

Regional Dynamics in the East-West Transnational Transport Corridor



31.12.2007

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Publication 2007

Publishing date: 31.12.2007

Publisher: Region Blekinge

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1. Introduction

Corridors along major transport routes are recognized as of having particular potential for economic development. In many regional economic studies, places along such corridors are described as potential key-areas for economic development. The argument is that the accessibility, which the transport infrastructure along these corridors provides for travel to and from these locations make them attractive to business to locate and for people to live. Economic theory might indicate this and the European Union seems to believe that upgrading the transport infrastructure standard on corridors is an efficient policy-measure to enhance economic development in border regions. ¹

1.1 Development corridors

In the *European Spatial Development Perspective* "development corridors" are presented as increasingly emerging in Europe. These corridors are often trans-national cross-border. Therefore the corridors require an integrated spatial planning approach that goes beyond purely national policies. Infrastructure investment is seen as one important policy measure to ensure balanced regional development. The future extension of the Trans-European Networks (TEN) should reassure economic development of particular regions and facilitate their integration into the global economy. In addition, however, priorities for action should include supplementary measures assuring development of intra-regional links (often referred as missing links). The efficiency and density of these secondary networks is said to be vital for the integration of the regional and urban economies and their competitiveness. Especially, they are expected to strengthen the smaller and medium-sized towns and their function in generating overall regional development.²

We know that existing and/or new transport infrastructure connections not always bring about economic prosperity. In some cases infrastructure has no visible regional impact at all. In other cases it opens up for new competitors in local markets. However, upgraded infrastructure always means shorter travel times and better accessibility. This will result in an enlargement of local markets, which gives new opportunities to businesses located along the improved infrastructure. To what extent these opportunities will be exploited varies between regions and depends on a combination of factors: access to latent resources waiting to be exploited and the presence of local and regional entrepreneurs.

A limited view of corridors is to see it as a set of infrastructure, which accommodate transport activities. In this case the corridor is a transport concept and is just seen as a transport-axis. Improving the infrastructure means primarily reduced transportation costs along the corridor. Therefore such investments increase competitiveness of firms located along the corridor.

A more demanding definition of a corridor is to see it as a connection-axis, characterized by interaction between nodes along the corridor. By building new infrastructure, connecting up

¹ "Development along Transportation Corridors" report from a seminar organized in Heerenveen, the Netherlands in April 2000 as part of the Interreg IIC-project "Integrated Development"

² European Commission *ESDP; European Spatial Development Perspective*. Luxembourg 1999

places and/or improving existing connections between places, new spatial interaction can be developed, or the existing ones can be strengthened. In this case infrastructure investments may support the interaction between the nodes along the corridor and enlarge the regional market for firms located in the nodes.

If one takes a step further, the corridor can be seen as spatial development concept. Corridors in this concept are seen as functional axes with a relation between living, working, recreation, transport and nature (there is not only a relation with space within the corridor but there is also a clear relation with the space outside the corridor).

Essentially the corridor concept embraces all these alternatives. The first of driving forces of the corridors are **the urban centres** along the corridor. Growing urban centres will increase the interaction along the corridors. First, growing urban centres manifest itself in enlarging urban regions. The geographical size of the functional urban region will increase preferably along existing transport corridors. Secondly, the growth of urban regions will also stimulate the interaction between different urban centres along the transport corridor. There is a mutual dependence between the dynamics of the urban centres and the transport corridor. Expansion in the urban centres creates more transport in the corridor and investments in the transport corridor make possible further expansion in the urban centres. Thus, a corridor development strategy must include as well urban policies for the centres along the corridor as an investment policy for the communication links. Growth in urban regions will always generate new transports. However, it is a more open question to what degree investments in transport infrastructure will stimulate growth in urban centres on the corridor.

1.2 The new economic context

The 1950s and 1960s was a period when the European economy experienced of secular boom and remarkable free of cyclical disturbances. In this period the annual average rate of growth in total output in Western Europe was 4,8 per cent and the output per head annually rose by in average 4 per cent.³ The manufacturing sector was the engine of the growth. Steel industry, heavy engineering and automotive industry was three dynamic industries. Many economists gave the honour for the successful economic development to a successful macro-economic policy. The Keynesian revolution implied that the governments by tuning demand could eliminate the cyclical variations and preserve full employment. Economic science seemed to offer policy-makers efficient tools to guarantee fast and stable economic growth. The oil-crisis in 1973/74 changed suddenly changed the picture. Growth rate was radically reduced while inflation rate increased. The economy was characterized by a combination of stagnant economic growth and high inflation. Keynes' theory gave no room for such a stagflation. Therefore, economists have to look after extraordinary exogenous factors to explain the odd situation. OECD asked a group of distinguished international economist analyze the situation and their conclusion was that "...that the most important feature was an unusual bunching of unfortunate disturbances unlikely to be repeated on the same scale".⁴ Based on this conviction did they "see nothing on the supply side to prevent potential output ... from growing almost as fast in the next five to ten years as it did in the 1960s."⁵ Looking back

³ Angus Maddison "Economic Policy and Performance in Europe 1913-1970". In Carlo M. Cipolla (ed.) **The Fontana Economic History of Europe. The Twentieth Century-2**. Glasgow 1976

⁴ Paul McCracken et al. **Towards Full Employment and Price Stability**. Paris 1977 p.14.

⁵ *ibid.* p. 16

we now we can say they were wrong. Growth rate became significant lower in the 1970s and 1980s than in the 1960s. It gradually also became clear that Keynes' theory no longer was an appropriate perspective. Obviously, a macro-economic policy focusing on fine-tuning demand was not an efficient way to secure fast and stable growth. Researcher started looking for other theoretical perspectives to understand what happened.

One of the revived perspectives was the Konradiev-perspective, which was made popular by Joseph Schumpeter in his book on business cycles.⁶ Some researchers took the new economic situation in the 1970 as an evidence for the existence of long waves in economic development and searched for explanations. Following in Schumpeter's footsteps much attention was put on the role of innovations and new technologies. The upswing of the long waves was considered to involve a simultaneous explosive burst of growth of one or several major new industries and technologies.⁷ The strength and the length of such an upswing were depending on the growth potential in the new emerging industries. During the upswing major new technologies generate both new investment and new employment on a large scale. As a result of rapid technological change and increasing competitive pressures, relative prices of new goods fall and their cost advantages increase. After a few decades, the new branches of industry's role as generators of additional new employment diminish. During the downswing competitive pressures within industry become stronger, capital intensity grows, and investment continues, but labour saving and material-saving changes become increasingly important.⁸

Interpreted from a Kondratiev perspective the crisis in the 1970s represented the end of a long upswing period, which was followed by a long period of slow and sluggish economic growth. His downswing gave birth to new technological systems, which will become the engine of the next upswing. Such technological systems included a combination of interrelated product and process, technical, organisational and managerial innovations, embodying a quantum jump in potential productivity for all or most of the economy and opening up an unusually wide range of investment and profit opportunities. Such a paradigm change implies a unique new combination of decisive technical and economic advantages. Such a new technological system was born in the 1970s. It started with the invention of the microprocessor in 1971, and the Arpanet in 1972 and the personal computer in 1975 followed. These inventions/innovations became important building stones in a new microelectronic technological system that opened up for wide range of product, organisational and managerial innovations, which in the 1990s became important engines of growth. (*Service industries*)

1.3 The East-West corridor

The East-West Transnational Transport Corridor is too long to be considered as a development corridor. With a total length from Esbjerg to Vilnius of 800 to 1 000 km by surface transport plus 12 hours on a ferry over the Baltic Sea this transport corridor is a very long transregional route. Moreover, the idea of East -West corridor is to join rough material markets lying in Siberia with the consumption markets in the Western Europe. Therefore we must also talk about prolongation of discussed corridor and connection with Trans-Siberian railway, which is

⁶ Joseph A. Schumpeter, **Business Cycles vol. 1**. New York 1939.

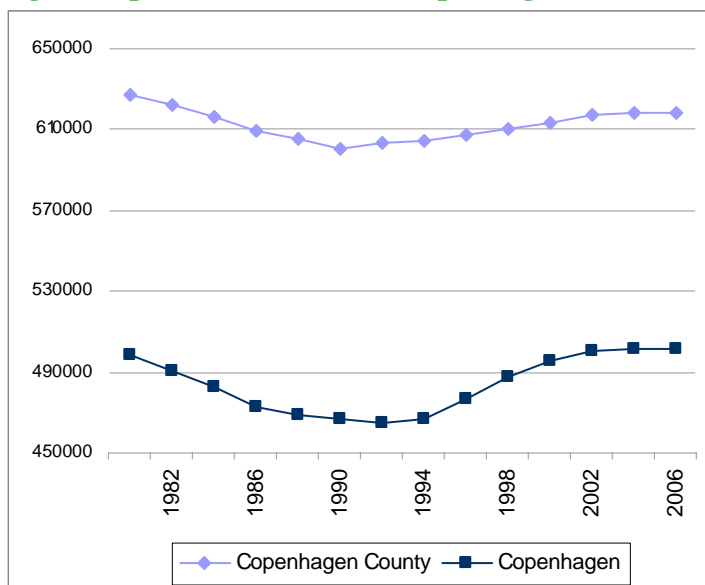
⁷ Chris Freeman, John Clark, & Luc Soete, *Unemployment and Technical Innovation. A Study of Long Waves and Economic Development*. London 1982.

⁸ Chris Freeman, (ed.) **Long Waves in the World Economy**. London 1984.

recognized to be the most important international transport corridor in East - West direction and vice versa, since it assures connection of Europe with China, Japan, Korea and Russia. It crosses two continents and 6 time Zones (Europe 1.700 km 19,1 % and Asia 7.600 km 80,9 %). So all to all the length of the corridor increases even to 12-13.000 km. It is unrealistic to assume that this develop into one continuous development corridor. However improvements in the infrastructure instigate the growth of existing urban centres along the transport corridor. This growth may result in growing local development corridors and gradually a number of local corridors will transform into regional development corridors. We can identify in total 11 urban regions along the transport route, Four in Denmark, three in Sweden, three in Lithuania and one in Russian federation (Kaliningrad).

The capital region in Denmark with about 1,8 million inhabitants is the largest and plays a dominating role in the Danish economy. More than 50 % of the Danish GDP is produced in the capital region. Due to de-industrialisation the region start to stagnate in the end of the 1960s industrial employment was reduced by almost 40 per cent until the beginning of the 1990s, which brought the region's share of the country's industrial employment down from 40 to 25 per cent. In this period all areas of industry were developing more weakly than in other regions o the country. Also the service sector showed a weak development. Retailing and wholesaling, business services and the hotel trade were the only segments of the service sector that grew faster than the national average. The lack of innovative creativity in the region's industries thus helped to turn the Copenhagen metropolitan region more and more into a national service centre. A declining population followed the decline in employment. In the 1990s a growing service sector generated employment growth and population started to slowly grow again.

Fig. 1: Population over time; Copenhagen



Source: Danish statistics

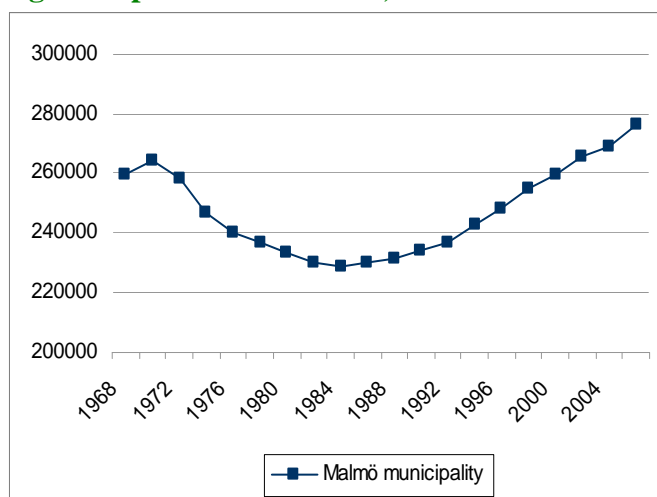
As a result of the declining manufacturing sector, also the population number decreased. The lowest population number was reached in the beginning of the 90s and since this time on there was a constant growth, which helped Copenhagen to recover from a strong decrease of population the years before. This growth however decelerated since the end of the 90s and a stagnation concerning the numbers of inhabitants can be seen. Although the stagnation begin in the year when the Øresund Bridge was opened, which led to an increasing number of Danes moving mainly to Malmö due to a more attractive house market, this can not be cited as the main reason for the stagnation. It is more likely that it is the result of the combination of circumstances like the modest number of housing construction and of the slow down of the euphoria. The population trend over time for Copenhagen County follows largely the trends, which can be seen for Copenhagen City, although

the turns seem to proceed less abrupt. This however is due to the much wider geographical area and larger number of inhabitants, where ups and downs can be compensated well by the greater number.

On the other side of Öresund is Malmö-Lund, which, with 650 000 inhabitants, is the largest urban region on the Swedish part of the transport corridor. Malmö-Lund is a polycentric region with two centres. Malmö, with about 250 000 inhabitants, is an old industrial town with a development pattern similar to Copenhagen's. A process of industrial decline started in the end of the 1960s making Malmö losing inhabitants to the beginning of the 1990s. During the end of the 60s, Malmö was facing a rapidly declining number of inhabitants, which was a result of the declining manufacturing industry. Since the mid of the 80s, where Malmö had the lowest number of inhabitants, a steady population growth began and continued until now. In the year 2006, Malmö's population amounts up to 276'000. Due to the expansion tendencies of the region, which includes among other aspects that people are moving further out in the region, while at the same time keeping their jobs in Malmö, the growth rate slowed down a bit in comparison with the last few years. The number of people who moved out of the city increased while at the same time the number of immigrants decreased. Like similar tendencies in the rest of Europe, primarily young families with children are moving out, while young adults are the major incoming group.

Malmö is also characterised by a high share of residents, which are born abroad. Especially people with former Yugoslavia as the country of birth are represented in Malmö. The share of people born in Denmark will continue to grow, since the construction of the bridge made it possible to commute daily between Malmö and Copenhagen in order to reach the working place on the other side of the Sound. In the year 2004 alone 1'800 Danes moved to Malmö, of which the vast majority kept their jobs in Copenhagen. Lower house prices and rents as well as the higher housing standards make the house market in Malmö so attractive for Danes.

Fig. 2: Population over time; Malmö



Source: SCB

A discussion was introduced in July 2007 with the proposal of several politicians about the vision to form a 'Greater Malmö'. Not only the incorporation of surrounding smaller municipalities, but also newly build quarters should be one step closer in reaching 'Greater Malmö'. At this moment, four new city quarters are being built in South Malmö, which should attract 4'000-5'000 new inhabitants in only this current year. If Malmö should keep on growing in the same speed as it is doing now, the available open space will be reduced rapidly and it is estimated that in eight to ten years Malmö will reach its limits. Already now most of the space is under construction and several old industrial areas like 'Norra Sorgenfri' are going to be transformed

into a meeting place for living, culture, services and recreation.⁹ All these plans and visions are showing that Malmö is currently in a process of growth and the signs are good that this trend will be persistent for the future.

⁹ Sydsvenskan 31 July 2007: *Politiker tror på ett Stormalmö*

Lund is an old university town which with no old industries. The industrialization process of the town is of late date and closely linked to the university. A number of new start-ups have developed into successful large companies – Tetra Laval, Gambro, Axis etc. – and some expanding large firms have established functions in Lund – AstraZeneca, SonyEricsson, Arla Foods, etc. The combination of a dynamic high-tech cluster and a growing university has generated a steady growth in the number of inhabitants in Lund. The number has now passed 100 000.

The opening of the Öresunds-bridge in 2000 created optimism about a future dynamic transnational Öresundregion encompassing Copenhagen Metropolitan region and the Malmö-Lund region. This transnational region is presented as one of the strongest pharmaceutical and biotechnological regions in Europe and comprises a dense cluster of universities, hospitals and more than 300 life science companies. This regional integration process has started, but it will take many years to tear down existing integration barriers.

The other three urban regions along the transport corridor in Denmark are Odense, with 190 000 inhabitants, Fredricia/Kolding/Vejle, called Trekantsområdet, with about 250 000 inhabitants, and Esbjerg with 115 000 inhabitants. Trekantsområdet, located in between Esbjerg and Odense, was one of the most dynamic regions in Denmark during the 1990s. In the period 1992-2005 the growth of the population in the region was twice as high as the national average and employment growth was about three times as high. A large and growing number of small and medium sized companies were the main dynamic force in the region. The region shows many of the characteristics well known from the industrial districts in Italy. A dominance of small and medium-sized firms, high turnover among the firms and a low share of labour with a university degree is typical for this districts.

The other two urban regions on the Swedish side is Kristianstad with 166 000 inhabitants and Karlskrona with 120 000. The short distance between Kristianstad and Lund offer good opportunities for a further economic integration of the two regions. Karlskrona is located at the eastern end of the Swedish part of the East-West transport Corridor. The town is the regional centre in a county, with in total 150 000 inhabitants and area not larger than an ordinary Swedish municipality. In the mid 1980s Blekinge was hit by substantial economic problems. Many large industrial companies were downsized and closed, and the employment losses were not balanced by growth in small and medium-sized firms. Other industrial regions in Sweden were experiencing similar problems, but for several reasons the future prospects of Blekinge looked particularly discouraging. Hence, the future of Karlskrona/Ronneby certainly was far from bright by the mid-eighties. The declining defense sector, a large manufacturing sector dominated by remotely controlled branch plants, a poor entrepreneurial tradition, a limited supply of professional services and no university definitely made for a difficult situation¹⁰. However, something unexpected happened on the region's road to depression.

At the end of the 1990s, the picture of the region had changed quite dramatically. Now Karlskrona/Ronneby perceived as one of the most dynamic regions in Sweden, outside the metropolitan areas. The dynamics was primarily based on industries that did not exist in the

¹⁰ SOU 1989:12

region fifteen years ago, namely the infocom industries. In the period between 1990 and 1997, employment in the information/ communication industry grew by more than 400 % or about four times as fast as the national rate of growth. Karlskrona/Ronneby, together with Stockholm, had the largest number of people employed in the infocom sector in Sweden. Almost 11 % of the population was employed in this sector, while the national average was a mere 5,1 %. In international journals and newspapers, Karlskrona/Ronneby was presented as a national center for the infocom industry. We can certainly talk about a Blekinge phenomenon.

In Lithuania there are 3 significant urban regions – Vilnius, Kaunas and Klaipeda. Vilnius is the capital of Lithuania, the country's administrative, cultural and economic centre. Population registered in the Vilnius County amounts to 848 300. (Vilnius city – 552 800) inhabitants. The city is home to major companies and key financial institutions. Highly developed infrastructure, high-quality services, and increased spending power of inhabitants all attract large foreign investments. Improving quality of life, organised city development, and intensive cultural life all contribute to creation of a welcoming and appealing environment. Foreign Direct Investment magazine of the Financial Times Group has named Vilnius the “City of Eastern European future” and the “Baltic city of the future” (February 06, 2006). In 2005, Vilnius accumulated € 2.815 billion in foreign direct investments (FDI). The biggest investors were Swedish, Danish, Estonian, German, American, Finnish and British companies. The services sector accounts for the largest part of DTI (88%). For several years in a row, Vilnius has been the hot spot in Eastern Europe in terms of investments attracted. The city's huge economic potential is being acknowledged.

Vilnius has seen rapid growth of modern commercial and business centres known throughout Baltic Region; a new city centre is being formed. In view of production and export volume, the key industries run in Vilnius include: electric facilities, electronics and appliances, textiles and textile articles, foodstuffs and drinks, wood processing and articles of wood, other manufacturing industries. Also numbers of Public Enterprises operating in the field of culture, health care and scientific research are set up in Vilnius city. Of all Lithuanian cities Vilnius is developing and renewing the most rapidly. Vilnius County generates one-third of the country's GDP. The unemployment level in the capital is almost two times lower than the country average (unemployment rate in country is 8.3 %). At the beginning of 2004, 29.1% of all economic entities operating across the country run their activities in Vilnius County. The title of European Capital of Culture 2009 is encouraging intense development of the city. Expansion of cultural and leisure infrastructure is planned, with a total investment of € 0.5 billion.

Kaunas is the second largest Lithuanian city in terms of size and number of inhabitants. Population in the County equals to 691 400. (Kaunas city – 366 600) citizens. Kaunas, located in the middle of the country, is the crossing point of significant European highways – Via Baltica (Warsaw-Tallinn) and IX B (Klaipeda-Minsk-Kiev/Moscow). The city boasts a good railway transport system and an international airport, creating excellent conditions for logistics and

industry. Kaunas is the perfect place for development of business. One-fifth of the country's GDP is generated in Kaunas. The unemployment rate is among the lowest in Lithuania. 14% of all operating economic entities of Lithuania are established in Kaunas city, 20% - in Kaunas County. The dominant industries: textile and light industry products (fabrics and footwear production; wearing apparel, furs and dyeing) makes 34.3 %, food products and beverages – 26 %. In 2005, FDI attracted by Kaunas totalled € 1.15 billion. Manufacturing, wholesale and retail trade, and real estate received the largest investments. It is planned to develop intermodal transport hub in Kaunas in order to use effectively the advantage of region, which is crossed by two Pan-European transport corridors (I and IX). By exploiting this opportunity Kaunas has ambitions to become an intermodal transport hub of European significance – a land port connecting the production and consumption markets of East and West Europe.

Klaipeda is a rapidly developing harbour city of Lithuania. It is the northernmost ice-free port on the eastern coast of the Baltic Sea, important transport junction between East and West. The port annually receives approx. 7,000 vessels from 45 foreign countries. Population in the Klaipeda County is 383 200. (Klaipeda city – 190 100 citizens.) Klaipeda generates almost one-fifth of the country's GDP. The County of Klaipeda in regard to economic index is one of the leaders in Lithuania. From 1994 gross domestic product annually grew by 3-4 %. Seventy per cent of the labour force is employed in the service sector. One-fifth of the city and region residents work in port-related companies. Thirty per cent work in various branches of industry, with food and beverage production, tobacco, electrical devices, and furniture being the main ones. In terms of foreign direct investments per capita, Klaipeda is second following the capital Vilnius and is well ahead of the country average. Klaipeda hosts 20 of the 100 largest foreign investors in Lithuania.

A 205 ha Klaipeda Free Economic Zone (FEZ), the first such zone established in Lithuania, has become a centre of investment attraction. It offers investors prepared industrial lots with developed infrastructure, maintenance services and tax incentives. Among the companies that operate here are enterprises such as Philip Morris International, Yazaki Wiring Technologies GmbH, and the Danish company A. Esperesen A/S.

Conclusions can be made that in Lithuania great changes in the population took place in the aftermath of the restoration of the independence. Emigration occurred on a large scale in the first half of the 1990s, contributing heavily to the population decline. Lithuania's population declined by 7,7 per cent 1991-2004. Population are still diminishing and the decline up to 2015 will, according to Human Development Report, be substantial. However, the coin has also another brighter side. Economic growth has been impressive for last 5-6 years.

Among the new EU member the Baltic states are the frontrunners which often are referred to as the Tiger of the North. During the last couple of years, Lithuania has been the leader in the Tiger group. With the fast economic growth Lithuania is slowly catching up with Denmark and Sweden. Privatisation of state owned enterprises started almost immediately after restoration of

independence and culminated in the period 1992-1998. By now, there are still a few companies to privatise. The Lithuanian economy has undergone profound structural changes during the last decade. A prominent feature is the rapid growth of the private service sector, which today accounts more than 50 per cent of total employment. Agriculture's contribution to employment is still very important. Its share of total employment is more than 15 per cent, but declining. Thus development in Lithuania is characterised by a combination of impressive economic growth, declining population and a strong urbanisation. This pattern indicates a further concentration of the economic activities to the largest urban regions in the country.

Kaliningrad oblast also is lying on the possible route of East-West transnational transport corridor. This oblast could play important role in the development of East-West corridor because of two reasons: the first – that it is significant demographical and economic region, the second – it is the part of significant non-EU country surrounded by new EU member-states. The territory of the oblast is nearly 15 100 km²; The population of the oblast reaches 955 300, of which 741 500 thousands are living in the cities. The basis of the oblast economy is industry, the largest of which are: fishing industry; machinery building; pulp and paper industry; food industry; coke production; extraction of natural resources (oil, amber, peat, coal). About 80% of the local industry is based in Kaliningrad city.

The industrial potential of the city is practically determined by the activities of 6 large enterprises manufacturing two thirds of the production. They are "Yantarenergo", "Lukoil", "Cepress", "SPI-RVVK", "Zapryba" and "Atlantrybflot" (fuel and energy complex, pulp and paper, fishing and alcohol industries). The small business has been successfully going on in Kaliningrad, it influences a lot the formation of the city budget About 46 000 entrepreneurs (construction, trade) are involved in it. Oblast has possibilities to develop tourism and recreation related business. Also the fact that oblast has a number of universities and research units show that there is a potential for science and technology development. The evidence for the second reason is that Kaliningrad oblast is the most western region of Russia, totally separated from the main land by the territories of new EU member-states. This circumstance makes oblast very attractive for national as well as foreign investors – vicinity of foreign economic centres makes oblast one of the leading regions for its integration into European economy. The fact that oblast has the only Russian ice-free port on the Baltic, and well-established connections by road and rail with the neighboring countries, stipulate favorable condition for its integration into European economy as well as create premise for its participation in development of E-W transnational transport corridor.

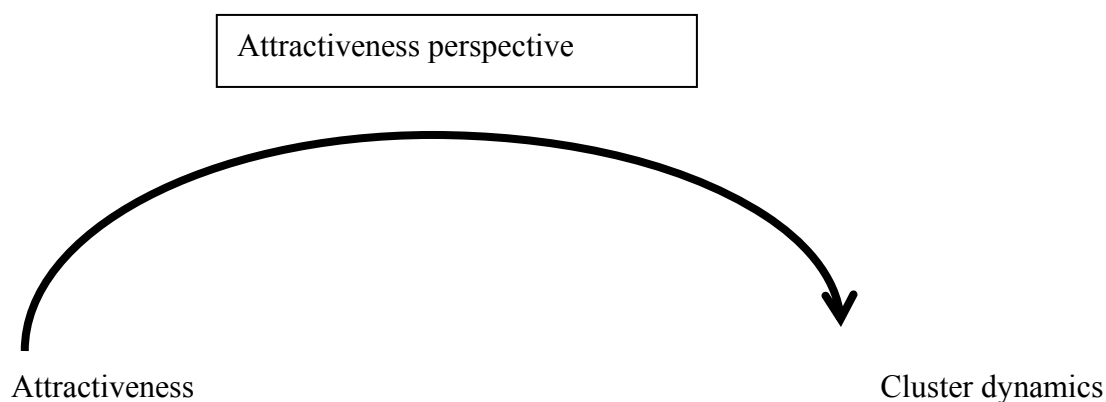
1.4 Research strategy

The key to a strong economic development along the East-West Transitional Corridor is the dynamics of the major urban regions along the corridor. The purpose of the study is to analyze the growth potential in some of these urban regions. Attention will be focused on the two largest urban regions in the corridor – the Öresundsregion in Denmark/Sweden and the Vilnius region in Lithuania.

The dynamics of the two regions will be studied from two different perspectives; a cluster perspective and an attractiveness perspective. Focus in the cluster perspective is on the industrial development in the

region. Economic growth in the region is manifested in increased employment, which increase demand for labour and stimulate migration to the region. Economic growth and increased employment makes a region attractive and stimulates migration to the region. In the attractiveness perspective the causal relation goes in the other direction. The creative class in a society are moving to attractive regions and are followed by high-tech industries.

The cluster perspective states that successful regional economic development is a process of successive economic upgrading. Such upgrading is normally more successful in regions with competitive clusters. Clusters are the result of a clustering process in which a number of interconnected companies in related industries occurs within a geographic location, in which the proximity of firms and institutions ensures certain forms of commonality.¹¹ Dynamic clusters exist in a local contexts that encourage investments and sustained upgrading and with an open and vigorous competition between locally based rivals. High quality, specialized inputs are present in the regions, like sophisticated and demanding local customers.¹² According to the cluster perspective dynamic clusters increase demand for labour, which make the region an attractive place for people. Thus, an expanding labour market makes the region attractive for job searching persons.



¹¹ Michael E. Porter, Location, Clusters and the 'New' Microeconomics of Competition, *Business Economics*, 33, 1, 1998 pp. 7-17.

¹² Michael E. Porter The Competitive Advantage of Nations, London: Macmillan 1990

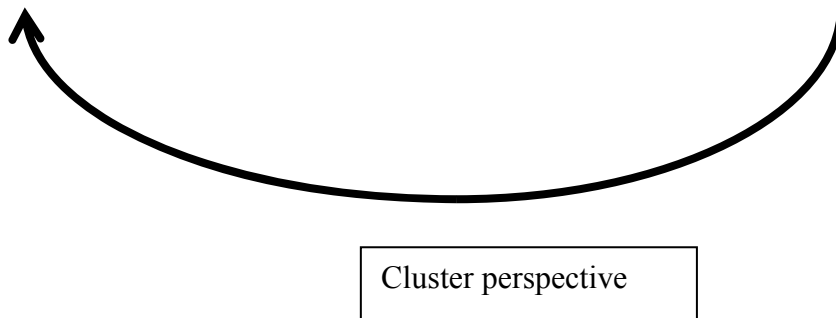


Figure 3. Two perspectives on regional dynamics

According to the American researcher Richard Florida dynamic regions in the knowledge society is characterised by a combination of talents, technology and tolerance. High human capital people have many employment options and thus are able to orient their location search to balance economic and lifestyle considerations. First of all, talented people attract other talented people. Talented people seem to prefer places that are open and tolerant, and offer a quality of life they desire. Places that attract people attract companies and generate new innovations, and this creates a cumulative process of growth.¹³ According to this perspective talented people are attracted to places that offer a quality of life they desire – like cultural and recreational amenities such as active recreation, high quality restaurants, bustling street life and music venues. A growing number of talented persons in turn make the place more attractive for firms and stimulate regional economic growth. To attract creative people, generate innovation and stimulate economic growth, a place must have talents, technology and tolerance.

