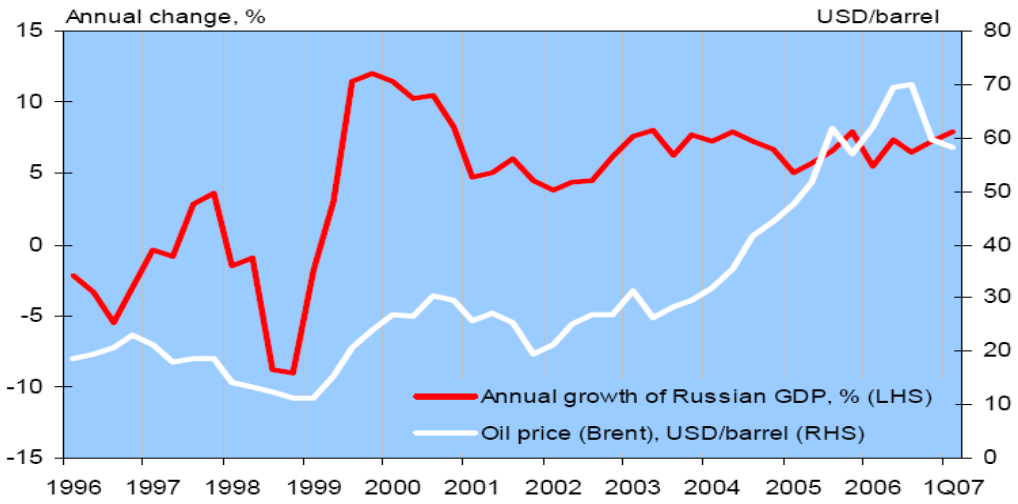

Figure 9. Russian GDP growth and international oil prices 1996-2007 (Lainela et al. 2007, p. 4)

As presented in Table 3 below, RF exports measured in billions (BN) of USD have grown considerably due to the favorable development of world market prices of raw materials. Imports have also grown very rapidly, especially since the turn of the millennium, but Russia's trade balance is still positive by a huge surplus. Imports to Russia are mainly (almost half of the total) machinery, equipment and transport vehicles, but also foodstuff and agricultural raw material are still imported at around 15 percent of the total (Gaidar et al. 2006, p. 384). The Central Bank of Russia (CBR) has gathered immense foreign currency and gold reserves during the economic growth. The currency reserves have actually grown almost 30 times in comparison to the 1997 level, and the total value of these reserves has reached already over USD 507 BN by the first quarter of 2008 (BOFIT 2008). This strong increase in currency reserves is reflected in the sustainable and high surpluses in the Current Account (CA). CA surpluses and the currency reserves are high mostly due to massive exporting, which has benefitted the Russian state e.g. through taxation revenues, and also caused a clear trade surplus. One other important background factor in the high CA surpluses has been the nominal undervaluation of the Russian ruble. The undervaluation was very high right after the 1998 crisis, but has since become more modest. The industrial production growth was considerable after the economic crisis, but has since slowed down especially in recent years. Investments (Gross fixed capital formation[2]) have grown at moderate speed since the economic crisis. Still, the overall investments can be considered inadequate in Russia, as the gross capital formation share of GDP has been roughly around 18-19 percent in recent years, while for example China has had 35-40 percent and Estonia over 30 percent, respectively (Rosstat 2006; Pekonen 2005). These investments,

[2] Measure of the net new investment by enterprises in the domestic economy in fixed capital assets during an accounting period.

domestic and FDI, in China and Estonia have resulted in significant economic growth, which is highly anticipated in Russia as well. The unemployment level in Russia has decreased and is nowadays, although still quite high, approximately at the same level as in Finland (CIA 2007).

Table 3. Main economic indicators of Russia in 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
GDP annual growth, percents	1.4	-5.3	6.4	10.0	5.1	4.7	7.3	7.2	6.4	6.7
Industrial production annual growth, percents	2.0	-5.2	11.0	11.9	2.9	3.1	8.9	7.3	4.0	3.9
Gross fixed capital formation (% of GDP)	16.5	14.9	14.4	16.9	18.9	17.9	18.4	18.4	17.8	18.0
Gross fixed capital formation annual change, percents	-5.0	-12.0	5.3	17.4	10.0	2.8	12.5	11.7	10.7	13.5
Exports, USD BN	86.9	74.4	75.6	105.0	101.9	107.3	135.9	183.2	243.6	304.5
Imports, USD BN	72.0	58.0	39.5	44.9	53.8	61.0	76.1	97.4	125.3	163.9
Foreign currency reserves (Gold incl.), USD BN	17.8	12.2	12.5	27.9	36.6	47.8	76.9	124.5	168.4	303.0
Current Account, USD BN	-0.1	0.2	24.6	46.8	33.9	29.1	35.4	59.0	83.8	94.5
Annual unemployment percentage	9.0	13.2	12.4	9.9	8.7	9.0	8.7	7.6	7.7	6.9

Source: BOFIT 2007; WIIW; author's own calculations

Russia's GDP was nominally a total of USD 984.6 BN in 2006 (EIU 2007, p. 5). The total nominal GDP is not the most descriptive or comparable figure of a country due to both population and price level differences between countries, but the origins of GDP are worth a more detailed analysis. In Figure 10 below, the composition of GDP in Russia is presented in 1989, which is actually the figure of the Union of Soviet Socialist Republics (USSR), and in 2006, and compared to the share of the EU in 2006. The share of services has risen by almost 20 percent in Russia since the USSR figures in 1989, but compared to the level of EU it is still rather small. The increase and high share of the service sector in GDP generally indicates economic development and maturity, which is a result of services generally having higher value-added in comparison to e.g. raw materials. The increase in services is also important for the IT industry in Saint Petersburg as presented below. The share of industry in Russia has fallen by approximately three percent from the 1989 USSR level, but it is still around 12 percent higher than in the EU. Agriculture has decreased its share substantially from the 1989 USSR level, but it is still over two times higher than the share of the EU in comparison. Agriculture in

Russia is generally hampered e.g. by old machinery, which leads to low productivity in comparison to Western countries. Therefore, the constantly decreasing share of agriculture cannot be considered as a surprise or a completely negative factor. The overall trend in the development of the GDP origins in Russia can be seen as good, but there is still some distance to cover before reaching the levels of the developed Western world.

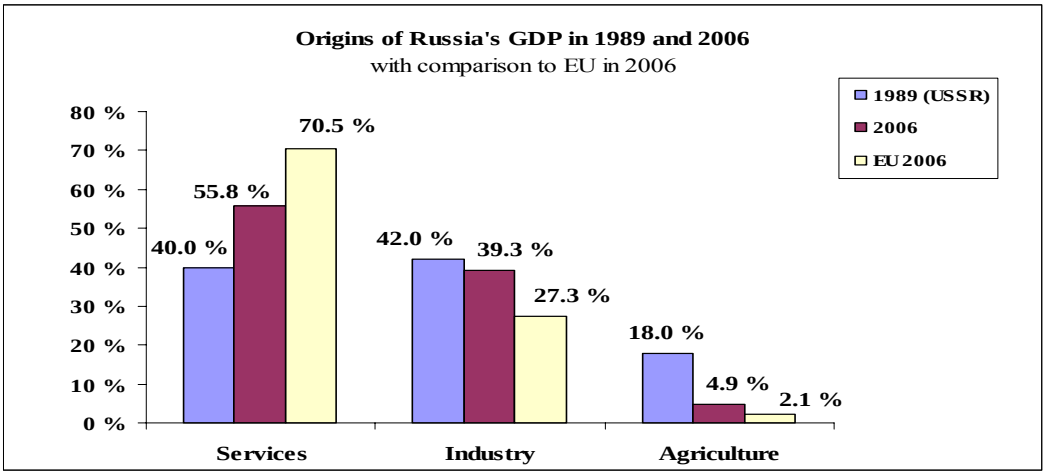

Figure 10. Development of Russia's GDP origins and comparison to the EU (CIA 2007, EIU 1992)

4.2 Development of living standard and monetary economic indicators in Russia

As the total Russian GDP has been growing, the living standard has risen as well. The living standard is normally measured by GDP per capita figures adjusted with the Purchasing Power Parity (PPP), which means in practice taking the price level of the country into account. In the RF the GDP/capita at PPP was 9,880 Euros (EUR) in year 2006, while in the 10 New Member States[3] (NMS-10) of EU it was on average 13,059 EUR and in all 27 EU countries 24,117 EUR, respectively (Gligorov et al. 2007). Another closely related living standard factor is wages. Normally monthly wages are presented with the same PPP adjustment to make them comparable to the figures of other countries. In the RF, the average monthly wages (PPP adj.) were approximately 564 EUR in 2006 and of the whole EU only Bulgaria had lower figures with 486 EUR. These figures show that the RF is still very poor in the international scale. But as can be seen in Figure 11, Russia's GDP per capita at PPP and monthly wages at PPP have increased quite well in recent years and show a clearly positive trend after the year 1999. The

[3] NMS-10 include in this case Romania, Bulgaria, the Czech Republic, Slovenia, Slovakia, Hungary, Estonia, Latvia, Lithuania and Poland

economic crisis of 1998 had an effect also on the next year's negative development, as can be seen in the figure below.

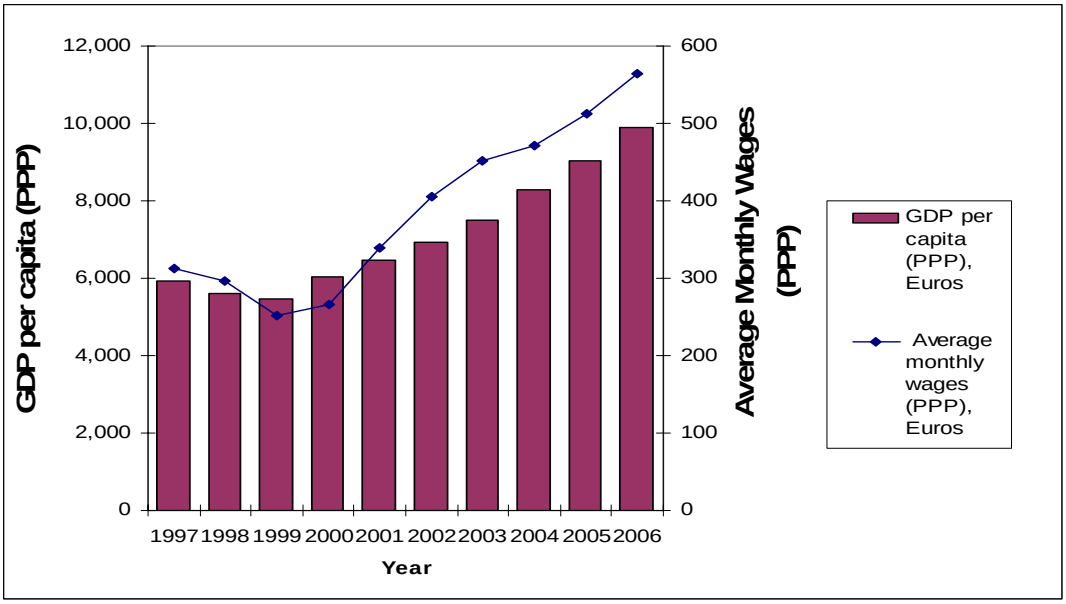

Figure 11. Russia's PPP adjusted GDP per capita and average monthly wages 1997-2006 (WIIW)

The increase of disposable income, which is a result of the above-mentioned increased living standard, is considered positive also in the IT industry, as it increases consumption in such goods as computers, software etc. However, the business sector consumption is far greater in IT and therefore the consumer side is less important. The average annual real growth of consumption of households in Russia was 9.8 % during the years 2000-2006, which indicates both rising incomes and inflation. The consumer expenditure profile in Russia is also shifting from basic cheap things, such as food, to more expensive ones like transportation (cars), communication (mobile phones, internet subscriptions etc.) and housing.

As seen in Table 4 below, inflation in Russia is still a big problem, although single digit figures in consumer prices were finally reached at least momentarily in year 2006. The producer prices in industry are actually in a worse shape with double digit inflation figures (Gligorov et al. 2007). The Exchange Rate Deviation Index (ERDI) indicates the under-/overvaluation of a nation's currency. It can be calculated by dividing the PPP-adjusted figures, of for example the GDP, with the nominal ones. The equilibrium is one, and figures over this indicate undervaluation of the domestic currency, which is common in the transitional and not yet matured economies. The ERDI of Russia has developed nicely and has already decreased below two, which indicates economic maturing. As seen below, the RUR exchange rate in comparison

to the USD was approximately at the same level in 2006 as it was in 1999, although some swings had occurred in between. The ruble has nominally lost approximately 30 % of its value in comparison to the euro since its introduction in 1999. Still, the average ER change is not as good a descriptive figure of the situation as the real ER. The real ER, which is Consumer Price Index (CPI) –based in the table, takes into account the consumer price level (inflation) and therefore describes the actual situation better. As seen below, since 1999 the ruble has actually appreciated in real terms in comparison with the euro, due to the much higher inflation rates in Russia than in the EU.

Table 4. Monetary economic indicators of Russia 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Inflation, in % (consumer prices)	14.8	27.6	85.7	20.8	21.6	16.0	13.6	11.0	12.5	9.8
RUB/USD, ER (year average)	5.79	9.71	24.62	28.13	29.17	31.35	30.69	28.81	28.30	27.34
RUB/EUR, ER (year average)	(6.54)	(11.06)	26.24	26.03	26.13	29.65	34.69	35.81	35.22	34.08
ER nominal, 2000=100 (Euro-based)			100.8	100.0	100.4	113.9	133.3	137.6	135.3	130.9
Real ER (CPI-based), 2000=100 (Euro-based)			119.5	100.0	84.4	84.2	88.4	84.0	75.0	67.6
ERDI	2.15	3.12	4.35	3.18	2.80	2.76	2.84	2.50	2.11	1.79

Source: WIIW

Russia has suffered, in addition to normal inflation, also of serious wage inflation. The Unit Labor Cost (ULC) is increasing very rapidly. In practice ULC defines labor cost per unit of manufacturing output. There is actually a labor shortage in many urban centers of Russia, and the inflow of foreign workers is increasing. This relative labor shortage puts immense pressure on the wages and therefore affects the ULC figures presented in Table 5 below. (Tiusanen 2007, p. 23)

As can be seen below, the RUB-based ULC index grew roughly 5.8–fold between 1999 and 2007. With the ER-adjusted index, the increase was roughly 4.3-fold in the same period. Even the lower figure indicates that the ULC development has been very inflationary in Russia recently. At the same time, the productivity improvement is much more modest, with around 5 %-6 % annual figures. This wage inflation in Russia is a huge factor in decreasing the price competitiveness of local production. (Tiusanen 2007, p. 23)

Table 5. Unit Labor Costs in Russia

	1999	2000	2001	2002	2003	2004	2005	2006	2007
ULC, RUB, (2000=100)	72.9	100.0	138.8	182.6	213.8	247.6	299.3	349.1	421.5
ULC, ER-adjusted (2000=100)	72.3	100.0	138.2	160.3	160.5	180.0	221.2	266.6	313.4

Source: Havlik et al. 2008

When considering the factors presented above, it can be summarized that Russia is actually suffering from a special variant of the Dutch Disease. RUB is clearly undervalued, but the advantages rising from the low ER are continuously decreasing. In other words, the actual appreciation of the real RUB exchange rate is good news for the Western companies exporting goods to Russia and bad news to firms producing import-substituting products in Russia, which can be considered price sensitive. This situation also poses a threat to the players in the Russian IT-industry exporting their products and competing with price. (Tiusanen 2007, p. 32)

4.3 Northwest Federal District of Russia and the St Petersburg area

In 2000, seven Federal Districts were formed to the RF by the initiative of President Vladimir Putin. The Northwest Federal District[4] (NWFD), which is presented in Figure 12, is one of them and is run by the administrative center of the city of SPB. The size of the NWFD was around 1.69 M square kilometers in 2005 and it covers roughly 10 percent of he total territory of Russia, which makes it the fourth largest Federal District. By population the NWFD was the fifth largest Federal district in beginning of 2007 with its 13.63 M inhabitants. As in the whole Russia, the population of NWFD has decreased considerably since the 1990's (almost by 1.7 M by 2005) and the trend is forecasted to continue in the future, except in the two biggest cities of Russia, SPB and Moscow and their immediate environment

[4] NWFD includes the Republic of Karelia, the Republic of Komi, the Arkhangelsk Region, the Nenets Autonomous District, the Vologoda Region, the Kaliningrad Region, the Leningrad Region, the Murmansk Region, the Novgorod Region, the Pskov Region, and the City of St Petersburg.