The two perspectives don't exclude each other. Dynamic high-tech clusters attract talented persons and a concentration of such persons attracts high-tech-firms. The balance between these two forces varies between regions. It is our ambition to apply both perspectives on the two major urban regions in the East-West corridor to identify the engines of growth in the different urban regions. The analyses will also give a hint of how important the East-West transport corridor is for growth in the different urban regions.

¹³ Richard Florida The Economic Geography of Talent. Carnegie Mellon University, Pittsburgh 2000 (mimeo)

2. The Øresund region

The Øresund Region is a region with a special distinctiveness. It is not only a cross-border region, but also the two different national parts are separated by the Øresund. In comparison with other cross-border regions, which share one common border over land, the exchange of goods and people is limited to two transportation links: The Øresund Bridge and the ferry link between Helsingborg and Helsingør. The establishment of a fixed link between Copenhagen and Malmö in 2000 is considered to be one main factor in bringing the two different parts closer together.

Although the region is growing more and more together, there is still no common understanding about how the Øresund Region should be defined. Several institutions are defining the Region in a similar way, other have a different definition. About the Swedish side there is the common understanding that whole Skåne is part of the Region. The differences about the definition are related to which Danish parts should be integrated. In this report the definition of the Øresund Science Region, Ørestat and Øresundskomitten will be followed. This means that the Øresund Region is a cross-border partnership between the eastern part of Denmark, represented by Zealand, Lolland-Falster, Møn and Bornholm, and Skåne (Scania) in Southern Sweden.

Fig. 4: Map of the Øresund Region



Source: <http://www.sk.kk.dk/oresundsregionen.htm>

KEY FACTS OF THE REGION

Area:

21'201 km²; Swedish: 11'366 km² and Danish: 9'835 km².

Population (year 2005):

Around 3,6 mill. inhabitants of which 1,1 mill. are living in the Swedish part and 2,5 mill. in the Danish part.

Labour Force:

Total workforce of the Region: 1,7 Mio. with an average age of 40.

Unemployment (year 2006):

A total of 70'353 people (around 5%) of which 23'743 in the Swedish part and 46'610 in the Danish part.

GDP per capita (year 2002):

27'358 € in the Region; Swedish part: 23'559 € and Danish part: 29'148 €.

Number of universities:

The Øresund University consortium consists of 12 universities: 8 Danish and 4 Swedish universities.

Number of university students:

Around 150'000 university students.

Number of researchers:

The region has around 10'000 researchers at the universities. Around 48'000 people are employed in the public and private R&D.

Level of education:

27% of the regional population hold a higher education degree.

Global Players:

For example: Daimler-Chrysler, IBM, Microsoft, Nokia, Sony, Toyota, Unilever, Walt Disney, ...

Regional cluster:

Three defined clusters: Biotech cluster 'Medicon Valley', IT-cluster and Food cluster; 4-5 emerging clusters: DigiNet, Environment, Nano, Logistics, Humanities.

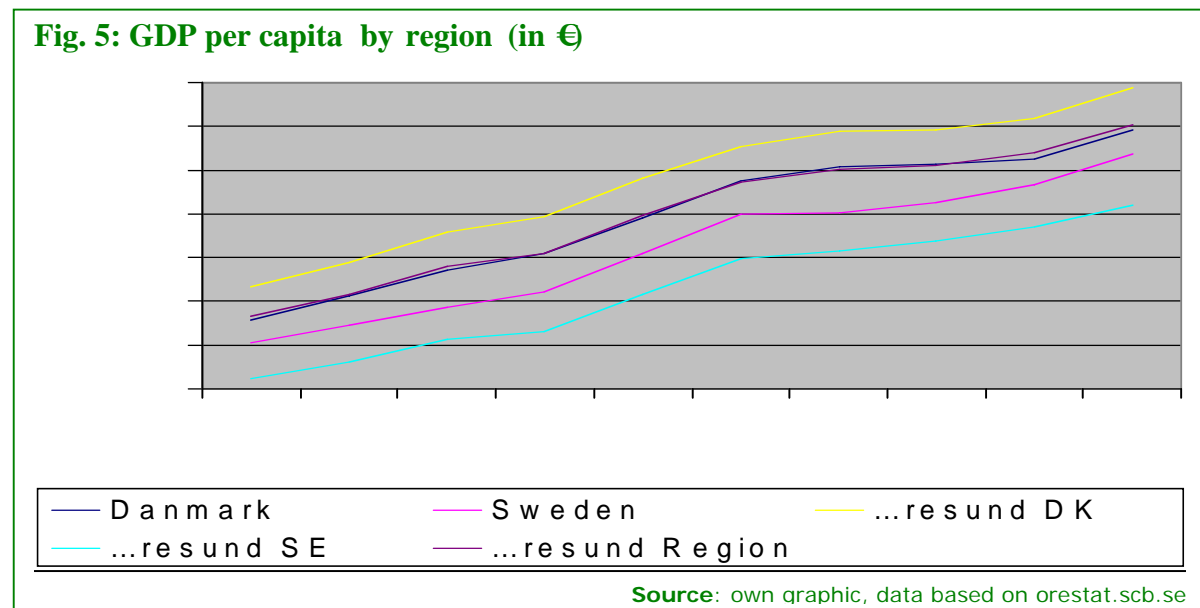
Source: orestat.scb.se

With the decision about the construction of a fixed link between the two largest cities in the region – Malmö, third biggest city in Sweden, and Copenhagen, the capital city of Denmark, – great expectations were created. In the view of the ongoing globalisation, the new Øresund Region will have a more suitable size and power to compete better with Asia and America than if Malmö and Copenhagen would stand for themselves. The economic centres of the European Union are often seen as too small to compete in a sustainable way on the global level. A study about Competitive European Cities carried out by the British Office of the Deputy Prime Minister deals with the question whether the Core Cities of Europe can face the global competition. The answer is that the European Cities are not yet in the premier league and that some development needs to go on. London and Paris are often considered as the only outstanding economic centres with enough economic power to face the global competition.

A Øresund Region with 1,7 mill. workforce and significant economic growth has certainly the potential to be one of the most promising candidates. The Øresund Region is seen in the ESDP as an *'isolated island of significant growth, where GDP is not yet high enough to change significantly the currently imbalanced spatial development'*¹⁴ When the European Spatial Planning Perspective was written, the Øresund Bridge was still in construction, but nowadays the accessibility has been improved and brings the Region one step closer to form one global knowledge-based economy.

¹⁴ European Commission *European Spatial Planning Perspective* Brussels 1999 page 20..

One special feature needs to be pointed out, if one is talking about the Øresund Region. Most cross-border regions in Europe are initiated by low performing regions, which suffer from their national wise peripheral location. The overall aim is to stimulate the economic growth in the area and to reduce their problems, which are coming along with the border location. The Øresund Region however is home to the largest city in Scandinavia and also Malmö can be considered as one of the bigger cities in North Europe.



The Copenhagen region with its high concentration of inhabitants and companies is the political and economical centre of Denmark, while Malmö and its surrounding do not reach the same status in Sweden. This power asymmetry will probably have a considerable influence on the distribution of the cooperation effects. The aim of the Øresund Region is however the same than in any other cross-border region: to decrease the national borders and stimulate the dialog and exchange between the two different parts. What makes the Øresund Region so special is its good starting position with a national centre and its location as a gateway to Scandinavia.

The Øresund Region is characterised by the formula 25 – 25 – 26, which means that the Region holds 25 per cent of the population of the two countries, 25 per cent of the employees of the two countries and 26 per cent of the combined GDP.¹⁵ Figure 5 shows the development of the GDP per capita over time. It can be seen that the growth rate is about the same for each part, but that the GDP of the Danish Øresund part starts at the highest level. This was expected since the Danish capital is the dominating pole in the region.

Also in terms of investments, the Øresund Region is outstanding in Scandinavian. In 2004, the Øresund Region in total was attracting 38% of all investment projects in Scandinavian and shows therefore that the Øresund Region, especially due to the help of the Copenhagen Region, *'become the most important investment region in Scandinavia'*.¹⁶ Enterprises see the main advantage by investing in this region *'in accessing a substantial local market, while at the same time, the region enables them to service the entire*

¹⁵ orestat.scb.se, 2006

¹⁶ Copenhagen Capacity, *IT opportunities in Greater Copenhagen*, Copenhagen 2004

Scandinavian area'.¹⁷ Another advantage is the access to a highly skilled workforce; therefore the vast majority of all regional investments in 2004 – 70% to be more specific – were taking place in the IT, telecom and electronics, business services and life science.

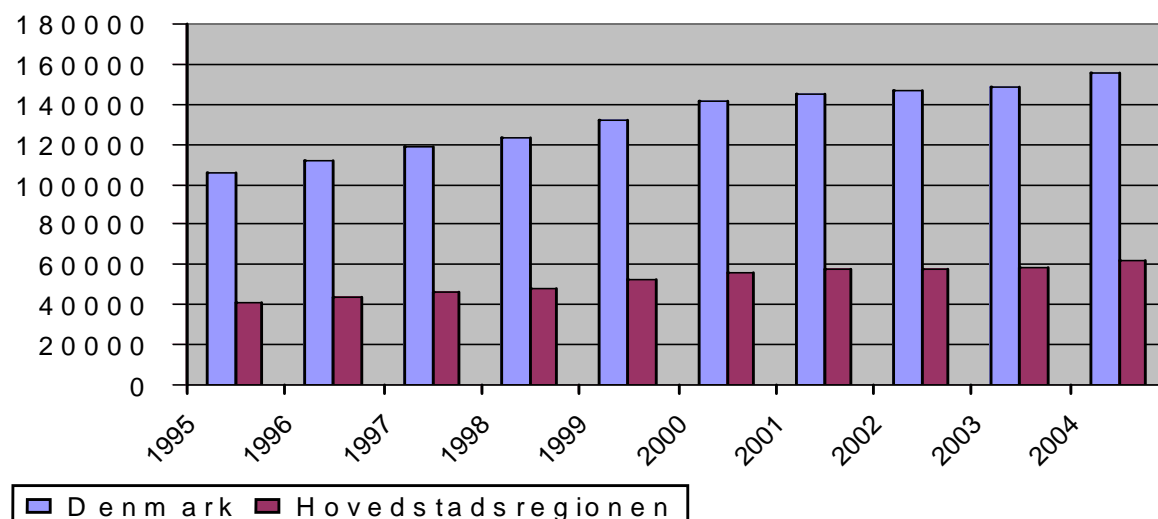
Although the Øresund Region consists of more than Copenhagen and Malmö/Lund the following parts will give an overview over the past economic development of the three main cities and how the transformation process from deindustrialisation into high tech locations took place. It is also important to see which role the different city regions play within their own country and to show the reputation of the Swedish and Danish economy in the world.

2.1 The transformation of the region

According to the World Economic Forum, Denmark is the most dynamic and competitive economy in the European Union. Denmark ranked strongly in all areas and was especially outstanding in boosting new enterprises.¹⁸ This is in accordance with the new numbers from Statistic Denmark, which reported that more start-ups than ever were established in Denmark in 2004. In comparison with the year before, there was an increase about 45 per cent¹⁹. Another report, which was carried out by the Economist Intelligence Unit, examines the business environment of the world's 82 largest economies and presented that Denmark will defend its pole position for at least another five years as the world's best business environment. In the Global Competitiveness Report from the World Economic Forum however Denmark reaches 'only' rank four after Switzerland, Finland and Sweden.²⁰ Despite those minor differences concerning the exact ranking position in the different lists, the major trend is clear: that Denmark has to be count as one of the top five countries relating to business climate and competitiveness in the world. Copenhagen as the Danish capital contributes to large extends to the success of the whole country.

Fig. 6: Copenhagen's share on national GDP (in Mio. €)

(Source: own graphic, data based on orestat.scb.se)



<http://www.weforum.org/en/initiatives/gcp/Lisbon%20Review/index.htm>

¹⁹ <http://www.oresundinnovation.org/asp/>

²⁰ World Economic Forum (2006b): *Global Competitiveness Report 2006-2007*

The graphic above shows the share of Copenhagen on the Danish Gross Domestic Product and stresses the importance of the Copenhagen Region for the Danish national economy. There is though the tendency that in Denmark there is to some extent a higher growth rate than in Copenhagen, which results in the slightly decreasing share of Copenhagen on the national GDP. However, Copenhagen's dominating role is still distinguished. This is not unexpected, since Copenhagen is Denmark's only metropolis and large city regions always played an important role as growth drivers. City regions have the power to provide the critical mass relating to skilled labour force, knowledge, purchasing power, international links and technology in a sufficient way.

Until the 1960s, Greater Copenhagen was the unchallenged centre of the Danish industry and industrialisation process. However, after the 60s, there was a successive migration of the industry from East- to West-Denmark taking place. The number of industrial workers decreased in Greater Copenhagen and rose in Jylland. Especially the wood, food and cloth industry was affected by the migration, while Greater Copenhagen kept its role as a leading Danish centre for the medical, graphical, chemical and engine industry. Several aspects caused the deindustrialisation of Greater Copenhagen: Some parts of the industry could not face the international competition and many companies were forced out of business, despite extensive company restructuring efforts. 38% of the industry jobs disappeared due to closure. Another aspect was that the companies in Greater Copenhagen showed a much slower growth rate than companies in other parts of Denmark. Between the years 1972 to 1988, 60% of the greater Copenhagen companies needed to reduce their numbers of employees, while only 40% expanded. Greater Copenhagen was the Danish region with the worst performance. Furthermore, a considerable large number of companies decided to relocate their activities from the Greater Copenhagen region to other parts of Denmark. Therefore, all sectors showed a weaker development in Copenhagen than in the rest of Denmark until the beginning of the 90s. The declining employment resulted at last in a declining population.²¹

Until the mid of the 90's the region was not considered to be a dynamic region, but passed through a remarkable transformation since then. One reason for the low performance in the region was certainly the above-mentioned reorientation of the economy and the decision in the 70's to restrict the development of the capital city region by relocating resources and to guide the economic development rather to other Danish regions. For many years the Danish government was not interested in the growth of Greater Copenhagen, but was following its geographical compensation politic, which included that Greater Copenhagen was subsidising other Danish regions during the 70s and 80s. The development of Greater Copenhagen was never part of a political document and therefore no measures were ever taken.²²

One reason for the successful transformation of Greater Copenhagen is certainly the integration of Sweden and Finland in the European Union in 1995. Denmark entered the European Community already in 1973 and Copenhagen was lying in the outer periphery of the EC. With the extension of the European Union in 1995 to the North of Europe and the formally establishment of the Single European Market, Copenhagen moved from a quite peripheral location to a more central one and its role as a gateway to

²¹ J. E. Nilsson *Blomstrande Näringsliv – Krafter och motkrafter bakom förändringar i europeiska och amerikanska regioner*, Kungl. Ingenjörsvetenskapsakademien, Stockholm 1998

²² *ibid.*

Scandinavia was strengthened. Another boost had the discussions and the establishment of the fixed Øresund link, which supported an active exchange between the Danish and the Swedish side. In the end of the 80's and beginning of the 90's, there was no institutionalised Øresund-network existing, which means that Copenhagen was involved almost inclusively in the Danish national system as the dominating city region and Skåne was part of the Swedish system dominated by Stockholm.²³

Almost 15 years later, the picture changed: Skåne is rather oriented towards Copenhagen and Denmark than towards Stockholm and is part of a strong Øresund-network with several bi-national institutions and worldwide acknowledged clusters. The Øresund Region is now one of the most dynamic regions in Europe and the high numbers of employees in the private and public R&D as well as the well-developed education sector contributes certainly to this positive development. In 2003, a total of approximately 48'000 employees were working in the public and private R&D sector and the Øresund University consortium includes 12 universities with over 150 000 students and 14 000 researchers.

Each year, Cushman & Wakefield carry out a survey with the title 'European Cities Monitor', which examines the attractiveness of the European business locations among Senior Executives from European companies. Relating to this survey, the important aspect to understand is that results are based on the estimation of Senior Executives and not on actual reliable data. For example, the sub-criteria 'Best cities in terms of cost of staff' as well as all the other sub-criteria are therefore rather judged by the impression of the participants than by the analysis of the actual costs. If a city performs in actual numbers better than the impressions of the participants are, there is the necessity of the respective city to improve its reputation by promoting itself.

Copenhagen however is not seen as doing a lot to improve itself and can be found – together with Stockholm and Helsinki – in the bottom of the list. The only sub-criteria where Copenhagen can be found in the top-10 is relating to 'Best city in terms of languages spoken' and 'Best cities in terms of freedom from pollution'. The survey included 16 sub-criteria and in nine of them Copenhagen can be found in the bottom third. Taking the performances of the cities in all sub-criteria, the best European city to locate a business today is according to the survey London, followed by Paris and Frankfurt. Copenhagen reaches position 27, but loses two places since the year before. Nevertheless, Copenhagen is still the second best Scandinavian city, after Stockholm. However, Helsinki and Oslo are close behind²⁴.

With the award 'Scandinavian City of the future 2006/2007' Copenhagen received another affirmation for its successful economical transformation until now and the judges acknowledged especially 'the overall economic potential, cost effectiveness, human resources, transport, quality of life and overall FDI promotion'²⁵. Copenhagen received the same award also the year before, which shows a certain positive consistence in the city's effort to reach excellence.

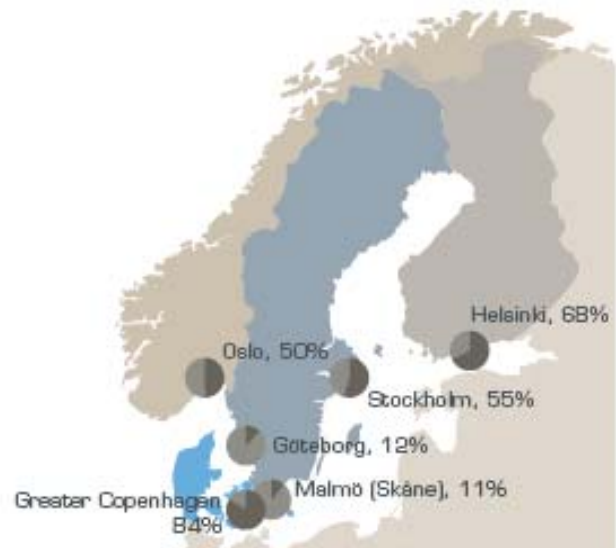
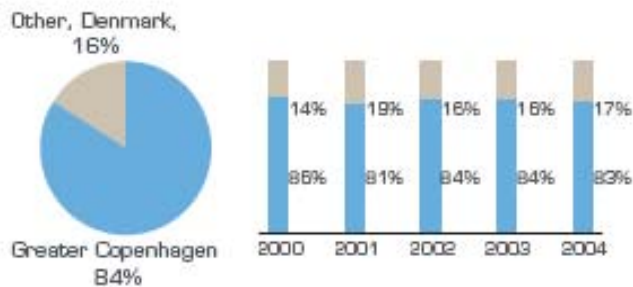
Fig. 7: Greater Copenhagen's share of foreign investment projects in DK, 2000-2004

Fig. 8: Scandinavian city regions' share of foreign investments (number of investments by country). 2000-2004

²³ Å. E Andersson & C. W. Matthiessen *Øresundsregionen – Kreativitet, Integration, Vækst*, Copenhagen 1993

²⁴ Cushman & Wakefield (2006): *European Cities Monitor 2006*, London

²⁵ fDi Magazine (2006): Issue April/May 2006



Source: Copenhagen Capacity, 2005

Source: Copenhagen Capacity, 2005

Copenhagen houses also the only two Danish companies, which were included in the Fortune Global 500 list. This list ranks the 500 largest companies across all industries in the whole world in relation to revenue. The Danish A.P. Møller-Mærsk Group is the leader in the global shipping industry and ranks with 45 billion \$ revenue on the overall 138th place and lies far in front of the next shipping company. The other Danish company is the Danske Bank Group and reaches the overall rank 279 with 24 billion \$ revenues, but does not play a major role in its economic sector. For the Swedish side, none of the companies from Skåne is included in the top 500 list, although Sweden has six companies, which are mostly located in Stockholm.²⁶

The important role of Copenhagen for the Øresund Region is among others shown in terms of foreign investments in the Region. In the year 2005, the Øresund Region in total had the fifth highest number in foreign investment projects in Europe. Copenhagen alone attracted 50 out of 57 projects and concentrated the vast majority of the projects in the Danish capital. Between the years 2003 and 2005, the number of foreign investment project rose by over 57%. Stockholm as the direct Scandinavian concurrent of the Øresund Region attracted a total of 55 foreign investment projects in the same year. With the aid of the good Copenhagen performance, the Øresund Region can be found since the last three years in the European top-10 list regarding to foreign investment projects. Six years ago, the Øresund Region was only included in the top-20 list, which means that the Region and especially Copenhagen were developing since then into an more attractive location for foreigner investors.

²⁶ Fortune Magazine (2007): *Fortune Global 500*, available on:
<http://money.cnn.com/magazines/fortune/global500/2007/snapshots/11152.html>

	Scandinavian	Head	quarters	
	(2000-2004)			
Greater Copenhagen	40	(53%)		Not only in connection with the Øresund Region, but also in comparison with the rest of Denmark, the extraordinary situation of the Greater Copenhagen is obvious: Greater Copenhagen allures since many years over 80% of all investment projects which are done in Denmark as a total. In none of the other Scandinavian countries one city region attracts such a high share of the investments. One
Stockholm	22	(29%)		
Skåne	6	(8%)		
Gothenburg	5	(7%)		
Total	76	(100%)		

explanation could be that some of the attracted investments are not seen as investments in Denmark, but are rather considered as investments for whole Scandinavian. Such investors want to position their investments in a strategic and central location.

Despite the raise in foreign investments, the Copenhagen region has to face however the quite moderate economic growth rate. The GDP is still over the average for the EU-25, but the growth rate was lower than in many other European regions. It is worth noticing that also Stockholm had a stronger growth rate between 1995 and 2003. Also by taking only the Copenhagen region into consideration, it can be seen that Stockholm and many other regions still show a higher growth rate.²⁷

Another remarkable accomplishment is the fact that Greater Copenhagen has an especially high success rate in attracting head quarters. Data from the years 2000 to 2004 reveal that foreign enterprises, which established a Scandinavian head quarter, rather chose Greater Copenhagen than Stockholm. In fact, Greater Copenhagen attracted more than 50% of all newly established Scandinavian head quarters, while Stockholm could only allure 29% in the five year period. Also Skåne performed quite well during the last years and attracted slightly more Scandinavian head quarters than Gothenburg.²⁸ Probably also here, Copenhagen and Skåne profit from their location. The fixed link between Denmark and Sweden strengthened Skåne's and especially Copenhagen's position in being the gateway to Scandinavia and the Baltic Sea Region as well as being the transport hub from Scandinavia to Central Europe.

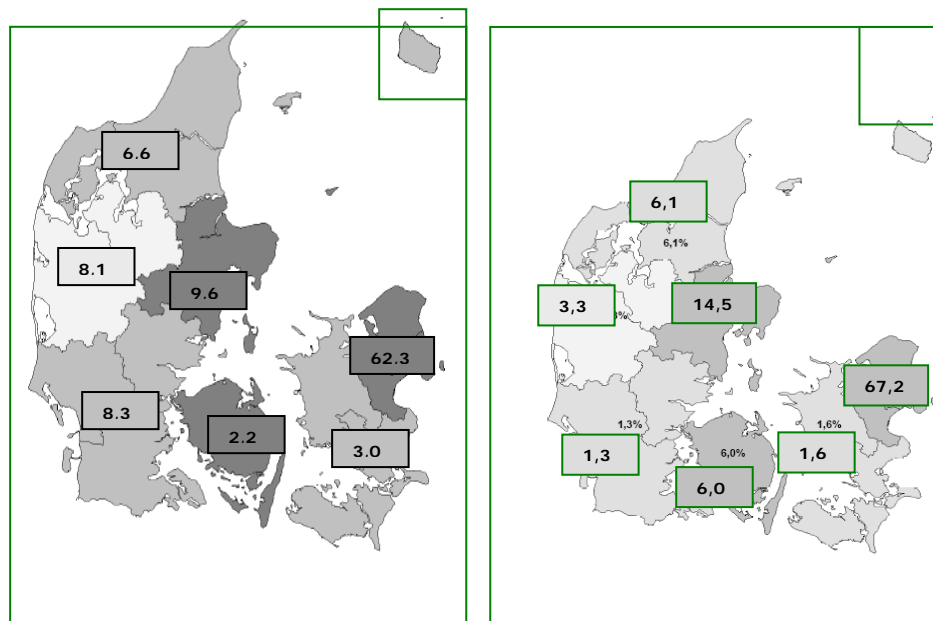
In 1997, the Danish Institute for Studies in Research and Research Policy (AFSK) carried out a research project based on a random sample of around 3'500 Danish enterprises to analyse R&D activities. The result of the project was that 36% of the enterprises with R&D activities were located in Greater Copenhagen and concentrated 63% of the R&D expenditures. This means that in average 12,15 Mio. DKK per enterprise was invested in R&D activities, which is more than double than the Danish average with about 6,87 Mio. DKK per enterprise.²⁹ There is a certain consistency to see, since also three years later the distribution of R&D expenditures is still the same (see Fig. 10). It can be stated that geographically, private and public R&D expenditures are to large extent concentrated in the Greater Copenhagen Region.

²⁷ Öresundskomiteen (2007): *Öresundsregionen i siffror 2007*; available on: http://www.oresundskomiteen.dk/regionen-i-siffror/se/html/00_00.html

²⁸ Copenhagen Monitor No.5 – Investment update from Copenhagen Capacity, Copenhagen 2005

²⁹ AFSK (Analyseinstitut for forskning) *Betydning af regional beliggenhed for forsknings- og udviklingsaktivitet*, Aarhus 2001

Fig. 10: Share of private (right) and public (left) R&D expenditures by region, 2001



Source: AFSK p. 43

Struggling until the beginning of the 90's with stagnation due to de-industrialisation and political decisions, Copenhagen is now part of one of the most dynamic regions in Europe. Copenhagen succeeded to reach within a 15 to 20 year period outstanding positions in several sectors and concentrates the vast majority of foreign investments and R&D expenditures. Its excellent performance in many areas was acknowledged in the achievement of several awards. It can however also be seen that Copenhagen has since several years a slightly lower growth rate relating to GDP than the rest of Denmark. Copenhagen's dominating position is far away from being in danger, but still this tendency needs to be noted.

According to the OECD, Sweden is the 'World's most knowledge-based economy', since Sweden performed the best in relation to investments in knowledge. This means that Sweden has the highest R&D expenditures on total higher education from both the private and public sector.³⁰ In the Global Competitiveness Report from the World Economic Forum, Sweden is listed on third place and impressed especially with its excellence technology readiness and higher education.³¹ Sweden also ranks on third position in the Lisbon Review 2006, which was also carried out by the World Economic Forum. Sweden gets here best marks in relation to Information society and scores high in R&D and Innovation.³² Taking all these good performances into consideration, it is clear that Sweden has, similar to Denmark, to be count as one of the top five countries relating to business climate and competitiveness in the world. Although Sweden has with Stockholm a large city, which attracts a lot of investments and expenditures, the Malmö/Lund Region can be found together with Gothenburg on second place.

³⁰ OECD *Science and Technology Scoreboard*, Paris 2001

³¹ World Economic Forum *Global Competitiveness Report 2006-2007*

³² World Economic Forum (WEF) (2006a): *The Lisbon Review 2006*; available on: <http://www.weforum.org/en/initiatives/gcp/Lisbon%20Review/index.htm>

Skåne as the Swedish part of the Øresund Region is characterized by the two urban centres Malmö and Lund. Malmö as the largest city in Skåne has about 250'000 inhabitants and is an old industrial town. The development followed a similar pattern that the one in Copenhagen. Like Copenhagen, Malmö had to face a serious de-industrialisation process between the 60s and the beginning of the 90s. Also here, similar to Copenhagen, the declining employment was followed by a declining population. Malmö was profiting in the beginning of the 90s from a growing high tech and media industry. Between 1990 and 2000, the Malmö-Region showed a growth of 20,1% and ranked on 8th place among the other Swedish regions.

Lund has no tradition in industrial employment, but is rather known as an old University town. The University plays until now an important role for the city and a number of start-ups and spin-offs related to the University are developed into successful large companies. Outstanding innovations, which are originated in Lund, are among others Tetra Pak and Bluetooth technology.