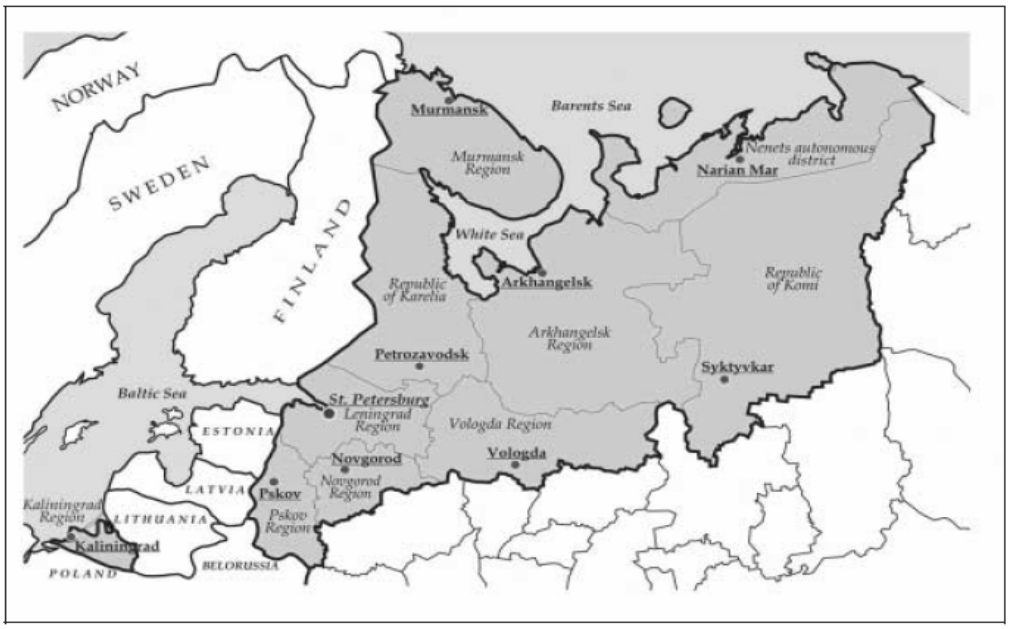

Figure 12. Map of Northwest Russia (Dudarev et al. 2004, p. 17)

Also known as the cultural capital of Russia, the city of SPB covers only 1,400 square kilometers, as is seen in Table 6 representing the main characteristics of the NWFD. On the other hand, in 2007 SPB had clearly, in comparison to the other areas and cities, the biggest population of the NWFD with around 4.57 M people. The second largest area by population in the NWFD was the Leningrad Region with 1.64 M people. Together SPB and the Leningrad Region formed 46 % of the total population in the NWFD. As seen in the map of Figure 12, SPB and the Leningrad Region combined can be considered to be the core of the geographical term "St Petersburg area". SPB is a true European metropolis with a population density of over 3,000 people per square kilometer and 100 % urban population. The Leningrad Region is quite scattered in comparison, as its population density is only 20 persons per square kilometer and the share of urban population is roughly two thirds. Still, the population of the Leningrad Region is the second largest of the NWFD, and also the population density ranked 3rd in the District is well above the average. The Nenets Autonomous District (see Table 6) will be included in the Arkhangelsk Region figures from now on and will not be presented individually in the figures and tables.

Table 6. Main characteristics of NWFD in the beginning of 2007

	Population (thousands)	Area size in 2005 (1,000 km²)	Population density (persons/km²)	Share of urban population (%)
Northwest Federal District (total)	13,628	1,687.0	8.1	82.2
St Petersburg	4,571	1.4	3,265.0	100.0
Leningrad Region	1,638	83.9	19.5	66.3
Arkhangelsk Region	1,280	589.9	2.2	73.2
Vologda Region	1,228	144.5	8.5	68.4
Republic of Komi	975	416.8	2.3	75.7
Kaliningrad Region	937	15.1	62.3	76.8
Murmansk Region	857	144.9	6.0	91.3
Pskov Region	713	55.4	13.1	67.4
Republic of Karelia	693	180.5	3.9	75.8
Novgorod Region	658	54.5	12.2	70.6
Nenets Autonomous District (included in the Arkhangelsk Region)	42	176.8	0.2	64.2

Source: Rosstat 2007b

4.3.1 Economic circumstances in Northwest Russia and the St Petersburg area

Northwest Russia is in general terms quite scattered both population and industry-wise. There are large areas with no real infrastructure and very few people in terms of population density. Naturally the SPB area offers, in comparison to the rest of the NWFD, both more labor force as well as higher total buying power for product markets, as there are over 6 M people living in the area.

The size of the total nominal Gross Regional Product (GRP) in the NWFD was around USD 64.3 BN in 2005, which was roughly 10 % of the total GDP of USD 36 BN in the RF. More importantly, SPB was the 4th and the Leningrad Region the 21st largest in the rankings of total GRP amongst all, over 80 in total, Russian administrative divisions. Above the city of SPB in these rankings were only the city of Moscow, the Tuymen Region and the Moscow area, in the order of ranking. Therefore the SPB area can be seen economically as remarkable force inside Russia. As seen in Figure 13 below, Saint Petersburg and the Leningrad Region also formed almost half of the total GRP in the NWFD in 2005 with their share of approximately USD 31 BN. During the period 1995-2005 the share of the NWFD in the total Russian GDP did not

change much, staying constantly around 10-11 percent. It is worth mentioning that the share of the Central District in the Russian GDP grew from 25 % in 1995 to 34 % in 2005, mostly due to more people and business, especially headquarters of the richest and most powerful companies, concentrating in Moscow or its close surroundings. The growth of the total nominal GRP in SPB was roughly 7.8-fold and in the Leningrad Region 9.9-fold in 2005 in comparison to the 1998 figures. The growth has been faster than in the NWFD, which grew almost 7.6-fold during the same time. GRP of the whole RF grew almost 8-fold during same period of 1998-2005. These figures do not give a complete picture of the growth, as they are nominal figures, and for example inflation, which was high in Russia especially in 1998, has not been taken into consideration. (Rosstat 2007b)

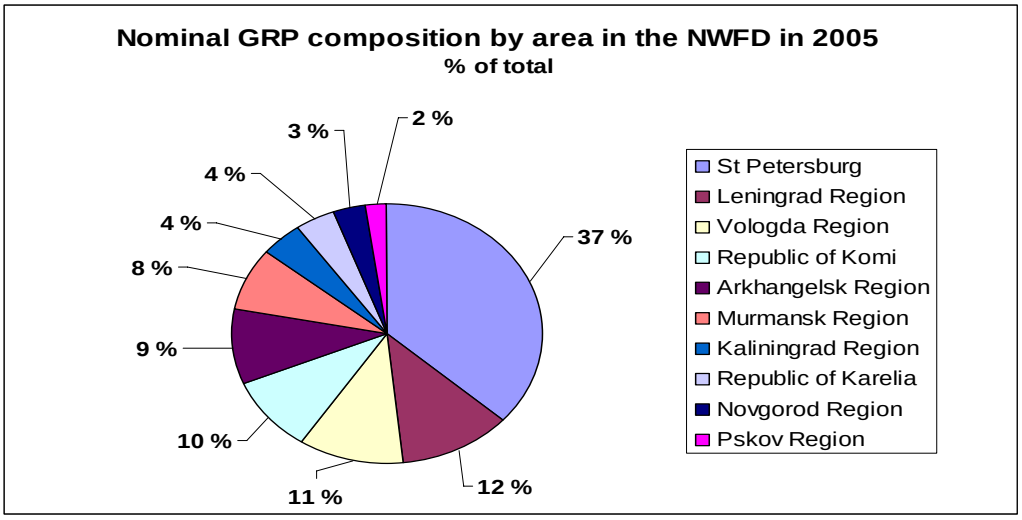

Figure 13. NWFD nominal GRP composition in 2005 (Rosstat 2007b)

The total GRP of the St Petersburg area is clearly the biggest in the NWFD (see Figure 13 above). Still, there are some problems that decrease the amount of GRP per capita in some locations in comparison to other locations performing better, such as the Republic of Komi and Murmansk, Vologda and Arkhangelsk Regions, as seen in Figure 14 below. These problems include the absence of natural resources and related capital-intensive industries, which are found in the better performing areas. Still, St Petersburg with basically no natural resources has better nominal GRP per capita than the average figure in the RF. The NWFD average and the Leningrad Region are also slightly above the national average.

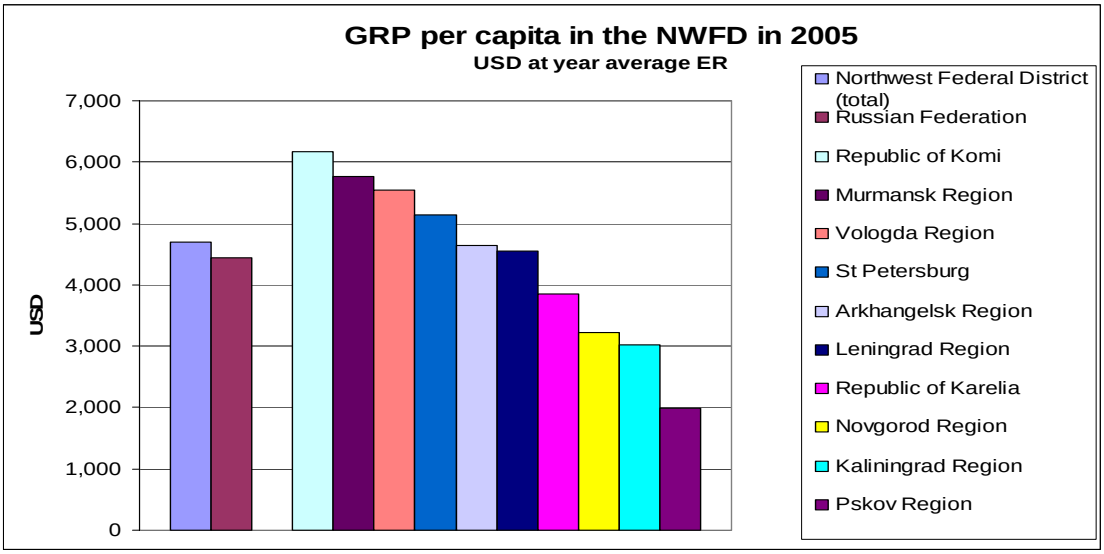

Figure 14. Nominal GRP per capita in the NWFD in USD (Rosstat 2007b)

4.3.2 Gross Regional Product composition in the Northwest Federal District

The composition of GRP in Russia and the NWFD is presented in Table 7 below. The shares of manufacturing and transport and communication are higher in the NWFD than in the RF generally. The areas within the NWFD with the highest GRP per capita (see Figure 14 above), the Republic of Komi, the Murmansk and Vologda Regions, can be seen to have high shares of capital-intensive activities in forms of mining and extraction and/or manufacturing. Saint Petersburg has, on the other hand, the highest share of wholesale and retail trade with repair activities (services) in the NWFD, but also relatively lots of manufacturing and transport and communications. The high share of the wholesale and retail trade in SPB can be explained by the large population and its density, and the fact that 100 % of them are urban, which combined increase the need of sales and services in the area. The number of people explains also the high share of transport and communications, because SPB have very heavy traffic and therefore the need for a good public and private transportation network is great. The Leningrad Region has a higher share in manufacturing activities than the RF and NWFD in general. Manufacturing activities are more easily spread to the Leningrad Region than to SPB due to the larger unused area with less population in the first mentioned, which enables easier establishing of industry. It is also common to locate manufacturing activities near and around the biggest cities in the world. The Leningrad Region has a lot of transport and communications and wholesale and retail trade activities as well.

Table 7. GRP composition (%) in selected locations by three biggest industry branches in 2005

Russian Federation	Manufacturing (20.4 %)	Wholesale and retail trade, repair activities (19.4 %)	Mining and extraction (12.8 %)
Northwest Federal District	Manufacturing (23.7 %)	Wholesale and retail trade, repair activities (16.2 %)	Transport and communications (14.6 %)
St Petersburg	Wholesale and retail trade, repair activities (24.7 %)	Manufacturing (20.9 %)	Transport and communications (15.1 %)
Leningrad Region	Manufacturing (28.0 %)	Transport and communications (20.8 %)	Wholesale and retail trade, repair activities (11.5 %)
Arkhangelsk Region	Mining and extraction (20.1 %)	Manufacturing (18.5 %)	Wholesale and retail trade, repair activities (12.0 %)
Vologda Region	Manufacturing (46.4 %)	Transport and communications (11.7 %)	Construction (10.3 %)
Republic of Komi	Mining and extraction (34.4 %)	Transport and communications (12.6)	Manufacturing (10.1 %)
Kaliningrad Region	Wholesale and retail trade, repair activities (17.2 %)	Manufacturing (16.3 %)	Mining and extraction (14.8 %)
Murmansk Region	Manufacturing (24.9 %)	Mining and extraction (14.1 %)	Transport and communications (12.7 %)
Pskov Region	Wholesale and retail trade, repair activities (21.6 %)	Manufacturing (17.9 %)	Transport and communications (16.5 %)
Republic of Karelia	Mining and extraction (19.5 %)	Manufacturing (17.8 %)	Transport and communications (15.6 %)
Novgorod Region	Manufacturing (36.2 %)	Wholesale and retail trade, repair activities (15.2 %)	Agriculture, hunting and forestry (9.8 %)

Source: Rosstat 2007b

5 Saint Petersburg area IT industry[5]

Northwest Russia and the SPB area have a long history in IT-related activities. The construction of the first telegraph line of Russia started in SPB already in the mid-19th century. After the creation of the Chief Telegraph Workshop by Siemens and Halske in 1853, the domestic demand increased quickly, which led to the development of electrical engineering industry. In 1879, the first telephone call was made in Russia and the construction of SPB telephone network began soon after that. In the beginning of the 20th century almost 20 electric engineering plants were already operating in SPB area. SPB was the invention center of the 19th and 20th century, as the radio was invented there and the first TV set in the world was built there, as well as the first color TV in Russia. The main reason for this electrical engineering leadership was the accumulated skills, the commitment of the government and the traditions deriving from the concentration of activities to this specific location, SPB. (Averin & Dudarev 2003, pp. 36-37)

In the middle of the 20th century, radio engineering and electronics dominated in Northwest Russia. It was also within the framework of the central planning system, when large investments were made to Northwest Russia in the 1970-1980s in the sphere of telecommunications manufacturing. At the same time IT was raising its head in the Soviet Union after many decades of disfavor from the government. At that time, electronics was considered important for the military industry, which played a big role in the Soviet economy. IT did not, however, rise to the level of technology elsewhere, since it had not been considered important, and therefore had not been developed. Quite soon, a scientific and industrial complex was formed in the Northwest Russia on the basis of existing companies and production facilities, and specialized research institutes. Just before the dissolution of the Soviet Union, in the late 1980s, there were over 50 companies and research centers operating in the microelectronics sphere in SPB alone. (Averin & Dudarev 2003, p. 38)

The electronics industry has had great influence in the development of the SPB area IT industry already since the Soviet time. Electronics industry is actually still nowadays a substantial force in Russia and the NWFD. The growth rate of the electronic component market in Russia has been around 20 % during the last few years, while the average in the EU has been around 6 % and in the USA 10 %. The market volume of Russian electronic components was around USD 1.2 BN in 2006, of which roughly USD 513 M fell to the domestic producers. The RF

[5] Expert interviews conducted for this study are used in this and the following chapters as one of the main information sources and they will not be referred to in each paragraph separately.

government has also acknowledged the potential of electronics industry and started investments and development initiatives to promote it. The Russian electronics industry is still closely related to the IT industry, as companies operating in electronics still create spin-off companies to IT, and also many electronics companies have expanded their operations to the IT field (e.g. Sitronics). (Cnews 2007a)

The state of IT and electronics-related R&D system was controversial in the Soviet Union. R&D was a heavily invested sector, but it was not working efficiently. The structure of the R&D institutions was hierarchical, and the linkages between actors were stronger on vertical levels than on horizontal ones. Research institutions, which were highly independent, were the primary ones performing R&D in the USSR. Very few enterprises and higher education institutions participated in R&D in general. The location of innovative activities in different hierarchies and lack of proper linkages between actors led to problems and dysfunctions in the whole R&D system. Overall, R&D was carried out separately from production, and interaction between different sectors was very difficult. Eventually the situation developed to almost total absence of innovation diffusion, which is still a major problem in Russia. This has a negative influence in the SPB area IT industry still today. The current R&D situation and potential is assessed in more detail in chapter 5.2.1. (Egorov & Caraynnis 1999, p. 160)

The Soviet Union was also under strict trade control, which severely prevented its technological development during the cold war and until the Soviet system collapsed. The Coordinating Committee for Multilateral Export Controls (COCOM) established in 1949, was important factor in facilitating multilateral cooperation to control exporting of strategic goods and technology to e.g. the Soviet Union and China. In practice, 17 countries including the most powerful countries in the world e.g. United States, Japan, Germany, France and United Kingdom, participated in COCOM and did not export any advanced goods to the Soviet Union. This was primarily done to ensure that the Soviet Union's military effectiveness would not increase, but also to leave them purposely behind in technological advance. COCOM obstructed trade, and therefore technological development of the Soviet Union and its former member states until early 1990's when trade of sensitive goods and technologies were liberalized to some former Soviet Union countries. COCOM ultimately quit operating in the mid-1990 and it was replaced by a new organization. (U.S. Department of State Dispatch 1993)

In spite of the trade restrictions, some individual devices and technologies were secretly imported to the Soviet Union. Reverse engineering, which is mainly discovering the technological principles of a device through analysis of its structure, function and operation, was extensively used to get new knowledge of the imported devices and to copy them. Reversed

engineering was actually used in the Soviet Union already during the Second World War in e.g. copying emergency landed United States airplanes (CNN.com 2001). Reverse engineering was not very efficient and consequently the Soviet Union was clearly left behind in the technological development. This has also slowed down the technological development of the SPB area IT industry, at least indirectly.

After the system of central planning collapsed in 1991, many expected an early and strong economic boom to take place in Russia, which did not happen, although people expected post-communism to free the riches of this vast county to its citizens (Tiusanen & Talvitie 1998, p. 22). Instead of an economic boom, some radical changes occurred in Russia and in the IT (electronics back then) industry of Northwest Russia. Old user-producer relations and R&D linkages disappeared, as local companies were exposed to open market competition and lost markets in many product groups. Consequently, many companies ceased to exist or diminished, which enabled birth of *de novo* (newly established after the dissolution of the USSR) private firms. Resources released from the old companies came available for the use of these de novo firms, which have, according to several studies in general better economic performance in comparison to older ones and also speed up the economic transition (see e.g. Richter & Schaffer 1996; Berkowitz & Jackson 2006). The share of de novo private sector was roughly 20 % of the total GDP in Russia already in 1995 (Miller & Tenev 2007, p. 562). Most of the SPB area IT industry companies operating currently are actually de novo companies.

The shift to open market conditions in Russia led first to a decline in the development of manufacturing and technology in the RF. At that time the leading economies had very opposite kind of results, as the increased investments led to remarkable technological development. These events consequently resulted in a huge technology gap between Russian and international companies, which has left a mark in the general development, still seen today. (Averin & Dudarev 2003, p. 38)

5.1 Biggest Russian IT companies

As in many other industries, the biggest IT companies in Russia can be found in Moscow, when considering the location of their headquarters. This can be explained by IT being mostly business-to-business -concentrated, so it is natural to locate near the concentration of the biggest companies in Russia. Though the top Russian IT companies are listed in Moscow, they seem to have some operations in the SPB area as well. For example, the top five companies presented in Table 8 below have operations, in addition to Moscow, in the SPB area and naturally also elsewhere. The first non-Moscow-based company in the voluntary “Biggest IT companies in

Russia" –list by RaExpert (2007) can be found in the 18th place. Business Computer Center is the biggest Saint Petersburg-based IT company in Russia with main operations in IT services, which cover almost 80 percent of the company's activities. The second biggest company in SPB, Ramec, has also a rather substantial turnover and does business mainly in hardware (35 % of total activities), IT services (26 % of total) and delivery of hardware and software (25 % of total). The four next companies in the list, based in SPB, are all most active in the software development sphere: Bercut (61 % of total activities), ASCON (67 % of total), Reksoft (71 % of total) and Digital Design (36 % of total).

Overall, the size of the biggest Russian IT companies in Saint Petersburg is not staggering in comparison to the Moscow-based ones or the two Finnish ones presented in the bottom of Table 8. The Russian IT companies in Saint Petersburg can be considered to be rather small, as their average turnover in this top company listing is only around USD 29 M, and the average number of specialists is also only around 195 people, which cannot be considered truly substantial, as the corresponding numbers for Moscow based firms are USD 168 M and 618 employees. The EU definition of Small and Medium Sized Enterprises (SME) is officially companies having fewer than 250 employees and an annual turnover of up to EUR 50 M (USD 63 M in 2006) or annual balance sheet up to EUR 43 M (USD 54 M in 2006). Of the Saint Petersburg-based companies on the list only the top two, BCS and Ramec, with their clearly above average turnovers, clearly exceed the SME criteria. From the employment perspective only three companies in SPB exceed the SME criteria level.

Table 8. Listing of biggest Russian IT companies in 2006. St Petersburg-based companies are marked in bold in the table

Rating in 2006	Rating in 2005	Company	Turnover in 2006 (M USD)	Growth of turnover from 2005 (%)	Number of specialists in 2006
1	1	National Computer Corporation (NCC)	1,090.6	31.6	2,193
2	3	LANIT	834.5	33.0	2,320
3	2	IBS	723.2	21.6	3,142
4	5	TechnoServ A/S	722.0	32.2	1,194
5	4	R-Style	636.5	12.6	2,450
18	18	**Business Computer Center (BCC)**	134.8	17.7	580
25	29	**Ramec**	93.5	118.9	187
39	-	**Bercut**	33.0	2.8	279
54	55	**ASCON**	14.1	26.3	443
58	60	**Reksoft**	11.5	24.7	247
64	66	**Digital Design**	9.4	40.0	158
66	-	**ITEL**	8.8	139.6	22
73	74	**Monolit-Info**	3.8	25.8	70
75	-	**Computer Systems for Business International (CSBI)**	3.3	25.8	85
79	80	**Compas**	1.0	0.9	60
81	-	**Trinet**	0.2	33.3	17
		TietoEnator	2,052.4	4.8	14,600*
		F-secure	100.6	30.6	479*

Source: RaExpert 2007 and companies annual reports

Another listing by Cnews Analytics (2007a), representing 30 biggest IT companies in Northwest Russia is introduced in Table 9 below. Many of the listed companies are the same as in the above RaExpert voluntary listing. Most companies in this listing are categorized to be in the integration field of activities, which is included in the IT services –category from here on. There are also several software developing companies, as well as distributors. The turnover numbers of the same companies have some differences between the two listings, as well as the number of employees in comparison to the number of specialists. There are also several new

* Number of employees in 2006

companies or company groups in the Cnews Analytics listing. The average turnover for companies listed below was USD 27.7 M in 2006, which is lower than in RaExpert's listing. On the other hand, the average number of employees per company in the beginning of 2007 was higher with roughly 283 people. However, the employment figures and the turnovers can be seen to be somewhat distorted and unreliable, as many companies or groups of companies listed below are actually operating in many locations in Russia and the rest of the world and their employment and turnover figures are in some cases total, not just for SPB area operations. Overall, both listings indicate that SPB-based IT companies are mostly rather small, but there are also bigger company groups and subsidiaries of Moscow-based companies present in the SPB area.

One interesting feature concerning the fourth biggest company, Tranzas, in the table below is its participation in the SEZ initiative in the SPB area. As explained below the SPB area SEZ initiative has not yet gathered many companies to participate in the project, and therefore Tranzas, which is mainly an integrator and software developer, makes an exception. The company is expected to transfer its activities to the SEZ-zone quite soon, and with consequent tax privileges is forecasted to grow and make good financial results in the near future (Cnews Analytics 2007b). Whether or not this success actually comes through locating activities in the SPB area SEZ remains to be seen.

Table 9. Thirty biggest IT companies in Northwest Russia in 2006

Rank in 2006	Company	Main field of activity	Turnover in 2006 (M USD)	Growth from 2005, %	Number of employees in Jan. 2007
1	BCC	Integration	134.8	18.9	720
2	Ramec	Manufacturing of computers	110.0	157.7	295
3	Superware	Distribution	103.0	52.4	155
4	Tranzas	Group of companies	102.7	27.5	1,200
5	Paladin-Invent	Group of companies	82.0	905.2	65
6	OLLY	Integration	55.9	15.0	114
7	Exigen Services (Starsoft)	Software development	53.3	383.7	1,500
8	Bercut	Software development	33.0	20.8	360
9	GMCS (SPB)	Integration	19.4	74.0	300
10	Croc (SPB)	Integration	16.2	179.6	1,188
11	Polikom Pro	Integration	14.9	32.4	120
12	Ascon	Software development	14.1	555.5	443
13	Trinity	Distribution	11.6	49.4	50
14	Reksoft	Software development	11.5	25.0	300
15	Softbalans	Group of companies	10.3	38.5	192
16	Lynx	Integration	8.7	6.5	70
17	Aura	Distribution	8.7	6.5	50
18	Lanit-tercom	Integration	8.2	75.6	350
19	Digital Design	Integration	6.7	***	243
20	Devexperts	Software development	4.4	25.0	114
21	The Monolit-info	Integration	3.8	25.8	74
22	Nevo-D	Integration	3.6	40.8	18
23	NB Company	Distribution	3.4	56.5	21
24	Arcadia	Software development	3.2	13.0	130
25	Confident	Integration	3.1	26.9	250
26	TRIM (Спецтек)	Integration	1.8	92.0	47
27	Compas	Software development	1.0	0.9	60
28	West Concept	Integration	0.9	257.1	25
29	Docs Vision	Software development	0.6	2.5	26
30	Megapolis	Integration	0.5	11.9	18

Source: Cnews Analytics 2007a

5.1.1 Short-term development of the biggest IT companies in Russia

The Russian IT market would be able grow with better rates, as the preconditions for this already exist (RaExpert 2007). Actually the growth rates of Russian IT have not changed much during the last five years. According to the 2006 ratings of Russian IT (mainly domestic companies) by RaExpert the overall turnover of companies had increased roughly by 28 % from 2005, reaching almost USD 9.5 BN in total. Since 2002, the growth rate has been varying between 25 and 32 percent annually. In Table 10 below, the author's own calculations of certain key figures from the RaExpert ratings are presented for the years 2004-2006. The previous years could not be included in the table due to the different calculation methods used by RaExpert. Cnews Analytics listings could not be used in this context either, due to missing data. As seen in the table below, the Moscow-based companies have on average increased their turnover with USD 70 M between the years 2004 and 2006. Saint Petersburg-based companies have actually decreased their average turnover by roughly USD 2 M in the same time period, with a decrease of 23 % in comparison to the year 2005. However, this sudden drop of USD 8.4 M in the average turnover between 2005 and 2006 can be explained by the shift of head office location from SPB to Moscow by the company Nienschanz, which had a significant turnover of USD 113 M in 2005 and therefore influenced positively the average of eight companies in SPB in the same year.

Table 10. Average key figures of the top Russian IT company listing according to the head office location

Year	Area	Avg. Turnover (M USD)	Avg. Turnover change (in %)	Avg. Number of specialists	Avg. Turnover per specialist (thousands USD)	Number of companies
2004	Moscow	97.7	N.A	397	246.4	56
	St Petersburg	30.7	N.A	170	180.7	7
	Total	72.2	32	329	219.5	80
2005	Moscow	129.8	33	530	244.9	55
	St Petersburg	36.9	20	248	148.7	8
	Total	93.4	29	435	214.8	82
2006	Moscow	167.9	29	618	271.6	52
	St Petersburg	28.5	-23	195	145.9	11
	Total	117.5	26	499	235.5	81

Source: RaExpert 2007

The Russian IT industry has concentrated mostly on IT services and software development in recent years. In 2002, the average share of IT services was 43 %, and the share of software 25 %, while hardware accounted for only 10 % in the activities of top Russian IT companies in the

listing. In 2006, IT services were still dominating with their average of 40 %, accompanied by 20 % share of software development. Hardware and telecommunication services had rather small shares with around 5 %-7 % on average. In SPB-based companies, the average share of software development was a substantial 35 %, which is almost on the same level with the 39 % share of IT services. New rising fields of activity in Russian IT in general have been distribution and deliveries of equipment and software, which have gained roughly 10 % and 16 % in the newest 2006 rankings. (RaExpert 2007)

The location of the headquarters of IT companies operating in the SPB area is ultimately not very relevant. All companies, both domestic and international, located in the area can be regarded positive for the competitiveness development and clustering of the area. The headquarter-based perspective is just taken into account in the calculations presented above to give some insight into the development of SPB area -based IT companies. Naturally, especially the increasing presence of foreign companies in the area is regarded positive, as it enables integration and linkages to global IT value chains also for the domestic players in the industry.

5.2 International competitiveness of the Saint Petersburg area IT industry

The competitiveness analysis presented in this chapter offer more insight into the overall international competitiveness and clustering potential, as well as to the current situation of the industry in general. Detailed analysis of competitiveness factors in the SPB area IT industry is presented from the international perspective.

5.2.1 Factors

According to the conducted interviews and information gathered from statistics and various publications, there are both positive and negative factor conditions influencing the international competitiveness of the SPB area IT industry. Positive factor conditions include education, R&D potential, geographical location and inherited industrial capital. Negative factor conditions are the labor supply and cost situation and their development and capital resources. All relevant factor conditions are discussed below with the broad categories introduced in the theoretical part.

Human resources:

Skills of personnel

Northwest Russia has very strong historical roots in education, especially in science and engineering. The first Russian university, Saint Petersburg State University, was established in

the first quarter of the 18th century. Later on, many technical and other universities have been founded in the area and they have attracted also international students and, consequently, received international recognition already during the years of the Soviet Union. All these universities and other educational institutions, combined with investments put in them in Northwest Russia have provided most of the needed qualified personnel with higher education to the different industries, ranging from the electronics manufacturing under the Soviet Union to the current situation with new industries like IT and telecommunications, in the SPB area.

The total number of Higher Education Institutions (HEI) has doubled in Russia since the transition begun in 1991, reaching 1 068 in 2005/06. It is interesting that almost 40 % of the HEI in Russia were non-state in 2005/06, when naturally under the Soviet system in 1990/91 all were state-run. The number of HEI in SPB was 87 in 2005/06. A better description and understanding of the education situation in the SPB area is gained through the total number of higher education students and their number in relation to the population in different cities and areas. The number of higher education students has increased heavily, as can be seen in Table 11 below. The number has actually grown in the whole Russia roughly by 150 percent from the beginning of the transition, reaching over 7 M people in total in 2005/06. The NWFD and SPB have not had similar growth rates as the whole Russia or Central Federal District and Moscow, but have still grown substantially.

Table 11. Number of higher education students (in thousands) in selected areas of Russia

	1990/91	1995/96	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	growth since 1990/91
Russian Federation	2,824.5	2,790.7	4,741.4	5,426.9	5,947.5	6,455.7	6,884.2	7,064.6	150 %
Central Federal District	921.3	901.4	1,489.9	1,747.0	1,755.0	1,967.6	2,191.1	2,167.2	135 %
Moscow	528.7	508.5	869.6	1,036.3	957.5	1,124.9	1,306.5	1,198.0	127 %
Northwest Federal District	339.7	317.4	534.9	598.3	647.7	684.5	713.0	732.0	115 %
Saint Petersburg	247.5	217.8	356.7	383.9	380.1	421.8	443.4	428.8	73 %

Source: Rosstat 2007b

Moscow and SPB are the higher education centers of Russia. This can be seen below in Table 12, which shows the relative number of higher education students in comparison to area

population. In this comparison, Moscow is the leading city/region in Russia with SPB just behind it. Both cities have roughly double the number of higher education students in comparison to the whole country. Combining this information with the population and the total number of higher education students in these metropolises, it can be concluded that these cities are the major source of highly educated labor force in Russia.

Table 12. Number of higher education students per 10,000 people, relative to the area population

	1990/91	1995/96	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	Position in RF
Russian Federation	190	188	324	373	410	448	480	495	
Central Federal District	241	236	390	459	462	521	584	580	
Moscow	586	550	860	1,009	922	1,082	1,255	1,149	1
Northwest Federal District	222	215	377	425	464	495	519	537	
Saint Petersburg	494	452	757	819	816	912	964	936	2

Source: Rosstat 2007b

In international comparisons made by the OECD, Russia ranks very well in the relative amount of science and engineering education, as illustrated below in Figure 15. Science and engineering education produced almost 40 % of degrees in Russia in 2004 and this education is also the most common among employees in the IT industry.

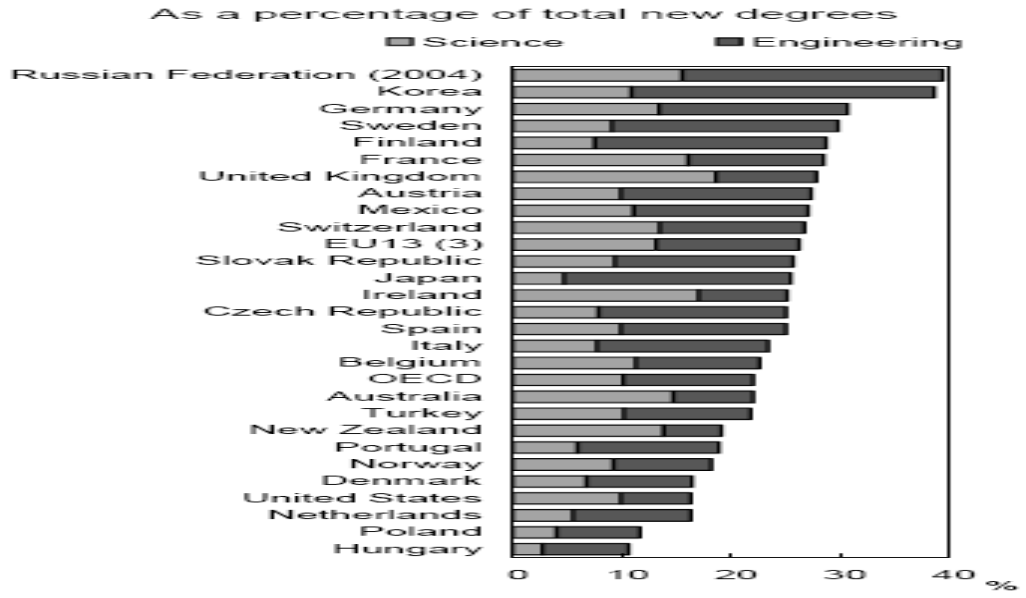

Figure 15. Science and engineering degrees in higher education in 2003 (Gianella & Tompson 2007, p. 15)

Still, according to the conducted interviews with foreign and domestic players in the SPB area IT industry, the education given to the labor force does not match with their practical skills and knowledge, although the basic education is considered to be very good also internationally. Naturally this type of problem persists also elsewhere, all around the globe, and new employees often need further training and experience in the practical work environment. The experts argued in the conducted interviews that most improvement in personnel skills is needed in the in the higher management side, which naturally influences the companies' operations the most. Higher management development was in the interviews considered as an important factor for most companies, especially for domestic ones in the SPB area, for them to become truly international and competitive. Overall lack of personnel skills was in the interviews seen to be on the business knowledge and management side. The management should improve their capabilities on handling basic, but important, business activities, such as product commercialization, project control, and marketing and sales of products. However, technical know-how and basic education of personnel were factors which in the interviews were claimed to be already very positive in the SPB area even in international comparison.

Cost of personnel

The moderate speed of development of the living standard, and consequently wages, in Russia were discussed above. The average wages in Russia were nominally around 320 EUR in 2006 (WIIW). Unfortunately, these average wages are not applicable to the SPB area IT industry. First of all, the nominal average wages are considerably higher, especially in Moscow (around 900 Euros) and the SPB (around 400 Euros) area, than elsewhere in Russia. This is due to the

higher price levels in these regions, as for example the living costs (housing, services and foodstuff) are considerably higher than elsewhere in Russia. Secondly, the IT industry in general and in the SPB area has higher average wages than in other industries, among other things due to the high demand of IT specialists.

According to the conducted expert interviews, the SPB area is not anymore very competitive internationally in IT personnel costs, and it is continuously losing its competitiveness. According to the interviews, in the software business wages for junior and senior coders are roughly four to five times higher in the SPB area than in India, which is one of the main global rivals in software outsourcing business. Naturally, Russia still offers personnel cost advantage in comparison to more developed Western countries, but in global terms such countries as China and India have taken the lead. The wages are on average increasing nominally in Russia over 20 percent per year and in real terms even by 10-15 percent (WIIW). Still, straightforward international comparison cannot be made in the IT sector personnel cost, as the Russian personnel especially in the SPB area, is mostly higher education graduates, whereas in India the personnel is more likely to be considerably less educated. It is also worth mentioning that the personnel costs are just a part of the total costs. For example, the project initiation costs are seen to be lower in Russia than in India and China. The related productivity features in Russian manufacturing are covered in more detail in chapter 5.2.5 below.