The Malmö/Lund Region attracted between 2000 and 2004 11% of the foreign investments, which were invested in Sweden as a whole. This is on the same level with Gothenburg, which attracted 12% of the foreign investments. It can be assumed that also the Malmö/Lund Region profits – similar to Copenhagen – from its strategic location in the Øresund Region and attracts investments, which are considered to be investments in Scandinavia. Skåne shows even a slightly better performance in relation to attracting new Scandinavian headquarters than Gothenburg, which supports the above stated estimation.³³ (Copenhagen Capacity, 2005) Sweden's entry to the EU in 1995 is seen as one reason of the strengthening of the amount of foreign direct investments, but also the opening of former protected economic sectors to competition and the newfound independence of the central bank are considered to be causes.³⁴

Concerning private R&D expenditures, Skåne takes the third place behind Stockholm and Västra Götaland County. The ranking shows no change between the places one to three. Between 1997 and 2005 there was a similar positive growth in the private R&D expenditures in Skåne and Västra Götaland of 75% respectively 73%, while Stockholm County had a growth of only 37%. Concerning public R&D expenditures, Skåne ranks on fourth place behind Stockholm, Uppsala and Västra Götaland County. Between 1995 and 2001, Skåne and Västra Götaland had both similar positive growth rates of 10,5% respectively 12%. Uppsala showed a decrease for the same time period of -4% and also Stockholm had a negative rate of -1,5% between 1999 and 2001, while in the years before an increase could be noted. Also here the ranking did not change over the years, although Uppsala County is soon over speeded by Västra Götaland and Skåne County, if the trend does not change. Stockholm is by far the County, which attracts the most private and public R&D expenditures, although especially Västra Götaland County shows higher growth rates. Over one quarter of the public and over one third of the private R&D expenditures are attracted by Stockholm, while Skåne attracts in both cases 15%.

Skåne belongs to one of the most innovative regions in the EU, thus rewarded the European Commission Skåne with the 'Award of Excellence for innovative Regions' in 2001 and 2002. Although Stockholm is the leading economic centre in Sweden, Skåne performs better than Stockholm in several areas: So is the foreign direct investment inflow higher in Skåne than in the capital due to the cross-border business climate. The several strong clusters in the Øresund Region with high international reputation stabilises the region's economy and leads to a higher employment rate than in Stockholm.

³³ *Copenhagen Monitor No.5 – Investment update from Copenhagen Capacity*, Copenhagen 2005

³⁴ Invest in Sweden Agency Business and Investment Opportunities – Report 2007/08, Stockholm

The economic transformation of the Malmö-Lund region has been dramatic in the last three decades. The importance of the mature industries has declined dramatically. Its share of the economy has been reduced by 50 per cent, while the share of the new industries has increased by 100 per cent.³⁵ In total the industrial sector was growing. The growth has been especially strong in the business-to-business service sector. Thus, the reindustrialisation of Malmö-Lund has taken the form of mature industries being substituted with new industries. In the other two Swedish metropolitan region revitalisation of old industries has played a more important role in the reindustrialisation process.

The picture is quite different in the other parts of Skåne In these vitalised industries expanded while the old industries was reduced and in total the size of the industrial sector was reduced by almost 10 per cent. The business-to-business service sector has been growing but is almost 50 per cent smaller than in the Malmö-Lund region. A new division of labour between the Malmö-Lund region and the other parts of Skåne seems to emerge. The former are specialised in advanced business-to-business services, while the rest of Skåne is specialised in a vital manufacturing industry.³⁶ The importance of personal services is also growing in these parts of Skåne.

2.2 The integration process

Initially the integration process in the Öresund region primarily manifested itself in the creation of a number of cross-boarder organisations, which aimed at support political corporation – the Öresund Committee - or to promote transnational regional clusters and networks. The work in the Öresund Committee is guided by an overall vision of the Öresund region developing into Europe's most functionally integrated boarder region.³⁷

The intention to form one common region did however not start with the creation of these institutions, but is over hundred years old. The probably most radical vision was discussed in the 60s: the idea was to create Örestad, a linked city belt along the coast lines of both side of the Sound and fixed links in the North and the South of Örestad should ensure a permanent exchange. This vision emerged out of the expected regional growth in population, traffic and economy, which should lead to a vanishing distinction between the cities Copenhagen, Malmö, Helsingborg, Helsingør, Landskrona and Bromma. This should eventually result in the formation of one large physical city belt with one common political administration.³⁸ In the light of this discussion a new city quarter named Ørestad was build near Copenhagen as one element in the vision of Örestad. 40 years later, the coast line shows indeed an increasing population and the region Hovedstaden is absorbing surrounding municipalities little by little, but the creation of a huge, physical city belt is still only a vision.

The Swedish side shows indeed a lower population density than the Danish side, but is recently included in one common labour market. After the 70s, the vision of Örestad was not included in discussions any more and nowadays it is more the regional aspect of the Øresund Region, which is included in the political agenda rather than the vision about a physical construct. In the 80s, both Malmö and

³⁵ K. J. Lundquist & L. O. Olander, *Omvandlingens geograf. En studie I svensk ekonomi och regions roller enom tre decennier.* Lunds universitet 2007.

³⁶ Ibid. p.136

³⁷ Action plan for he Öresund Committee 2005-2006 *The ongoing development of the Øresund Region.*

³⁸ P. Boye *Developing transnational industrial platforms – the strategic conception of the Öresund region,* Lund 1999

Copenhagen were struggling with a declining traditional industry resulting in a decreasing employment rate and migration trends of the population. With the discussion about the integration of Sweden in the European Union, Joakim Ollén, at that time local council in Malmö, began to realise how this could influence the possibilities of the Øresund Region. Soon a Danish supporter was found in Jens Kramer Mikkelsen, who was at that time major of Copenhagen. These two idealists succeeded to form an informal alliance, which resulted later in the establishment of the Öresundskomiteen in 2003 as a platform for the regional and local politicians.³⁹ (Öresundskomiteen, 2003)

Great hopes were connected with the establishment of the Øresund Bridge as the first fixed link between Denmark and Sweden. The construction of the bridge had the intention to promote the exchange of goods, people and knowledge in order to advance the integration process of the cross-border region. Without any doubt the bridge improved the accessibility between the two dominating urban centres of the Øresund Region. Copenhagen as the Danish capital is the administrative and post-industrial growth centre in Denmark, while the bipole Malmö-Lund does not possess a similar strong position in the Swedish system but can still be considered as a centre of great regional attraction. The importance of the Øresund Bridge for the integration process can be seen in results like:

- The transport of passengers with the Øresund trains is growing fast
- Car traffic on the bridge is growing
- The number of boarder commuters has tripled
- The number of student commuters is growing in both directions
- University cooperation has strongly developed
- A long-standing hospital cooperation is being formalized
- The purchase and establishment of companies across the Sound has more than doubled during the last years

Until 2020 it is expected that the daily commuters will account for over half of the car traffic per day, while the majority of the commuters will still use the train.⁴⁰

The major driving forces behind each economic integration process in cross-border regions are often the creation of synergy effects, the exploration of new potentials and the search after complementarities.⁴¹ In the case of the Øresund Region, Malmö-Lund as well as Skåne in total profits from the close connection to the growth pole Copenhagen, while the Danish capital profits from a better accessibility of a wider consumer market in Scandinavia and from increased activities of Swedish entrepreneurs in Copenhagen. Several reports⁴² show that the number of Swedish enterprises in several industrial sectors increased strongly in Greater Copenhagen directly after the establishment of the Bridge.

³⁹ Öresundskomiteen (2003): *Öresundskomiteen 10 år, Copenhagen*; available on: http://www.oresundskomiteen.dk//site_dir/oeresund/upload/historiedok.pdf

⁴⁰ Öresundsbron (2007): *Fokus Öresund*, Nr.2 April 2007; available on: <http://osb.oeresundsbron.dk/library/?obj=5091>

⁴¹ K. J. Lundquist & L. Winther The Interspace between Denmark and Sweden: The Industrial Dynamics of the Øresund Cross-Border Region; in: *Danish Journal of Geography* 106(1) 2006 p. 115-129

⁴² For further reading see among others: Öresund IT Academy (2003): *IT-sektorens udviklingsmuligheder i Øresundsregionen - en analyse af erhverv, forskning og uddannelse*, Roskilde; Boston Consulting Group (2003): *Commercial attractiveness of biomedical R%D in Medicon Valley – the role of R&D in attracting regional investments*, Copenhagen as well as Copenhagen Capacity *Copenhagen Monitor No.5 – Investment update from Copenhagen Capacity*, Copenhagen 2005

A few years after the opening of the bridge, the Øresund Region is an integrated part of the majority of the inhabitants. This conclusion was stated in a report from the analytical institute Norstat, which was commissioned by the Øresundsbron Consortium to carry out an analysis about the integration in the Region. This is in accordance with the outcome of another survey carried out by the Øresund Bridge analysis department: Over 70% of the regional population believes that the two different parts of the region will be grown together in at latest two to four years. One year before, only 45% of the regional population were this opinion. In order to stimulate a faster integration by strengthening the exchange of people and goods, the City of Malmö has the intention to reduce the bridge tariff. But also without a reduction in the bridge tariff, the traffic across the Øresund increased steady over the last years. Also the number of commuters is increasing significantly. The vast majority is commuting from the Swedish to the Danish side, which reflects the high migration numbers of Danes moving primarily to South-Western Skåne by at the same time keeping their jobs in Denmark.

The integration process of the Øresund Region proceeds fast, but differences in the national systems, tax systems and regulatory frameworks are among others still barriers for the economical co-operation across the Sound. But with the construction of the Bridge the accessibility was improved and the possibility for the population was created to commute daily between the two parts, which will advance the integration process.

2.3 Cluster in traditional industries

2.3.1 The logistic cluster

The Øresund Region has naturally a long history as an important transit region for goods. Due to the location of the Øresund Region, 25 Million consumers in Scandinavia and another 125 Million customers in the Northern part of Central Europe can be nowadays fast accessed showing the demand after a well functioning logistic. From Copenhagen and Malmö these customers can be reached within 24 hours without using express deliverance. Over the last years the cargo volume in the Øresund Region decreased, while in the European Union in total a slight increase could be seen. Nonetheless, the logistics still play an important role for the regional economy; so are for example still over 77 000 people employed although the number is declining. In 2003 the organisation Øresund Logistics started its operations as one part of the Øresund Science Region in order to guide the activities on both sides of the bridge. The aim is to develop the Øresund Region into one of the three leading European logistic hubs, in a physical and also in an academic way. This quite young network has already over 1 200 representatives from logistic companies, government and universities generating values for all participants.

As two examples for logistic companies based in the Region, two quite different companies were chosen: The Maersk Group as an international player with a long tradition and the Malmö Main Air Cargo as a young but quite successful company performing in a rather small sub-sector of logistics.

The Maersk Group, the largest intercontinental transport company in the world, has its head quarter in Copenhagen, but was originally founded in Svendborg, Fyn. Father and son buying a second hand steamer incorporated the company in 1904. Until 1912 the company could successfully extend their fleet to six ships and established a second company in Copenhagen: Dampskibsselskabet af 1912 (The Steamship Company of 1912). The company continued to grow fast and in 1917 their own shipyard was opened in Odensk. During the Second World War the company lost over half of its fleet, but regained strength fast in the post-war era due to increased international activities. Of special importance was the contract with the California Shipping Company ordering a number of 50 000 ton ships in the mid 1950s.

This forced Maersk to open up new shipyards leading to a considerable growth of capacity. Another important event was the exclusive concession to explore and produce oil and gas in Denmark, which was granted in 1962.

Throughout the following years the company added new subsidiaries and new competences like Maersk Medical subsidiary. Suffering from the decline in the global shipping market around 2001, the company announced to rather concentrate on its core competences and to sell non-core subsidiaries.⁴³ Over the last few years the revenue is growing again and nowadays the Danish A.P. Møller-Mærsk Group is included in the Fortune Global 500 list as one of only two Danish companies. This list ranks the 500 largest companies across all industries in the whole world in relation to revenue. The Maersk Group is the leader in the global shipping industry and ranks with 45 billion \$ revenue on the overall 138th place and lies far in front of the next shipping company. The other Danish company is the Danske Bank Group and reaches the overall rank 279 with 24 billion \$ revenues, but does not play a major global role in its economic sector.

Another company within the logistic sector is the Malmö Main Air Cargo company (MAC), which was established 2000 at the Malmö-Sturup airport and deals with cargo handling. The development of this company shows that although the air cargo volume is rather stagnating in the Øresund Region over the past few years a new established company can still have extraordinary growth rates in this field. The company is considered in Sweden as a gazelle company. This means that the company had for the last four years straight an annual growth rate of at least 20% measured by growth in sales revenue. The sales revenue grew from 2,5 Million € in 2000 to 13,8 Million € in 2005. The good performance caught the attention of the large logistic group John Menzies with its base in Edinburgh, which acquired MAC in August 2006 in order to expand its operations into the Scandinavian market.⁴⁴

The Øresund Region has two international airports, a tight network of railways and roads as well as several ports presenting good conditions for the cargo transport. Based on a survey of Øresund Logistics, storage was identified as the main activity within the cluster, followed by transport. These two main activities are characteristic for a logistic hub. The good logistic infrastructure attracts international companies: in 2003 Dresser Wayne Europe, a supplier of energy distribution technology relocated its European headquarter and manufacturing plant from Germany to Malmö in Skåne due the logistical opportunities offered in the region. This plant will produce all European export and although Germany is the largest market, the relocation from Germany to Sweden already boosted the operations of the company. (ISA, 2003a) According to an article published in the end of 2007, Dresser was so successful that the company extends its activities in Malmö. In the next few months 30 new job places will be created summing up to a total of 280 employees in Malmö. And also Royal Scandinavia, the parent company of numerous glass and porcelain companies in Denmark and Sweden chose to establish a new distribution centre in the Øresund Region due to the logistic opportunities.⁴⁵

⁴³ J. Pederson *International Directory of Company Histories*, Vol. 57, Detroit 2003

⁴⁴ Invest in Sweden Agency *Scottish logistics firm buys in Malmö*; Article from 29.08.2006, available on: http://www.isa.se/templates/News___51426.aspx

⁴⁵ Invest in Sweden Agency *Øresund bridge/tunnel link key to Royal Scandinavia in Malmö* Article from 16. February 2000 available on: http://www.isa.se/templates/News___3029.aspx

Furthermore, the car manufacturer Toyota chose to establish its Nordic hub in Malmö. The decision was made upon the strategic position of the Øresund Region for Scandinavian and its close position to the Baltic States. It is expected that every year around 80'000 cars are passing the distribution centre on the way to distributors in Finland, Denmark, Norway and Sweden. Linked with the new distribution terminal is the decision of the Japanese company to withdraw from four minor ports in Denmark, Sweden and Norway in favour of the new terminal. It is expected to increase the company's efficiency and to decrease the deliverance time for the customer.⁴⁶

Not only new companies are attracted to the region, but already established companies can merge. The ongoing integration process in the Øresund Region led to new discussions also in the logistic sector: Just a few weeks old is the discussion in which a newly published Swedish governmental report suggests to sell the governmental shares on the international airport in Malmö to Copenhagen-Kastrup. From the other side of the bridge, the Danes signalled a certain interest, but stressed also the need for some analysis on which the decision can be based on.⁴⁷

The logistic sector in the Øresund Region experienced a structural change over the past few years. This change is mainly based on the shift from material production to a more service oriented approach of the economy. This shift led to a weaker need of good transports compared to the growth of the knowledge based economies. In the EU there was only a weak growth rate for the logistic sector, while the Øresund Region even had a decreasing number of cargo turnovers in tonnes. A connection can be seen in the declining importance of the industry sector compared to the growing significance of the service sector.⁴⁸

The development of the logistic sector is therefore closely linked to the development of the regional economy. The decline in the industrial sector was more severe in the Danish side of the Øresund, which also can be seen in the decline of the logistic sector in Sjælland, while Skåne had a slight increase. The industrial production stands for 10% of the economy in Sjælland, but for 18-19% in Skåne (Øresundsbron, 2007). With its status as the Danish capital, Copenhagen was more successful in attracting service companies than Malmö-Lund leading to a faster transformation of Copenhagen's economy. Projecting these tendencies into the future, it can be expected that the cargo volume will decrease continuously and that also the Swedish side of the Øresund will soon have a negative growth rate due to the decreasing importance of the manufacturing industry. This development in terms of cargo volume has of course an impact on the employment numbers. A heavy concentration of the employees of the logistic sector can be found in the centre areas Copenhagen and Malmö, while the largest growth rates occur in more peripheral areas with low absolute numbers on the Swedish side. The slightly rising number of employees in Skåne however does not compensate the relatively large declining number on the Danish side: Overall seen, the number of employees is declining with around 7,4% from 1998 to 2004.⁴⁹

⁴⁶ Invest in Sweden Agency *Toyota showcases new Malmö hub*; Article from 11. June 2003, available on: http://www.isa.se/templates/News____2510.aspx

⁴⁷ Copenhagen Capacity *Danish-Swedish airport merger moving closer*, available on: <http://www.copcap.com/composite-10761.htm> 17.10.07

⁴⁸ P. A. Hansen & G. Serin G. Regionala näringslivsstrukturer i Öresundsregionen – mellan centrum och periferi, forskningsrapport No. 122; Roskilde 2001

⁴⁹ *ibid.*

A potential growth factor in the future can be the recent opening of the Eastern Market and the ongoing shift of manufacturing from the region to Asia, which might result in an increasing cargo import from these countries and compensate the logistical results of the declining manufacturing industry in Scandinavia. Another growing sub-sector within the logistic sector is the supporting services: The supporting services are the only sub sector, which shows a positive growth in the Øresund Region in total. Just like in the rest of the economy there has been a shift towards a service-oriented approach resulting in a growth of the supporting services. The share of supporting services is largest in Skåne with 30% of the logistic in Skåne, but the fastest growth is occurring on the Danish side of the Øresund, which has a share of 25% in the Danish part.⁵⁰ Just like any other industry too, the logistic industry has to fulfil the demand of the customers about ‘Just in time’ deliverance. In order to be able to fulfil that demand, the focus on intermodal transport systems increased. Such just in time deliverances demands after new intelligent solutions and stronger research activities. A new logistic centre at the Lund University is established in order to meet the demand of the regional logistic industry after a stronger R&D. The Next Generation Innovative Logistics Center (NGIL), located at Lund University’s Institute of Technology, is a centre of national excellence in innovative logistics and it is estimated that 23 Million € are needed to build up the centre, whereof one third will be raised by VINNOVA.

Due to its geographical position, the cargo logistics of the Øresund Region is mainly competing with regions in Northern Europe and the Baltic Sea. Except for the international airport in Copenhagen, no other infrastructure is really competing on the global level. Västra Götaland is claimed to be one of the major competitors of the Øresund Region relating to the logistic sector, since Skåne and Göteborg are considered to be Sweden’s export doors to the world. Sjælland does not play the same important role for Denmark, since the vast majority of the industrial production is located in Fyn and Jylland and the export is here more oriented to the West and South not crossing Sjælland. According to a report from the University of Roskilde for the organisation Øresund Logistics, Västra Götaland deals only with a fraction of the Øresund’s cargo turnover and also in absolute numbers of employees the Øresund Region is far ahead.⁵¹ The size of the logistic industry in Västra Götaland is therefore more comparable with the Swedish part of the Øresund logistic industry than with the size of the Øresund logistic industry in total. Similar to the Øresund Region, also the logistics in Västra Götaland is facing challenges resulting in a stagnation of the employment rate. Different however is that especially the air transport, including the transport of people, is a growing sector in Västra Götaland.

An important reason for the success of the Øresund Region as the major logistic hub in Scandinavia is certainly its strategic position as a link between Scandinavia and the rest of Europe. The region however is not only trusting in its natural advantage, but invested considerable sums in developing additional advantages further. The Øresund Region is nowadays considered to have one of the most modern and efficient infrastructures in Europe attracting many international logistic companies.

With the new centre of excellence at the Lund University a platform is established which encourages a close co-operation between private companies, university and public sector. Several research projects

⁵⁰ Øresundsbron (2007b): *Facts worth knowing about the Øresund*, available on: <http://osb.oeresundsbron.dk/library/?obj=5034>

⁵¹ P. A. Hansen & G. Serin G. Regionala näringslivsstrukturer i Öresundsregionen – mellan centrum och periferi, forskningsrapport No. 122; Roskilde 2001

related to smart and efficient solutions for logistical problems will be realised at the centre enabling to recruit new researchers and to contribute to the changing demands of the logistic sector. As already now can be seen, the fields with the best potential for the future are the supporting services and air cargo. The shift from a former industrial to a service dominated regional industry will lead also in the future rather to a demand after quality than quantity transport systems.

2.3.2 The Food cluster

'The functional foods business is a new Scandinavian area of cooperation that blends biotechnology with the traditional food industry, and it has grown up from a great collaborative spirit involving government, industry and academia. The key players in the functional foods industry are based in Skåne, a province known as the breadbasket of Sweden.'

From the US-based newsletter ScienceNextWave, May 2003

From the European point of view the food and beverage industry is seen as a major contributor to the European economy, but with still insufficient R&D expenditures.⁵² Due to the increasing significance of the functional food segment relying on R&D, the food cluster in the Øresund Region meets the demand of the EU after more R&D activities within the food industry. Functional food however is just one part of the Øresund food cluster, which is one of the largest food clusters in the world with an annual turnover of about 48 billion € and a high export rate. Due to its high share on the regional employment and regional GDP, this cluster is of special importance for the regional economy.

The Øresund Region have a long history as the main producer of Scandinavian food products. Over the past 10 years however, there was a decrease in the numbers of food producing companies but also of employees accounting with around 225'000 employees to almost 20% of the total employment in the region.⁵³ The declining number of employees might be a result of the shift from the traditionally food production to a more research based approach, while the decreasing number of food companies can be explained by the tight co-operations with biotech: Biotech companies are more and more engaged in co-operation with food companies delivering a good research base needed for the development of healthy food products. The food industry is using the biotech for outsourced activities ensuring high quality R&D. Most interesting for this report is therefore how the new food science is developing in the region rather than the traditionally food production. In the following there will be for that reason an emphasis on the development of the functional food activities.

Ceba Food is a Swedish company strongly involved in research and development within the functional food area. The main product of the company is the patent protected trademark Oatly, which is a result of the intensive and long-term research activities at the Lund University. The company was established 1994 in order to commercialise the research results gained at the university; already in 1996 Danone launched its first oat product using the trademark of Ceba Food. Although the sales results of the product were rather disappointing at that time, the oat products found later an increasing market all over the world. Nowadays Ceba Food dominates the European Oat product market and plays a major role in the global market (Lagnevik, 2003). According to its profile as a research intensive company, Ceba Food invests currently around 7% of its annual turnover to R&D compared to the average of 1-2% for the European

⁵² CIAA Data & Trends of the European Food and Drink Industry, Brussels 2006

⁵³ EMCC (2006): *The food cluster in the Øresund Region*, Dublin

food industry in total . In 2005 the company took the decision to build an own factory in Landskrona investing 13 million \$ in the facility in order to meet the increasing demand after oat products. Although already established in 1994 the company is still considered to be a gazelle company with 20 – 30% annual growth rates for the last years straight .

The food cluster calls itself the most innovative food cluster in Europe and the world leader in functional food development. The presence of large international companies like Nestlé, Unilever, Carlsberg and Campbell Soup show the attractiveness of the location. The Øresund Region is the first choice of international food companies willing to establish a manufacturing and/or research plant in Scandinavia. One aspect in the choice is certainly the geographical location of the Øresund Region, but also the excellent reputation of the regional food industry and its R&D is another driver. Skåne alone for example houses around half of the Swedish R&D expenditures within food, showing the important position of the research for the cluster. Known regional based products are Becel, Oatly as well as other research results within functional food developed in one of the many laboratories. Oatly was developed at the Lund University as a suitable product for people with milk intolerance, which lowers additionally also the blood cholesterol level.⁵⁴

In order to strengthen the so far gained competences, the Functional Food Science Centre with several research groups was formed in January 2000 based at the Lund University providing a perfect environment for innovations and research. Functional food is however only one part of the food cluster, but offers best possibilities for research and industry. The functional food market is predicted to be the segment in the food market with the highest potential growth rates of annually 15 to 20% due to changing consumer trends and lifestyle including increasingly the dietary aspects. Regional companies producing special kind of food like organic or functional food show annual growth rates of between 10 to 30% in average.⁵⁵ Biotechnology introduced many new competences into the food cluster and is therefore of special importance for the functional food. These competences are certainly one driver for the successful research activities within the regional food industry. It can be said that the region is currently in a transition from food industry to food science using a tight co-operation with the rather successful biotech cluster.

The Øresund food cluster has an excellent reputation also outside of the European Union: Rowett Research published in 2002 a report in which the food cluster is addressed to as probably the most successful global food cluster. And especially the research activities with functional food attracted the attention of the US food industry and market.

Clusters are closely linked to the term innovations in order to promote a certain dynamic within the cluster. In case of the European food cluster, the European Union would like to see more innovations, but studies suggest that there are simply too few innovations in the food industry.⁵⁶ The R&D expenditures remain low and the failure quota of food innovations is high. With the high R&D expenditure concentration on especially the Swedish side and an export share of around 60% on the produced food and beverages, the Øresund Region seems to have good requirements for a successful and competitive food cluster. With newly emerging competences like functional food, the regional food cluster will

⁵⁴ M. Lagnevik *The Dynamics of Innovative clusters: A study of the food industry*. Lund 2003

⁵⁵ EMCC *The food cluster in the Øresund Region* Dublin 2006

⁵⁶ For further reading: M. Lagnevik *The Dynamics of Innovative clusters: A study of the food industry* Lund 2003 as well as B. W. Traill, M. Meulenber, (2002): *Innovation in the food industry*, in: *Agribusiness* 18(1)

tighten up its cooperation activities with the regional biotechnology cluster profiting from an excellent research infrastructure and an outstanding international reputation of Medicon Valley.

2.4 Clusters in new industries

2.4.1 The Environmental cluster

Especially after the UN conference in 1992 with the title ‘Conference on Environment and Development’, the environmental aspects came in the spotlight of the public and political attention. The term sustainability was coined and environmental aspects were stronger integrated into political documents. Due to the general popularity, the demand after environmental related services and products emerged several years ago. A number of western countries like for example Denmark, Sweden and the Netherlands were exemplary countries with relatively large research activities within the environmental sector. Denmark for example was the first country in the EU introducing taxes on CO₂ and generates nowadays 20% of its energy need from wind power. The Øresund Environmental Academy takes this progress and tries to strengthen a possible environmental cluster in the region.

Already quite early the environmental dimension was introduced in the Øresund Region. In 1994 the Danes and Swedes aiming to make the Region one of the cleanest urban regions in the European Union initiated a joint project. In 2001, the Øresund Environment Academy was established by the Øresund University as a cluster initiative intending to ‘*promote dissemination, innovation and commercialisation of environmental knowledge and research*’ as well as to ‘*make the Øresund Region better known as a world leading environmental cluster, thus attracting environmental experts, researchers and competencies*’.⁵⁷

The environmental sector is hard to define due to its relevance for other industries. Each industry has nowadays the intension to keep the negative effects on the environment as low as possible investing in environmental-friendly technologies and processes. Included in the activities of the cluster initiative Øresund Environment Academy is two main areas: the waste disposal and recycling on one side and the more research based fields like sustainable energy sources. Included in the employment numbers are therefore also the people working for the waste disposal and recycling, which account for the highest share on the employment and also for the majority of the annual turnover. The employment here however shows stagnation on the Swedish side, while on the Danish side a decline can be seen.

Responsible for the overall increasing employment rate in the environmental sector is rather the increase in the consulting business on both side of the region.⁵⁸ (Hansen et al., 2003) Additionally to that it is especially the production of wind mills for energy generation which contributes to the growth on the Danish side; a branch which can not be found on the Swedish side of the region. Denmark for example was the first country in the EU introducing taxes on CO₂ and generates nowadays 20% of its energy need from wind power. The largest offshore wind farm in the world, Middelgrunden Windmill Farm, is located near the Copenhagen harbour producing around 3% of Copenhagen’s power consumption. Due to the

⁵⁷ Øresund Environment Academy, 2007

⁵⁸ P. A. Hansen et.al *Miljøsektoren i Øresundsregionen - en analyse af forskning, uddannelse og erhverv*, Roskilde 2003

importance of windmills for the energy generation in Denmark, the environmental sector has a relatively high share of employees working within the production of windmills.⁵⁹

Similar to the regional food cluster the emerging environmental cluster has several segments which are research intense and show extraordinary annual growth rates. A focus on these potential segments will help to develop new core competence enabling to compete on a European and even international level.

Despite the popularity of sustainable development and the stronger integration of environmental aspects in political documents, institutionalised environmental clusters are still rare. There might be several reasons for this: environmental aspects are mainly included in the activities of other clusters and are therefore not gathered in one specific cluster. Another reason might be the understanding of the industry that environmental activities are still linked to decreasing financial winnings. The introduction of environmental aspects in industrial production is still connected with restrictions and expensive reorientation of the process. Few companies see this field as profitable investment opportunities.

Most regions in the western world include environmental aspects, but those are often limited to the improvement of the already damaged environment. Such end-of-pipe approaches need to be replaced by the stimulation of innovative and environmental-friendly technologies. With the initiation of a potential environmental cluster, the Øresund Region is one of the few regions in the world, which include coordinated R&D activities within the field of environment. Within the wind turbine manufacturing and development, the Øresund Region has however in Jylland strong competitors, where most of the large manufacturers are located like Nordex Denmark, Siemens Power Generation and Vestas. Jylland has in comparison with the Øresund Region better position due to its high concentration of large companies and research activities.

The associations of environmental aspects with restrictions and a reduction of the financial gains are still dominating the understanding of the economy. Beside the business with waste disposal and recycling, the environment is not very often linked to as a field of business opportunities. Within the environmental sector in the Øresund Region an environmental cluster is currently emerging trying to combine business opportunities and environmental-friendly technologies. The initiative is still very young and therefore it is hard to estimate the effects of their activities. The focus areas of the environmental cluster should be the production and development of wind mills for energy generation as well as the consultations. These two segments were proven over the last few years to be the fields with high growth rates and it can be expected that this trend will continue. Innovative, but environmental-friendly technologies should be promoted in the region. The intention to create a comprehensive environmental cluster however might encounter soon difficulties. Due to the large variety in which environmental friendly technologies can be used, the approach of an environmental cluster might be chosen too wide. In order to gather core competences within the environmental sector, focus areas need to be chosen aligning the skills towards some selected areas.

2.4.2 Medicon Valley

Although early states of biotechnology has been used in food and pharmaceuticals for several decades, like the fermentation and pasteurisation processes, it was the exploration of the 'modern' biotechnology

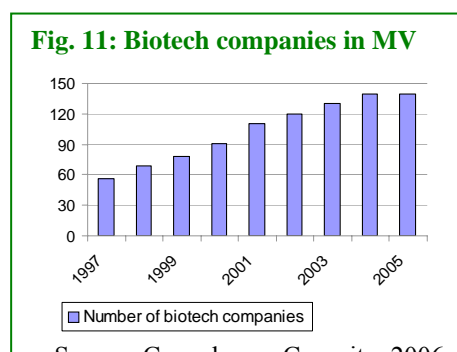
⁵⁹ P. A. Hansen et.al *Miljøsektoren i Øresundsregionen - en analyse af forskning, uddannelse og erhverv*, Roskilde 2003

in the 60s and 70s that led to a rapidly increasing number of life science applications in the following years.⁶⁰

The development in the Øresund Region followed a similar pattern: H.Lundbeck, for example, originally founded as a trade company, started already in the 20s to be involved in the pharmaceutical industry. But it was not until the 70s, where the biotechnological activities rapidly increased. More and more life science companies emerged, but also the settlement of plants from large companies outside the region led to a growing number of companies. For example, Alfa Laval, originally founded in Stockholm in the 18th century, established its international headquarter together with large research facilities in Lund in the 70s and also Astra, nowadays AstraZeneca, located a large R&D facility in the region some years earlier. The life science industry arose in the region by increasing the number of start-ups, although not so much in the 70s, but later in the 80s and 90s. First intensive activities begin in Skåne in the 80s, where numerous university-based research outputs resulted in spin-offs like BioInvent and Biora. On the Danish side the development started slightly later, but nowadays Greater Copenhagen is the centre of attraction with much higher start-up rates, although Skåne is slowly catching up.

The rudimental concept of Medicon Valley was brought in discussion in 1993 by a book of the two urban geographers Wichmann Matthiesen and Andersson⁶¹, which highlighted the great potential of the life science industry in the region, in particular, the medical research. The book did not only show the European top-3 position of the Øresund Region in terms of medical publications per researcher but also stressed the good co-operation between the two different parts of the region already at that time. The findings of this book caught the interest of the Øresund Committee and one year later the term ‘Medicon Valley’ was introduced, expressing the intention of the Committee to focus on biotechnology in order to promote the development in the region. Shortly later, the cluster authority Medicon Valley Academy was initiated not only to promote the idea of a life science cluster, but also to help to improve the knowledge transfer between the regional universities and the private economy. Medicon Valley Academy, recently renamed to Medicon Valley Alliance, has nowadays a central role in coordinating the cluster activities and to initiate collaborations between the different companies.

The presentation of the development of several selected life science companies in the region will be given in order to illustrate the development of Medicon Valley from the companies’ point of view and how the business structure did change over time. The years before mostly larger, regional companies and the settlement of manufacturing and research plants of large companies from outside the region dominated the 80s and especially 90s. But in the end of the 80s and beginning of the 90s the emergence of regional start-ups and spin-offs contributed to a great extend to the fast-pace development of Medicon Valley, although research and manufacturing plants from large international companies were still attracted.



The figure to the left illustrates how the number of existing biotech companies in the Øresund Region developed over time. The figure includes only the number of biotech companies, but the number should look similar to the rest of the life science companies. The figure should anyway be representative for the life science cluster in

B. Explaining Spatial Patterns of Innovation: Analytical and Synthetic Modes of Life Science Cluster; **Forthcoming in Environment and Planning A**

Øresundsregionen – Kreativitet, Integration, Vækst; Copenhagen 1993

total, since the biotech companies are representing almost the half of the regional life science companies. It can be seen that the number increased rapidly between the mid 90s and the beginning of 2000. Since 1997 on, the number of biotech companies had more than doubled, giving a total number of 140 in 2005. The last few years however were dominated by a decelerating growth rate, which finally resulted in stagnation.

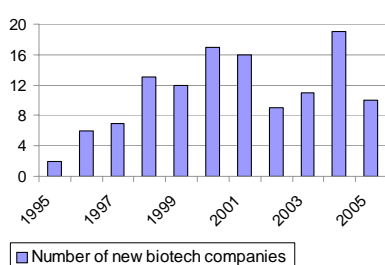
Biotech Scandinavia identified in 2007 several key companies within life science industry for the Øresund Region. The vast majority of the identified companies are located either in Lund, Skåne, like Gambro, Active Biotech, Alligator and Cellavision, or in Greater Copenhagen like H. Lundbeck, Novozymes and Novo Nordisk, which however have mostly large manufacturing or research plants in Skåne. These two are the clear concentration centres in the region, where Greater Copenhagen is the largest. The other key companies are enterprises with headquarters in Stockholm County, but with large R&D facilities in Lund or Greater Copenhagen like AstraZeneca, Biogaia and recently established Biogen.

On the Danish side H.Lundbeck is identified as one of the regional key companies. Established in 1915 as a pure trading company, H.Lundbeck started in 1924 to be involved in the pharmaceutical industry. After almost 60 years of constant growth, the product variety was too wide to maintain overview; therefore the decision was made to reduce the numbers of products clearly in the mid 70s. Especially the cosmetic products, which provided until the end of the 70s a reliable source of income, should be cut away from the product range. With the focus on medicine development, especially to treat the diseases of the central nervous system, the earnings of Lundbeck in the 80s were disappointing. The research activities in a new field are cost-intensive and time-consuming, at a time when increasing demand for environmental and safety improvements required major investments. In the 90s, the company experienced finally dramatic growth rates based on the finally successful former research activities. The product Cipramil®, for example, which grew later to be the most dominating product in the company, had a development time of over 15 years. Around 40% of its 5 500 employees are hired in Denmark and are concentrated in Greater Copenhagen, although the share of employees hired outside of Denmark was increasing constantly over the last few years. Lundbeck is in the need of highly educated people, since the company is focused on research and product development. For that reason, over 40% of the Danish employees hold a university degree of which 13% are PhD candidates, which expresses the close cooperation with the regional universities. Also Novozymes stimulated the region's ability to research and boosted the cooperation between academia and private economy. Several business decisions, which turned out not to be marketable and the resulting financial loss forced Novozymes to reduce its number of employees during the 70's and 80's. After recovering from these setbacks, Novozymes currently employes around 4'500 people all over the world of which half are employed in Denmark mostly in Greater Copenhagen.

AstraZeneca was established with the fusion of Astra (Sweden) and Zeneca (UK) and employees nowadays around 12 600 employees in Sweden and 64 000 worldwide. Astra founded 1960 an R&D facility in Lund with a close relation to the University. Currently 1'200 researchers are working there, of which 20% are educated PhD researchers. The R&D facility in Lund is one of three in Sweden, but is also

the smallest of AstraZeneca in Sweden. Between the years 1997 and 2003, AstraZeneca reduced its number of employees in Malmö/Lund, although the number of employees in Sweden increased by 38%. The number of employees in Malmö/Lund decreased therefore in favour of Stockholm and Gothenburg. Not only AstraZeneca favours Stockholm and Gothenburg, but also

Fig. 12: New biotech companies in MV



Source: MVA, Homepage, 2007

other companies: Stockholm/Uppsala and Gothenburg have much higher growth rates in number of employees than Malmö/Lund. Stockholm even replaces Malmö/Lund as the region with the highest number of employees within biotech companies.

Another key company is Gambro, which was founded in 1961 by industry mogul Crafoord and Prof. Alwall, who invented the first artificial kidney. The young company aimed to develop the first, university gained results further into a marketable product. From this time on Gambro expanded and did not have any major setbacks. Nowadays, Gambro is seen as one of the key companies in the Øresund Region.

Beside these large enterprises, Medicon Valley is characterised by other, relatively new established life science companies with a strong research profile and growth: Active Biotech with 230 patents and 89 employees, which was founded 1997 as well as Cartela AB founded in 2000 which has currently 15 employees and 7 patents, only to mention a few. The figure to the left shows how the number of new established biotech companies, both start-ups and university spin-offs, developed over time. Like the figure above, this figure shows also only the number of biotech companies, but the number should look similar to the rest of the life science companies. The number increased rapidly between the mid and the end of the 90s. Although 2004 had the highest number ever, the overall tendency of deceleration can be clearly seen. Due to the change in the investors' behaviours to invest in fewer companies but with larger investments, the number of start-ups dropped so dramatically.⁶² The business structure shows nowadays a balanced mix between larger companies with plants in the region on one side and young regional companies on the other hand. The close interactions and business agreements between the different life science companies contribute to a dynamic business environment in the region, which will be introduced in the following part.

Life science companies seem to be optimal actors in a dynamic cluster. The life science industry offers best possibilities, since a cluster is also depending on interactions between the companies: In the literature, it is acknowledged that life science companies and biotechnological companies in particular are strongly involved in co-operations.⁶³ Several surveys tried to deliver an answer for the question why biotechnology firms in particular are in such a need of close links with similar companies. Not only small and medium-sized enterprises are strongly involved in co-operations, but also international players with large internal R&D facilities and research budget are linked up with universities and much smaller companies. The result of the studies was that both sides profit from such a collaboration, since there is a need of '*accessing each other's complementary assets in each case*'.⁶⁴ The driving factors were that smaller companies profit from the large financial base of the international players, while the larger companies benefit from the specialised knowledge and technologies of the smaller companies.

⁶² Ch. Persson, *Cluster-oriented regional development in the Baltic Sea Area: The case of Medicon Valley in the Øresund Region*, Malmö; Presentation for the European Week of Regions and Cities - Open Days 2006 in Brussels; available on: http://ec.europa.eu/regional_policy/conferences/od2006/doc/presentations/a/

⁶³ See for further reading: Powell, W. (1998): *Learning from Collaboration: Knowledge and Networks in the Biotechnology and Pharmaceutical industries*, in: California Management Review, Vol. 40:3; J. Senker, M. Sharp, M. *Organizational Learning in Cooperative Alliances: Some Case Studies in Biotechnology*, in: Technology Analysis & Strategic Management, Vol. 9:1 (1997); A. Nilsson, *Biotechnology firms in Sweden*, in: Small Business Economics, Vol. 17:1-2 (2001)

⁶⁴ J. Senker, M. Sharp, M. *Organizational Learning in Cooperative Alliances: Some Case Studies in Biotechnology*, in: Technology Analysis & Strategic Management, Vol. 9:1 (1997);

One study concludes that biotechnology companies, which are not able to absorb new technologies from smaller firms, have a great disadvantage. Transferring these results to Medicon Valley, it can be clearly seen that this is also the case for the Øresund Region. The key companies of Medicon Valley are also strongly involved in collaboration with other smaller, mostly new established companies. For example, Alligator Bioscience AB, which was founded in 2001, has successfully run a project for AstraZeneca, the largest and one of the oldest life science companies in Sweden. The key was that, with the aid of its patented technology, Alligators was able to considerably improve the properties of a protein for AstraZeneca. Also in the later years, AstraZeneca used the knowledge of the much smaller company in order to improve its products; just recently both firms entered a technology collaboration agreement regarding drug development. But AstraZeneca is only one example of a thriving collaboration. Since its foundation six years ago, Alligator Bioscience is successfully involved with many biotechnological and pharmaceutical companies by improving their proteins and helping them to establish a qualitatively higher pipeline.

By examining the links between different selected life science companies in Medicon Valley, it can be concluded that also in the Øresund Region the life science companies, no matter of which size and of which specialisation they are, are closely involved in collaborations with each other. Especially in the life science industry there is a long time between first research result and the successful transfer into a marketable product. 15 to 20 years are more the rule than the exception. In this time the company does not have any financial profit by initiating research activities within this field, which makes it more interesting for the companies to co-operate and to use the technology and knowledge of other companies.

Furthermore, biotechnology companies are strongly linked in the literature to academia. Many of the new established start-ups in the field of life science are based on research results, which were gained in research groups at the different regional universities. Especially Lund and Copenhagen University share together with institutions like the Danish Pharmaceutical Academy and the Royal Veterinary Academy a long history of biological and medical research and succeeded to produce several Nobel price winners like Jens Christian Skou (1997, chemistry) at the University of Copenhagen as well as Arvid Carlsson (2000, chemistry), who studied and worked at the Lund University before receiving the Nobel Price. Alligator Bioscience again is a great example of the development of a typical Medicon Valley spin-off company. Based on the FIND™ technology, which was developed at the department of Immunotechnology at the Lund University, the company was founded in 2001 as a university spin-off and is since then closely involved in collaborations with other regionally active companies. Medicon Valley has Europe's highest concentration of life science companies of which the vast majority are small, in the 90s and afterwards founded companies. A great share of those companies was founded on the base of university research activities or as spin-offs of larger companies. The dynamic of a cluster is closely linked to its ability to initiate start-ups and spin-offs, which bring new technologies and knowledge into the cluster and stimulate the cluster dynamic.

One tendency, which could be identified in the life science industry and was illustrated above, was that the larger companies are focusing more on core competences and outsourcing more and more projects to start-ups with new technology and knowledge. Usually the high barriers in accessing venture capital are seen as one limiting factor in the ability to stimulate new life science start-ups all over the world. This however is not the case in Medicon Valley. After the establishment of the Øresund Bridge, the amount of accessible venture capital increased rapidly and is not considered as a bottleneck any more (Frank, 2002). One reason might be that in the Scandinavian countries, but in particular in Sweden, the last years were clearly dominated by the IT, where also most of the venture capital was going to. With the burst of the IT

bubble, the saturation of the economy was reached and venture capital was now reoriented to other high-technology industries with great potential for the future. Until the mid 90s it was unknown in Scandinavia to have venture capital which was devoted to biotechnology and life science, but in 2002 local and foreign investors succeeded to collect over 650 Million \$ for biotechnology companies. Forerunner was the Danish Copenhagen's BankInvest, which opened the first biotechnology fund in 1997. Instead of Venture capital human resources are now claimed to be the bottleneck in Medicon Valley.⁶⁵

The rapid growth of the companies and venture capital will lead to the need of more scientists. It is suggested that companies also have to attract high educated people from outside of Denmark, but there are as well obstacles identified which makes it hard to recruit foreigners: The tax system and the weather. While tax brakes were introduced for highest-paid positions, which however lasts only for three years, *'the Scandinavian weather — especially the long, dark winter — can make it hard to recruit scientists from warm sunny regions such as California'*.⁶⁶ The Copenhagen start-up 7TM Pharma, for example, needed to recruit its entire staff for its chemical department from outside Scandinavia due to the lack of postdoctoral chemists in Northern Europe. Appreciated in the region however, is the increasing mobility of life science employees between larger and smaller companies, which has a positive effect on the exchange of knowledge.

All the above-mentioned aspects influence the business environment in a mostly positive way and make it easier for life science start-ups to find funding and network links. But characteristic for Medicon Valley is the balanced mix of life science companies in different states of development. On one side, the start-up rate is still very high, although the number is declining since the last couple of years, but on the other side, the region is able to attract production and research plants from established, large international companies. The decision of Biogen, one of the largest biopharmaceutical companies in the world, to build a manufacturing plant in Greater Copenhagen is one of the largest deals and will bring about 340 Million \$ on investments in the region as well as 200 new workplaces. The company hopes to employ people from the region, but a survey of the Danish pharmaceutical industry showed a clear lack of about 800 PhD over the next years. Although the education standard is highly praised by the new CEO's of the new companies, the problem is that the regional universities do not have enough graduates. The Life science cluster is a very fast growing cluster in the region and profits from the efficient international branding of Medicon Valley. Nonetheless, measures need to be taken in order to satisfy the need of the industry on highly educated employees. If this can not guaranteed companies will soon prefer other locations where the human resources are less limited.

Medicon Valley is often called the region with Europe's highest concentration of life science companies and has also on the global level a certain reputation. The report of the Boston Consulting Group, which was published 2003, stated that *'measured on R&D strength, Medicon Valley is among the strongest regions in Europe and--within several major medical fields--among the strongest in the world'*.⁶⁷ Another report from the Medicon Valley Academy concludes that the Øresund Region is at the same level with other *'world class centres of biotech, such as the Karolinska Institutet in Stockholm, Stanford University in Silicon Valley (USA) and Oxford (UK)'*, regarding to input to public research, publications or invention

⁶⁵ P. Smaglik *Bridging sectors – Medicon Valley*, in: NatureJobs 21 June 2001

⁶⁶ *ibid.*

⁶⁷ Boston Consulting Group Commercial attractiveness of biomedical R%D in Medicon Valley – the role of R&D in attracting regional investments, Copenhagen 2003

disclosures.⁶⁸ However, in comparison with those other international centres of biotech, Medicon Valley falls behind in terms of commercialisation of public research and license agreements. Furthermore is the situation for start-up companies not as good as in other biotech regions, although the Øresund Region is described as, according to international investors, one of the most attractive regions in Europe.

But not only the international competition need to be considered, also the national competition is tough: Three of the most competitive life science clusters can be found in Sweden. VINNOVA and Addendi AB carried out a study, which analysed the life science companies in Sweden, in 2004.⁶⁹ The study came to the result that the vast majority of the companies can be found in the three largest metropolitan areas in Sweden, all with large universities: Stockholm/Uppsala, Gothenburg and Malmö/Lund. The study also revealed that this concentration increased during the last few years. The number of biotech companies increased only in these three regions between 33 to 41%, while the rest experienced a decrease in numbers. (VINNOVA, 2003) This indicates that also the start-ups are highly concentrated in these three regions. The Øresund Region is therefore in the need to improve the business conditions for biotech start-ups. In Medicon Valley, 40% of the companies are biotech companies. Concerning the number of employees in biotech companies, the Stockholm and Gothenburg regions show a much higher growth rate than Malmö/Lund. This development can cause a negative impact on the competitiveness of Medicon Valley.

Medicon Valley has currently a good position in the European competition and also in the global context Medicon Valley reached already a good reputation as the settlement of Biogen showed. Medicon Valley is seen as an interesting location of business opportunities by foreign and national investors, but one bottleneck is already in the focus also of international investors: the number of qualified university graduates. Although the quality of the education at the regional universities is described as very good, it is the quantity, which concerns the investors. They see problems in the future for recruiting local employees. The universities are however aware of this situation and are discussing what can be done in order to increase the number of students. All decisions the universities are deciding now have a temporally delayed impact on the private economy: the education of students takes at least four to five years. Also the attraction of foreign employees, which could relieve the tensed labour market in the future, is described as rather challenging due to the above-mentioned tax and climate situation. Tax reductions are implemented, but only for three years and if the employee decides to stay longer, all the granted tax reduction needs to pay afterwards.

Although the region is still able to attract foreign investors, the rate of new biotech start-ups had its peak around 2000. In the second half of the 90s, the number of biotech start-ups and spin-offs increased rapidly, while in the years later the rate shows an overall stagnation on a lower level.. This development is not (yet) an object of concern as long as the number of start-ups and spin-offs can be secured on a relatively high level and the dynamic process of the cluster can be maintained.

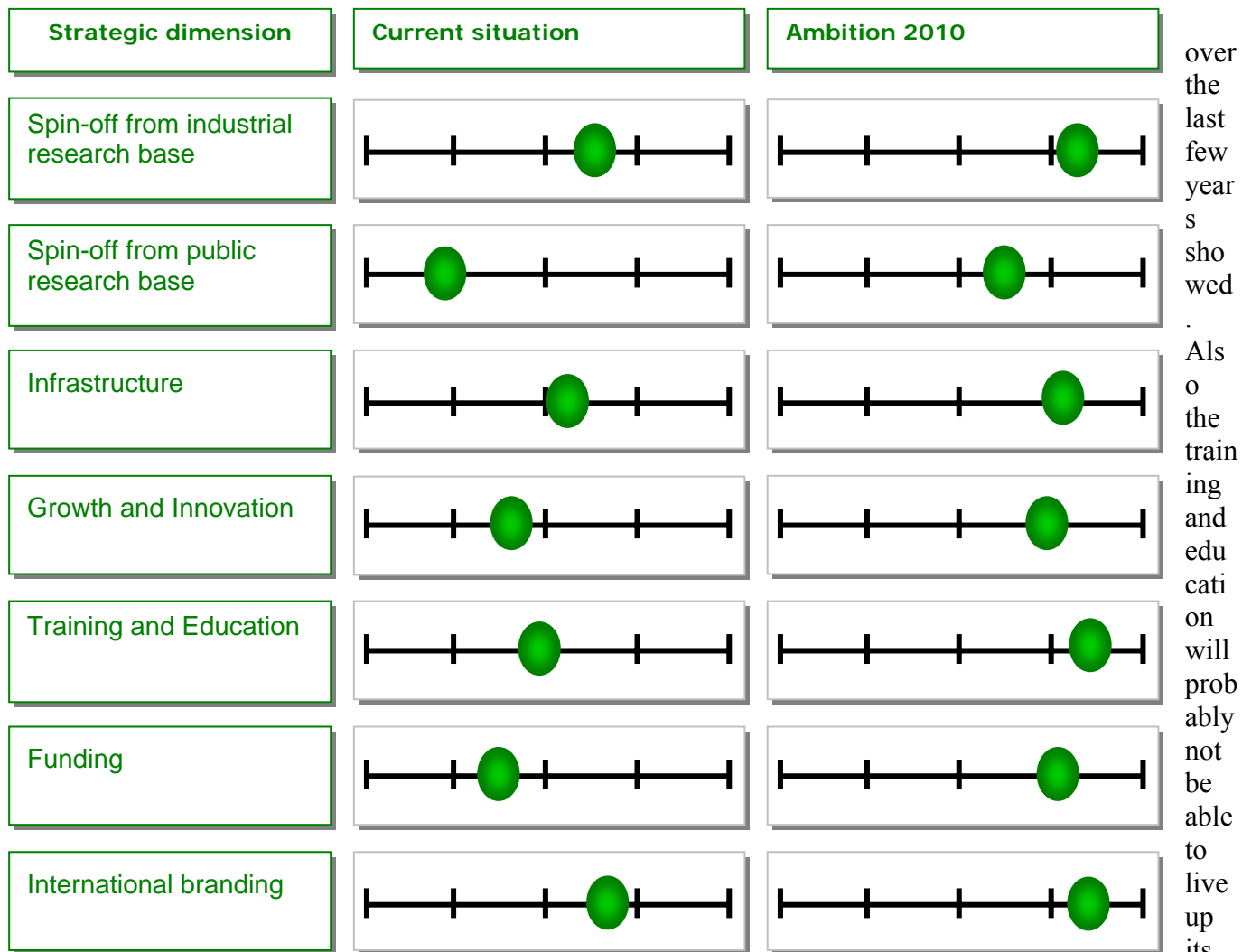
⁶⁸ Medicon Valley Academy From Bioscience to New jobs in Medicon Valley, Malmö 2004

⁶⁹ *National and Regional Cluster Profiles. Companies in biotechnology, pharmaceuticals and medical technology in Sweden.* VINNOVA Analysis 2007:4

The number of start-ups and spin-offs will be difficult to increase as the development

Fig. 13: Medicon Valley – Current situation and ambitions

(Source: B. Streijffert, Öresund University, Öresund Science Region, Medicon Valley 2007)



over the last few years showed. Also the training and education will probably not be able to live up its

expectations. The quality of the education is considered to be very number of graduates cause the problem. The pharmaceutical faculty of the University of Copenhagen, for example, shows a declining number of newly enrolled PhD-students. Although there are only a few companies, which could not recruit its personal from local employees so far, a much larger problem is predicted for the future: Already in three to four years a massive lack of qualified employees is expected.⁷⁰ (

The international branding worked excellent and improved the reputation of Medicon Valley in the world. This aspect, together with the funding, has the best potential for the future. The funding, especially the access to venture capital, is good in the region, although the low mobility of national seed money is seen as one obstacle. The infrastructure in the Øresund Region is quite sufficient: five Science Parks which are

⁷⁰ L. Frank, *Biotechnology in the Medicon Valley*, in: Nature Biotechnology Vol. 420: Supplement 2002

focused on biotech and additional six without this biotech focus as well as 12 universities of which the vast majority offer life science related programmes. Also the research infrastructure is already on a high level with over 300 research groups and several research centres like BRIC, the Biotech Research and Innovation Centre at the University of Copenhagen and the Centre for Stem Cell Biology at the Lund University are established in the region, which offer a perfect environment for research.

One aspect which includes potential for the future is the fact that each part of the Øresund Region has its own focus: The Danish side is leading the commercial race, while Skåne is far ahead in supporting the academic potential of the life science cluster, which lead to the creation of relatively many university spin-offs. Skåne profits especially from few wealthy foundations, which bring a lot of funding in the public research sector. Common for both sides is however, the insufficient outcome of the research. The research activities on a high level lead to too few numbers of marketable products. Medicon Valley falls here behind its competitors. Another potential, which is not (yet) exploited are the advantages which could be gained through cross-border interactions of the two different national systems. A report for the HUR (Hovedstadens Udviklingsråd) on benchmarking came to the conclusion that the interactions were very limited, since there is still a national focus of the national systems existing (Hansen, 2003). The combination of both above mentioned emphasis should obviously have a positive effect, once the cross-border interactions are increased.

Despite Medicon Valley already reached a good international reputation, there are several aspects, which would improve the overall performance of Medicon Valley. Including parts from two different national systems, the cluster interactions are facing special barriers. Like the integration process of the Øresund Region in total is proceeding, the cross-border co-operation within Medicon Valley will increase and free more potential.

2.4.3 The ICT cluster

The interest for the information technology in the industry increased rapidly with the possibility to produce the first affordable home computers, which were introduced by Apple and Commodore in 1977 (apple.com). The door was opened for the later following Information Age and the industry discovered a new field of commercial interest. Private persons had now access to digital processors, which were reserved for research institutes and large enterprises before that. The development was accelerated later on with the establishment of the Internet and the industry recognised the potential of personal computers and information technologies. Nowadays almost everything is depending on computers: manufacturing, education, research, health care and many more. This comprehensive ability to be valid for all kinds of industry and also the private use of computers makes ICT so important. In opposite to for example nano- and biotechnology, ICT and especially computers are not only part in the working life but also in the private life of people and are therefore accessible to a much larger target group.

The ICT industry contributes to a large extent to the growing insignificance of distance, while at the same time the companies, which are involved in such distance-shrinking technologies have the tendency to gather together. Silicon Valley is considered to be the prototype of a successful IT cluster. The term Silicon Valley emerged in the 70s and referred first to the large number of silicon chips manufacturers, but corresponds nowadays to all regional high-tech companies. All over the world, there have been tries to create a similar successful phenomenon, but not everybody has profit from the rapid growth of the information- and communication technologies in the same way.

IT Øresund was established in November 1999 by the Øresund Academy and the Øresund Business Council in order to provide a platform where actors from the universities and the economy can cooperate. Just three years later, the name was changed to Øresund IT Academy. The trigger for such an establishment was that the number of ICT companies was rapidly increasing and that many actors saw the ICT industry as the industry with the greatest potential for the future in the region. The discussion at that time about a pure IT University was one additional element in focusing on core competences. Nowadays, Øresund IT Academy promotes its competences with the slogan 'IT with a human touch' and refers to regional concentration on bioinformatics and applied IT within life and bioscience. It cannot be precisely said when the first ICT companies were established in the Region. Nonetheless, one of the decisions, which contributed to a successful ICT cluster in the region was certainly the decision of Ericsson in 1984 to develop mobile phones in Lund. Until now, Ericsson holds a large R&D facility in close collaboration with the local university. IBM, nowadays one of Denmark's largest IT companies, established itself in Greater Copenhagen even already in 1950s. Activities within the ICT sector in the Øresund Region are reaching therefore relatively long back, although the largest promotion started in the 80s following the development of the ICT in the USA and the rest of Europe. The Øresund Region houses nowadays the largest Scandinavian ICT cluster with over 100 000 employees and over 10 000 ICT companies.

The Øresund Region has an extremely high concentration of R&D facilities: Each major global player established R&D facilities mostly in Copenhagen: IBM, Microsoft, Nokia, Oracle, Motorola, Vitesse Semiconductors only to mention a few. One of the latest success stories is the Danish company iMotions, which has its roots in the IT University in Copenhagen. Founded in 2005, the company won several prizes and was very successful in attracting capital. Two years later the company opened offices in the US and India and grew from 2 to 45 employees. This year, the company received also the prize of the American Chamber of Commerce for its unique solution for registering emotions through the eye, which is considered to find a special interest in the US market. The company is considered to be the most promising start-up company within the IT sector. This can be seen in the award of the Edison prize 2006, which is awarded every year to the best IT company of the year.