Supply of personnel

Although the inherited human capital from Soviet time electronics industry and the current higher education system in Russia and the SPB area, which produces well educated people with science and engineering degrees to the labor market, there is still a lack of IT specialists in Russia. This lack is due to many factors, such as the already previously mentioned mismatch between the education and practical skills and knowledge of the graduating students, and also the all the time increasing labor demand, as the IT industry, as well as other industries needing the same qualified labor force, are growing and developing rapidly. There is also some sort of lack in the labor mobility, as labor markets in Russia are very tight in few cities (e.g. Moscow, SPB, Novosibirsk and Nizhni Novgorod), while many of the potential employees are scatted around the country (Gianella & Tompson 2007, p. 11). Despite the relatively high wages in the sector, the relocation costs can prevent the labor force from moving. Some IT companies have, however, managed to start to source labor force to the SPB area from elsewhere, such as other Russian regions and Belorussia. It is also worth mentioning that labor mobility from a local company to another is rather active. Most of the time, respected and well known foreign companies in the sector are able to attract labor by their reputation and by offering higher salaries in comparison to their domestic rivals.

As already mentioned, there is also a specific lack of highly capable management personnel in the SPB IT industry. There are however, some positive signs of higher management mobility, as Russian managers, who have gained experience from working in foreign companies in Russia and abroad, are returning to domestic IT companies and taking management control of the companies, as the old generation is slowly starting to retire and step aside.

Physical resources:

Geographical location

Russia's natural resources are not in a key role in the IT sector. However, the geographic location can be seen as a positive factor condition in the SPB area. Firstly, the SPB area has some special inherited industrial and human capital features from the Soviet Union times, which benefit the IT industry. Secondly, the city of SPB is located in Russia so that it is in close proximity or within good transportation routes with other countries (e.g. Scandinavia) and the whole Europe, which gives it some competitive advantage over for example Indian and Chinese companies. This proximity to Europe enables foreign companies to cooperate first with local SPB area IT companies or import goods more easily, and eventually to establish themselves in the Russian territory.

Inherited industrial capital

As mentioned above, the SPB area was the chosen core location of electronics and telecommunications production in the Soviet period. Unfortunately, these operations were mostly military-related back then and therefore more detailed information is hard to obtain. Due to the past concentration of electronics and telecommunications activities in the area, there are still all sorts of different manufacturing facilities in the area. During the early years of the transition period, many of the old companies ceased to exist or shut down parts of their operations due to many features of open market conditions, such as competition from foreigners, lower efficiency than competitors, etc. Consequently, there is still relatively much unused production infrastructure in the area, which could serve as a basis for new and old companies' operations. Naturally, most facilities and their utilities are becoming outdated, so they would need to be improved and modified accordingly.

Knowledge resources:

R&D potential

After the Second World War, the USSR was considered the other major player in R&D besides the United States. Russia's strong roots in science and technology can be found already in the time of the tsars, when several educational, institutional and military organizations were

founded to enable success in R&D. The strong background for R&D started already in the 18th century, and led eventually to the situation where just before the dissolution of the USSR, the country had one million researchers and their contribution to especially nuclear and space R&D had gained wide recognition around the world. Because the Soviet economy was so research-intensive, it was expected that the R&D sector would flourish and bring high-technology exports and economic growth under the Russian flag and territory as well. These expectations proved to be wrong. (Gokhberg et al. 1997, pp. 1-2)

In the early 1990's some rather unique technologies existed in Russia, especially in the large R&D institutes and enterprises established under the central planning system. However, the lack of investments, or rather resources, blocked the further development and commercialization of already existing and new technologies at that time. Russia was also, and still is, suffering of poor innovation diffusion overall due to several problems in the R&D system. In addition, in the IT business according to the conducted interviews, some pioneer foreigners in Russia "drained" many of the ideas and technologies already existing or under development from locals by exploiting the poor overall situation in the country in the early 1990's.

Already in the beginning of the transition and still today, a majority of different innovative ideas and technologies in Russia do not reach the market. This is due to multiple factors, but one of the main reasons is the lack of specialists in the transformation of ideas into products. Specialists are desperately needed in marketing and sales operations as well. In the IT sector the situation is not different. According to the interviews, the computer and mobile phone game business is one of the few examples where Russians have been able to develop and commercialize their products. Otherwise, many of the innovative developments never reach the markets due to the above mentioned reason and lack of financing and opportunities to promote new ideas.

Traditionally, the R&D organizations in Russia have been under state ownership and working under public sector rules. This has caused severe problems in the adoption of achievements of such organizations as they have practically none or very little experience of the corporate sector and therefore product markets. Only a few R&D institutes have successfully adapted themselves to the new market conditions after the dissolution of the USSR. Russia also suffers from poor coordination and cooperation between the mainly public sector research institutes and the private sector companies, which also prevents the commercialization of innovative ideas.

The overall R&D situation in Russia is the best way to describe its state and influence on the SPB area IT industry. According to Gianella and Tompson (2007), the Russian situation can be described through the following features:

- Russia's innovation potential is probably higher than that of most other countries with a similar living standard, which is illustrated below in Figure 16. The country has also a substantial inherited science base and proper education system on especially science and technology, deriving from the Soviet Union times.

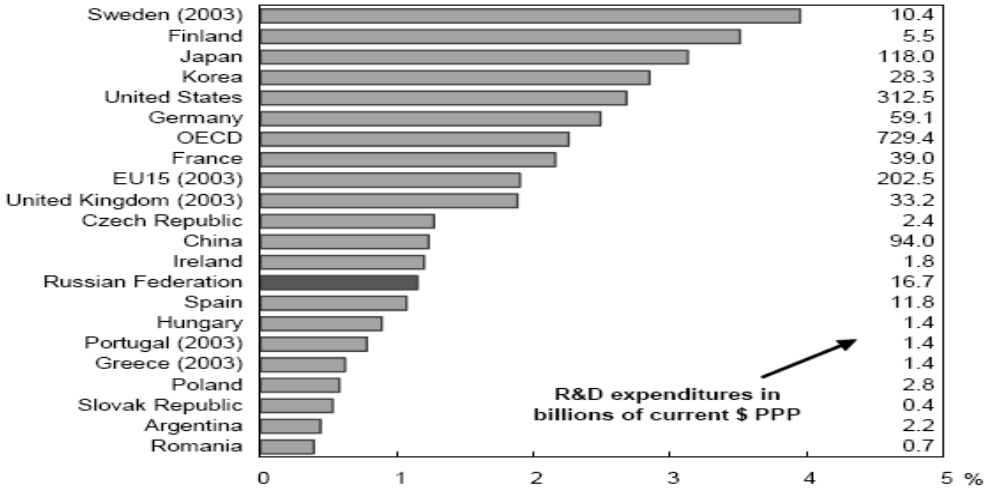

Figure 16. Gross domestic expenditures (as % of GDP) on R&D in 2004 (Gianella & Tompson 2007, p. 7)

- The indicators of actual innovation activity are still very disappointing. The input of public resources for knowledge creation is not balanced with the observed outputs in terms of innovation.
- Private sector involvement in R&D is very limited in Russia. The private sector is mostly oriented in imitation activities rather than R&D-based innovations. Most Russian R&D is financed by the state, which differs largely from better developed Western countries.
- Human resources in R&D are seen to be too large in comparison to the total R&D spending. In practice, Russian R&D expenditure per researcher is seen to be with PPP adjustment only 14 %-15 % of the figures of the United States and Germany.
- Over 50 percent of business side expenditure on technological innovation is targeted at improving production processes rather than creating totally new products to the market. The IT sector plays a big role in this, as new machinery and equipment targeted to improve production processes and often imported, is focused on improving IT in

companies. Technical and organizational innovation is argued to come from sophisticated IT, which consequently improves the production processes.

- The production and exporting of innovative goods is very low, as illustrated in Figure 17 below. The share of high-value-added goods in manufacturing exports to OECD countries does not exceed even 1 percent (0.2 % for ICT) and high-medium value-added goods reach only the level of about 10 %. In comparison to other countries and the OECD average, these figures are very low.

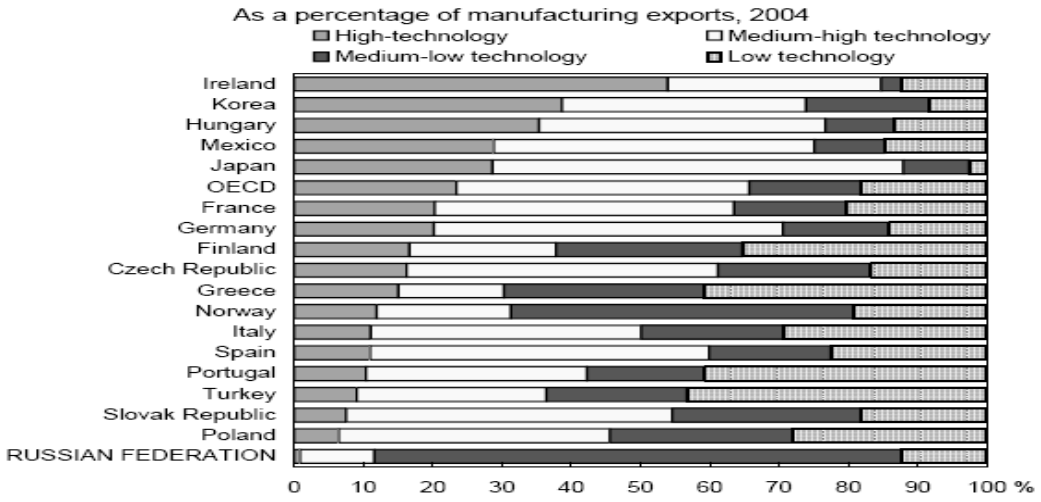

Figure 17. Share (as % of manufacturing exports) of high and medium high-technology in manufacturing exports to OECD countries in 2004 (Gianella & Tompson 2007)

Capital Resources:

According to the conducted interviews, the capital resource situation can be seen as quite poor with much room for development. The situation is actually such that most companies are just getting by with their own operating profits, and financing would be needed for further growth of these companies. Due to this, financing can be at the moment seen to be a restricting factor for the industry's competitiveness. Especially the following, mostly problematic, points were brought up by several interviewees:

- The financing markets are unstable and not functioning properly in the area (uncertainty about the future global situation currently).
- Loans from banks are really difficult to acquire due to lack of collaterals in IT firms.
- Loans are considered expensive overall.
- The financing offered to companies, especially from banks, is in general inadequate.
- International banks support well-known foreign companies in the area, but not locals.
- Venture capital is becoming more available and it can be acquired if certain criteria are fulfilled (transparency, good business idea, lucrative outlook etc.), and the investors can

be convinced of a better outlook than in e.g. India. However, not many companies currently fill the criteria or are willing to acquire venture capital.

- Risks and uncertainty are still seen as too big to finance the industry, although some instances are already willing to do it.
- Overall, the situation is improving and has already improved since the early 1990's.

Infrastructure:

The infrastructure of the SPB area was generally seen to be on a decent level by the interviewees. However, there are some negative features which decrease the location's competitiveness from the IT industry perspective. These include especially:

- Lack and expensiveness of good quality office buildings.
- The network connections are not on sufficient reliability levels for some services, such as online banking.
- The prices and availability of housing for employees is problematic in comparison to other regions in Russia.

On the other hand, the infrastructure situation was mostly seen to be on a decent level for most companies' operations. The Internet connections are generally fast and available, and decent office buildings can be found, although they are often expensive. The SPB area also attracts people (labor force) because it is the cultural capital of Russia and it has very wide services to offer, as well as higher living standard conditions. Of course, the higher living standard brings also higher costs, but still SPB is according to many studies a good place to be in Russia. The transportation network is also rather good, although roads are not in very good condition and the traffic gets jammed really often in SPB. In the SPB IT industry the wide establishment of companies offering office facilities and additional services (e.g. Technopolis), is highly anticipated to improve the infrastructure situation in the SPB area.

5.2.2 Saint Petersburg area IT firms' strategy, structure and rivalry

The analysis in this part is restricted mainly to the SPB area IT industry in general and to its major spheres of activities, software development and IT services. Assessing the firms and their strategies and rivalry in the IT industry of the SPB area requires some background information of the birth and transformation of the industry after the collapse of the Soviet Union. It can be called the birth of the IT industry, as during the Soviet period there was no separate sector of, for example, software development, which is one of the dominant activities in the SPB area IT sector nowadays. Different kinds of scientific centers or enterprises and R&D institutions used to have their own programmers or specific departments, which handled the internal

programming operations for these companies in the Soviet times. (Averin & Dudarev 2003, p. 99)

In the early years of transition in Russia, many big enterprises and institutions established in the Soviet period collapsed when put under market economy pressure of competition and general operation. As a result, many specialists from the field of IT started to look for new possibilities outside their former employers. These specialists eventually started a number of spin-off companies in IT industry and especially in the field of software development. In a way this process can be put under the term "creative destruction" (see Schumpeter 1975), as the collapse of the Soviet Union caused wide destruction in the form of enterprise and institution collapses, but the results were still positive as new IT fields of activities and markets were born and several specialists established their own de novo companies to the market-driven industry. The transformation of the industry has included, in addition to the birth of totally new spheres of activities of software development and IT services, the decrease of hardware-related electronic equipment manufacturing. IT developed ultimately with the support of software development and IT services to a modern, successful and functional industry in Russia and the SPB area.

A majority of the new spin-off companies established in the early transition phase were small and went through the rough path of learning market economy rules and ways of doing business. The change was dramatic, as most companies started basically from scratch with no idea of how to do business. As many of the companies were started with very little financing as some sort of entrepreneur ideas, most of them have only been able to reach a moderate size due to the fact that most of the acquired profits have gone to just running the company. Further development and growth of the company to a truly substantial enterprise would often have required outside financing. Due to the specific fields of competence in the various Soviet time parent companies, many of the new spin-offs focused in smaller niches of the IT markets (Averin & Dudarev 2003, p. 100). Many of these companies started their activities internationally from the very beginning, as the domestic demand was nonexistent in certain fields, such as software. This early internationalization has brought at least two major features to the industry:

1. Experience, new skills, western styles of management and company organizing, imitation effects, new technology and contacts to the outer world from working with mainly western companies.
2. The start of offshore programming and outsourcing activities and competition in them in the field of IT in the SPB area and Russia.

The short historical background presented above has many similarities to the SPB area IT industry structure nowadays. As in the early 1990's, most of the IT companies in the SPB area

today are considered to be small or medium sized, de novo (established after early the 1990's) and the number of companies is moderate. The growth and development of these companies to be globally big players would still require most of all outside financing, which is hard to obtain in Russia, and therefore restricts the competitiveness development of the firms. According to the conducted interviews, most IT companies in the SPB area range from around 50 employees to a few hundred, and their turnover is not very substantial. Of course, there are some larger companies and also a large group of smaller ones than those mentioned above, but generally these companies do not have a big role in the IT industry or the market in a larger scale. Overall, the players in the field are quite evenly matched in terms of market shares, as there are no companies which could be defined clear industry leaders in the SPB area IT industry. Naturally, some foreign companies have globally huge employment and turnover figures, but also their local operations in the SPB area are quite moderately sized.

The fields of activities vary among the companies quite a lot. Most companies operate in the sphere of IT services and software development, but they commonly serve specific market niches, at least in some parts of software development, and therefore do not compete with each other directly. As an example of specific markets, in software development a few companies serve the Russian government, which can be argued to be at least partially out of reach for most companies, especially foreign. The same concentration to specific markets applies to the services side, but not to the same extent as in software development. Software development is an international business, as the demand for Russian software development comes strongly from abroad, although domestic demand is increasing rapidly, according to the interviews and other sources. IT services, on the other hand, are both local and international, but the domestic demand is actually already substantial and increasing to far greater figures than software development due to the government, as well as companies outside IT industry, becoming big clients in this field.

When the number of foreign IT companies increases in the SPB area, also more and more domestic ones are getting new experience, knowledge and skills (of working according to international standards and certificates etc.) in working with foreign enterprises. For example, in the software sector the Capability Maturity Model (CMM) standard, known as Capability Maturity Model Integration (CMMI) after 2004, had been obtained by only two Russian companies in 2002. By the start of 2007 this figure had risen already to approximately 20 companies and several Russian software exporters are undergoing certification at present or are planning to do so in the near future. CMMI certification is in most cases a passport to participation in major tenders globally. In addition, many major Russian software exporters that do not have CMMI certification have certification to ISO 9001 standards, which are applicable

to various sorts of business. The same situation and development applies to all IT activities in Russia and the SPB area. (Russoft 2007)

The foreign clientele is not anymore just for the outsourcing or offshore companies as it mostly was in the past, and therefore the consequent development of these "international" activities develop the domestic industry more and more to the right direction. On the other hand, in software development the main market is global and therefore local companies should be able to compete and increase their visibility and presence abroad as well. This would require heavy investments, which are very hard to acquire from outside sources in the SPB area. One option would be to merge with larger, mostly international, companies and seek access to global markets this way. Also direct company acquisitions are getting more common, and through these consolidation activities the international competitiveness of the whole industry and its participants may improve. Mergers and acquisitions (M&A) are overall expected to increase substantially in the IT industry of the SPB area, according to the interviews.

The conducted interviews pointed heavily towards the improvement of higher management and its structure when targeting at higher competitiveness, internationalizing and growth of IT companies in the software development sphere in the SPB area. Although many companies adapted western style and structure of management in the early years of transition, they are not anymore very optimal. This is due to the fact that most companies' highest management has not been sufficiently dynamic. On the other hand, many of interviewees saw improvement especially in the middle-higher management, in which there are several young, ambitious and internationally experienced Russians capable of taking the companies to the next level. The higher management should spread control of the Russian IT companies to new generation managers. Still, the experience and accomplishments of the older higher management cannot be underestimated, as most of them have built their companies from scratch to the good situation where they are now.