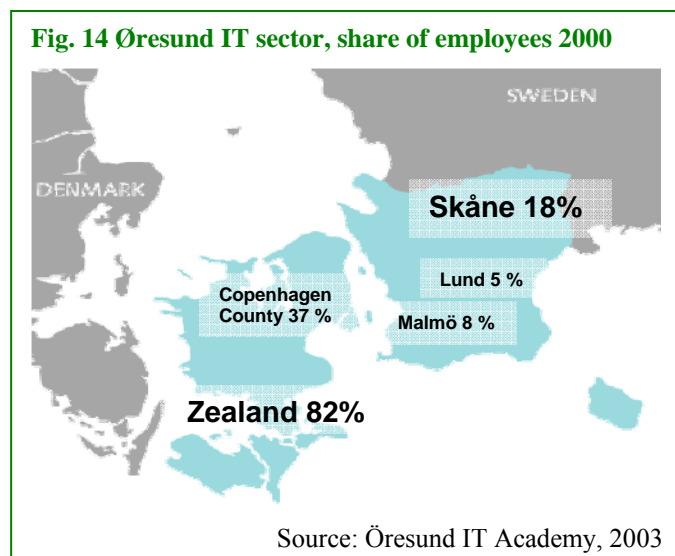
Another Danish company with recently high growth rates is NNIT A/S, a spin-off company of the Danish Novo Nordisk, which wanted to split out its IT activities. The company was established 1994 in Lyngby, Denmark and its headquarter is still located there. NNIT describes itself as one of the leading consultancies in the IT development and implementation. In 2006, NNIT hired 250 new employees, both newly graduates and more experienced workers, which means that there are at the moment around 1'000 employees hired at NNIT A/S. The strong increasing number of employees in such a short one-year period is one indicator for an expanding company. In 2007 the company was searching for 25 students to fill the positions for its own graduation program, which will lead, if passed after 18 month, to a job in the fourth biggest IT company in Denmark.

On the other side of the bridge, Anoto is a successful example and is based on a PhD work at the Lund University. Founded in 1999, the company aimed to realise the technological idea of the founder. The Anoto technology enables to recognise handwritten texts and drawings and to send them to computers. The digital pen is used like a normal pen, but contains a digital camera, sensors, image processor and a mobile communication device, which enables to send wireless to any computer or mobile. Many companies included this technology in their portfolio: Even Ericsson and Nokia. Especially in Asia, the technology experienced the greatest interest. 2002 the first contract was signed between Anoto and a Japanese company involved in e-Government solutions. The application field for the pen is endless. It is

used in medical research centres, Bakeries, design studios, for communication purpose during Paris-Dakar and fire departments. The company has nowadays 140 employees.

Handwriting recognition technology seems to offer great business opportunities. In the same year another company dealing with a similar technology was created. The company Decuma was established also in the year 1999 as a spin-off company from the Mathematical Imaging Group at the Centre for Mathematical Sciences, Lund University/LTH and moved into the IDEON Science Park one year later. The invention of the enterprise was the development, sale and the licence of products and systems based on a unique handwriting recognition technology. In 2003, Decuma won the European Information and Science Technology (IST) prize, which is organized by the European Council of Applied Science and Engineering, for its new technology. In 2001, one of the three founders received for his pioneering PhD research in the field of handwriting recognition the ‘Chester Carlson Award’ from the Royal Swedish Academy of Engineering Science. The products of the company are developed based on the patented Geometrical Invariant Technology (GIT). In the year 2003, the company had 25 employees of which seven have a PhD degree. In December 2004, the Japanese Zi Corporation acquired the Decuma handwriting recognition technology for a purchase price of approximately 1 Million US \$. Zi Corporation purchased all intellectual property from until then privately-held Decuma and incorporated Decuma later. According to the Swedish IT Industry Guide the company employs now 10 people and has revenue of 10 Million SEK.

Fig. 14 Øresund IT sector, share of employees 2000



The Øresund ICT cluster is described as the largest ICT cluster in Scandinavian showing its important position for the regional economy: The ICT industry in the Øresund Region has higher growth rates than the rest of the economy.⁷¹ Within the Øresund Region, a high concentration of the annual ICT turnover and of the workforce can be seen in the urban centres Copenhagen and Malmö/Lund whereof the Danish capital is the unchallenged regional centre.

The importance of the Copenhagen area is shown in the uneven distribution of the employment share. In 2000, the Danish side of the region concentrated 82% of the regional ICT workforce whereof 37%

were concentrated in Copenhagen County. Stronger growth related to ICT employment however occurs on the Swedish side, where also almost all are working in one of the larger cities Malmö or Lund. Only four percent are working in the rest of Skåne. These are clear numbers and are in accordance with other reports, which stated that the IT sector in general is mainly concentrated in larger agglomerations.⁷²

The share of IT employees in the Øresund Region outside the larger agglomeration is almost insignificant. Since several years a new element entered the discussion in the IT cluster: a serious labour shortage on the Danish side. The lack of qualified IT consuler has never been more severe in the

⁷¹ Copenhagen Capacity *IT opportunities in Greater Copenhagen*, Copenhagen 2004

⁷² For further reading: W. Van Winden *The development of ICT clusters in European Cities: towards a typology*, in: International Journal of Technology Management, Vol. 28(3/4/5/6) 2004

Copenhagen region forcing the Danish IT companies to recruit Swedish workforce from the other side of the bridge. The Øresund IT Academy published even a Mobility Guide how Danish IT and telecommunication companies will find and recruit Swedish consultants. One of the largest IT company located in Copenhagen, which started already in 2006 to search intensively after Swedish employees, is Microsoft's R&D facility in Vedbaek, right in the North of Copenhagen. The facility in Vedbaek is with 850 employees the largest R&D facility of Microsoft outside the USA. 50 new jobs should be created and mostly recruited from Skåne.

Two problems are tied to this development: One are the differences in the two tax systems. According to the Danish law the employees have to pay their taxes where they are working, while according to the Swedish law the taxes need to be paid where they are living. Unsolved tax issues are occurring when the employee is working in Denmark, but is still living in Sweden. The second problem is closely connected to the new emerged competition on the IT labour market. The Danish side has much higher salaries than Skåne, which makes it interesting for Swedish consultants to work in Denmark. Sony Ericsson, located on the Swedish side, just recently needed to stop its campaign for recruiting Danish employees, since newly graduated IT specialists are offered salaries in Denmark which are about 8 000 to 9'000 SEK more each month compared to Swedish salaries. Danish and also to an increasing extend the Swedish IT specialists prefer therefore to work in Copenhagen although it is not excluded that they will live in Skåne and commute to work over the bridge. This considerable difference in salaries led to a reorientation of Swedish IT specialists leaving IT companies in Skåne behind which have now troubles to recruit qualified workforce.

In contrary to the flourishing labour market for IT specialists, Skåne experiences a strongly decreasing number of IT students. In the case of the Lund University School of Economics and Management the department needs to cut down their capacities with about 20% due to the lack of IT students. The reason why the IT education seems to be less attractive to students is seen in the history of the burst of the IT bubble in the beginning of the 21st century. The unpopularity among young people to choose IT educations is based on the lack of confidence to get a job after the exams.⁷³

This lack of confidence however is not justified: The IT cluster in the Øresund Region is in a status of growth and the number of unemployed people with an IT education is decreasing rapidly. Danish companies chasing Swedish IT specialists and over thousand employees are needed alone in the Copenhagen area. Also Skåne has still over hundred job openings according to estimations. Due to the rising number of students in the Danish part, which compensates the decline on the Swedish side, the region has overall seen a modest increase of student numbers, which is currently however not able to supply the demand of the industry after skilled workforce.⁷⁴

Education plays for the ICT industry a more important role than for other industries: Comparing the share of ICT employees with a third level education in ICT services and ICT manufacturing with the service and manufacturing in general, it is obvious that the ICT sector is more dependent on highly qualified persons: in both comparisons the shares in relation to the ICT industry is doubled. Comparing the share of

⁷³ Sydsvenskan *Färre utbildas när IT-jobben blir allt fler*, Article from 13. June 2006
<http://sydsvenskan.se/lund/article165531.ece>

⁷⁴ Sydsvenskan *Stort sug efter IT-folk i Danmark*, Article from 13. June 2006 <http://sydsvenskan.se/varlden/article165533.ece>

employees with a third level education, the knowledge-intensive character of the ICT sector becomes clear.

Unfortunately it was not possible to get data for Denmark on comparable basis, but also there the picture should show the same general tendency: That the ICT sector employs more people with third level education than the national average of services and manufacturing in total. In order to satisfy the demand of the IT industry after a qualified workforce, the IT University was established in 1999 in Copenhagen. In 1999 the university started with around 140 students, but grew until 2005 to 1 300 enrolled students. The IT University moved now to other facilities in order to be able to double its capacities up to 2 500 students. The quality of the education there was awarded with several national prizes. Since 2003 on, the Danish Agency for Science, Technology and Innovation carries out a national analysis involving all the 12 Danish Universities in terms of entrepreneurial education. Each year the university, which has the highest share of students involved in entrepreneurial activities by at the same time access to excellent entrepreneurial education gets the title Entrepreneurial University of the year. The IT University in Copenhagen achieved this title already twice in that short time. In the year 2003 and 2006 were around 33% of the students engaged in entrepreneurial activities; with a number of 1'700 IT-students a quite impressive share. (Danish Agency Homepage, 2007) This underlines the importance of the IT University in Copenhagen for the entrepreneurial climate in the region.

The business structure in the ICT sector in the Øresund Region is strongly characterized by many smaller ICT companies. However, concerning employment and annual turnover there is a clear share between the smallest and the biggest ICT enterprises. The ICT sector comprises a few larger, international competing companies on one side and many smaller companies on the other. Within the Øresund Region, the Copenhagen County is the ICT centre of the region. The Copenhagen area hosts all major global players like IBM, Microsoft, Intel, Nokia, Motorola and Ericsson, which located large research facilities. The importance of the Copenhagen County is obvious. Nokia has its biggest research facility outside of Finland in the Copenhagen area and employees around 1 000 IT researchers. But also Lund houses large R&D facilities. Ericsson Mobile platform, which located one of its research facilities in the Lund area, employees even 2'500 people. The ongoing integration process shows also an effect on the cross-border entrepreneurial activities. After the construction of the Øresund Bridge, the number of Swedish ICT enterprises opening establishments in Zealand increased. In 2002, in total 173 Swedish ICT companies were identified in Zealand. This however is a one-way direction: There were only 18 Danish ICT enterprises counted in Skåne.⁷⁵

One reason might be the attraction of the Copenhagen Region for Swedish ICT companies while on the Swedish side such a concentration point for the Danish side is in form of Malmö-Lund only limited existing. The explanation of the uneven distribution of the ICT cluster in the Øresund Region lies in the different importance of the cities: Danish ICT service companies are most likely choosing the Danish capital as a location. From this location on they can serve the national market, but also the European market. Due to the quite peripheral location of the other Scandinavian capitals Copenhagen is also an excellent position for Scandinavian headquarters close to Central Europe. In the case of Malmö and Lund, the Swedish service companies are choosing Stockholm as the preferred location. The companies in Malmö and Lund are therefore more focused on the regional market. These two cities are also quite unimportant in terms of Scandinavian headquarters: Although strategically better positioned than

⁷⁵ Øresund IT Academy IT-sektorens udviklingsmuligheder i Øresundsregionen - en analyse af erhverv, forskning og uddannelse, Roskilde 2003

Stockholm, the closeness to Copenhagen is redirecting large international companies rather to Copenhagen than to Malmö or Lund.

Due to the severe competition, where everybody wants to participate in a perfect growth, it is quite difficult to show the ICT cluster of the Øresund Region in the frame of an international competition. Although the Internet bubble burst several years ago, ICT clusters are still popular all over the world and each country wants to possess one or more competitive ICT clusters. Silicon Valley is the unchallenged, almost flawless example of an extremely successful ICT cluster and it is still holding the best reputation.

But how is the performance of the regional ICT sector in comparison with other strong Scandinavian ICT regions? The Stockholm Region was seen in a report from the Øresund IT Academy as the biggest concurrence in Scandinavia relating to the ICT sector. Taking the development of the employment number over time into consideration, it can be seen that Stockholm County had in none of the years a higher number of ICT employees. From 1996 on, a stronger growth in the employment rate could be seen in the Øresund Region. Especially in the two branches commerce and telecommunication, the Øresund Region has clearly a higher employment rate than its direct concurrent, while Stockholm County shows a higher employment rate in the IT industry and consulting.⁷⁶ Concerning the annual turnovers, the Stockholm County shows not only in all the years a better performance than the Øresund Region, but has also a much higher growth rate. Considering the growth rate between the years 1997 and 1999 Stockholm County has a growth of 34%, while the Øresund Region falls with 19% far behind. In conclusion: Comparing the Øresund region with its direct concurrent Stockholm County, it can be seen that the annual turnover is higher in the Stockholm County and it also shows a higher growth rate there, while the Øresund region has a higher number of ICT employees.

The Swedish IT Industry guide identified Øresund IT as one of six IT Hot Spots in Sweden. The main core competence was identified to be human technology, which includes bioinformatics and applied IT within life and bio science. The growth in the regional ICT industry is so high that especially on the Danish side the lack of qualified workforce is significant. Due to the increasing number of Swedish IT specialists hired on the other side of the bridge and the decreasing number of students, it can be expected that also in Skåne problems will emerge to recruit qualified workforce and meet the demand of the IT industry in Skåne. Due to the heavy concentration of the regional IT cluster on the Danish side, there is an imbalance between the two different parts of the region. The importance of the city regions for the cluster is clear: The vast majority of the IT cluster is concentrated in the city regions.

At the moment the regional ICT cluster is in a status of growth and on both sides of the bridge the ICT sector is growing faster than the rest of the economy resulting in a greater need of skilled employees. The need of the ICT sector in qualified workforce is much higher than in other manufacturing or service branches, which shows the important role of the universities. The numbers of students, especially in Skåne needs to be increased if the current growth should not be slowed down due to the lack of employees in the future. But currently the Øresund Region is to be considered as one of the leading IT clusters in Scandinavia. The high significance of research activities and high numbers of IT start-ups are important elements in the cluster. Just in March 2007 Sony Ericsson stressed the importance of the research and development business in Lund. Due to global expansion of Sony Ericsson, 1'500 new jobs will be established: *'Many believe that it is possible to build mobile phones anywhere in the world, but it*

⁷⁶ ibid.

is a very complex process. In Lund the right mix of collaboration between university, the local community and the many small companies can be found. That is why Lund is of crucial importance to us.' (Miles Flint, President of Sony Ericsson) This right mix of collaboration results in many different regional based innovations. One of the most remarkable innovations within the IT-technology generated in Lund is the Bluetooth technology from Ericsson Technology Licensing, which still has its company located in the IDEON Science Park near the Lund University. The regional ICT cluster profits from its strength in the high number of international companies and in the strong regional research environment mainly at DTU and Lund University, but also in private companies.

2.4.4 The Nano Cluster

The Danish Ministry of Science, Technology and Innovation stated its aim clearly to develop Denmark as one of the absolute world leaders regarding to nanotechnology. Also in Sweden the importance of

Towards 2020, Denmark is to be amongst the absolute world leaders in regards to the mastery of nanotechnology (...).

Steering Group on Technology Foresight on Nanotechnology (2004)

nanotechnology is understood and it was in 2007 pointed out by VINNOVA as one potential growth segment for the Swedish industry. However, recent reports and studies are pointing out that Sweden risks to fall behind the development and that more efforts need to be initiated in order to exploit the full Swedish potential.

The interest for Nanotechnology lies in the great expectations which are connected with this relatively new research area and there is a market foreseen of about more than 1'000 billion US\$ in the year 2015⁷⁷. In the light of increasing interest in nanotechnologies, the Danish and Swedish performance within the field of Nanoscience and Nanotechnology is the subject of several reports. MEYER's report⁷⁸ for example states that Sweden ranks, from an international perspective, on 14th place in terms of absolute number of publications, while Denmark is not even among the best 20 and is therefore not integrated in the list. Denmark however managed to be included in the top 20 regarding the citation impact and ranks here on 18th place, five places below Sweden. Nonetheless, Denmark's share on the worldwide publications shows a higher growth than Sweden's.

⁷⁷ M. C. Roco, National Nanotechnology Initiative: Planning for the next 5 years, National Science Foundation, USA 2004

⁷⁸ M. Meyer *Nanotechnology in Sweden: An overview of Bibliometric and Patent Studies, Knowledge Flows*, Helsingfors 2005

Considering the marginal percentage of Sweden and Denmark on the total world population, the number of publications per million populations qualifies better for measuring the performance on an international level. At this point, both countries are reaching international top rankings. However, when using a different indicator which reflects the publications per 1000 researchers, Sweden and Denmark are falling back again. This implies that in both countries there is a disadvantageous proportion between the amount of publications and the number of researchers. Also in proportion with the expenditures on R&D within nanotechnology, the scientific outcome is low and therefore the efficiency of the research system needs to be improved in both countries. Taking the number of patent application into consideration, Denmark did not manage to be included in any of the top-20 ranking lists. Sweden can be found in all rankings in the middle field and scores slightly higher on patent applications at the European Patent Office (EPO) than at the United States Patent and Trademark Office (USPTO). But the difference is really insignificant. The findings of the report can be summarized in that Denmark and Sweden are countries with a relatively large research system, but that the scientific output, measured in publications and patent applications, is modest in proportion to the amount of R&D expenditures and employed researchers.

Above the performances of the two countries were shortly shown, while the following part will illustrate now the regional performance of the Øresund Region within the field of Nanotechnology.

In 2002, in the Greater Copenhagen region approximately 200-300 people were employed in the field of nanotechnological, of which 100-200 were primarily public researchers. The above mentioned numbers were stated in a report published by the Network authority Nano Øresund in 2006. Unfortunately, it was not able to find more recent data. However, as the numbers of employed researchers below, which cover only the Nano•DTU and the Nano-Science Centre,

Rank	Country	Pub. per mill. population
3	Sweden	206.4
6	Denmark	137.6

clearly demonstrate, the total number of employees in the Greater Copenhagen region must be much larger today, as there are many other new established research institutions besides Nano•DTU and Nano-Science Centre, who employ 'nanoresearchers'. For Skåne, data about employees is missing.

Rank	Country	Pub. per 1000 researchers
9	Sweden	50.5
11	Denmark	47.0

MEYER undertook several studies, where the Nanotechnology in Sweden and in particular the innovative activities were analysed. One outcome of the studies was that *'if one examines Swedish nanoscience activity in relation to the size of the country's research system and in terms of overall R&D expenditure, the country may not exploit its potential fully.'* Among the top ten ranking concerning most publishing organisations (1996-2001) within the EU, Lund University was ranking directly after Chalmers in Gothenburg, however Lund was not represented among the top ten organisations with impact, which means that the citations per publication is low. In none of those top ten lists a Danish organisation was represented.

Regarding patent activities, the special position of Greater Copenhagen for Denmark is obvious. Between the years 1996 and 2001, 16 out of 18 Danish patents in nanotechnology were produced in the Greater Copenhagen area. For the Swedish side, the situation looks different. In the same time period, only 24 patents out of 80 Swedish nano-patents were developed in Skåne. The Stockholm region is the producer

Rank	Institution	Publications in total
7	Chalmers (Goth.)	460
8	Lund University	432

of the most patents in Sweden. However, the public research organisation, Lund University, and the private company, Obducat AB, with the most number of patents in nanotechnology are both located in the Øresund Region.

Recently, a report was published, which was dealing with the comparison of the three leading Scandinavian regions with significant positions within the field of nanoscience and nanotechnology: the Øresund Region, the Stockholm region and the Helsinki region. The aim of this report was to compare these three regions in terms of bibliometric data and education. Taking the number of publications into consideration, the Øresund Region is the leading Region in Scandinavia. In comparison with other two well performing Scandinavian areas, Stockholm-Uppsala and Helsinki-Espoo, the Øresund Region issued since 1993 the most publications. Looking at three four-year periods, it can be seen that the Øresund Region has by far the highest number of citations, which is in line with the fact that the region has the highest number of publications. On the other hand, the report also shows that the Øresund Region is losing ground against the Stockholm-Uppsala area. The Øresund Region might still be leading in terms of total numbers of publications and citations, while the Stockholm Region shows however a more rapid growth.

Region	Publications (2001-2004)	Citations (2001-2004)
Öresund	899	3'718
Stockholm	785	2'652
Helsinki	524	1'989

Since the nanotechnology and its related areas are just recently discovered as a field of interest from an economical and political point of view, statistics are not (yet) created. This is also the chase regarding to start-ups and their survival rates as well as R&D expenditures. Also the reports, which deal with nanoscience and nanotechnology, are not referring to start-ups and R&D expenditures. Due to the lack of data it is therefore not possible to illustrate the regional entrepreneurship and the development of the R&D expenditures.

Of the eight comprehensive education programs within Nanotechnology in whole Europe, three are located in the Øresund Region, which are all offering courses at Bachelor and Master level. Therefore it is claimed that Øresund is the leading region in research and education in Europe. In 2002, the Nano-Science centre at the University of Copenhagen was the first in Denmark and in the Øresund Region to introduce a full Bachelor- and Masters Education in Nanotechnology and also in the international context this education program was one of the first. Today, the centre has more than 200 students in Nanotechnology and it is expected that the first students are graduating 2007. One year later, in 2003, the Lund University offered the program Engineering Nanoscience with specialised courses in four areas and in 2004 enrolled also the technical university of Denmark the first students in its new Nanotechnological program. In 2006, all together were 680 students enrolled in a comprehensive nanotechnological education program in the Øresund Region. Nowadays, it is expected that every year around 170 new

Region	Students	students start their nano education in Øresund. The Lund University plays an important role for the Swedish side of the Øresund Region, since currently all the Swedish students are enrolled in the nanotechnology program in Lund. There might be students in other educational programs at the same university, which chose later in their studies an emphasis in nanotechnology, but those numbers were not available and are therefore not considered in the calculation.
Öresund SE	178	
Öresund DK	502	
In total	680	

According to the project manager both of Nano•DTU and the Danish national network for nanotechnology, there are at the moment more than 200 scientists, Post Docs and PhD-students working at Nano•DTU, which is located at the Technical University of Denmark, coming from more than 15 research groups at 11 different institutes, while the Nano-Science Centre at the University of Copenhagen employees currently 100 scientists, Post Docs and PhD-students. The Copenhagen Graduate School for Nanoscience and Nanotechnology (C:O:N:T) is a combine effort of the University of Copenhagen, the Technical University of Denmark, the Risø National Laboratory and Haldor Topsøe A/S company, which has the objective to establish a multidisciplinary graduation school where enrolled PhD-students from different organisations can come together and visit joint PhD courses. At the Malmö University on the Swedish side there is no comprehensive program, but one course in nanotechnology offered. This means that there are neither students nor PhD students enrolled at this university in a complete nanotechnological program. At the Lund University the Nanometer Structure Consortium was founded around 20 years ago and employees today almost 100 researchers. According to the department at the university, which is responsible for the implementation of Engineering Nanoscience, it is hard to estimate the number of PhD students within nanotechnology, since they are spread out in the different departments.

Nanotechnology is an emerging technology, which has the potential to be the base for pioneering innovations and its future importance for the economy is compared nowadays with the introduction of steam machines or computers at their time.(In what time horizon?)

Recent reports and studies are pointing out that Sweden risks to fall behind the development and that more efforts need to be initiated in order to exploit the full Swedish potential.

As several reasons for the fallback are mentioned:

- Around 30 countries with a strong role regarding to technological, industrial and knowledge importance have initiated national strategies and initiatives for developing nanotechnological research activities. Sweden however did not develop such a program.

- The public research organisations are spending only two third of the R&D expenditures per capita than the other ‘old’ EU countries.
- The Swedish academical research within nanotechnology is relatively high from an international perspective, while the numbers of patent applications is very low. The Swedish research does not (yet) commercialise their research activities in a sufficient way.
- In Sweden there is not yet a discussion about the risk of nanotechnology.⁷⁹
-

These quite general reasons also apply for the Skåne region as a part of Sweden, since the Lund University is the third important education institution in Sweden in regard to Nanotechnology and almost one third of the Swedish patents are developed in Skåne

2.5 The Creative Class

The Öresunds region has experienced a period of population growth since the end of 1990s. One important element in this growth seems to be an inflow of people belonging to the creative class.

Table 1. The size of the creative class in larger municipalities and city regions in Denmark and Sweden

Municipalities (Denmark)	Creative class (2004)	City regions (Sweden)	Creative class (2002)
Copenhagen	61,1 %	Stockholm	46,0 %
Aarhus	46,0 %	Uppsala	44,7 %
Sønderborg	41,5 %	Linköping	42,3 %
Odense	37,8 %	Malmö/Lund	41,4 %
Svendborg	37,3 %	Gothenburg	40,2 %

The city region of Copenhagen have the highest share of creative class among their inhabitants, followed by the city region of Aarhus and these two regions happen also to house the two largest cities in Denmark. Odense however, the third largest city in Denmark, has a considerably smaller share. A remarkable fact is that two of the top-5 municipalities don't have a university – Sønderborg and Svendborg. Due to the outstanding position of Copenhagen, in terms of that around 40% of the Danish population lives in the capital region, Copenhagen contributes to a high Danish average: 36% of the total Danish workforce can be accounted to the creative class. According to the national ranking of Danish municipalities the first 18 municipalities with the highest share are all located in the Greater Copenhagen area.

A similar study of Sweden concluded that the Swedish creative class is concentrated in university towns and the largest city regions in Sweden. The table 1 shows the top-5 Swedish city regions. In Sweden, the average share of the creative class is slightly lower than in Denmark and shows also a less distinguished concentration of the creative class in the capital. Such comparisons between two different reports

⁷⁹ IVA (Royal Swedish Academy of Engineering Sciences) *En nanostrategi för Sverige – ett förslag från IVA*, IVA, Stockholm 2007

however should be done extremely cautious due to possible differences in defining the creative class and different statistical systems leading eventually to a different approach. The data can only be compared if the occupations, which represent the creative class are the same in both reports and the two statistical systems use the same occupation definitions. Not all reports however defined clearly which occupations are included in the respective creative class. Therefore such comparisons need to be seen cautiously.

In Malmö-Lund region a significant growth of the size of the creative class is one important element in this growth. One indicator of this is that the share of workforce with university degree increased by almost 75 per cent between 1990 and 2000. The creative class includes persons engaged in conceptual and creative types of occupations like managers, scientists, architects, engineers, artists, entrepreneurs etc. Malmö-Lund region is ranked high when it comes to the creative class' share of the workforce.⁸⁰ Lund, with 50 per cent of the work force belonging to the creative class, belongs to the top four, when it comes to the share of the creative class, in Sweden, while Malmö, with about 40 percent, is on place 11 among Swedish municipalities. This difference reflects the two towns historical development.

Lund as an old university town hosting the largest university in Sweden did not become an important industrial town until the emerging knowledge society made the university an important source of new industries. In the last four decades a number of new high-tech companies has grown up and some older companies have located R&D departments adjacent to the university. Malmö, on the other hand, grew up as an important industrial town in the early industrialization process in the second half of the 19th century. For many decades the growth of the town was made possible by the expansion of what we now consider as mature and old industries. In the last decades the town has gone through a radical transformation. The share of workforce with a university degree is about twice as high in the high-tech sector as in the other sectors. In the period 1993-2002 the size of the workforce with a bachelor degree or more increased by almost 140 per cent in the high-tech sector, while the growth rate was less than half as big in the other sectors.⁸¹ The Malmö-Lund is characterized by a high share of workforce employed in bohemian occupations like authors, artists, etc where the region is second to Stockholm. Parallel with this the Malmö-Lund region scores high on the formation of new high-tech firms.⁸²

Although Greater Copenhagen has the highest share on the creative class, its share on the national GDP is slowly decreasing due to a higher growth rate of the Danish economy in total. This is not in accordance with the creative class concept. Florida's thesis might be too linear to be applicable to all various cases. As the main weakness in his thesis is considered that he can not deliver clear facts and numbers to what extend the creative class is contributing to a prosperous economy. The creative occupations, which were chosen by Florida, include for example primary and pre-primary education teaching professionals as well as secondary education teaching professionals forming together the largest group in Skåne by creative occupations. The education has of course a strong influence on the later choices of people in which field they want to work, but the teaching professionals are from a different point of view rather setting the premises for the regional creative class than being creatives by themselves.

Despite the differences in how the creative occupations can be chosen, the importance of well-educated people is however undeniable in today's economy. Studies identified the role of human capital for the

⁸⁰ I. Tinagli, R. Florida, P. Ström & E. Wahlqvist *Sweden in the Creative Age*. Göteborg 2007.

⁸¹ Høgni Kalsø Hansen *Technology, Talent and Tolerance- the Geography of the Creative Class in Sweden*. Lund 2007

⁸² Kalø Hansen *ibid*.

economic development and were verified later on.⁸³ Skilled workforce like scientists and engineers are of special importance for the Øresund Region. The regional clusters like Medicon Valley and Nano Øresund are in the need of qualified researchers. In most of the clusters the lack of qualified workforce is noticeable demanding after the recruitment of employees from all over Europe and even the rest of the world. Decreasing obstacles in terms of national borders especially within the European Union encourage the free movement of people: Mostly younger and well-educated people decide to move knowing about possibilities which are offered in another country. These new possibilities offer therefore also the creative class opportunities to go where they find the best environment for themselves. Due to the changes in lifestyle and the globalisation these people are less attached to their companies and their place of living forcing the cities and companies to compete even harder to attract and keep the creative class.