On the general level, the rivalry in the SPB area IT industry is all the time intensifying, but still on a rather modest level. New companies, both domestic and foreign, are still attracted to come to the local market, as it is perceived that there is low level of competition, at least in international comparison. In practice, a market share is still achievable for new players as the industry is rapidly growing and no single players occupy dominant positions in the markets.

The future competition in the field of software development is in specialization and integration. The software development companies in the SPB area should find their own specialized markets and strengthen their position by e.g. marketing activities and differentiating through innovation,

and integrating a wider range of services to their products both globally and domestically. The integration of services is a good development path, as it is a possibility for the companies to create more value to their customers and therefore strengthen their competitiveness. Another important strategy development would be increasing cooperative actions through supporting organizations, such as Russoft, or growth in "coopetition", cooperation of competing enterprises. It was also clearly stated in the interviews that the Russian software developers do not actually compete with e.g. India for the same projects. This is mostly due to pure scale differences, as many Indian companies in this sphere of activities are huge in comparison to the SPB area firms, and therefore Indian companies tend to have a natural advantage in bigger projects. M&A are one possible strategy to internationalize the business and to make it more competitive. On the other hand, the domestic companies in the SPB area are not capable of making a lot of acquisitions due to the lack of financing means. Russian software companies are still quite unknown internationally, so they should aim at increasing their visibility and gather good references from respected customers.

In the IT service sector, competition is different from the situation described above, as the domestic market of Russia plays a bigger role. In this sector the specialization can be somewhat different as services can be offered to many different customer groups, such as domestic and international companies and the RF government, and the offered IT services may vary greatly from company to company. Here the service providers have best by focusing on their core competences, product differentiation, further innovation, integration and development in primary services and trying to find the best suitable customer groups from domestic, but not necessarily local, markets. Actually, on the service side the biggest market area was in the interviews seen to be in Moscow, although the SPB area was also mentioned as a rather substantial and fast developing market area. In the service sector also consolidation activities, e.g. M&A, can be expected especially in bigger domestic companies from Moscow and also in newly established bigger foreign enterprises. Domestic companies should also more actively seek to increase their visibility on the markets and acquire good references. Also acquiring international certificates (e.g. CMMI) might help gaining especially foreign customers operating on the domestic and international markets.

In the SPB area IT industry, and especially in software development, the general progress has already reached the stage in which rivalry is changing from low wages to low total costs through enhancing efficiency in product or service delivery. Innovations are also increasing their share in business and the investment climate is gradually improving, although both are not yet on a sufficient level in international comparisons. Domestic investments suffer from general and future uncertainty in the IT industry and in government actions, as well as overall lack of

investors. One factor influencing the investment climate in the Russian IT industry is inadequate Intellectual Property Rights (IPR), which is a negative factor. However, according to the interviews, severe IPR problems are quite uncommon. Foreign investments are discussed in the section on FDI below. The traditional product imitation and low wage competition is shifting to new more developed areas, together with increasing domestic demand and technological and skills improvement in the SPB area.

The features SPB area IT in strategy and rivalry are summarized below in Table 13. In addition to the features, the general situation of rivalry and consequent development strategies are presented.

Table 13. Summary of SPB area IT industry strategy, structure and rivalry features

	Structure	**Investment climate**	**Management**	**Rivalry**	**Development strategies**
SPB Area IT Industry	Many de novo companies, mainly SMEs whose market shares are quite even	Moderate-poor, but improving	Domestic companies' higher management needs improvement in comparison to foreign ones	Moderate and intensifying, but depending on the sphere of activities.	Foreigners following their customers or coming to growing new markets. Domestic companies' strategies dependent on the sphere of activities
Software development	Both internationalized and solely domestic companies, most of which are SMEs	Moderate and improving. Increasing industry consolidation activities expected (M&A)	Capable middle-high managers with international experience emerging	Domestic rivalry not very intense in comparison to global in smaller and medium-.sized projects	Specialization, operating by international standards and acquiring certificates (CMMI), visibility increase, integration, differentiation, innovation, M&A, expansion and commitment to new markets, cooperation and "coopetition"
IT service providing	A majority are SMEs, both domestic and foreign companies	Improving, but overall investment activities modest	Management problems not severe, improvement expected from new middle management personnel	Domestic rivalry intense and getting stronger	Focus on core competences, increasing visibility, integration, operations' certification (CMMI), product differentiation and innovation, penetration to new markets, expansion of activities, and consolidation

5.2.3 Demand

The IT markets, together with telecommunications, are and have been for the recent years one of the fastest growing sectors in the world, and the SPB area makes no exception. Increasing investments and consequent development of IT is very common in Russia currently in all spheres of the economy, ranging from government institutions to the gigantic gas and oil industries. In these different fields of activities, newly acquired machinery and equipment, which is ultimately targeted to improving production or other processes, is in practice many times improvement of IT systems to achieve efficiency and productivity improvements. Since the whole Russian economy and its industries are developing and growing all the time, the demand of IT is consequently getting bigger and bigger.

Unfortunately, statistical data on the market conditions and demand in the SPB area IT industry are not available. Therefore some features are analyzed from data concerning the whole Russia and otherwise interviews and other qualitative data are used to describe the general situation in the SPB area.

Composition of home demand

From the perspective of the IT segment structure, the highest demand for SPB area IT can be found for products in the field of software development and IT services (including integration), which are also the dominating areas of activities in the industry. The demand for hardware delivery and distribution is quite high all over Russia, but their manufacturing is a minority activity in the SPB area IT industry. Most hardware is actually imported to Russia and there are some distributing companies and assemblers, which then deliver the equipment forward to their customers. The demand for hardware is not covered in full detail in this research due to their low share in the activities of the SPB area IT industry.

According to the conducted interviews, the sophistication of customers and demand in the Russia IT market are increasing. Companies outside the IT sector are continuously improving their efficiency and productivity and targeting to create more value for their customers by investing more and more in sophisticated IT systems. These companies are often engaged in fierce global or domestic competition and are increasingly more aware of the potential benefits available from increased investments in IT systems. Therefore, these companies also demand high quality services from the IT companies in the SPB area to enable e.g. productivity improvement in comparison to their competitors.

Another factor strengthening the sophistication and demands of customers is the increasing number of foreign companies' operations in the Russian markets. Many foreign enterprises have established operations in Russia and demand the same quality of services as in their other, often developed Western, markets. This has provided incentives for the local IT enterprises to improve their operations, through e.g. innovating and adapting operations according to the foreign standards and certificates (e.g. CMMI) required by the customers, to become potential service providers for these foreign firms. The increased presence of foreign companies in Russian and SPB area markets, for example in the retailing and banking sectors, has attracted also many foreign IT firms from the services field to follow their home market customers abroad and establish themselves in Russia and the SPB area. Actually, according to the interviews, the pressure for foreign IT companies to follow their customers to foreign markets is in general very high, due to relatively high risk of losing the customer also in the other markets.

A need for an increasing number and wider range of IT services is expected in Russia, as its economy and consequently the industries are developing with rapid speed. For example, the increase of consumer-based mobile communication penetration and the number of Internet user will pose new challenges for the IT industry, as consequently the demand for different services is expected to grow. The adoption of new telecommunication technologies and services (3G, IPTV etc.) will also increase the demand for IT industry directly and indirectly. The demand for more sophisticated IT systems is expected to grow especially in such industries as oil, gas, banking and retailing. Also the increased perceived value of data as a corporate asset is increasing the demand for new sophisticated solutions from IT service companies. Due to the above mentioned features, anticipatory needs on markets of the SPB area IT can be argued to be large and rapidly increasing.

Size and pattern of growth of home demand

The size of the Russian IT market has grown fast, reaching EUR 10.7 BN (approximately USD 13.3 BN) in 2006. The average growth has been roughly 30 percent per year during 2004-2006, as can be seen in Table 14 below. The size of the Russian IT market for 2007 is estimated with quite variable figures, as the market values range between USD 11.9 BN and USD 17.6 BN, according to the source (Russoft 2008). The growth figures also range between 15 and 25 percent for 2007, but they are mostly claimed to be close to the 20 % in 2006. Growth figures of around 30 percent are not forecasted any more to be seen in the following years, and this was also predicted in the conducted interviews.

Moderate growth is seen also in the strongly related telecommunications sector (see Table 14 below), in which mobile communication penetration passed the 100 % marker and the number

of Internet users also increased to almost 27 M in 2006. Above mentioned mobile communication penetration includes all Subscriber Identity Module (SIM) cards, which means in practice taking into account active and passive users, as well as users with multiple SIM cards. Many people in Russia do not actually have mobile phones and the real mobile communication penetration (relative to the entire population) in Russia is estimated to be between 60 % and 80 % (PMR 2007).

The total volume of Personal Computer (PC) sales reached almost seven million units, of which Acer, Formoza and Depo Computers were the market leaders in Russia, in 2006 (Cnews 2007b). In 2000 the amount of PCs sold was around 1.5 million units, so the growth has been rapid also in equipment sales (Averin & Dudarev 2003, p. 82). The high penetration of mobile communication, the increase of the number of Internet users, and the rapid development of the total volume of PC sales have all been heavily influenced by the economic development of Russia and the consequent increase of consumers' living standard.

Table 14. Data on IT and telecommunication markets in Russia during 2004-2006

	2004	2005	2006
Penetration of mobile communications (%)	51.8	87.9	106.7
Number of Internet users (M)	19.9	23.7	26.8
Growth rate of Internet users (%)	65.1	19.2	13.1
IT market value (BN EUR)	6.9	9.0	10.7
IT market growth rate (%)	37.7	34.5	18.6
Total volume of PC sales (M)	-	5.7	6.9

Source: PMR 2007; Cnews 2007b

According to a survey conducted by RaExpert (2007) and the interviews, most demand in the field of IT services is in communications, the state sector, financial institutions, oil, gas and electricity industries and, transportation. The trade sector, mechanical engineering, metal working and metallurgy have also rather high demand for IT services. The automotive sector is expected to increase its IT demand in the future as more international car manufacturers come to Russia and they use quite sophisticated IT systems. Overall, the IT service sector in Russia was expected to reach USD 3.65 BN in 2007, having a 22 % growth compared to nearly USD 3 BN in 2006 (IDC 2007). The hardware demand is highest in the state sector and trade. The demand for distribution services is strongest in trade.

The software development demand is clearly split to domestic and international demand. While the demand was according to the interviews mostly international in the early days of transition,

now there are multiple software developers serving mainly the increasing number of domestic customers. In the SPB area and in whole Russia the main domestic customers for software developers are in the sphere of state institutions, the military, heavy industries (oil, electricity, metal and gas), telecommunications, banking and retailing (RaExpert 2007). The software market value in Russia was claimed to have reached approximately USD 3.2 BN in 2007 with a 40 % growth from the year 2006 (Russoft 2008b). Software development has very strong demand also internationally and has demonstrated stable growth in exports, as presented in Figure 18 below. Although the increase has been substantial after the year 2002, Russia is still far from India's figure of USD 31.4 BN for software and service export revenues in fiscal year 2006-07 (Nasscom 2007). Still, if the software market size and export figures are correct, roughly 30% of the total value of software in Russia was exported in 2006. Russian software exports are mainly to Europe and the United States, according to the conducted interviews.

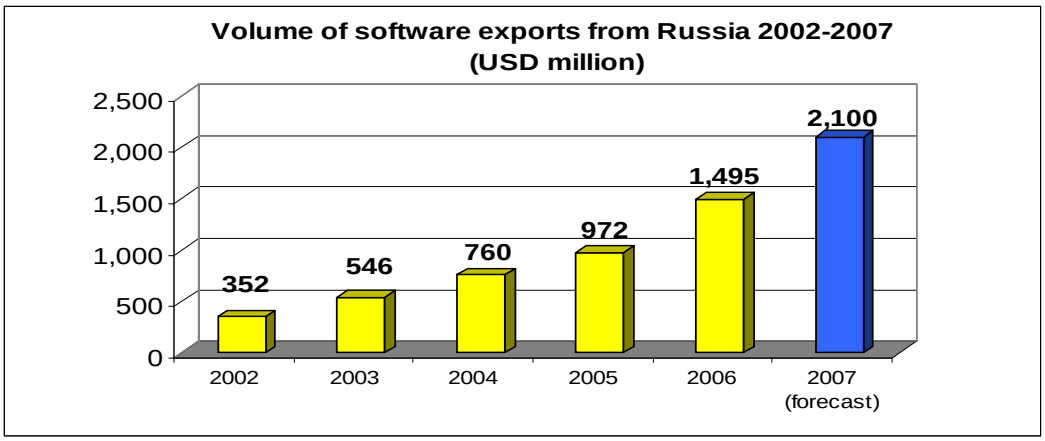

Figure 18. Software exports from Russia during 2002-2007 (Russoft 2007)

The characteristics of demand are quite varying in the RF and SPB area. There are a lot of different sized customers with very varying IT demands. Government institutions in general can be seen as very big clients with a need for a wide range of IT products and services from hardware to integration. On the other hand, the Russian government only uses services of certain, mainly domestic, companies. Other big clients are industrial giants, whose headquarters are mostly located in Moscow, in the field of for example gas, metals and oil. There are also a lot of moderate and small sized companies, especially in the SPB area, demanding various IT services and products. Overall the IT markets in Russia are substantial, although they are not yet saturated according to the interviews, which can be seen to slow innovation activities, but at the same time enable still increasing demand conditions.

One demand feature came up in the interviews and can also be seen in the statistics: the market for IT in the SPB area is substantially smaller compared to the Moscow area. The Moscow area

is the core of Russian business and industrial life and it has attracted all the largest domestic and international companies and their headquarters to the city. Consequently, the strongest IT demand in Russia can be argued to be in the Moscow area, and therefore, also the SPB area IT companies should aim to penetrate and integrate more deeply to this core market.

Internationalization of home demand

The increasing presence of foreign IT companies in the SPB area, both seeking new markets and following their customers, intensifies competition and at the same time brings international demand characteristics to the home market. An increasing number of IT companies in the SPB area operates according to international standards and acquires certificates to meet the quality requirements of foreign, and increasingly also of domestic, companies in the Russian markets. The demand of companies in for example the industry sector is becoming more sophisticated, as they internationalize or engage in global competition, and are aware of developed and globally used IT systems and their benefits. The demand for the same features is also brought to the domestic market as well. Different certificates and official recognitions are highly appreciated in the IT industry and are actually sometimes compulsory when dealing with certain international and domestic companies.

Overall, the demand for IT is steadily increasing in Russia and companies are able to specialize in certain activities and gain market share, as there is still demand for a wide range of services and products. The demand is continuously becoming more sophisticated and differentiating and innovation activities are becoming more and more important for companies to succeed in the domestic and international competition.

5.2.4 Related and supporting industries

The importance of related and supporting industries cannot be underestimated when assessing the competitiveness of an industry. Related and supporting industries contribute to the improvement of competitiveness and formation of competitive advantage, and enable the primary industry to work properly.

One important supporting industry for the SPB area IT is the capital market, which is currently slowing down the development of the industry. As was already explained in the factor conditions part of this study, capital is difficult to obtain in Russia. SMEs cannot afford loan capital, because the loans are too expensive for most companies. Equity financing is to a large extent the only solution for domestic companies to achieve capital, but the investment climate is still rather poor, and investment markets are not very well developed in Russia. Foreign

investors and companies interested in equity investment and M&A offer some possibilities for domestic companies to gain capital, but the Russian owners are not selling their companies easily. According to the interviews, M&A activities are becoming more common in the SPB area IT industry, however. Some capital is available also domestically, but for most companies it is not sufficient to really improve the overall situation and to increase the companies' competitiveness. An increasing number of initial public offerings (IPO) and venture capital activities could improve the situation in the future. However, quite few IT companies in the SPB area are large enough or otherwise suitable to carry out an IPO. Also improvements in the private equity and seed financing venture capital are definitely needed.

One important supporting supplying industry almost totally missing in the SPB area is component and hardware manufacturing. Most vital equipment and components are imported to Russia from abroad. Formation of local equipment and component manufacturing would improve competitiveness through e.g. subcontracting relationships and enabling global IT cluster formation to the SPB area. In addition, a wider range of activities in the total IT value system located in SPB area could form true cluster-specific advantages to the area. Unfortunately, the presence of large local equipment and component manufacturing is highly unlikely due to lost cost advantage in Russia in comparison to e.g. Asian countries.

The most important related industry for SPB IT can be argued to be telecommunications, which has a very strong complementary relationship to IT. The revenue of telecommunication services was roughly EUR 21 BN in 2006 with around 18 percent growth from 2005 (PMR 2007). The growth of the telecommunications sector seems to have already slowed down to more moderate figures in comparison to IT, which is also expected to slow down in growth percentage within the following years. The telecommunications sector can be divided to two important sub-industries from the perspective of IT industry:

- The *Mobile communications* sector is considered to be one of the main driving forces behind the IT industry growth in the SPB area. The penetration of mobile telecommunications has reached already almost 107 % in Russia due to rises in the living standards and reductions in subscription prices. The competition in mobile telecommunications is extremely intense, as a few large companies dominate most of the Russian and Commonwealth of Independent States (CIS) markets, and they are currently investing heavily in new third generation (3G) technologies to achieve competitive edge to their rivals. At the moment there exists high uncertainty on whether or not the next generation services will gain popularity in Russia. This is because the mobile telecommunication penetration has increased quite quickly to over 100 percent of only 52 percent in 2004, and the typical users are, according to the interviews,

delighted to use the basic calling and text messaging services, but they are not at the moment ready to pay for expensive add-on services or in general not interested in using them. However, the increasing investments in new mobile communication technologies and the overall increase of mobile communication penetration increases demand for several IT products and services. IT provides the mobile communication industry for example a wide range of software services (games and tool software for mobile phones etc.), and also general IT services, such as billing systems combined with equipment and software.

- *Internet services* are also important for the IT industry as they provide necessary conditions for operating in the industry. Quality Internet connections and services are vital in IT, as well as open new market opportunities. The PC sales market has grown, and consequently, the number of Internet users has grown already to almost 27 M (almost 20 percent penetration) in Russia in 2006. The Internet provides the IT companies with new markets in the field of businesses and consumers in e.g. content distribution (such as electronic newspapers, movies and music), software (such as Skype) and general IT services (such as offering of network components, web-cameras and other accessories).

One rapidly developing sector related to IT is media and entertainment. These industries are becoming natural parts of the IT and telecommunication sectors with high hopes in future success. In this context entertainment and media are considered as digital content producers. The development of this sector is in its early phases, but some companies (e.g. Expert and Kommersant e-magazines) can already be seen actively working in this area in Russia. Internationally, these digital content providers and distributors are numerous and they are actively seeking new markets. Therefore their presence in the Russian market can be considered to grow in future years. The development of this sector already enables such services as digital video and music content access, broadcasting through the Internet, electronic newspapers, video conferencing, information portals, etc. in many countries, and will also do it increasingly in the future. In Russia, the full potential of this sector is not yet exploited, as it would require increase and improvement mainly in Internet connections and services, and more active participation of IT industry companies. Increasing the activity of this new media sector offers new markets for IT companies, enables product differentiation, and opens possibilities for innovation. Adaptation of new digital content requires new equipment and software from both IT and telecommunications industries.

A summary of the main factors of competitiveness in the SPB area IT industry are introduced below in Figure 19. External competitiveness factors concerning the SPB area IT industry are analyzed in the next chapter.

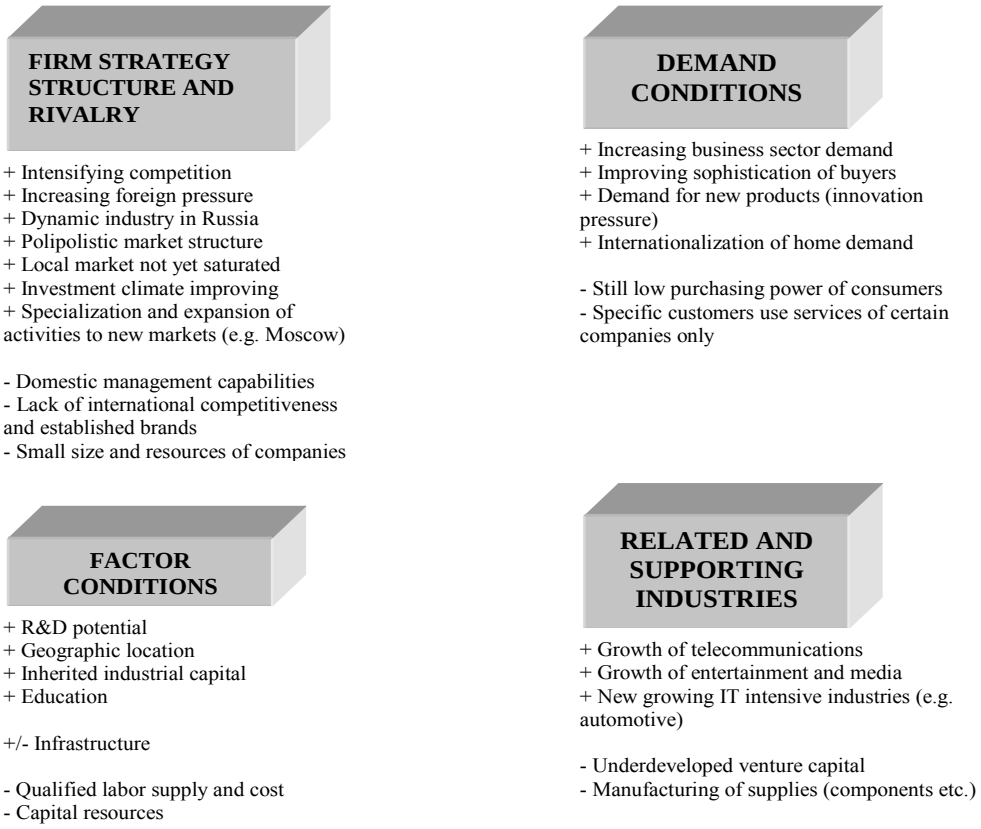

Figure 19. Main factors of the international competitiveness of the Saint Petersburg area IT industry

5.2.5 External factors

Chance:

The economic environment in Russia can be considered rather stable. Financial issues are in good condition, as the CBR has collected good currency supplies since 1998 crisis and the government has also been able to gather special stabilization funds from the received revenues, coming especially from exporting and its taxation, and these may be used in case of economic deterioration. One negative factor is the real appreciation of the Russian ruble. This causes continuing decrease in Russia's competitiveness and may eventually lead to at least temporary collapse in exporting activities (e.g. in the software business of IT) and domestic manufacturing. This problem is acknowledged by the Russian government, however, and should therefore not cause any totally unexpected changes.

Politically, there are small possibilities that the role of IT will be changed in Russia due to the recent presidential and Duma elections. At this point, however, IT is unlikely to become so called strategic industry in Russia, which could at least increase protectionism in form of foreign ownership and investment restrictions. The IT industry is still so small in Russia that the government is not at the moment overly interested in it. The newly elected President Medvedev is expected to continue generally in the same line as the former President Putin, which would in practice mean the government having mostly neutral influence on the IT industry.

One, although unlikely, scenario is a sudden drop of global natural resource (mainly oil and gas) prices, or their reserves running low or totally out in Russia. This would probably have a positive influence on the competitiveness of the SPB area IT industry in the long term, as Russia would be forced to improve her other industries to cope economically with the hole caused by the decrease in natural resource exports revenues.

Government:

The role of government in competitiveness is controversial from the perspective of the SPB area IT sector. The government has not deemed IT as a strategic industry in Russia, which would have restricted foreign investments and ownership in the industry. The sectors defined as strategic range from energy and the natural monopolies to aerospace and the mass media in Russia, while just recently e.g. power grids, telecom companies and Internet providers were no longer classed as strategic in the final draft of the becoming law on strategic sectors (Russia Today 2008). The government has also started a Special Economic Zone -project in the SPB area to develop and support especially the growth of the IT industry, which sounds promising for the companies in the sector. Also the local government has directed funding to promote and develop the IT sector in SPB, according to the interviews. On the other hand, the government actions are not considered highly beneficial for companies operating in the industry.

According to the answers received from Russian government official, there are two primary operating locations, Neudorf and Novo-Orlovsky, for the ICT focused SEZ located in SPB area. Neudorf is bound to receive RUR 3 BN (roughly USD 130 M) from the city and federal budget from 2008 until 2010. Infrastructure construction has already started in Neudorf in 2007 and is planned to be finished by December 2008. The whole project is planned to include at least the creation of roads, housing (a hotel etc.), additional services (a restaurant, a gym etc.), and a business center and customs terminal for the use of companies. Plans are that full scale operating can start in Neudorf in the third quarter of 2009 and in Novo-Orlovsky in summer 2010.

In addition to infrastructure and additional services, the SPB area SEZ by law offers its residents among other things customs and the following tax benefits: decreased rates of social taxes, exemption from tax on properties, reductions in land tax, five-year exemption from transport taxes, and reductions in profit taxes. Still, participation of companies in the SPB area SEZ, in terms of number of firms or their investments, has not been very considerable so far. According to the government official's response, there are only roughly ten companies actively participating in the project at the moment.

According to the conducted expert interviews, government actions do not in practice help companies in the SPB area IT industry. Due to this, the companies are not participating in this SEZ initiative and its outlook is at the moment uncertain. Many managers, both foreign and domestic, are still hesitant about all government projects, which is due to lack of trust and feelings of uncertainty towards the government. Also, for example the tax benefits offered in the SEZ are not meaningful enough for most IT service companies, and therefore do not provide powerful incentive for companies to establish operations to these areas.

The government was claimed in the interviews to be responsible for further improvement of the investment climate, which is still in poor condition in Russia, and could have a wide positive influence if made better. Increased investments in basic science, R&D and higher education are also needed, as well as improved development policies for them. Policies on import and export duties, legislation, permission grants, different regulations and bureaucracy of government were especially mentioned and criticized by the foreign company representatives. For example, import duties of the IT component made the operation of Electronics Manufacturing Services (EMS) companies suffer in Russia. Also physical exporting outside Russia is considered problematic due to e.g. problems at customs and borders.

Altogether, the government was considered as a moderately negative or neutral factor for the SPB area IT industry and its competitiveness. Many interviewees thought that increased presence of infrastructure, office space and business service providers, such as Technopolis, would be more beneficial for companies in the SPB area IT than the government SEZ initiative. Still, although the government actions do not produce much improvement for the industry or benefits to its companies, the government and the companies owned by it are among the largest customers of IT industry. Therefore, through that channel the Russian government supports the growth and competitiveness in the SPB area IT industry.

Technological development and productivity:

According to the conducted interviews, the level of technological development of the SPB area IT companies is mostly good and on an equal level with western ones. However, in some areas, such as network technologies, there are very old technologies in use, needing improvement. After the dissolution of the Soviet Union, the technological development of IT and related equipment, such as wired communication lines, was in general very poor in Russia. In this perspective the SPB area IT companies have been able to tap into the international technology pool and acquire sophisticated equipment for their use. Technological development in the sphere of IT is all the time improving in Russia, as the customers become more sophisticated and demand world class IT systems and equipment to improve their companies' productivity. Still, productivity and other manufacturing factors in general in Russia are considered to be poor, which can be seen as a barrier for the formation of wide IT hardware and equipment manufacturing industry in the SPB area and Russia.

According to a survey conducted by Schaffer and Kuznetsov (2007, pp. 11-36), the productivity indicators in Russia do not favor locating manufacturing operations in the country, which can be seen in Table 15 below. The Total Factor Productivity (TFP) is a framework for assessing productivity and growth, and it can be used to compare productivity of sectors or countries. TFP is based on the following: economic output can be generated by increase in factor inputs, such as capital and labor, and by increase in the productivity of these inputs. The TFP for Russia in 2004 is indexed to 100 and as can be seen, China was almost on the same level while Germany had roughly 350 % and India roughly 40 % better TFP in 2000. The better productivity of India and China, together with clearly lower wages compared to Russia (roughly 22 % lower in China and 83 % in India) gives clear incentive to establish manufacturing operations in the two first mentioned countries. The manufacturing value added per employee is lower in China and India in comparison to Russia, but the clearly lower wages together with better TFP figures outweigh it. Germany represents a developed economy in the table below and as can be seen, the TFP is roughly four and a half times and the manufacturing value added per employee almost nine and half times higher than Russia's figures, but on the other hand the wages are roughly 28 times higher. The considerably higher wages in Germany outweigh the benefits of the TFP and manufacturing value added, and therefore it is not a very desirable location anymore.

In summary, the best conditions for manufacturing activities in general are in Asia, and the competitiveness of IT manufacturing is strong in countries like China and India. Naturally, these indicators are not always the main criteria for companies to establish manufacturing operations somewhere, as such factors as close geographic location to customers may be a stronger factor in the decision making. Also, some variations exist in the presented figures between different

industries and locations in a specific country, but the figures below are still valid to for assessing the attractiveness of IT manufacturing conditions in a country.

Table 15. Productivity indicators in selected countries

	Russia	China	India (2000)	Germany
Manufacturing value added per employee in USD (2004)	7,226	6,894	1,908	68,640
Manufacturing value added per employee (Russia = 100)	100	95.4	26.4	949.9
Monthly wages in manufacturing in USD (2002)	142	111	24	3,972
Annual manufacturing productivity growth, 2000-04	10.6	7.9	n.a.	1.8
TFP estimates for manufacturing firms (Russia = 100)	100	102	139	452

Source: Schaffer and Kuznetsov 2007, p. 20

International business activities:

In the early years of the economic transition in Russia, the overall investments decreased dramatically and FDI did not flow much into the country. Due to the economic difficulties, the Russian government started to create restrictions for foreign investments in so called strategic industries (mainly natural resources), which was fundamentally a totally different starting point from other post-communist countries. In some other transitional economies, such as Estonia, FDI were appreciated and welcome, and privatization was realized through auctions open for international bidders. In Russia the voucher method was used in privatization, which was in general not very successful. Due to these factors, Russia was lagging behind in FDI for many years. The collapse of the ruble in 1998 and its consequences to the economy made all investments in Russia possible once again. Also the turn of the millennium brought a substantial increase to oil prices, which enabled formation of domestic investment funds. Also the Russian capital started to flow back into the country in the form of FDI after having moved abroad (to e.g. Cyprus and the Virgin Islands) during the bad times in the past. This returning capital distorts the analysis of FDI figures, since the actual number of real foreign investments is hard to determine.

In the recent years, FDI have finally started to increase, and MNEs are more actively locating to Russian markets, although foreign investments and ownership are still restricted in many sectors. The overall increase of FDI since the turn of the millennium can be seen below in Figure 20. The Russian Federation received nearly USD 14 BN of FDI in the year 2006. According to the World Investment Report (2008) statistics of the United Nations Conference on Trade and Development (UNCTAD), the FDI inflow to Russia was even close to USD 29 BN in 2006. The Central District gathered the most FDI in Russia with its almost 50 % share of the total in 2006, and the NWFD received only roughly 11 % of the total. Unfortunately, IT industry-specific FDI data was not available and therefore could not be used in this research. The country and region-level FDI development figures are still valid and can be applied to the SPB area IT industry.

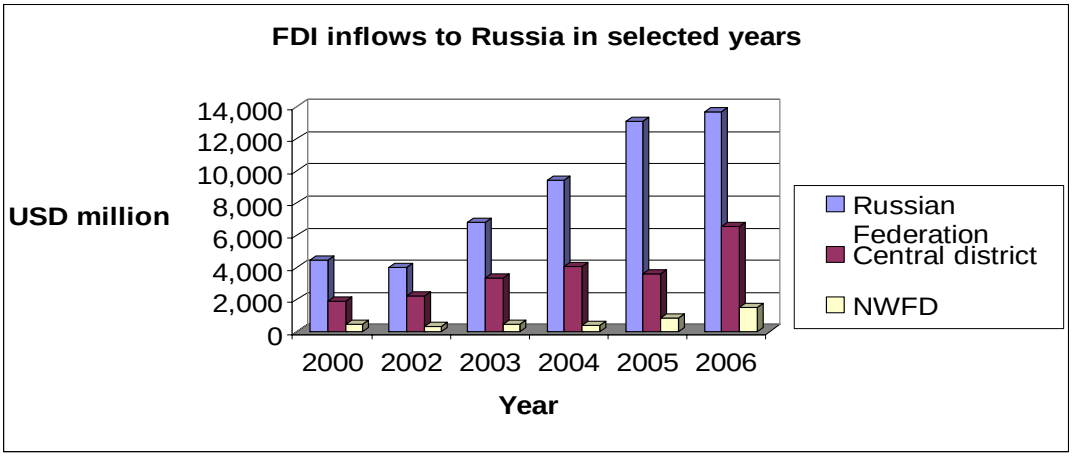

Figure 20. FDI inflows to Russia and Central and Northwest Federal Districts (Rosstat 2008)

The NWFD and the SPB area have gathered moderate amounts (ranging from USD 70 to 643 M yearly) of FDI since the turn of the millennium, although Moscow and the Moscow Region are combined the biggest FDI collectors of Russia, which is illustrated in Figure 21 below. One very active FDI destination (approximately USD 3.8 BN in 2006) in Russia is also the Sakhalin Region, in which large natural resource projects are implemented by foreign and domestic companies. Russian IT cannot be proved to be based on foreign investors' money, as according to made estimations, Western investments (direct and others) account for less than 30 % of the total IT investments in Russia (Telnews.ru 2006). Still, the SPB area IT market has experienced a growth of foreign companies' activities in recent years and is fortunate not to be considered a strategic sector in Russia, which would decrease FDI inflow to the industry. According to the conducted interviews, the overall number of foreign companies is not yet very high in the SPB area IT industry (especially compared to Moscow), but their increasing presence has been

noticed and is somewhat feared by the local companies. Local companies naturally dislike intensifying competition, which is due to the increasing MNE presence possibly driving them out of business. However, increasing rivalry gives incentive for companies to innovate and increase their R&D activities. According to the interviews, the already poor labor supply situation is getting worse due to foreign companies being able to attract the personnel from domestic companies with their higher wages and other offered benefits.

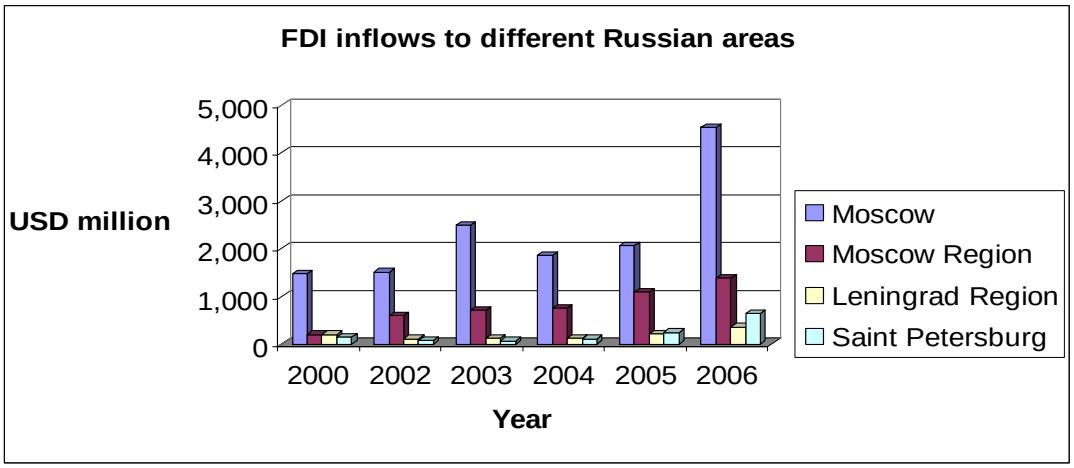

Figure 21. FDI inflow to selected Russian areas (Rosstat 2008)

On a positive side, foreign companies have brought to the area directly and indirectly at least technological advance, knowledge and capable internationally experienced personnel during the last decade or so. One other positive spillover factor of FDI has been the domestic IT companies' adaptation to international standards and requirements of operating. This is due to the fact that MNEs, especially the well-known and successful ones, often obligate their service providers and suppliers to meet the international requirements for IT products and services. FDI has been for many companies, especially outside IT manufacturing activities, the primary choice of operating in Russia due to for example control issues, the service nature of operating, and the urge to benefit most from the market growth.