The Øresund Region currently takes part in such a competition trying to satisfy the need of the regional economy after researchers as well as after ICT and biotech specialists. Many occupations, which are counted to the creative class, are in general linked to research and/or entrepreneurial activities contributing to a healthy dynamic of a cluster. Especially in high-tech clusters like biotechnology and nano-technology, start-ups are usually based on intense and expensive research activities requiring a qualified education.

We can assume that the integration process in the Öresunds region will make that region even more attractive for the creative class. The integration means that the third largest region in Sweden will become a part of the largest metropolitan region in Scandinavia. Unfortunately, we don't have access to figures from the Copenhagen region. However, from a study undertaken by Richard Florida and Irene Tinagli we know that the size of the creative occupations in Denmark, as a share of total employment, is rather similar as in Sweden.⁸⁴ We also know that Copenhagen is the undisputed centre of high-tech industries in Denmark and the region hosts a number of large universities. Based on this, there are reasons to believe that Copenhagen is more dominant as a centre for the creative class in Denmark than the Stockholm region in Sweden. However, significant lower values on technology and talent index may have some impact on development.

2.6 Karlskrona in the outskirts of the Öresund region

The Karlskrona/Ronneby region has a long history of stagnation. Thus, the population in 1990 was lower than 50 years before. In the mid-80s the future of the region was regarded to be bleak, to say the least. The region was characterised by a big but rapidly shrinking defence sector, an industry sector that was dominated by production units of Swedish companies with headquarters and development departments in other regions, a weak entrepreneurial tradition and few new companies, a limited supply of professional services, and no higher education.

However, something unexpected happened on the region's road to a long-term depression. In that moment when utter stagnation seemed to be unavoidable for the region the trend took a surprisingly new course. A new, modern and development oriented business life started to grow. The more specific causes of this unexpected turn of events were a mixture of local

⁸³ For further reading: R.E. Lucas Jr. *On the Mechanics of economic development*, in: *Journal of Monetary Economics*, Vol. 22(1) 1988 and E. L. Glaeser & D.C. , *Maré Cities and skills*, in: *Journal of Labor Economics*, Vol. 19(2) 2001

⁸⁴ R. Florida & I. Tinagli *Europe in the Creative Age*. Philadelphia 2004.

initiatives, a couple of critical decisions taken outside the region, and some fortunate circumstances.

During the 1990s the region quite suddenly appeared as one of the fastest growing regions in Sweden. The main driving force behind this expansion was the growth in the ICT-industry. The number of employees within the industry grew with more than 400 per cent. At the beginning of the new millennium there were more than 100 firms within this cluster that employed more than 5000 people. This new industry contributed to a radical change of the social and economic structure of the region. The number of people with a university degree increased for example by 75 per cent.

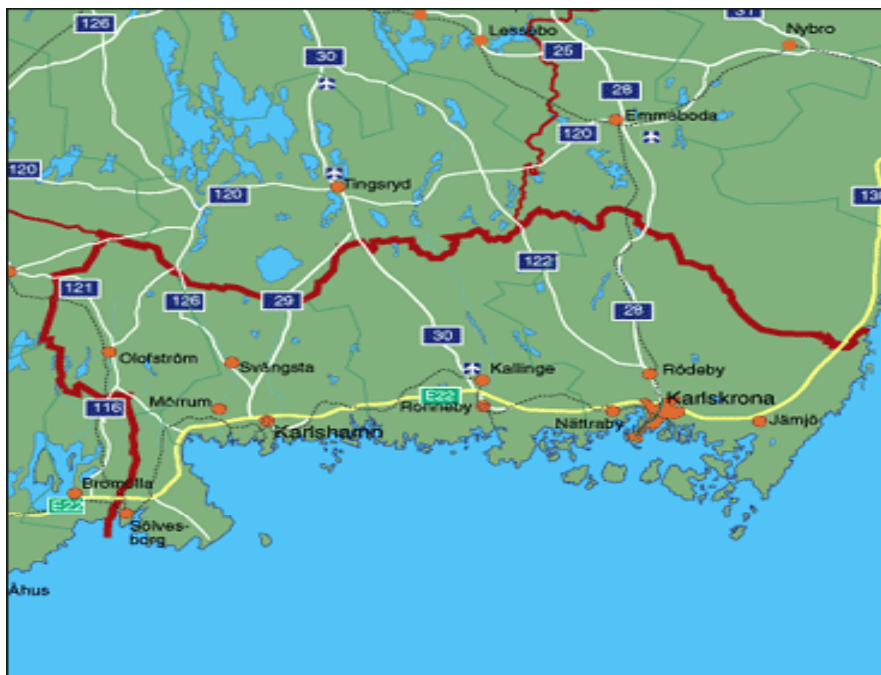


Figure 15. Map of Blekinge

2.6.1 The ICTcluster

The regeneration process started in Ronneby, a municipality with 30.000 inhabitants, situated 30 km to the west of Karlskrona. After a series of shut downs and downsizings in 1984 the unemployment figures in the municipality approached 10 per cent of the workforce. In January 1985 Volvo announced that the ironworks had to shut down, and further 400 people had to go. In this situation the political leadership had to choose between two alternatives, either to ask the Government in Stockholm for public support, or to try to do something themselves. They opted for the second alternative and sat down a taskforce with the assignment to develop concrete projects that were later to be presented to the Minister for Industry.

One of the many project ideas was to establish a centre for education, R&D, and software engineering – "Soft Center", as it was called. This idea was presented at a time when research parks and technology centres were popular solutions in Swedish regional politics. In the Ronneby case three prerequisites were identified in order for the project to succeed: (a) Soft Center had to have a critical mass of companies; (b) It had to include education and further education on different levels; (c) As soon as possible R&D projects had to get started. And surprisingly soon Ronneby succeeded to get support from the software industry, but also from prestigious institutions like The Royal Swedish Academy of Engineering Sciences. In April 1987 the first Soft Center building was opened and a second was started just months later.

In March 1988, after some discussion, the Government proposed to the Riksdag that a University College should be established in Blekinge, and that it ought to have a profile towards software engineering. Just a couple of days after the positive decision in the Riksdag the Soft Center board started to plan for the new University College. Education in software engineering, data processing and business administration were to be placed in Ronneby, while pure technological educations were to be located to Karlskrona.⁸⁵

Soft Center reached a high national and international reputation especially during the mid 1990s. The Ronneby campus got to be known as Sweden's best IT programming school. In 1994 the Soft Center Foundation was rewarded the founder of Xerox, Chester Carlson's price for "stimulating use of information technology, working out a model for bridging geographical obstacles and bringing about renewal within trade and industry".⁸⁶ Ronneby was also mentioned as one of Europe's top ten IT-cities according to a report of the European Digital Cities Project, published in 1998.

The basically municipal project of Soft Center was, no doubt, a major contributor with approximately 60 IT companies and the BIT.⁸⁷ The collaboration between municipality, BIT and private companies in the IT service sector worked as an efficient regional growth booster.⁸⁸ An enterprise manager has expressed *one* aspect on the integrated milieu of academic education/ research and companies: "Being located at Soft Center implies a three year long employment interview with the students." Integration meant, among other things, that people from different activities at Soft Center met frequently and naturally, and thus made social networks. The students got a function of binding academy and business together.⁸⁹

The success of Soft Center in Ronneby was looked upon as a challenge in the adjacent town Karlskrona. Local actors like conspicuous business executives, especially the local manager of Ericsson, the principal of the University College and local politicians intensified their efforts to attract new business to the town. Finally Karlskrona succeeded in attracting Nordic Tel, which had got a license for the coming national GSM network, to town.

At this time the BIT was already founded with its main campus in Ronneby and a minor campus in Karlskrona. The Karlskrona campus was relocated to a site close to Nordic Tel's new head office. Some

⁸⁵ Å. Uhlin, H. Finsrud & J. E. Nilsson *Cross Regional Learning. First impression from a cross-regional learning project between Blekinge and Vestfold*. Karlskrona 2007 (Mimeo)

⁸⁶ <http://www.iva.se/templates/Page.aspx?id=176>, 2007-07-06.

⁸⁷ <http://www.ronneby.se/publicdefault.aspx?id=3113>, 2007-05-10.

⁸⁸ Alsén et al, *The University – A Regional Booster?* 1999.

⁸⁹ S. Stranne & Å. Uhlin *Local Development with impediments*. Karlskrona 2007 (mimeo).

years later an enterprise and research park focused on ITC corporations was established closely to Nordic Tel and BIT – TelecomCity. While the enterprise and research profile of Soft Center by way of introduction circled round programming and software innovation and development, TelecomCity in Karlskrona focused on mobile telecommunication. Gradually more and bigger companies in the IT sector were established at the two development networks. Especially Soft Center reached a high national and international reputation. The education at BIT in Ronneby got known as the best IT programming school of Sweden.

The ICT sector peaked in Ronneby in the beginning of the 1990s, when almost 1 000 persons were employed in the sector. Later the number was reduced by 50 per cent before a new expansion phase started after the millennium. When the decline started in Ronneby the ICT-expansion in Karlskrona took off. A remarkable expansion in as well absolute numbers as in relative terms started.

Members

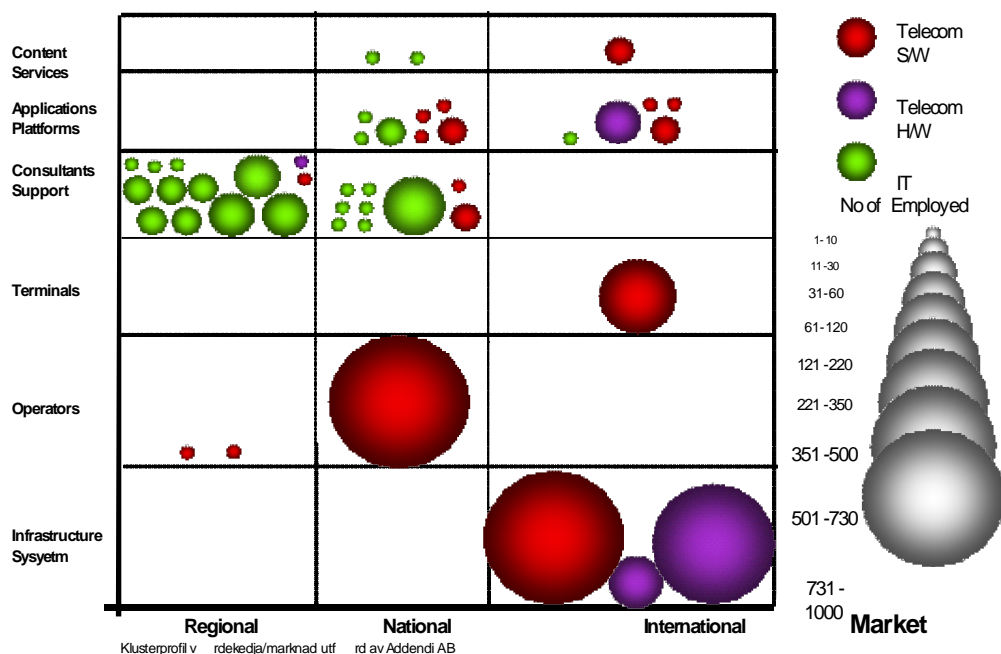


Fig. 16. Profile of members in TelecomCity
Source; TelecomCity

In eight years the number of employed in the cluster increased by almost 2500 persons and its share of total employment doubled to 14 per cent in 2001, which was almost three times as high as in Sweden as a whole. At this time, the local ICT-cluster was dominated by three large corporations –Ericsson, Vodaphone and Flextronics . Almost 90 per cent of the people employed in the cluster worked at these three workplaces. However during the expansion in the 1990s the number of workplaces in the cluster increased from 38 to 87.

The cluster organization TelecomCity includes more than 50 world leading international companies and small entrepreneurial development companies participate. TelecomCity has both vertical and horizontal features. TelecomCity consists of a core of enterprises producing hardware and software, operators, companies making applications and providing services. The other group of enterprises within TelecomCity contains service enterprises, which deliver for instance security solutions or partial systems to the core companies. Blekinge Institute of Technology provides with education of the labour and municipality is responsible for infrastructure and suitable conditions for economic growth. TelecomCity includes more than 50 world leading international companies and small entrepreneurial development companies participate with approximately 4 000 employees. The unifying element for member-enterprises is the info com/telecom area or contributing to the development of the competence in this field. In the 1990s TelecomCity became a well known trade-mark for the region.

The economic transformation, which Karlskrona/Ronneby underwent in just a few years, attracted a lot of attentions from journalists, researchers, policy-makers and businessmen in Sweden and abroad. An image of the Karlskrona region as a dynamic centre in “new economy” did grow up. Among the persons involved in the ICT cluster this was a source of pride and self-respect and it gave promise of an promising future for the region. The local politicians started to formulate a vision for the new era. They did in fact formulate a vision for how to make the region attractive to the creative class, which was central for a growing ICT-industry and they did it before Richard Florida had presented his idea about the importance of the creative class. However this dynamic economic development based on the knowledge intensive ICT industry did also create visible political tensions.

The growing ICT industry generate a flow of people moving to the region, people with different kinds of lifestyles and worldviews, and with money to buy the best properties in Ronneby and Karlskrona along the river and by the sea. While people moving into the region saw a promising future in a transformed region, the native considered the transformation a threat to the traditional identity of the regions. They were not willing to support a transformation based on the need of the industries and people. The political balance was in favour of the conservatives, they who gave priority to preserve the old identity of the region. This movement was strengthened by the fact that UNESCO’s World Heritage Sites Committee gave Karlskrona, as an exceptionally well preserved example of a European naval base, the status as a world heritage. Therefore, the vision, which by the local political assembly in Karlskrona decided upon unanimously, did never have any impact on real politics. Local policy-makers followed the path of the conservatives and were more interested in preserving the historical identity of the region than to support the region’s economic and social transformation. The ICT industry boomed in 2001 and the following crisis influenced on the local ICT industry. The number of employees and the number of ICT corporations in the region declined and that was considered as a proof of the that the ICT cluster did not represent an economic base for sustainable growth.

2.6.2 The creative class

Policy-makers become even more uninterested in the TelecomCity. Policy-makers' focus changed from mobile communication to sports events and tourism. The strength of the conservatism in Karlskrona has probably contributed to reduce the attractiveness of the region in the creative class. The small size of the region in combination with its peripheral location indicates that Karlskrona will not be considered one of the most attractive regions for the creative class in Sweden. It is a region in need of a policy to make it more attractive. Based on figures for Swedish counties. The region's weak position in the creative class is confirmed by statistics. The size of the creative class is about the same in Karlskrona as for Sweden as a whole, which is 30 per cent lower than in for example Lund, while the size of the class in Ronneby is just 70 per cent of the Swedish average. Karlskrona scores weak on the tolerance factor, while Ronneby is especially weak on technology.⁹⁰

⁹⁰ I. Tingli, R. Florida, P. Ström & e. Wahlqvist *Sweden in the Creative Age*. Göteborg 2007

3. Lithuanian Growth regions

Changes in the economical framework of the Baltic States after the dissolution of the Soviet Union opened up new opportunities for these countries as well as for the other East European countries. Most of the former Soviet Union member states show remarkable annual growth rates for the last years straight. It is however the Baltic States, which seem to perform even more impressive, gaining the designation as Baltic Tigers. The term Baltic Tigers refers to the Asian Tigers like Hong Kong and Singapore, which were characterized by their maintaining high growth rates and fast industrialisation in the 80s and 90s. Nowadays these Asian Tigers, which were praised in the mid-90s as the centre of a vital Asia, are facing a hard competition with China and India, which are claimed to be the future Asian Tigers.⁹¹

In March 1990, Lithuania declared as the first former Soviet republic its independency, which was not acknowledged by Moscow until September 1991. The last Russian troops left Lithuania two years later. Since its independency, the former central steered economy in Lithuania tried to find its position in the

Fig. 17: Map of Lithuania



Source: CIA - The World Factbook; revised

free global market and was consequently working on the integration into the European Union. These efforts resulted in the entrance of Lithuania together with other seven Eastern European countries as well as Malta and Cyprus in 2004. Lithuania is nowadays called together with Estonia and Latvia the Baltic Tigers referring to their huge efforts and results in strengthening the free market economy and increasing the wealth of the nations.

The term Baltic Tigers was coined during the economic boom of the three smallest Baltic countries, which started with the new millennium and continued until now. Lithuania is the Baltic Tiger with the highest population with around 3,4 Mio. inhabitants, but has like the other two countries a declining population number.

The economic centre of Lithuania is its capital Vilnius. The capital concentrates not only nearly a fifth of the Lithuanian population, but is also the most thriving regional economy in Lithuania. Lithuania however struggles at the moment with its problems in attracting Foreign Direct Investments (FDI), which results in the relatively low foreign direct investments per capita and also in ratio to the Gross Domestic Product. In comparison with the other 10 new EU member states, Lithuania falls far behind in both indicators and reaches only the second last place before Poland. (Statistics Lithuania, 2006) In 2004, the World Bank carried out a survey in order to analyse the investment climate in Lithuania and came to the conclusion that *'Lithuania has made serious efforts in recent years to improve its investment climate'*, but *'yet Lithuania remains unable to attract significant amounts of foreign direct investment'*.⁹²

⁹¹ J. Studwell *Asian Godfathers: Money and Power in Hong Kong and Southeast Asia* 2007

⁹² World Bank *Lithuania – Investment climate assessment*; 2005 available on: www.worldbank.org/countries

As one reason is mentioned the quite small market with limited purchasing power, but somehow Cyprus, Malta and also Estonia, all smaller than Lithuania, managed to attract at least three times higher FDIs. This aspect seems therefore not to deliver a sufficient explanation for the disillusioning performance of Lithuania in terms of FDI. More likely is that the reputation of Lithuania as a slow reformer after the independency from the Soviet Union in comparison with peer countries is one drawback in attracting investments. With the aid of interviews of managers several other barriers were identified in the survey of the World Bank: tax burden, corruption, unfair competition, uncertainty of business regulation measures as well as quality of labour force.

In order to improve the business environment and to attract more foreign companies, Lithuania recently started the development and construction of five new industrial parks, which were partly financed over the PHARE Project: The establishment of the Šiauliai industrial zone in the fourth largest Lithuanian city, development of the Klaipėda industrial park in the third largest city, development of engineering infrastructure in the Kėdainiai industrial region and establishment of the Visaginas industrial park as well as the Science and Technology Park in Vilnius, which should later house the Sunrise Valley knowledge economy cluster. Other Middle and East European Countries were since several years successful in attracting foreign companies into business parks with arranged infrastructure, like Czech Republic, Slovakia, Slovenia and Romania and therefore Lithuania wants to catch up by establishing new Science Parks all over the country.

Main trading partner is (still) Russia, although Latvia is continuously closing the gap and can soon be the top export partner of Lithuania. In terms of import, Russia however takes the unchallenged top position with almost 25%. Ever since the break-up of the Soviet Union, Russia is struggling with the creation of a democratic political system and a market economy. While most of the smaller countries are rather successful in leaving the former social, political and economical controls of the Communistic era behind and reoriented their economy, the recent years showed that Russia experienced a re-concentration of power under Putin and that democratic tendencies remain weak. Russia with its economic problems would therefore not be the most consistent trading partner for Lithuania. With the reorientation towards the West, Lithuania will be less dependent on the performance of one specific country. Russia's share especially in terms of export decreases continuously which is a result of the orientation of the Lithuanian economy towards the west. Other important trading partners are the neighbouring and Scandinavian countries as well as Germany, which means that especially the EU member states are important partners.

The (still) important role of Russia for the Lithuanian economy lies in Lithuania's long history of integration into the Soviet Union after the Second World War; this Russian dominance is however slowly diminishing. Due to the central steered economy, Lithuania had the task in Soviet times to supply Russia with food, machine tools and consume goods, while Uzbekistan for example was supposed to deliver cotton, uranium and airplanes and Latvia was specialised in the production of railway cars, radio electronics and minibuses.⁹³ The comprehensive macroeconomic collapse of Russia in August 1998⁹⁴ had therefore a certain impact on the economy and the employment rate of Lithuania and its different

⁹³ V. Gendlin *Lithuania – the past and sand dunes*; in: Russia's Daily Online, January 2003; available on: http://www.kommersant.com/t360857/r_2/n_23/Lithuania/

⁹⁴ For further reading see: B. Pinto et al *Lessons from the Russian Crisis of 1998 and Recovery*, 2004; P. Desai *Why did the rouble collapse in August 1998?*, in: *The American Economic Review* Vol. 90:2 2000 and Y. Gaider *Lessons of the Russian Crisis for Transition Economies*, in: *Finance and Development*, Vol. 36:2 1999

Counties. Continuously after the break-up of the Soviet Union, Lithuania orientated indeed its economy step by step towards the West and gained membership in the EU as well as in the World Trade Organisation and several other western institutions.

This reorientation of the economy led to foreign support from especially western countries and helped the transformation from the central steered economy into a market economy, which contributed positively to the economy and to the employment rate. However, the integration process is a slow process over time and the employment rate showed a fast sudden change. This can indicate that it was not so much based on the market reforms and EU integration, but rather on the fast recovery of the Russian economy after its collapse in 1998. The Russian economy profited hereby mainly from the increasing oil price. Despite the ongoing reorientation of the Lithuanian economy towards the West, Lithuania remains to be the Baltic State with the tightest economic connection to Russia. The other two Baltic Tigers are far less depending on Russia as a trading partner on account of their more radical approach in opening up to the West.

Quite a paradox is the fact that with the EU membership of Lithuania, the country and also the other Baltic States will become more dependent upon Russia for energy imports. The EU demanded that Lithuania has to shut down its Nuclear Power Plant (NPP) in Ignalina for safety reason, although the Lithuanian Plant is one of the most advanced types of the Soviet reactors and has been upgraded. The EU demands this shut down until 2009 due to the similarities between the Ignalina NPP and the one in Chernobyl, Ukraine. The request of the EU seems reasonable taking the latest event into consideration: In November 2007 the Lithuanian Power Plant needed to be shut down due to electrical faults, just two month after it underwent maintenance.⁹⁵

The problem for Lithuania is constituted in the fact that the Lithuanian energy sector is primarily based on nuclear generated electricity. Nowadays around 72% of the electricity the Ignalina NPP, the only NPP in the country, generates production. Due to the low energy consumption level, Lithuania exports most of its production to other countries. After 2009, this will turn in the opposite direction: instead of exporting, Lithuania will be now depending on Russian imports and it is predicted that the CO₂ emissions will increase due to the replacement with gas-fire power plants. Just to illustrate how far reaching the decision of shutting down the NPP is, the social dimension should also be shown:

So far, Lithuania was the only Baltic State, which was not confronted with issues of the Russian-speaking minority. Granting citizenship immediately to its Russian minority, Lithuania removed one possible source of conflict between Russia and Lithuania, but also between the Russian minority in Lithuania and Lithuanians.⁹⁶ This however is most likely to be changed. The employees working in the NPP are mostly from Belarus and Russia, immigrated in the 70s and can hardly speak Lithuanian. Closing the Plant will therefore exclusively affect the Russian-speaking minority able to create ethnical tensions in the region. But not only Lithuania will be placed in a passive position, also the other Baltic States and Poland. Lithuania is exporting around two third of the total electricity production to countries with energy deficits like Latvia and Estonia. Russia will be therefore in quite a strong position and hold all the aces.

⁹⁵ *Electrical fault shuts down Lithuanian power plant, 2007* article available on: http://news.monstersandcritics.com/business/news/article_1372543.php/

⁹⁶Y. Bilinsky *Toward the West – Baltic Realignment and Russia’s Reply*; in *Soviet Legacies*, Vol. 28(1) 2006

An idea about how Russia could use its power can be given considering an event several years ago: Russian companies were accused to manipulate energy deliveries to oil terminals in two Baltic ports in Lithuania and Latvia. The two Russian companies LUKoil and Transneft had the intension to take over the Mazeikiai refinery in Telšiai County, Lithuania as well as the Ventspils oil terminal in Latvia. In both cases the companies reduced their oil deliveries gradually over several months aiming to decrease the market value of the infrastructures and to purchase them cheap. Ventspils' oil export decreased significantly, but survived due to increasing oil deliverance by railroad, which are not Transneft's jurisdiction. In the case of Lithuania, Mazeikiai was bought by the Russian Yukos company, the direct competitor of LUKoil, and could increase its capacities. After the divestiture of Yukos due to frictions between the company owner and Putin, Mazeikiai refinery operates only at half of its capacities or less.⁹⁷ In order to decrease the dependency, the Baltic States agreed recently on an agreement to build together a new modern Nuclear Power Plant in Lithuania by 2015. In February 2007 Poland and the Baltic States signed this agreement.

Over the last years, the manufacturing industry within the industry sector was the driving force of the Lithuanian economy by generating the highest share on GDP and showing significant growth rates. Lithuania stands out by the other two Baltic States through an increasing manufacturing industry, while the other countries are facing a slight decline. Export plays a special role for the manufacturing industry, since over 60% of the production is exported. This means that manufactured goods account for around 90% of the total national export. The importance of the manufacturing for the industry sector gains more and more on importance, compensating the decreasing employment numbers in electricity, gas and water supply, which results in an overall stagnation of the industry sector in terms of employment numbers and the share of gross value added.

Multinational companies of all kinds of industries discover the former Soviet member states as new locations for their outsourcing activities. The costs for the companies would be of course lower, if Asia would be chosen as a location, but many of the Baltic metropolises are less than 4 hours away from Central Europe “so it's like having a European presence with almost Indian costs”. Labour costs are around only one third of the Western countries.⁹⁸ Very few really expect that the East European countries can endanger Asia's position in being the leading outsourcing destination due to low-cost, highly skilled labour force. The new free market economies however attract the attention as a bridge between Western Europe and Russia. Also the Asian market discovered the Eastern countries in diminishing the geographical distance between their companies located in Asia and their clients in Western Europe by outsourcing to the former Soviet bloc. The question is how long these cost advantages can survive.

Without any doubt the EU membership is linked to many advantages, but one aspect should not be excluded from the discussion: The overall goal of the European Union is to diminish the difference between the member states as well as within the member states. In a long-term perspective, this will mean that the cost advantages will also diminish. Already nowadays, only a few years after the enlargement of the European Union, Ukraine shows only one third of the labour costs by similar education structures compared to Lithuania and Latvia. *‘Spiraling costs and tightening labor markets in neighboring Central*

⁹⁷ V. Socor, *Russian oil Supplies to Lithuania cut off*, in: Eurasia Daily Monitor, Vol. 3 (150) 2006

⁹⁸ Perry, J. (2003): *All business on Eastern Front*, in: U.S. News & World Report, Vol. 135 (17)

and Eastern Europe are creating a new low-cost manufacturing hot spot on the EU's doorstep in Ukraine'.⁹⁹

Lithuania profits as well as the other former Soviet member states from the Soviet education heritage. In the Czech Republic for example 35% of the university graduates received a science or engineering degree. This situation is similar across all former Soviet states and the unexploited engineering skills are an advantage several international companies are aware of. Currently another discussion is emerging: How strong and if at all, Lithuania is affected by brain drain. Due to the lack of comprehensive statistical data, there is no common understanding if and to what degree Lithuania is affected by the brain drain.¹⁰⁰

The government however takes it as a serious threat and included measures in the Lithuanian governmental programme to convince migrated highly educated Lithuanians to return to their home country (Lithuanian Government, 2004). Especially the laser tech cluster, which is presented later on in this report, is facing at the moment such tendencies. The university education enjoys an excellent reputation also outside the country and companies outside Lithuania hire many laser tech graduates. Unfortunately no concrete migration numbers were available for this report, but the tendency is noticeable as several institutions mention it as an emerging problem.

Another important driver for the Lithuanian economy is the Mazeikiai refinery located in the Telšiai County, the neighbouring county of Klaipeda. A study published in 2001 showed that around 30% of the Lithuanian GDP can be linked to the only oil product refinery in the Baltic States (Roe et al., 2006). Recent studies include lower estimations of about at least 10% of the Lithuanian GDP, which is produced by Mazeikiai in 2005 (Socor, 2006b). This shows the high influence of Russia on the Lithuanian economy due to, until recently, the total reliance of this facility upon Russian oil imports. Butinge, the second port in Lithuania and also located in the Klaipeda County, is owned by the Mazeikiai refinery. Over the last years the Mazeikiai refinery became however the pawn of different political powers and private companies. In 1999, the Russian largest oil producing company LUKoil had the intention to acquire the Mazeikiai refinery due to privatisation plans of the Lithuanian government. The offer was denied from the Lithuanian side displeasing the Russian company which reacted almost instantly with the reduction of oil supply down to a minimum leaving the refinery two choices: either going out of business or accepting the Russian offer. Not foreseeable for LUKoil was the friendly acquisition of the refinery by the second largest Russian oil producing company Yukos two years later. Great hopes were connected with the acquisition, but the divestiture of Yukos just a few years later by the Russian government¹⁰¹ led again to difficulties for the refinery and resulted in a deflated growth of the Gross Domestic Product in the Telšiai County (Statistics Lithuania, database).