FDI has not been the only source of knowledge and technology absorption for the SPB area IT industry. Software developers were the pioneers in IT-related foreign trade (exporting) and they learned mostly from their more advanced customers abroad. Also the technology was, according to the interviews, sourced through foreign customers and partners in the early years, which provided a basis for the operations in general and their improvement.

Foreign companies active in the manufacturing of IT products do not come to Russia and the SPB area anymore, due to e.g. the lost price competitiveness and low productivity of the country

(see the productivity indicators in Table 15 above). These companies have as MNEs a possibility to locate their operations in almost every country in the world and they can export their products to countries such as Russia, which are not attractive manufacturing locations. However, foreign companies active in the IT services, R&D and software development field have came to SPB area and the FDI activity is increasing. According to the conducted interviews, most of these companies have established themselves in the SPB area quite recently, entering an already existing agglomeration of IT companies. The companies getting established in the SPB area, or having recently done so, are primarily seeking rapidly growing markets (SPB and Moscow) and relatively cheap skilled labor force, not low costs or exploitation of local companies and suppliers. The labor supply situation is, however, quite poor at the moment, but foreign firms are many times able to attract qualified personnel with higher wages, better benefits and good reputation.

A majority of the FDI coming to the SPB area IT industry is considered these days to be market seeking. As described above, Russian IT markets are growing fast, and due to increasing costs and problems in the labor supply situation, foreign companies are not, at least anymore, pure resource seekers. However, the education level of the SPB area (science, mathematics, physics and overall number of higher education) and other location-specific knowledge factors are still important. For instance in the software business the problem solving abilities of the SPB area IT personnel were claimed to be superior in comparison to India and China due to their better basic education. According to the conducted interviews, a majority of foreign companies establish their own offices (Greenfield investment) when coming to the SPB area and there are not a lot of acquisitions. Overall, acquisitions are becoming more common, however, and many smaller-sized software companies have changed owners recently or have received offers from abroad.

Unfortunately, specific data of all foreign companies that have established operations in the SPB area IT industry is not available. Many of the biggest foreign companies in the field of ICT have established themselves in Russia and have also operations in the SPB area. Table 16 illustrates a Cnews Analytics rating (2007c) listing the biggest foreign ICT companies in Russia. Of these companies many have at least side-offices in the SPB area, although Moscow is the main location for most foreigners. Foreign IT and closely related telecommunication companies in the SPB area include or have included in the past at least HP, Siemens, LG, Alcatel-Lucent, EMC, Motorola, Nokia, Microsoft, Google, Sun Microsystems and Intel. More recent ones are Sunrise-R, Digia, Techlabs, AtBusiness, Flextronics, Gemini-Systems, Veoh, Veltech, Technopolis, TietoEnator, Endero, Enfo and many more (Cnews Analytics 2007c).

Table 16. Biggest foreign ICT companies in Russia

Rank	Company	2006 Revenue in Russia and CIS, M USD	2006/2005 Growth, %
1	Nokia	1,958.1	11.2
2	HP	1,602.6	17.4
3	Siemens	1,545.9	-22.7
4	Alcatel-Lucent	795.3	23.2
5	Huawei	775.4	19.1
6	Ericsson	758.6	20.5
7	Acer	497.1	42.1
8	Fujitsu Siemens	271.4	35.7
9	Microsoft	256.5	62.9
10	Oracle CIS	241.6	27.9
11	SAP	227.0	43.4
12	Sun Microsystems	191.7	34.5
13	Accenture	85.0	15.3
14	Autodesk	54.7	75.2
15	Symantec	16.5	12.0
16	Columbus IT	14.0	13.6
17	Terralink	11.3	27.4
18	Check Point	9.9	50.6
19	TrendMicro	6.4	22.0
20	Eset	5.0	330.5

Source: Cnews Analytics 2007c

According to the conducted interviews, it can be argued that most MNEs locating in the SPB area IT industry come mostly because of the dynamism of the sector. Moscow is the largest IT market in Russia, but the SPB area is growing more rapidly. Foreign companies often seek to enter the new SPB area IT market or follow their customers from other industries (e.g. retailing) to Russia and SPB. Foreign companies tend to establish moderate-sized operations in the industry to serve their internationalized customers, and trust their international brand to be able to take an additional local market share. Foreign companies of a moderate size are often highly adaptable and can therefore gain full benefit of the dynamic market environment in the SPB area IT industry.

5.3 IT industry structure of the St Petersburg area from the cluster perspective

The primary products of the SPB area IT industry are, as illustrated in Figure 22 below, general purpose software packages, tailor-made software, information security, integrated systems, and IT services. Companies offering these products represent the majority of companies in the industry and can be considered to form the core of the possible cluster. As can be seen, the core

products are from the sphere of software development and IT services, and hardware and component manufacturing are not very common activities in the SPB area.

The IT industry in the SPB area has had immense growth, especially during the last five years. This type of growth would not have been possible or at lest not as rapid without a good higher education basis, inherited industrial and human capital from the Soviet times, and R&D potential embedded in the SPB area. These factors are called specialty inputs, which together with technology, including software, networks, hardware and partially product components, form the basic inputs or factor conditions enabling manufacturing, offering and developing of primary goods.

Venture capital investors, which are one part of the associated services, are very important for the SPB IT industry and the possible cluster. These investors have and will in the future provide funding for many projects and company establishments, enabling a rapid development and growth of the industry in the area. Previously this venture capital has been very scarce, but the situation is slowly improving. Venture capital and improvement of other associated services are still needed to further develop the industry and to ensure sustainable growth also in the future.

The telecommunications industry is closely related to the actual IT sector in the SPB area. The primary goods in telecommunication can consist on one part of mobile and fixed line and data communications, as well as providing Internet access. The other part consists of telecommunication equipment in general. IT industry products (including services) are used for example to create and provide supporting products to the telecommunication sector and vice versa, therefore strong complementarity exists between these industries. The convergence of IT and telecommunications and of traditional media and other manufacturing and service industries with ICT is a phenomenon of the current world. This has created tight linkages between these industries both globally and in the SPB area. Consumer electronics have to be included in the related industries due to its strong presence in SPB area already during the Soviet period. Electronics industry is also important as companies operating in the industry still create spin-off companies to IT, and many electronics companies have also expanded their operations to the IT field. One rather new related industry is business consulting, which increasingly uses IT products, such as different applications and systems (e.g. enterprise resource planning), as an important part of their product range.

Generally telecommunications have been growing in Russia and the SPB area at a rapid speed during the last few years, as presented in Table 14 above. The demand for telecommunications is growing all the time, as for example also consumers are actively shifting to mobile

communications from the old fixed lines and also making more Internet subscriptions all the time. The Russian telecommunications sector is also internationally competitive, as its expanding outside Russia (to CIS), especially in mobile communications.

Last but not least, consumers are the main receivers of the primary goods produced in the possible cluster. These consumers include companies from various industries, such as banking, metallurgy and gas. Other consumers are the government and public organizations and naturally also private consumers. Consumers can naturally be both foreign and domestic customers, depending on the product.

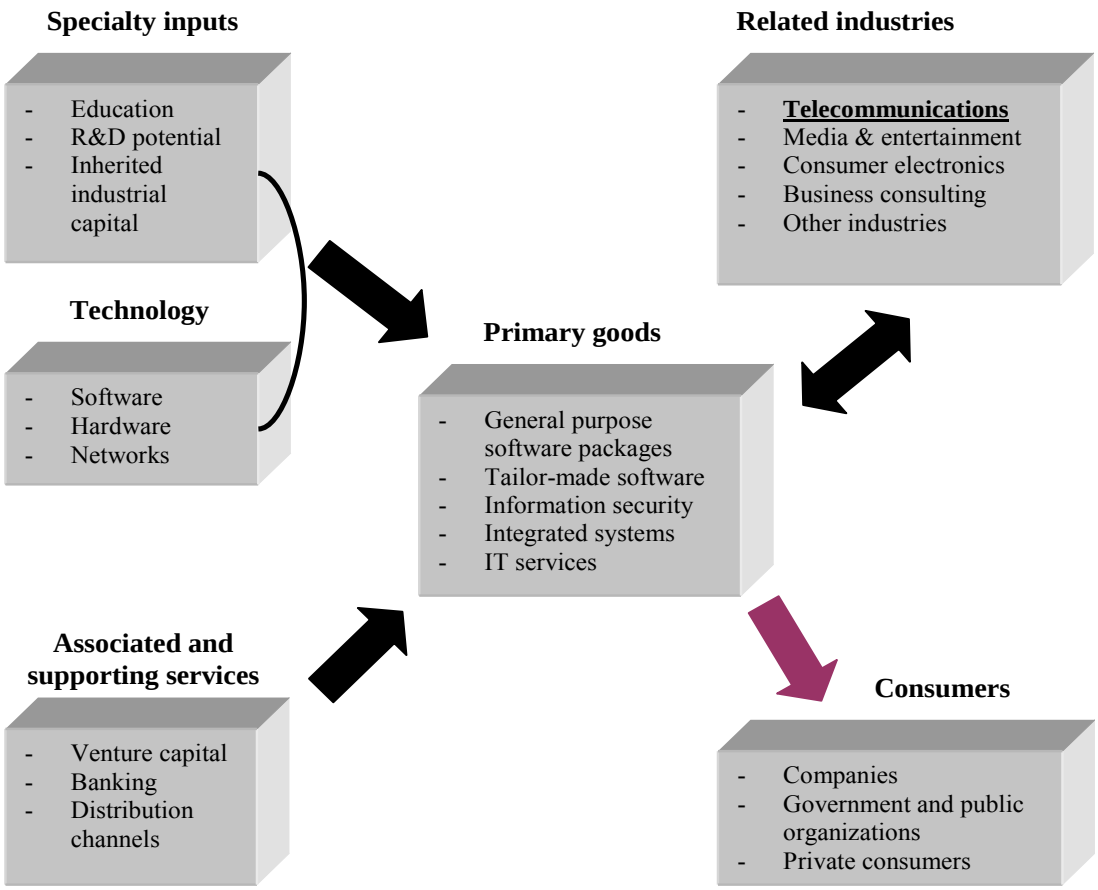

Figure 22. Saint Petersburg IT industry structure from the cluster perspective (Adapted from Averin & Dudarev 2003, p. 13)

5.4 Fulfilling the initial conditions for clustering

As presented in the theoretical framework of this research, there are certain conditions that should be fulfilled for an industry to cluster, and some others that support it. These conditions and their status in the SPB area IT industry are assessed individually in the next subchapters.

5.4.1 Divisibility of production processes in the industry

Many types of products and services are offered to the customers by the IT industry of the SPB area. As explained earlier, IT companies in the Saint Petersburg area work in the fields of software and hardware, IT services and distribution. Many companies have specialized only in a certain field of activities, mainly in software and IT services.

In the era of globalization, many SPB-based IT companies offer their products and services over the Russian borders. These international operations, together with the domestic demand give the required customers and sales volume to IT companies to survive and grow slowly. Recently, foreign and domestic outsourcing activities have become more common in the IT industry of the SPB area, especially in the software development field. A large number of companies in the SPB area serve large international IT companies and offer them the needed pieces for their production process. It means that Russian companies do not yet use the domestic outsourcing possibilities, but they are mostly the ones offering them to foreigners. It can be argued that the domestic players of the SPB area IT industry are not strong enough to form the critical mass of both actors and business volume, so the already existing and new foreign companies are needed in the industry.

When considering the IT industry in global terms, it is clear that the SPB industry does not yet represent the full range of possible production processes. Most companies are actually software development and outsourcing and service firms, or resellers of imported products. Therefore it can be argued that there is no actual divisibility of production processes in the SPB area IT industry currently, at lest to a large extent. This situation applies only locally, as generally the IT industry represents high divisibility of production processes. The real diversity and divisibility of production processes of the global IT industry and of the players in the SPB area are maybe easier to understand through the value chain and system presentation of chapter 5.4.3.

5.4.2 Transportability of the final product

IT industry products in general are considered to be easily transported. Both physical products and services are not bound to any specific location in such sense that they could not be transported easily. Actual physical IT products, such as servers, PCs and data storages are all transportable as final products. Components, supplies and semi-finished products are also transportable and therefore do not cause problems in this sphere. Most IT services are such that they are very transportable, as the service providers with their equipment can go to the

customer's location and offer the service locally. It is also possible in many occasions to offer the service or final product online over a network, such as the Internet, which actually removes the importance of location and makes the products very transportable. The overall product transportability in the IT industry of the SPB area can therefore be considered to be very good.

5.4.3 Value system and value chain length

It is difficult to give an unambiguous value chain description in the case of Saint Petersburg IT industry, as a wide variety of final products and services are offered by many different companies. A general example of a value chain in the IT (service) industry is presented in Figure 23, which indicates IT value chains to be short from the perspective of the primary activities. This view is also strengthened by the conducted interviews.

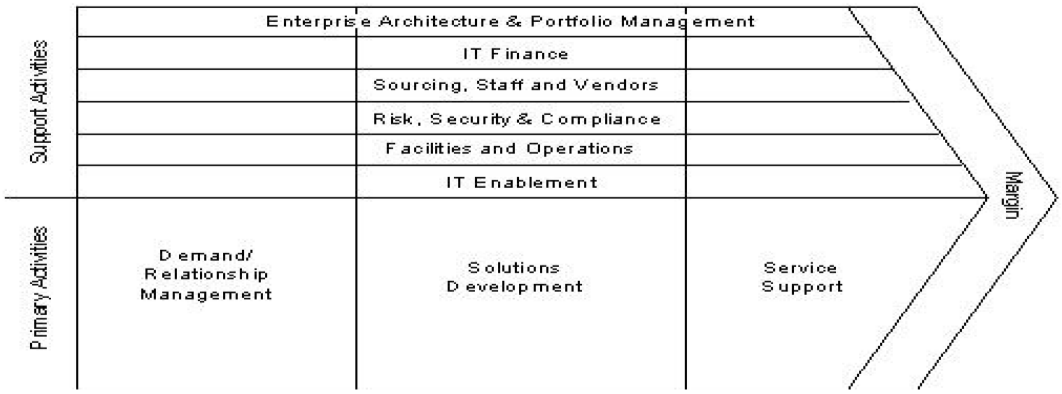

Figure 23. IT value chain (Betz 2007)

Due to the problems in defining an unambiguous value chain for the SPB area IT companies, a more general perspective of the value system is used to deepen the understanding, and also as a starting point to determine the typical value chain length for the companies. The presentation of the value system is here slightly different from the one presented in the theory, due to the fact that it is here analyzed from the industry, not individual company, point of view, and modified accordingly. The value system of Saint Petersburg IT industry is presented in Figure 24, in which the highlighted boxes represent the primary activities of the majority of actors in the SPB area IT industry. Parts of the value system are discussed below.

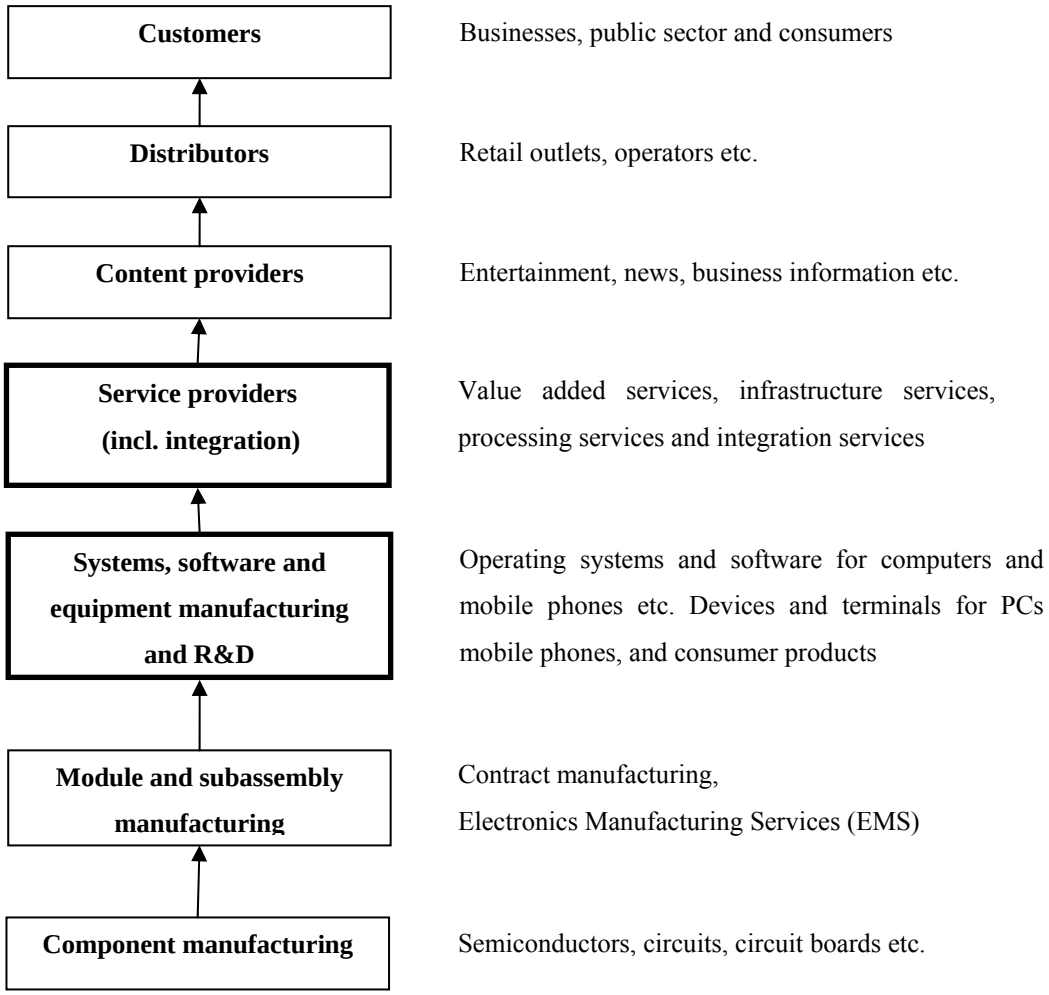

Figure 24. Value system of the Saint Petersburg area IT industry (Adapted from Averin & Dudarev 2003, p. 16)

Many companies in the IT industry are active in several parts of the value system in different combinations. Some big international players are actually active in all the parts illustrated above, from component manufacturing to distribution. Therefore, all value system levels are gone through next to determine the typical company activities in the SPB IT industry.