After the bankruptcy of Yukos, the Polish company PKN Orlen in 2006 preferred by the Lithuanian government fearing the sold out of Lithuanian infrastructure by Russian investors bought the shares. After the acquisition by Orlen, the Russian oil company Transneft stopped its oil deliverance to Mazeikiai claiming technical reasons at the oil pipelines for the stop. The struggle of the Mazeikiai refinery can be

⁹⁹ D. Wilson Report from Europe – Invest in Ukrainian hot spot, *Electronic Business*, 8/21/2007

¹⁰⁰ As no acute problem it is seen by: A. I. Mockaitis & L. Šalčiuvienė *Brain drain from Lithuania: a realistic threat or an exaggeration*, in: TILTAI, 2005, Vol. 4 (33); different argues V. Zydziunaite, *Relationship between professional expectations of University graduates and their motivation to emigrate*, for 5th annual TiSSA 07 in Messina, Italy

¹⁰¹ In 2004, the Russian government claimed over 20 Billion € in back taxes leading to the financial collapse of the oil company Yukos. (BBC news, 2004)

seen in the declining number of cargo volumes at the port of Butinge and the published financial results of Mazeikiai which show significant loss after 2000. Representatives from the Polish and Lithuanian government were seeking meetings with the Russian government and companies in order to resume the oil deliverance. The discussion seemed not to end in a positive result for the refinery: The oil pipeline is still closed from the Russian side. Although this stop effects the economical situation of Mazeikiai, it will not force them into bankruptcy: A shift from oil deliverance by pipeline to tankers helped to compensate the lost. Paying '2 to 2,5 \$ more per barrel', the company 'is just not earning as much as they could have', said English, the director of the refinery (Bohlen, 2007).

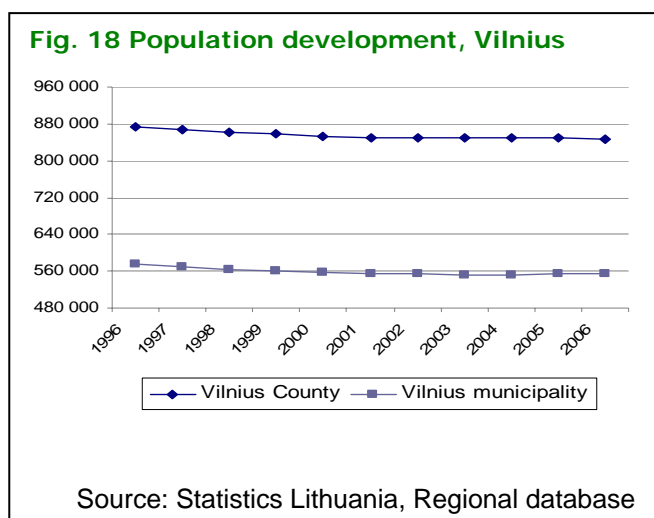
However, problems can emerge in the future based on the just recently published plans of LUKoil to establish a new, large refinery in the Kaliningrad Region. The Mazeikiai refinery is by far the most lucrative economy entity in Lithuania and is the only refinery in the Baltic States, which explains the long ongoing fight about this company. That an entity, which has such a large impact on the Lithuanian GDP can be used as a pawn by Russian companies might be not the best solution for the Lithuanian government. But on the other side the Lithuanian government is in a difficult position. Although Lithuania has own oil storages, the amount is far too small to compensate the stop of the Russian oil pipeline. The Polish main stakeholder recently signalised more investments in Lithuania and in the oil refinery giving hope for a stable leadership. The Lithuanian government chose to exclude Russian oil companies as major stakeholders preventing a sale of the Lithuanian infrastructure by Russian companies. Keeping in mind that Lithuania will from 2009 onwards depend on Russian oil deliverance to compensate the lost of Lithuania's only Nuclear Power Plant producing over 70% of the Lithuanian energy, it might be a wise idea not to sell Mazeikiai to a Russian company leaving Lithuania in a total energy dependency of Russia.

3.1 The Vilnius region

The economic centre of Lithuania is its capital Vilnius with more than half a million inhabitants. The capital concentrates not only nearly a fifth of the Lithuanian population, but is also the most thriving regional economy in Lithuania. Vilnius in addition concentrates over half of the foreign direct investments and is responsible for one third of the Lithuanian GDP. The share of Vilnius on FDI is however since several years to some extent declining.

The population in Vilnius County shows several years a minor declining rate, which decelerated over the last few years. The municipality of Vilnius on the other hand a declining population number, but over three years, the number recovered slightly contributed to the overall stagnation for Vilnius County.

Compared with the development of the population in Lithuania in total, it can be Vilnius County and the municipality have lower declining number. Over the last ten Lithuania in total lost over 200 000 inhabitants. And at the moment there are



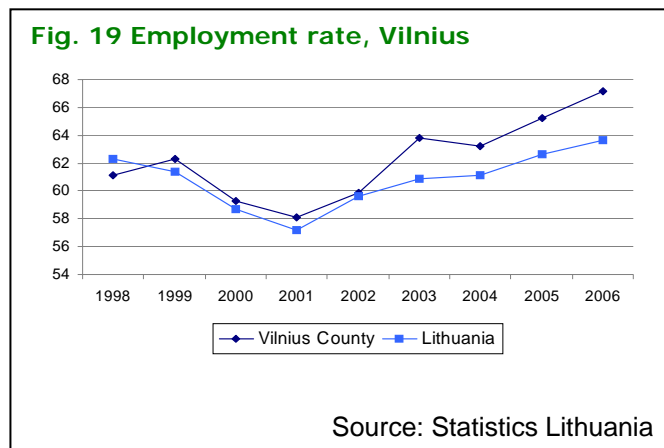
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expectations that this tendency will turn or decelerate. The reasons for a contracting number of inhabitants in Lithuania are the migration tendencies and natural decrease.

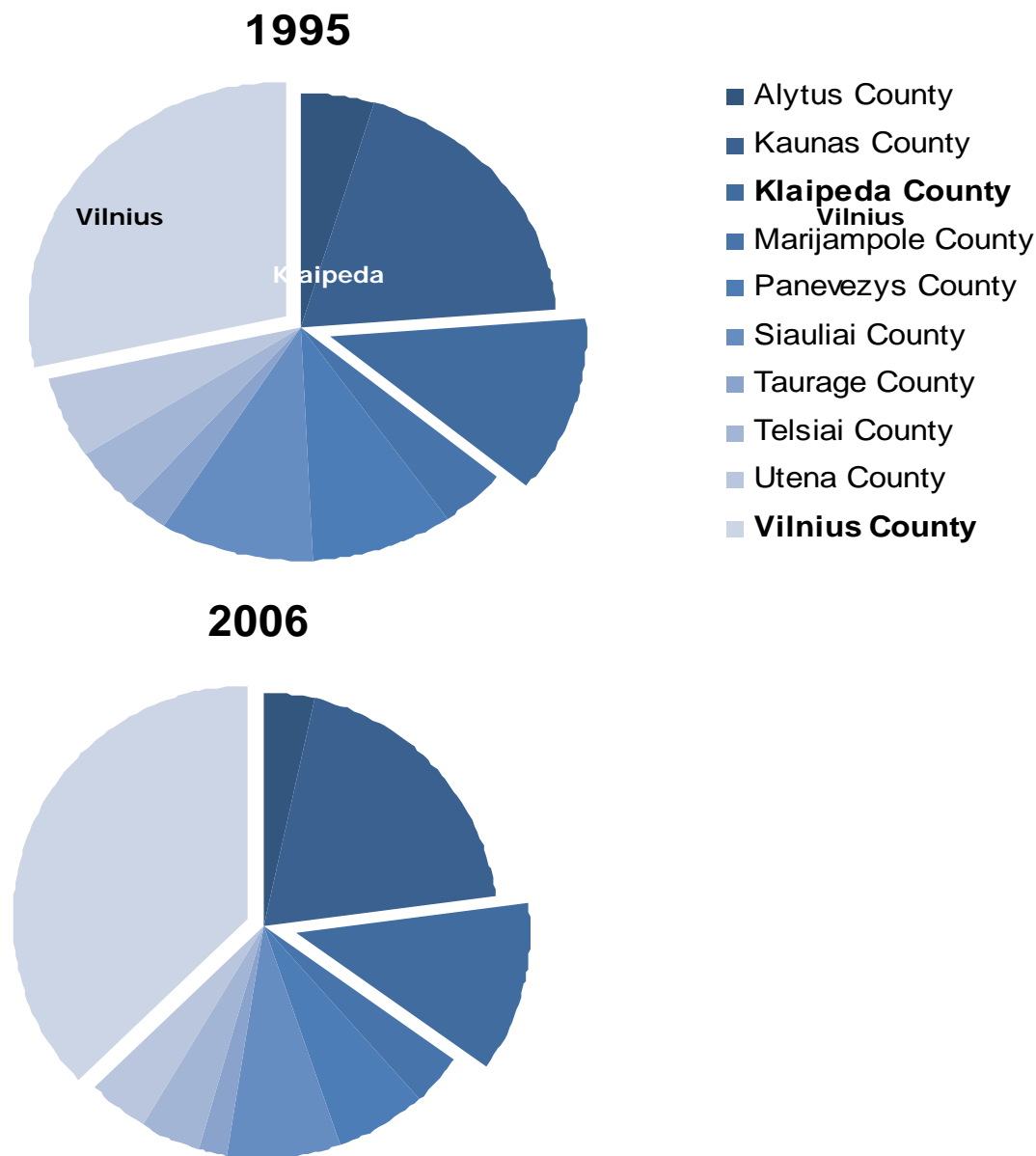


Concerning the employment rate for the Vilnius County, it can be seen that from 2001 on, there is an almost steady increasing employment rate, which follows mainly the development for Lithuania in total. Comparing Vilnius County with the average of Lithuania, the numbers show that Vilnius has a constantly higher and mostly also faster growing employment rate than the average of Lithuania.

The Vilnius region is without any doubt economically seen the most important region in Lithuania. As the capital region, Vilnius is attracting the majority of the foreign direct investments, although the share is continuously decreasing over the last few years (Statistics Lithuania). The economic importance of the Vilnius Region grew significantly over the last years, as it can be seen in the graphic below. Interesting to see is the fact that although the share of Vilnius on the FDI is decreasing, its share on the national GDP is continuously increasing. The FDI invested in Vilnius seem to have therefore a stronger economic effect. An explanation for this could be that for Lithuania in total the majority is flowing into the manufacturing sector, while in the specific case of Vilnius the FDI is mostly guided into the financial and telecommunication sector creating higher economic values than the manufacturing sector.

Vilnius County accounts nowadays to almost 40% of the total Lithuanian GDP and is the only County which shows an increased share over the years. The other Counties have either small declines or stagnations in their share. In comparison with Latvia and Estonia, the Lithuanian capital has a quite lower concentration. Riga and Tallinn had each a share of around 60% on their respective national GDP in 2003. Thus, in Estonia and Latvia the capitals have an even more dominant position as the national economy centre, while in the case of Lithuania the share of Vilnius is similar to Northern European Capitals, which have a share of 30% to 40% of their respective national GDPs (National Statistic Offices, 2007).

Figure 20 Share of Lithuanian Counties on the national GDP



Source: own graphic; based on Lithuanian Statistics

Of all regions in Lithuania the capital region attracted by far the most of foreign direct investments from 1990 on, although other urban regions also had a relatively high share. With the ongoing progress of Lithuania to establish independent structures and liberalisation of trade, the amount of FDIs, which was flowing into the country and Vilnius, increased almost exploding after 1995. The key cause behind this immense inflow of FDI was the privatisation of former state-owned companies, whereof many could be found in Vilnius, the governmental centre of Lithuania. Over the years, the manufacturing industry attracted the most of the foreign direct investments; especially the manufacturing of food, beverages and

tobacco profited in the beginning the most since it was a core competence of Lithuania during the Soviet era. Nowadays it is the manufacturing of refined petroleum and chemical products which have the by far highest share of the manufacturing sector. The different acquisitions of the Mazeikiai refinery by different non-Lithuanian companies contributed certainly to the increase of importance of FDI for the manufacturing of refined petroleum due to the large investments in modernizing the infrastructure enabling to produce fuels of European standard. Since the Lithuanian oil industry is concentrated on the Mazeikiai refinery, Vilnius does not profit from the strongly increasing share of investments of the oil industry. Telšiai County, where the refinery is located, is now the county, which attracts the most FDIs after Vilnius leaving Kaunas and Klaipeda behind.

Vilnius is still attracting over half of the annual foreign direct investments, but the share of Telšiai County is increasing strongly over the past three years. Due to the dominance of the refinery however, the investments are mostly spend on one entity, while Vilnius has a broader field of investments. Vilnius County plays however only a minor role in terms of export of goods produced in Lithuania. Although steady increasing over the last decade, other counties show a higher growth rate and the Mazeikiai refinery plays also here a dominant role. This is in accordance with the status of Vilnius as a financial centre of Lithuania with a dominant service sector. Although still 25% of the employees in Vilnius are working in the manufacturing industry, the city profits also from an increasing importance of the service sector. After the independence of Lithuania, large Western trading companies have established subsidiaries mainly in Vilnius: Most of the investments are therefore going into wholesale and retail trade as well as into post and telecommunication sector. Due to the privatisation process, Western investors were given opportunities to (partly) acquire many telecommunication companies and contribute to the modernisation of the infrastructure, which explains the high investments in this sector. In opposite to Vilnius the foreign direct investments in Kaunas and Klaipeda, the second and third largest cities in Lithuania, were mainly going into the manufacturing sector in 2000.¹⁰²

While Western companies discover Lithuania as a European manufacturing location with almost Asian labour costs, Vilnius as the capital is ahead of this development and is currently in the development of a strong service sector following the trend of the Western Capitals several years ago.

The Lithuanian government and the cities, especially the capital, agreed in developing Lithuania into a knowledge economy and to create with 'Vilnius Technology Valley' an aspirant as a new European Centre of Excellence.¹⁰³ Consequently, the focus in the political documents lies on the development of high-tech industries with a high growth potential for the future: identified as such are biotechnology, laser technology as well as Information- and Telecommunication Technology. These intentions are long-term perspectives since the development needs time to evolve and to be anchored in the national economy. In a short-term perspective, Lithuania will still rely on traditional industries, while the new high-tech clusters will evolve into the next pillars of the national economy. Such high-tech clusters can mainly be found in Vilnius indicating that the Lithuanian capital will be the national forerunner. This can also be seen in the distribution of the foreign direct investments over the different branches and industries.

¹⁰² OECD Lithuania: Foreign Direct Investment – Impact and Policy Analysis, Paris 2000

¹⁰³ A. Bagdonas *Sunrise Valley: Bringing Business and Science together*; Presentation for the European Week of Regions and Cities in October 2006

The investments in Lithuania in total are mainly flowing into the manufacturing sector, while in Vilnius over half of the FDI were invested into post and telecommunication sector as well as into wholesale and retail trade. Only around 10% was invested in the manufacturing sector showing the different distribution in Vilnius in comparison with Lithuania in total.¹⁰⁴ Comparing the capital with the second and third largest Lithuanian city, the role of Vilnius as a national forerunner becomes even clearer: In both cities the manufacturing industry plays a much larger role than in Vilnius attracting around 51% of FDI in Kaunas and 71% in Klaipeda in 2000. (OECD, 2000) But also the financial services in Vilnius attract increasingly the attention of foreign investors leading to a strongly increasing share of FDI. Vilnius profits more and more from these increasing investments in the financial intermediation, which succeeded in 2006 to attract the most FDI after the manufacturing sector leaving eventually wholesale and retail trade behind (Statistics Lithuania, 2007). Based on these tendencies Vilnius gained the title as the unchallenged financial centre of Vilnius.

The reason for this focus on the development and distribution of foreign direct investments is that the important role of FDI for the economic development is generally acknowledged and was also confirmed by the Organisation for Economic Co-operation and Development (OECD) in the case of Lithuania and Vilnius. The OECD organised in 2000 a conference in Tallinn discussing Foreign Direct Investment Policy and private sector development in the Baltic States. The aim was to provide a good insight about the contribution of the Foreign Direct Investment to the economic transformation of the Baltic States since their independency in the beginning of the 90s. The main conclusion was that *'foreign direct investment has played a determining role in the economic progress of the Baltic States towards market-based economies and their integration into the global economy'*.¹⁰⁵

There is no general answer how Foreign Direct Investments are influencing the economic growth of an country or an region, but high investments in one specific branch show that foreign investors see a lot of potential in this branch. FDI are therefore seen as an important indicator of economic growth and stability. The ongoing privatisation process has a certain impact on the distribution of the FDI. During the end of the 90s the Lithuanian government decided to privatise major state-owned enterprises like Lithuania's largest telecommunication company Lietuvos Telekomas, which was acquired by the Swedish-Finnish Telia/Sonera. Such major state-owned enterprises can mainly be found in Vilnius.

Taking the distribution of the FDI, share of employment, but also the expressed intention to become a knowledge-based economy into consideration it can be said that the manufacturing industry still plays a not to underestimate role for the economy in Vilnius. The economic structure of the capital however stands out from the rest of Lithuania due to a strong trade and financial service sector. Keeping in mind that also the most of the high tech companies can be found in the city, it is clear that Vilnius takes the role as a forerunner being currently in a stage of transformation. The emerging clusters are contributing mostly only to a still small, even though continuously increasing, degree to the growing economy of Vilnius. The current economical fundament of Vilnius is still the traditional industries like the manufacturing sector benefiting from significant modernisation processes. Although the share of industrial employment in the economy's structure is still considerable in Vilnius, other sectors are attracting most of the FDI indicating changes in the regional economy leading to a slow, but continuously shift from the industrial to the knowledge economy.

¹⁰⁴ OECD Lithuania: Foreign Direct Investment – Impact and Policy Analysis, Paris 2000

¹⁰⁵ *ibid.*

The Lithuanian government expressed in several documents its intention to create a knowledge economy in Lithuania and Vilnius. One of these documents is the National Programme of High-Technology Development, which is coordinated by the Lithuanian State and Study Foundation. Five existing high technology industry branches with promising potential for the future are identified and the programme aims to formulate development perspectives for these five promising industry branches: Biotechnology, mechatronics, laser technologies, information technologies as well as nanotechnology and electronics. The programme also estimates the growth potential of the biotech sector in Lithuania and predicts that in 2012, the turnover should reach around 130 Mio. € and should attract at the same time foreign investments of around 45 Mio. €. Since the annual turnover in 2006 was only 40 Mio. €, the estimate numbers for 2012 show the great expectations, which are connected with biotechnology.

In accordance with this, the Vilnius City Municipality and the Knowledge Economy Forum prepared several projects which should stimulate this creation of the knowledge economy in Vilnius: Northtown Technology Park, Biotechnology Science Park, Sunrise Valley as well as Visoriai Valley. These science parks have a clear orientation towards the identified high-tech sectors with the most promising growth potential in Vilnius: Biotechnology, Laser technology as well as Information and Telecommunication Technology. (Knowledge Economy Forum, 2004) Beside the high growth rates, another reason for choosing these three of all sectors to be the future core competences of the Vilnius economy might be the export advantages of these sectors. The growth of these new technology sectors is the highest in the country and also the export volumes are constantly growing. The high share of products which are exported shows that the Lithuanian and Vilnius' economy are international competitive in these sectors. As an example the laser tech cluster in Vilnius exports 90% of its production to almost 100 countries.¹⁰⁶ The municipal concentration on these three high-tech industries is furthermore also supporting the Vilnius Vision 2020: Vilnius – capital of Lithuania, most modern city in Central and Eastern Europe, international centre of politics, business, science and culture.

3.1.1 Clusters

3.1.1.1 Biotech

Lithuania is participant of the ScanBalt Bioregion, which is a Baltic biotech-network without any formal power. ScanBalt is a platform where the different individual biotech-networks can meet and common ideas and projects can be implemented. As member of ScanBalt the Lithuanian Biotech industry was part of different projects concerning cluster mapping, which delivered to a certain extent a good insight in the Lithuanian biotech cluster.

The Oxford Research Institute described the life science cycle of biotech clusters in the Baltic Sea region with three stages and assigned the Biotech cluster in Vilnius to the middle stage. This means that the Lithuanian cluster is further developed than the biotech clusters in Latvia, North Poland and North-West Russia. These three clusters are characterized by a low number of spin-offs and weak links between industry and universities, but quite high numbers of scientific publications and some have even a high number of patents. It is estimated that the Vilnius cluster is currently one stage further and is situated in a condition of a low spin-off production, but fruitful co-operations between companies and university research institutes with a geographical concentration of biotech companies near the university. For

¹⁰⁶ Knowledge Economy Forum *Knowledge Economy in the City of Vilnius*, Vilnius 2004

comparable reasons it should be mentioned that Medicon Valley is classified as a mode-3 cluster with a large pool on highly educated workforce, high number of spin-offs and close interactions between the regional life science companies.

Firms	Turnover	No. employees	Competences
Fermentas	8,5 M€	250 (185)	Life Science
Sicor Biotech	5,5 M€	158 (150)	Life Science
Biocentras	1 M€	28 (20)	Environment

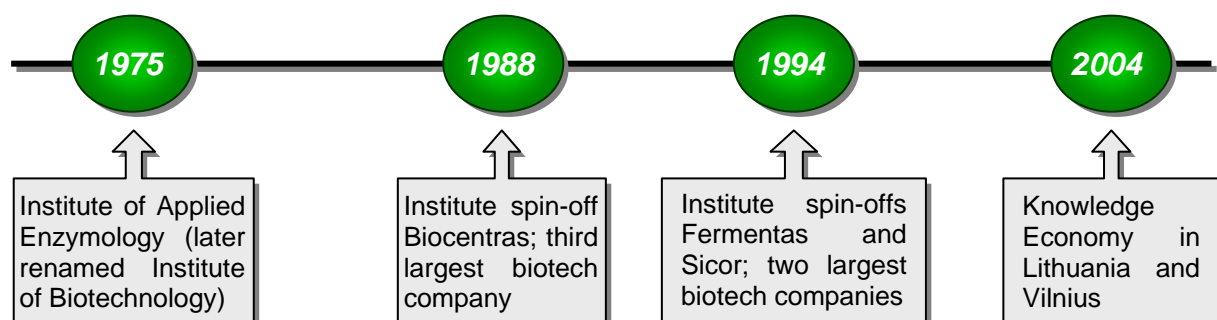
Author's note: numbers in bracket are for the year 2003, without for 2006

First steps into the new field of biotechnology were made with the establishment of the Institute of Applied Enzymology at the Vilnius University in 1975. It however was not before 1988, when the number of spin-offs increased significantly. This was the year when Biocentras was created in order to transfer the university-gained research results into

the private economy. Smaller spin-off activities seemed to be present also the years before,¹⁰⁷ but it can be said that the creation of Biocentras was the second important milestone – after the establishment of the Institute – in the development of a biotech cluster in Vilnius. After the spin-offs Fermantas and Sicor in 1994, which are nowadays the two largest biotech companies in Lithuania and Vilnius, entrepreneurial activities occurred on a higher level than before, but no company which stands out by large turnovers or number of employees from the other biotech companies was established after 1994.

In 2004, the Lithuanian government as well as the Vilnius City Municipality expressed the intention to form a knowledge economy with several high-tech industries as locomotives for the Lithuanian economy (EKT, 2004); these high-tech industries include among others biotechnology. With this declaration, the biotechnology might experience another impulse which will lead to the development of a close meshed network of biotech companies with strong connections.

Figure 22 Timeline Vilnius biotech cluster – Milestones



Source: own graphic, 2007

The biotech cluster in Vilnius, but also in whole Lithuania is dominated by three main players, which are all three spin-offs from the State Research Institute of Biotechnology in Vilnius: Fermentas, Sicor Biotech and Biocentras. Since these three companies are responsible for 80% of the biotech industry income in Lithuania, their development will deliver a good insight about the development of the biotech cluster in

¹⁰⁷ Knowledge Economy Forum *Knowledge Economy in the City of Vilnius*, Vilnius 2004

Vilnius. Beside these three large, dedicated biotech companies, Vilnius has with Sanitas and Valentis two quite large pharmaceutical companies, which were established in 1922 and 2002. Sanitas has nowadays around 300 and Valentis around 120 employees. Due to the specification rather as a biotech cluster than a life science cluster with a broader approach, neither Sanitas nor Valentis are considered as primary players in the biotech cluster¹⁰⁸. Unfortunately there is no further information about if and to what extent Sanitas and Valentis are co-operating with dedicated biotech enterprises. In case of a co-operation these two companies would have a certain input into the cluster.

The leading Lithuanian Biotech company is Fermentas, which invests around 1-1,5 Mio.€ in research activities every year and was founded 1994. The impressive growth of Fermentas can be seen in the change of the annual turnover. Between the year 1999 and 2002 the turnover doubled from four to eight Million € and is currently in a stagnation on a high level above eight Million. Fermentas is the largest biotech firm in Lithuania and Vilnius by turnover as well as by number of employees. Fermentas is claimed to be the leading producer of molecular biology products in the world with a share of 10% of the world market (ScanBalt Homepage, 2007). In 2004, Fermentas was chosen to be the Knowledge Economy Enterprise of the year in Lithuania. Acknowledged with this price was their competence in successfully transforming knowledge into marketable products (Knowledge Economy Forum, 2004). Fermentas is strongly involved in R&D activities not only with the Institute of Biotechnology with which Fermentas still shares certain resources due to the location in the same building, but also with other mostly foreign biotech companies and research institutions. Fermentas is also involved in joint research activities with Alna, one of the largest ICT companies in Lithuania. At the moment Fermentas has 185 employees of which around 90% graduated from a university within the fields of chemistry, biochemistry or molecular biology. This shows the demand for a highly educated workforce.

Sicor Biotech UAB develops and manufactures biopharmaceuticals and was established 1994 as a spin-off of the research Institute of Applied Enzymology (STEMTI) in Vilnius under the name Biofa AB. After 1999, the company received considerable foreign investments, which made it possible to explore new business opportunities by at the same time stay focused on the core competences. The company experienced a fast growth since that time on, since the establishment of the new multipurpose biotech production facility made it possible to develop into a more modern and qualitative stage. In 2001 the company joined the international pharmaceutical group SICOR Inc. The company has nowadays around 150 employees of which over 10% hold a PhD-degree in biotech related fields. The company has a close relationship with the University in Vilnius, which results among others in the relatively high number of employees educated in the particular university.

Biocentras was already established in 1988 and was therefore the first of the largest companies. Nowadays Biocentras is the third largest biotech company in Lithuania and Vilnius, behind Fermentas and Sicor Biotech, which both were established six years later. The company has a clear orientation towards environmental biotechnology and its core competence is to decontaminate soil and water, which is polluted by mainly oil, but also other environment threatening dangers. Biocentras distinguishes from the other Vilnius biotech enterprises by not having a clear orientation towards life science. Its profile poses a considerable obstacle in being involved in an international competition: Their core competences cannot be as easily exported as pharmaceuticals or medical instruments. Although engaged in several EU

¹⁰⁸ Author's Note: The Lithuanian and Vilnius' public actors, which represent the biotech cluster on the European level unanimously do not include the pharmaceutical companies Sanitas and Valentis as actors in the biotech cluster.

research projects like under EUREKA, the actual clients of the enterprise are exclusively from Lithuania, West-Russia, Latvia as well as Belarus, which are the neighbouring countries and are therefore easy and fast to reach. Around 27% of all the company activities so far were taking place outside of Lithuania in the neighbouring countries. It is interesting to see that before 1993 the company was mainly active outside of Lithuania, while from 1993 on until now only one project was implemented outside of Lithuania, which was in Russia. This means that the company experienced a shift from being a player in Eastern Europe to a company mainly of national importance after the descent of the Soviet Union. This orientation shift however did not have a negative impact on the employment numbers, since the number increased indeed very slowly but steady. With nowadays only 28 employees of which 22% are doctors of science, the company is still the third largest Lithuanian biotech company.

Despite the fact that it is often referred to the Lithuanian Biotech sector, the vast majority of biotech companies is concentrated in Vilnius. The concentration is so high that one might say that the whole modern biotech industry of the country can be found in Vilnius. The three leading biotech companies are the above introduced Fermentas, Sicor Biotech UAB as well as Biocentras, which are all located in Vilnius. These three enterprises are responsible for over 80% of the industries income. One distinctive feature is that all three companies are spin-offs from the State Research Institute of Biotechnology in Vilnius, which was founded under a different name and with a slightly different research field in 1975.

Another spin-off was Biok UAB, which started as a manufacturer of biotechnology products, but is now active in cosmetic products. Beside these private locomotives for the biotech cluster, all five dedicated Biotech R&D institutions are also located at one of the Vilnius universities.¹⁰⁹ This means that Vilnius concentrates the Lithuanian R&D facilities, companies and education institutions within biotech. Biotechnology is seen as one of the most promising sectors in Lithuania and Vilnius with 26 biotech companies. The three international acting companies in Vilnius dominate the business structure of the cluster, while the business structure of other East European countries show a more balanced structure with a higher number of biotech companies but smaller size. Estonia for example has, although a smaller country, around 40 biotech enterprises.

It is estimated that the Biotech cluster in Lithuania comprises of 26 biotech companies, which however are highly concentrated in the Vilnius County. In comparison with Medicon Valley in the Öresund Region, this concentration seems to be pretty small, but in comparison with the other Baltic Tigers, the number ranges only slightly on a lower level. Vilnius however has a clear advantage in opposite to the other two countries: Vilnius houses three large biotech companies, which have a high international reputation and raises the reputation of the whole Lithuanian respectively Vilnius Biotech cluster. 80% of the income is gained by the export all over the world.¹¹⁰ This high share of export shows, that the Vilnius biotech cluster is competitive on international level.