In the SPB IT industry, as in IT industries in general, component manufacturing can be considered to be the root level of the value system. In the SPB area it can be argued that in component manufacturing there are no successful local companies, and therefore most of the components are actually imported to Russia from abroad. This level of the value system is unlikely to form a strong presence in the SPB area due to the continuous loss of international price competitiveness, which is a consequence of the increasing wages, insufficiently growing productivity, and the real ER appreciation problem in Russia. Naturally, an increase in local

demand could change the situation, but at the moment module and subassembly and hardware manufacturing have a very small role in the area.

The next level in the IT value system can be considered to be module and subassembly manufacturing. These types of companies, especially international ones, are starting to emerge in SPB area to serve mainly the telecommunications sector. Moderate or large-sized and successful local companies are absent on this level. These companies have had problems, as the local markets have lacked strong demand for these products, which has consequently forced the companies to export their production. The exporting activity does not favor these companies as much as in the past, due to problems at the borders and the loss of Russia's international price competitiveness.

The next level in the value system is the systems, software and equipment manufacturing, integration and R&D. This level already includes several companies in the SPB area, which are small-sized and often concentrating on software development. Equipment manufacturers are less numerous, but some international and local companies exist in this sphere. Equipment comes into picture with the all the time increasing number of companies offering product packages, which include both hardware and software. These types of activities are also common for foreign firms in the industry. Still, hardware is not manufactured locally in large quantities, but imported to Russia. Information technology R&D activities are especially common for foreign I(C)T companies coming to the SPB area. At least following the companies have set up their R&D or dedicated development centers in the area in the past: Sun Microsystems, Motorola, LG Electronics and Siemens (OECD 2005, p. 37).

The level of service providers and integrators is an important area of activities in the SPB area IT with its value added and other services. Many companies are concentrated in the IT services field and especially integration services. These companies offer a wide range of services, such as different business applications for many industries. Together with software development, IT services (including integration) form the majority of local companies' operations and also the industries' primary products.

Content providers are not a very visible part of the IT value system in the SPB area. There is absence of well known and recognizable local domestic brands in this field, and in general the content providing is such a new application area that it is only starting to emerge. Most content providers in the global IT field are big international companies, such as Yahoo!, Google, MTV Networks Company, Time Warner and CBS, influencing also the SPB area locally and internationally through the Internet. Some domestic companies, such as Kommersant and

Expert, which are especially Russian news and information providers, are also operating in this field in Russia.

The next value system level is the distributors. This form of activities is not common among the bigger Russian companies in the SPB area. Distribution is handled by the smaller retailers and small companies in general. One example of a moderate-sized (turnover ca. USD 9 M in 2006) company in the SPB area, active in distribution (74 % of total activities) is ITEL, which focuses on deliveries of hi-tech network and telecommunications equipment for small and average-sized businesses. Distribution also occurs in the Internet in one form, where especially content is distributed by bigger international firms, such as Apple with its iTunes-store.

The last level of the value system is the customers, which in the SPB IT industry are consumers, the public sector (government and institutions) and companies (foreign and domestic). Companies represent the majority of consumers in the SPB area IT business, as it is mostly concentrated in business-to-business activities. The RF government and its organizations are actually big customers of the Russian IT industry. Many foreign customers are outsourcers seeking software development and other services from the companies of SPB area IT industry. Business customers in the RF are mostly found in the Moscow area, which is also a popular target market for SPB area IT companies.

As highlighted in Figure 24 and explained above, most companies in the SPB area specialize in offering software and IT services. Some companies offer also hardware or both software and hardware and are active also in distribution, but the software and IT services are clearly dominating the industry, especially among local companies. The primary activities of the value chain for these companies can be argued to be very limited on a simple level, as shown in Figure 23. Due to the above mentioned features, it can be concluded that the typical value chain of a company in the SPB IT industry is considered quite short. This can be argued through the fact that software development or services hardly require any components and are solely based on for example a specific company's internal activities, such as own programming and consultancy activities. Therefore, these companies do not need to cooperate or be linked with other or complementary actors in the IT industry. Still, some companies are active in several parts of the IT industry value system, and therefore companies may also have long value chains in some cases. This is more common with some bigger foreign companies, such as IBM, which operate globally in the IT market. In summary, the final product value chains are long in the global IT industry, but companies in the SPB area IT industry are active only in small parts of value chains and few value system levels.

5.4.4 Varying competencies

The competencies of the companies operating in the IT industry of the SPB area vary quite a lot. Some companies offer both hardware and software, some just IT services or software, others are distributors and almost all have a combination of some or all of these activities. Each activity and their combinations require different competencies. Although many companies in this specific industry work in the sphere of software development and IT services, their competencies vary also due to the fact that in the IT business in general employees and their skills to a large extent set the companies competencies.

5.4.5 Importance and type of innovation

In general, the Russian innovation performance is considered to be very modest. Science-based innovation can be found in small quantities in private spin-off firms and it often occurs as a by-product consequence of public sector restructuring. IT and especially software industry is seen as an exception of most other industries as the software companies are entering also foreign markets and therefore feel the pressure of innovating and competition in product ingenuity and quality. The SPB area IT industry actually competes globally with India and Israel at least partially in products such as integrated systems, information security, general purpose software packages and software packages customized according to customers' needs. Due to this competition situation, innovation arising from the knowledge base of companies is of high importance for the Saint Petersburg area IT industry. (OECD 2005, pp. 29-37)

The IT industry of SPB area actually represents a rare exception in Russia, in which foreign companies are establishing their R&D centers. Although many companies, both foreign and domestic, have established R&D activities in the location, and innovating is present in the IT industry of the Saint Petersburg area, innovation can be seen occurring more on individual company and entrepreneur level. Network innovations do not dominate because most companies compete with each other and are not cooperating much in product development sphere. Also, the public institutions, such as research institutes and universities, are not often heavily involved in the innovation process of companies. It is arguable that unofficial and indirect knowledge sharing occurs especially between software companies, but it is doubtful that this will lead to true innovations. Also, most of the knowledge embedded in the industry can also be seen as tacit, which is learned and gained through experience and therefore not easily communicated or shared. A positive innovation phenomenon is seen mainly in the software and service activities of the IT industry, but most of the actual physical technology, such as hardware, comes from abroad still. (OECD 2005, pp. 36-37)

5.4.6 Market volatility

Global ICT markets in general can be seen to be volatile, as for example fashion trends in mobile telephones change quite rapidly from one model group to another. In these cases fast reaction speed and adaptability is required from the component suppliers and highly appreciated by the actual cell phone manufacturers, such as Nokia. In these types of situations coordination of the players included in the final product value chain in an industry may result in actual competitive advantages, if the companies are geographically proximate and time (reaction speed) is considered important.

In the case of the SPB area IT industry, it can be argued that the market is not comparable to ICT industry in Beijing, China (see Yeung et al. 2006), where Nokia as an anchor company has formed a cluster of mobile phone manufacturing, in which suppliers and other value chain members operate actively. Most companies in the SPB area are software developers and IT service providers, or have only R&D activities located in the area and have in general very little or no hardware production. Software and service activities are time-sensitive, because producers cannot determine product demand as the products are almost always tailor-made to the customers in projects. Some long lasting partnerships occur between companies, but they are quite rare and do not decrease the market volatility substantially. Companies producing hardware or components mainly export the products to foreign markets or produce unremarkable quantities. Most of the finished hardware sold in the Russian market comes actually from abroad as imports to Russia and is just sold forward by local companies.

5.4.7 Clustering conditions in Saint Petersburg area IT industry

Assessing the clustering conditions in the SPB area IT industry is a complex task. Since the IT industry in general can be considered to be global in terms of for example sourcing possibilities and product (finished and semi-finished) transferability, the presumed cluster of SPB should be analyzed also in comparison to the global IT industry features. Consequently, the analysis here seeks to answer especially the questions of whether there is potential for clustering and whether there already is a global IT cluster in the SPB area.

As illustrated in Table 17, the SPB IT industry fulfills all the initial criteria for industrial clustering. Still, although production processes generally are divisible in the IT industry, most SPB area IT companies are actually operating in the same specific fields of activities, mainly software and service providing. Also the typical value chain for companies in the industry can be considered to be short, since they participate only in a very small share of the total value

chains of the final products. The value chains of final products can be considered to be long in most cases, and they are often global in terms of for example hardware and components manufactured abroad. Also it can be argued that some other initial clustering conditions are only partly fulfilled, as can be seen in the remarks in the table.

Table 17. Summary of clustering conditions in St Petersburg area IT industry with remarks

	St Petersburg IT industry
Divisibility of process of products (NC^1)	**YES** Production processes are divisible, but most companies currently concentrate on the same sphere of activities, which locally do not include many different steps of production
Final product transportability (NC^2)	**YES** Applies well also to software and IT services
Long value chain (SC^1)	**YES** Final product value chains are long, but generally the local companies have very small parts in these
Varying competencies (SC^2)	**YES** Competencies vary, although most companies operate in the same field
Innovation importance (SC^3)	**YES** Innovation activity not efficient and network innovation does not occur, it is more of the entrepreneur-type
Market volatility (SC^4)	**YES** The SPB area IT industry is volatile, but not the same way as elsewhere in ICT

In summary, clustering in the SPB area IT industry is possible. It can be argued however that there is not yet a true global IT cluster in the area. A global IT cluster should include a wide supplier (component, hardware, system) and production basis and other related parts of the whole IT value system. Also the lack of efficient innovation activities, as well as companies working in many different spheres of activities can be seen to restrict global cluster formation. In addition, the lack of substantial and sustainable international competitive advantages indicates an absence of a properly functioning global IT cluster.

6 Conclusions and summary

The Soviet Union and its central planning system collapsed in 1991, and consequently the newly formed country of Russia faced totally new conditions both politically and economically. Business companies faced open market conditions for the first time, and many of them did not survive this change. However, the destruction of specific companies and institutions, especially in the field of electronics and telecommunications, enabled "creative destruction" (see p. 61), which caused the birth of the Russian and St Petersburg area IT industry.

In 1998, Russia suffered economical and financial crises. The crises took the RUR to a more realistic ER, which gave increasing devaluation advantage to Russian manufactured products, and together with the following oil boom ultimately set Russia to the course of rapid economic development, still continuing today. Other sectors outside natural resources, such as the SPB area IT industry, were expected and hoped to increase their share in the domestic economy and also to improve their international competitiveness, as natural resources are very volatile (e.g. being very price sensitive) and not renewable. This development did not occur on the expected scale, however, at least in the SPB area IT industry. The SPB area IT industry does not currently have any substantial and sustainable advantages in this field. Still, there are positive factors enabling increase in international competitiveness as well negative once preventing it, presented in Figure 19 (see p. 74).

The Russian government, considered as the most influential external source in the international competitiveness analysis, has a controversial effect on the SPB area IT industry. It has started a SEZ-initiative to improve the industry and its competitiveness, but as found out in this research, has still not gathered appraisal from the company representatives or had any substantial positive influence on the industry. The Russian government is responsible for improving the still poor investment climate and developing new policies to ensure sustainable investment and improvement in the education sector and R&D, which have huge potential in Russia and the SPB area. Also, Russia does not have a fully innovation-friendly environment, and especially the government should aim to increase the involvement of the private sector in R&D and to create better linkages between public research institutes and private companies. This would definitely also enable improvement in the international competitiveness of the SPB area IT industry in the long run. Altogether, the Russian government's participation in the development of industries and clusters, such as IT in the SPB area, can be currently considered questionable, which reflects the results of the interviews in this study and the observations in recent publications (see Economist.com 2007).

The clustering of the SPB area IT industry is certainly possible, as concluded in Table 17 (see p. 92). However, already the lack of true international competitive advantage in the industry points towards the inexistence of such a cluster, at least in the global sense. On the basis of the analysis in chapter 5.4, it can be argued that merely a potential global IT cluster is located in the SPB area. It can be seen not to form a global IT cluster as long as it does not include a wide supplier (component, hardware, system) and production basis and other related parts of the whole IT value system. Considering the rising labor costs and low productivity (see Table 15 on p. 78), it is highly uncertain whether or not actual physical manufacturing activities will ever be moved to Russia and the SPB area unless the situation changes.

Although there is arguably no global IT cluster in the area, it is clear that especially many software and service provider companies have agglomerated to the area and created a possible sub-cluster of IT. Also the market in the area is considered substantial. With the specialized fields of activities in the SPB area IT industry, it could integrate itself into a domestic value system by strengthening linkages especially to Moscow, which is the biggest domestic market and business area in Russia. Actually increasing the part of domestic or global value chain can be argued to be an important factor for further success in competition, both internationally and domestically.

The purpose of this research has been to offer an insight into the potential of SPB area IT industry to become one of the key industries in Russia, by assessing the international competitiveness of the industry and its clustering. In the next chapter, the future outlook of the industry and its potential to become a key industry in Russia are discussed.

6.1 Future outlook

The outlook of SPB area IT industry is positive. The domestic demand is increasing at a good rate and the competition is intensifying, which gives incentive for companies to upgrade their activities and to increase their competitiveness. However, since the industry does not have any substantial and sustainable international competitive advantage and it is not expected to form a global cluster any time soon, it can be concluded that the IT industry of the SPB area will not become a key industry of Russia in the near future, unless a dramatic change occurs.

A tighter integration of the SPB area IT market and industry to the Moscow area would create a substantial IT power inside Russia. Also, as concluded from the interviews, the SPB area and the whole Russian IT market will continue to grow, although at a more moderate speed. The whole Russian IT market will be sufficient to support also increasing presence and share of the

SPB area IT industry in the Russian economy. The increasing amount of new communication and other technologies, as well as companies from various fields of activities, which are improving their efficiency through IT investments, are expected to be the main drivers of growth in the future. Although not becoming a new key industry in Russia, the SPB area IT will have at least an important supporting role in Russia's economic development in the future.

6.2 Further research

The clustering of Russian industries will remain an interesting research topic. Further and more detailed analysis (e.g. cluster mapping through labor comparisons, Input/output analysis etc.) of the SPB area IT industry is a highly recommended focus for further research with appropriate data. This type of research could provide more insight into the changes needed in Russia to form efficient industrial clusters, through e.g. international comparisons. Naturally, international competitiveness factors would provide related supporting data to this kind of research as well.

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Appendix 1. Interview questions

1. Tell about your background in the IT industry in Russia.
2. How do you understand the term “cluster” in the industrial context?
3. Can you give any examples of successful clusters from the world?
4. What industries are closely related to the St Petersburg IT industry or support it?
5. What is the competition situation in the St Petersburg IT industry?
6. Are there generally a lot of companies and what size are they most commonly?
7. Are the companies “de-novo” or old ones established before the dissolution of the USSR?
8. What has the development of the industry been so far in your opinion?
9. What is the potential of IT markets in the St Petersburg region?
10. Are there a lot of customers in the industry and who are they? Public/private sector?
11. Is the local demand strong?
12. What is the international competitiveness of the St Petersburg area IT industry in your opinion?
13. What factors especially enable the competitiveness of the industry? What factors restrict it?
14. Are Russian IT companies as developed as western ones? In what areas are there differences?
15. What is the technological development state of the industry in comparison to western countries and companies?
16. How do you see the future of Russian/St Petersburg IT industry?
17. Why do some companies do better than others in international competition? What factors prevent others from being internationally competitive?
18. Can you name successful companies in the St Petersburg area IT industry?
19. Are there any anchor companies in the industry attracting other companies to start operations there? If not, what companies could in your opinion be that kind of players?
20. What factors make it harder for international companies to establish themselves in the industry? What factors enable it?
21. What is the number of international companies in the St Petersburg IT industry?
22. What kind of motives do international companies have to establish themselves in the industry?
23. Are international companies in general willing to come to the industry?
24. Have international companies brought technology, management skills, knowledge etc. to the industry with them?
25. Do you think international companies are needed in the industry to develop it further and to make it internationally competitive?
26. Are employment costs still a remarkable motive for international companies coming to the industry?
27. Do international companies in general do a lot of mergers and acquisitions or do they establish their own offices in the industry?
28. What is the investment environment in the industry in your opinion?
29. What are the biggest problems in investments coming from abroad?
30. Is the financing environment good in the area and industry?
31. What is the role and influence of the government for the industry?
32. How do you see the SEZ and innovation projects of the government influencing the industry?
33. What kind of contacts and networks do companies from the St Petersburg IT industry have internationally to Europe and the rest of the world?
34. What is the state of innovation activities and R&D in the St Petersburg area and Russia at the moment and what does their future look like?
35. How do you see the educational situation in the St Petersburg area and Russia at the moment?

36. What is the level of IPR protection in Russia and how does it affect the industry?
37. Is the infrastructure good in the St Petersburg area?
38. Is there skilled labor available in the region or do the employees come from other regions?
39. Is there strong cooperation between the companies in St Petersburg IT industry and are there a lot of supporting organizations involved? What is their influence on the development?
40. Do you believe IT industry can become one of the key industries in Russia in the near future?
41. Who do you think I should interview in this project?