Due to the relatively small number of biotech companies in Vilnius, the interactions between them are on a low level. In the case of Medicon Valley for example, the biotech companies are in close co-operations with other biotech and especially large pharmaceutical companies. As already shown in the part of

¹⁰⁹ G. Dienys, *Biotechnology in Lithuania – Science and Industry*, 2006 Vilnius; presentation available on: <http://bmc.biomed.lu.lv/gene/print/>

¹¹⁰ EKT (Ekonomines Konsultacijos ir Tyrimai UAB) (2004): *The Knowledge Economy in Lithuania – A Study of the Industry's Prospects*; prepared for the Lithuanian Development Agency.

Medicon Valley, larger especially pharmaceutical companies like H.Lundbeck and Astra Zeneca outsource competences to smaller regional biotech start-ups which profit a lot from the close co-operation with the large and financially strong companies. Vilnius has not yet such a close meshed network of companies and is missing really large companies, which can finance big research activities and take smaller companies into contract. Bioneer, which is located in the Medicon Valley, is a spin-off of the Technical University of Denmark and was established in 2004. Two years later, the company had an annual turnover of over 4 Million € and 34 employees. Research collaborations with among others Chr. Hansen contributed certainly to the expansion of the company. Fermentas on the other side, which was established in 1994 as a spin-off of the State Research Institute of Biotechnology in Vilnius, has nowadays 185 employees and a annual turnover of a bit more than eight Million €. The development of each company depends of course on the product they develop and about the market possibilities, which are related to the product. But the growth possibility of a biotech company is also influenced by the regional possibilities in cooperating with other regional companies. Vilnius is missing large Global Players like Lundbeck and Astra Zeneca, which can hire smaller, new enterprises as sub-contractors and provide them a reliable base of income.

The most important motor in initiating the biotech cluster in Vilnius and Lithuania was the Institute for Applied Enzymology. The nowadays called Institute of Biotechnology was responsible for the spin-off of all four largest biotech companies in Vilnius and many other biotech companies. The Institute still has an important role within the biotech cluster: A large number of graduates within the field of biotechnology find their first jobs at the Institute. Some of them create later their own companies in the geographically close surrounding of the Institute. Usually co-operations are then taking place between these companies and the Institute. The Institute can therefore be described as the first driving force in the biotech cluster, while with the creation of the three largest biotech companies new important players were introduced into the arena. One obstacle in the way of developing the biotech cluster further might be the lack of specialists in the fields of biochemistry, microbiology, genetics and bioinformatics. This lack of skilled labour force was stressed in the analysis of the High Technology Development Programme. The number of graduates within biotech related study programmes needs to be increased faster than it occurs at the moment.

The Vilnius Biotech cluster is clearly the dominating centre in the national biotech industry, which keeps the national competition pretty low. Beside Vilnius, Kaunas as the second largest city in Lithuania has another concentration of biotech companies and research institutes, which however is far less distinctive. Of interest is the question how the Vilnius cluster is performing in comparison with the other Baltic Tigers and Poland. Estonia, Poland and Latvia are peer competitors, since they have as former members of the Soviet Republic similar economic conditions and joined just recently the European Union. Poland is by far the East European member state with the largest number of inhabitants and also in comparison with the EU-15 member states Poland is one of the largest markets. Due to its location, Poland has a key position between the Middle and East Europe. Poland's biotech industry however seems not to have the same international reputation than the Lithuanian biotech cluster and could so far not profit much from its strategic location. Concerning the Baltic Tigers, the entrepreneurship within biotechnology started in all the three countries around the some time: Mid of the 90s. Solis BioDyne Ltd is claimed to be one of Estonia's first 'modern' biotech companies and was established in 1995. Also in Latvia the number of newly established companies increased from mid 90's on.

According to Ernst&Young, the Vilnius biotech cluster stands clearly out from its Eastern European competitors and is considered to be the most advanced in East Europe. Huge potential is foreseen for the

future and already now the Lithuanian biotech companies are successfully competing on the European and international level.¹¹¹ Lithuania stands out from its Baltic peer competitors through the good reputation and three leading, international known biotech companies, which are the above introduced Fermentas, Sicor Biotech UAB as well as nowadays to a much smaller extend Biocentras. Latvia has in fact with Grindex and OlainFarm two rather large pharmaceutical companies (700 to 900 employees), but they have no special strong international position within their field of competences.

In the political documents, the biotech cluster is closely linked to the intention of the Lithuanian and Vilnius' political representatives to initiate a knowledge economy in Lithuania and Vilnius. The biotechnology cluster is furthermore identified to be the most promising cluster in the economy. Therefore policy-makers have taken the initiative to start several Technology and Science Parks in the last few years. The Vilnius City Municipality and the Lithuanian Ministry of Economy have the intention to establish a Biotechnology science park in Paneriai, which is a district of Vilnius. Since nearly all of the Vilnius biotech companies and institutions are already located in this area, the biotechnology science park aims to provide infrastructure, which is specific to the needs of the biotech sector. It is expected that such a facility will stimulate the development of more biotech start-ups in Vilnius. Beside Paneriai, which is completely dedicated to the biotech industry, another Science Park was already established with a partial emphasis on biotechnology: Biotechnopolis/Visoriai IT Park. Biotechnopolis is intended to become the strongest biotech centre in the Baltics.¹¹²

It is estimated that in the next five years the annual turnover of the Lithuanian biotech cluster will triple of which Vilnius will attract the most. This seems in accordance with the statement of Ernst&Young, which sees the Lithuanian biotech cluster as the biotech cluster with the best potential for the future in Eastern Europe. One obstacle for the future will be the shortage of skilled workforce. It is expected that Lithuania won't be able to satisfy the demand of the biotech industry for skilled employees.

In comparison with the rest of Europe and the USA, biotechnology in Eastern Europe was quite late discovered as a field of interest for the private economy. First, few companies emerged in the Eastern European countries indeed already around the 80s, which was similar to the rest of the world, but to a much smaller extend than in the USA and Western Europe. But it was not before the mid 90s, when the entrepreneurial activities increased significantly in Eastern Europe and started therefore around 10 years after the EU-15 and USA¹¹³, but still to much smaller extend. An analysis of EuropaBio shows that the number of newly established biotech companies was growing constantly until 2001 both in the USA as well as in Western Europe, but afterwards the number decreased considerably with around 30% in both Europe and the USA. Austria, Spain and Italy are the only ones, which show a positive growth rate, but they have anyway only few biotech companies so far.¹¹⁴

Overall seen, the conditions for the biotechnology sector in the industrial countries seems to be less friendly than just a couple of years ago, which will be challenging for the new EU member states to build

¹¹¹ Ernst&Young *Beyond Borders – Global Biotechnology Report 2006*

¹¹² A. Bagdonas, *Sunrise Valley: Bringing Business and Science together*; Presentation for the European Week of Regions and Cities in October 2006

¹¹³ Cp. 'Medicon Valley' part in the same report

¹¹⁴ EuropaBio (2006): *Biotechnology in Europe: 2006 Comparative study*, Brussels

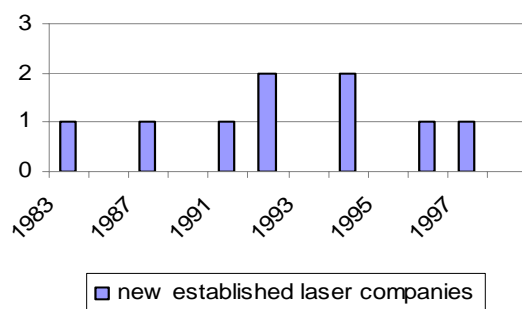
up a comprehensive, international competitive biotech cluster. Lithuania has here the advantage of having already a quite competitive base for a larger biotech cluster, which could help Lithuania and Vilnius to attract biotech activities within Eastern Europe to a better extend than the other Baltic Tigers.

3.1.1.2. Laser Tech

Albert Einstein laid the foundation for laser technology in his paper ‘On the Quantum Theory of Radiation’ which was published in 1917. But it was not until the beginning of the 60s, when in the USA the first laser was finally operating and four years later the American Townes as well as the Russians Basov and Prokhorov received together the Nobel price for their work, which made the construction of lasers possible. Nowadays, laser technology is integrated in the everyday’s life through applications in among others DVD and CD players as well as in laser eye surgery.

Already in the end of the 60s, the first picosecond lasers¹¹⁵ in Lithuania were designed and manufactured at the Vilnius University, where in 1974 the Department of Quantum Electronics was created. In order to intensify the research on laser tech, the Laser Research Centre later extended the Department.

Figure 23 Laser tech companies, Vilnius



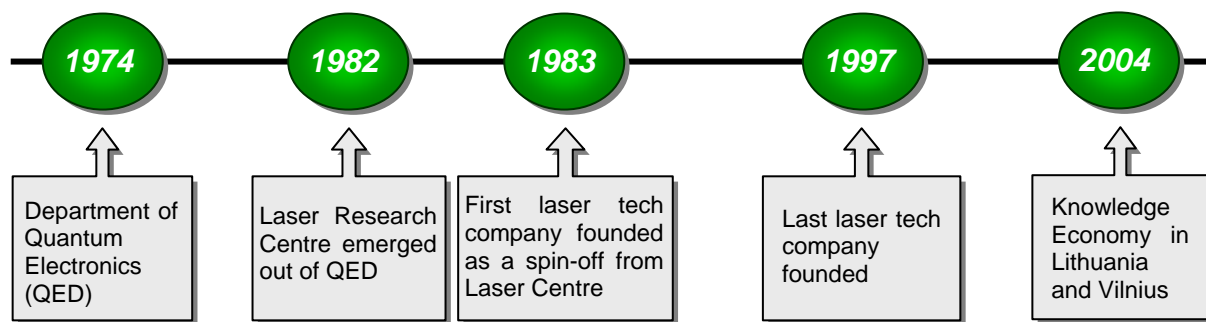
Source: LITHLASNET Homepage, 2007

Since its establishment the Department and later the Research Centre educated over 300 specialists in laser physics. The public research institutions are therefore since over 40 years active in laser technology research. Taking into account that in the USA the first laser was operating in the beginning of 60s, the Vilnius University was quite early involved in laser technology. In Germany, for example the first laser research institute was founded with BIAS (Bremer Institut für angewandte Stahltechnik) in 1977 and in the mid 80s a massive wave of formation of laser institutes occurred.

In Lithuania the first laser research institute was established in 1982 which was some years later than in Germany. Taking into consideration when the laser technology companies were established, it can be said that the private industry did not discover laser technology before the end of the 80s as a field of interest in Lithuania. The first company was established in 1983 as a spin-off of the Laser Research Centre, but the rest of the companies were all established between 1987 and 1997. After 1997 no other laser tech company was newly created, which means that the number of laser tech companies did not increase since ten years. Similar to biotechnology, laser tech is identified as one of the most promising industries and the Lithuanian government assigned laser tech the part of being one of the locomotives for the Vilnius economy. This new attraction of interest from the political and municipal point of view might have a positive effect on the development of laser tech start-ups in the future. The newly established Sunrise Valley has among others laser tech as one field of core competence, which should be specially promoted. Due to the short time in which Sunrise Valley is in business, no new laser tech company was started up yet. In the following graphic the milestones of the laser tech development are shown.

Figure 24 Timeline Vilnius laser tech cluster - Milestones

¹¹⁵ Author’s note: One picosecond is one trillionth of a second and one thousandth of a nanosecond. A picosecond laser is therefore a laser, which emits optical pulses with the duration between one picosecond and tens of picoseconds. (Encyclopedia of Laser Physics and Technology Homepage, 2007)



Source: own graphic, 2007

The laser technology cluster of Lithuania consisted until 2004 of ten companies of which all are situated in Vilnius. In 2004, the two largest companies formed a joint-stock company and are considered from now on as one company. Due to the short time of the emergence, these two companies will be presented first separately. An introduction to the three largest companies is necessary in order to introduce to the development of the laser tech cluster in Vilnius.

In 1983, Eksma was established as the first laser tech company in Lithuania and Vilnius. Its research outcomes resulted later in the establishment of the second largest laser tech company in the country. Eksma was until 2004 the largest one by annual turnover as well as by number of employees. In 2004, the company acquired 99,61% of the Ekspla shares and decided to emerge photonic components and laser businesses into one company: Ekspla. Before the purchase, Eksma had an international network of cooperation going on with companies from Germany, Austria and Russia. As joint ventures, the companies agreed to undertake economic activities together. Further, less strict co-operations were going on with entities in Western Europe, Japan and the USA. After the acquisition, these activities were transferred to Ekspla.

Ekspla was established as a spin-off from Eksma in 1992 and is nowadays, after the emergence with Eksma, the largest laser tech company in Vilnius by annual turnover and by number of employees. Ekspla succeeded in increasing its annual turnover strongly due to the development of new products, the access of the new market in South Korea and increased operations in the USA and European markets. In 2004, the stakeholders of the two companies Eksma and Ekspla decided to form a joint-stock company. Often this joint-stock company is referred to as Eksma Group Company.¹¹⁶ There is still no mutual perception existing if this group company should be considered as one or still as two companies. Depending on the publisher of the different reports, the laser tech cluster is considered to consist sometimes of nine and sometimes of ten companies. Since the annual turnovers and number of employees are still presented until 2004 for two different companies, this paper introduced Eksma and Ekspla as two separated companies. Since the resources of both companies within laser tech are however emerged later into one company, this paper will rather refer to the Eksma Group Company after 2004 instead to the two separate companies. In 2005, Ekspla as the Eksma Group Company received the price as the knowledge economy company of the year in Lithuania; one year after Fermentas, the largest Lithuanian biotech company, received the price. In 2006, Doclogix, which is an ICT company, took the price. It can be seen that over the last few years, the price as the knowledge economy company of the year in Lithuania was awarded to a company

¹¹⁶ Ministry of Economy of the Republic of Lithuania et al. *The investor's guide to knowledge economy in Vilnius-Kaunas dipole*, Vilnius 2006

of each of the most promising industries in Lithuania: Biotechnology, laser tech as well as Information and Telecommunication Technology.

Light conversion is the third largest laser tech company by annual turnover and was established in 1994 as a spin-off of the Vilnius Laser Research Centre. The company is also known under its Lithuanian name Sviesos Konversija, but for easier understanding the English name will be used in this paper. The most important market for this company is the USA, since around 50% of the production is being exported to the US. It has to be mentioned that the company's products are to a vast majority used by public educational and research institutes like Universities, since especially scientists are in the need of ultra fast lasers with the shortest and the most powerful possible pulse of light. Light conversion is there the unchallenged market leader and has a share of 60% of the global market of multicolour lasers (EKT, 2004). Light conversion is also quite actively involved in EU projects.

Last year, the co-operation of the four Lithuanian laser tech companies Light conversion, Ekspla as Eksma Group Company, Standa and Optika successfully accomplished a project, which was funded from the EU Structural Funds. The objective was to develop new types of laser, which correspond better with the changed requirements of the industrial application, which could open up new market possibilities beyond the scientific market. Another EU project in 2005 was to develop new components for the micro-optic production and was co-financed over PHARE. Although involved in several EU-projects over the last few years and distributors all over the world, Light Conversion seems to have mainly national research partners. Around 85% of the sold lasers are exported to USA, Germany and Japan, while Lithuania is a very small market with Vilnius University as the only entity with a light conversion laser. For comparable reasons it should be mentioned that in Germany 45 institutions possesses a light conversion laser and in the USA considerably more. Although active in an international market, the main research partners are still national. These research activities seem to result in several new products and the annual turnover of the company is continuously rising.

Vilnius houses nine companies, which are operating and manufacturing lasers and other optical components. Some of them are in a close co-operation with each other: Optida, Ekspla part of the Eksma Group Company, Altechna, Standa and Light Conversion are currently involved in a co-operation. All of the laser tech companies are strongly involved in export and sell their products into nearly 100 countries worldwide. The Vilnius cluster includes two companies, which are global market leaders in their specific field of laser technology: The company UAB Light Conversion was the first company within ultra fast parametric light generators and is seen as the pioneer and world leader within this field. The company has nowadays a share of about 60% of the global market in the production of ultra fast parametric light generators. Another company with a position as a world leader is Ekspla, which holds since many years a share of 50% of the global market for picosecond lasers. Ekspla as part of the Eksma Group Company is currently involved in the development and implementation of the Sunrise Valley knowledge economy cluster in Vilnius, which should among others create a good environment for laser tech companies.¹¹⁷

Although the laser tech cluster has such few companies with a moderate annual turnover, the laser tech cluster in Vilnius is successful in achieving positions as unchallenged market leaders in different market niches. It can be assumed that, generally speaking, smaller clusters will profit from a concentration on smaller markets, since less competition is expected: Due to a smaller market there is not so much profit

¹¹⁷ A. Bagdonas, *Sunrise Valley: Bringing Business and Science together*; Presentation for the European Week of Regions and Cities in October 2006

involved that it catches the interest of many other companies and especially the global competition will stay pretty low. This seems to be the case for the Lithuanian laser tech cluster. Currently NASA shows interest in multicolour lasers, which are now produced from Light Conversion, but were first developed from Physicists at the Vilnius University. The excellent reputation of the Lithuanian laser technology was also shown in 1999, when the European Commission chose the Laser Research Centre at the Vilnius University to be one of the 34 scientific institutes of the Candidate states with the status of a Centre of Excellence. Also the NATO Science for Peace Programme chose to support the Laser Research Centre by expanding the experimental base. The Centre has therefore the task to develop new components, which resist under extreme conditions. Furthermore, the laser research centre is participating in the Laserlab Europe network of the European Union funded by the Sixth Framework Programme.

Although the number of laser tech companies is quite low, the companies succeeded to create together with the Laser Research Centre a good reputation in the world, which attracts several commendations and projects from EU and NATO institutions. At the moment four of the nine laser tech companies are furthermore actively involved in Asia Invest LEAP, which is a platform aiming to link European and Asian companies involved in photonics. European companies within photonics can search here in theory for research partners, distributors or suppliers all over Asia; but in practice the platform covers only China. Altechna, Ekspla as part of the Eksma Group Company, Standa as well as Optida are looking for partners in China in order to extend their market possibilities and/or to enter co-operations with Chinese manufacturers.

Besides the international positioning, also the national level is considered. In order to develop the national laser technology further, the LITHLASNET was established as a result of the participation of EULASNET (European Laser and Optics Applications Network), which aims to generate transnational projects in specific fields of laser applications. Lithuania is involved in two of the ten projects. All current twelve actors of LITHLASNET are situated in Vilnius, which shows again the importance of Vilnius with the laser technology. The actors in the network are the identified laser tech companies as well as the Institute of Physics and the laser research centre at the Vilnius University. The close co-operation between the public research institutions and the private companies can be seen in the high number of private representatives in the Board of the Institute of Physics: Each of Optida, Eksma and Ekspla have one representative in the Board.

In the last 30 years, the Vilnius University educated over 300 specialists in laser physics. This education seems to have an excellent reputation in the world which is shown in the high number of university graduates which are hired in foreign research centres. By maintaining a close relationship between the university and its graduates, an international network of co-operation can be build up. But at the same time, Vilnius also needs to ensure that the local laser tech companies have access to a sufficient and skilled labour force. There is still no strong sign of a shortage of laser specialists in the Vilnius companies, but it is also predicted that the growth of the companies will cause an annual increase of 20-30 new jobs within laser technology (EKT, 2004). This means that the predicted need for the regional industry is at the moment higher than the annual output of the University on graduates. If some of the graduates decide to go abroad, the regional lack will be even more noticeable.

The four education institutions in Vilnius: Laser Research Centre, Semiconductor Physics Institute, Institute of Materials Science and Applied Research as well as Institute of Physics have currently together only 44 students enrolled within laser technology of which 27 are PhD students (Homepages of the institutions, 2007). Taking into account that the education takes several years, the lack of skilled

workforce for the future is foreseeable, if the number of students cannot be increased significantly over the next years. One response of the low numbers of skilled labour force might be that the Vilnius' laser tech companies outsource processes to other companies or establish even new plants outside Lithuania where employees can easily recruited. In the case of Ekspla as part of the Eksma Group Company, Altechna, Optida and Standa, these four companies are searching actively for suppliers and manufacturers of laser components in China (Asia Invest LEAP Database, 2007). Additionally to that Ekspla also established joint ventures with companies from Germany and Austria in order to implement joint research activities. This might be one reply to the high number of experts, which chose to work outside Lithuania, leaving a lack of skilled work force behind them.

The three largest laser tech companies in terms of annual turnover are EKSMA, EKSPLA and Light conversion which are strongly involved in research activities and dedicated 5% of their annual turnover to R&D. (Knowledge Economy Forum, 2004) Their annual turnover together however was no more than around eight Mio. US\$ in 2001, which means that these three companies dedicated only around 400'000 US\$ into private laser tech R&D. Due to the acquisition of Ekspla through Eksma, Standa is since 2005 the third largest laser tech company in Vilnius and Lithuania. These research activities of the companies result indeed in new products, which are exported all over the world, but so far no new company spin-offs or university spin-off was created. Since 1997 no new laser tech company was established in Vilnius. One main component of a cluster is therefore missing: the stimulation of new enterprises, which would bring a new dynamic to the existing cluster.

The laser tech activities are concentrated on the already existing companies and also the public research activities on the Vilnius Universities did not result in spin-offs since 1994. For the growth of the laser tech cluster in Vilnius it is crucial to stimulate the establishment of new companies. The Vilnius municipality and also the Lithuanian government are currently developing the establishment of a Science and Technology Park, which aims among others to the establishment of laser tech infrastructure. But the establishment of a Park alone does not lead automatically to new laser tech companies. Additionally to that the number of students needs to increase, the export of laser tech experts needs to decrease, the international R&D activities needs to strengthen as well as the transfer of research outcome to marketable products needs to increase.

Similar to biotechnology, the laser tech centre of Lithuania is clearly Vilnius. Beside Vilnius, Kaunas has with Kaunas Technology University also a research institution within laser technology, which however is the only one outside of Vilnius. The importance of this institution for the national laser tech cluster though is minor, so it can be said that the main research centres are all located in Vilnius. The laser tech cluster in Vilnius therefore does not need to fear national competition, not only because of the low public research activities outside Vilnius, but also because the no private laser tech company can be found outside of Vilnius.

Also the surrounding countries are trying to develop laser technology competences in their countries. Poland for example currently discusses the establishment of a Plasma and Laser Technology Centre in Gdansk, which should tie up with the results of the Institute of Fluid-Flow Machinery (IFFM). Due to the fact that IFFM has four plasma and laser technology laboratories as well as around 150 employees, resources for a good research environment are existing. (Mizeraczyk, n.a.) In the other two Baltic Tigers Estonia and Latvia laser tech is not holding such a comparable position. Latvia was never a laser country, although the laser spectroscopy has a certain history in the country. Estonia was in the past known for excimer lasers and still houses with Estla, Semento and Neweks three quite strong companies

manufacturing these excimer lasers. These lasers are however exclusively installed at research institutes and universities, but none for industrial use.¹¹⁸ Similar to the biotechnology, Vilnius not might have the highest number of enterprises or employees, but for that several Vilnius companies have a share of 50% or more of the world market in several product areas, which lets the laser tech cluster standing out from its peer competitors.

Vilnius also took the opportunity to be integrated in a European co-operation of other institutes with an international reputation within laser and optical technology. LASERLAB Europe is an infrastructure, which was founded by the European Community and aims to promote the development of laser tech infrastructures as well as to ensure the access of researchers to adequate research facilities. The Vilnius University is one of the 17 participating partners of nine European countries and is together with one institute from the Czech Republic the only participants from the East of Europe.

The Lithuanian laser tech cluster which is exclusively concentrated in Vilnius enjoys a very good reputation all over the world, which is however mostly science based: The vast majority of lasers which are exported are bought by public research or education institutions for scientific research purpose and many of the Lithuanian laser tech graduates are recruited by companies and institutions outside of Lithuania, which is a double-edged sword: On the one side, the popularity of Lithuanian laser tech graduates is an acknowledgement for the good education, but on the other side this export of skilled labour force slows down the development of the Lithuanian laser tech industry. Especially in the future there will be a problem to fulfil the increasing demands of the local industry for a skilled labour force. It is predicted that there will be an annual increase of about 20 to 30 new employees in the private industry. Since the private industry and the public research institutions are in a very close co-operation, the public institutions might also profit from the positive growth of the laser tech industry and will also be in the need of a higher number of employees. The actual numbers of students, which are enrolled within relation to laser technology, are not (yet) able to cover the need of the private industry in the following years. The lack of skilled labour force is one bottleneck, which needs to be solved, if the laser tech industry should be able to grow.

Several of the laser tech companies are actively searching for Chinese partners in order to extend their market and networks. The laser tech industry is therefore currently working on an enlargement of their supply chain and market. Many of the laser tech companies, especially Light conversion, are selling their products to public research and education institutions, which keep their market and the growth potential quite manageable. The reason for this well-defined clientele is that especially the research is in need of ultra fast lasers with the shortest and the most powerful possible pulse of light, while the manufacturing industry and other industries have just a limited field of application for ultra fast lasers. This concentration on the academic world is linked to a limited growth potential. But currently there is a new development occurring: The focus on *'laser microfabrication [will] open new possibilities for the lasers made in Lithuania to enter the industrial market'*.¹¹⁹ One step closer to this was the implementation of an EU project in 2006, which aimed to develop new types of lasers, which should fulfil the requirements of the industry. Four laser tech companies took part. These new possibilities open up a new market with huge growth potential for the Vilnius cluster.

¹¹⁸ G. Raciukaitis *Baltic Tigers rediscover laser technology*, Industrial Laser Solutions 2005.

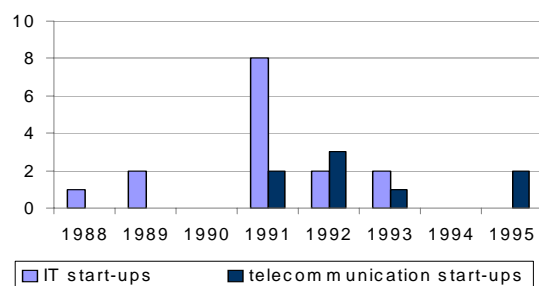
¹¹⁹ Ibid.

In order to stimulate the growth of the laser tech cluster, the number of companies should be increased. Successful and growing clusters are in the need of a spin-off and start-up production, which will enter a new dynamic to the cluster. Spin-offs are usually also a sign of successful research activities at the university and research centres. In the case of Vilnius the research results are rather integrated in already existing laser tech companies. With the establishment of Sunrise Valley, the opportunities for new established companies are given in the future.

3.1.1.3. ICT cluster

The ICT industry in Vilnius and Lithuania is the fastest growing industry in the country. Already nowadays ICT contributes to around 6% to the whole Lithuanian GDP and it is predicted that the share will increase steady¹²⁰. The ICT cluster is furthermore also identified to be one of the three pillars of the knowledge economy in Lithuania in the future. As located in the capital of Lithuania, the Vilnius ICT cluster concentrates the majority of the national ICT industry and shall therefore be presented in the following. Due to differences in the development, the ICT cluster will be shown partly from two different angles: The information technology (IT) companies with their emphasis on among others Internet and hardware as well as the telecommunication (TC) companies with a focus on among others mobile services and WAP services.

Figure 25 Largest ICT companies in Vilnius by year of establishment



Source: own graphic

Splitting up the ICT sector in information technology (IT) companies on the one hand and the telecommunication (TC) companies on the other hand, it is obvious that in the case of Vilnius the nowadays largest companies in IT were earlier established than the largest telecommunication companies. Taking the 15 largest IT companies in Vilnius into consideration, it can be seen that the first company was started in 1988 with the name Baltic Amadeus. The company is at the moment the ninth largest IT company by turnover. The vast majority of the large companies however were started between 1991 and 1993.

After 1993, no IT company, which belongs currently to the largest in Vilnius and Lithuania, was established. The first of the nowadays largest telecommunication enterprises in Lithuania were established in 1991, three years after the first large IT company. One reason for later development of the telecommunication sector might be that international companies play especially in this sector an important role for the economy. After the dissolution of the Soviet Union in 1991, the Western companies were increasingly entering the East European telecommunication market. Especially the Swedish-Finnish TeliaSonera holds an important position due to its partly acquisitions of the two leading telecommunication companies in Lithuania. But also the Lithuanian branches of the Swedish Ericsson and Tele2 as well as the German Siemens are among the top 7. From 1991 on telecommunication attracted the vast majority of foreign capital within the ICT sector. In the case of the information technology, the picture looks totally different. Most of the IT companies in Vilnius and Lithuania are established with local funding and it was not before 1997 when the IT companies could slowly attract

¹²⁰ For the year 2002; while for the end of 2007 the ICT sector is expected to have a share of 10% of the national GDP (Outsource 2 Lithuania Homepage, 2007)

more foreign capital. (VTT, 2002) Similar to the telecommunication companies is that the IT companies, which attracted the most foreign capital are nowadays the strongest in the market.

Although 95% of the Lithuanian ICT cluster consists of small and medium-sized enterprises, the large companies dominate the cluster. In the following, some of the largest information technology as well as the largest two telecommunication companies will be introduced, since these companies have the best potential in competing on the (East) European market.

The IT company Alna started its business 1989 in Vilnius and has these days offices in Poland, Latvia and Estonia. The company employs 420 people in the three Baltic Tigers and Poland, but the vast majority is concentrated in Vilnius. It can be said that Alna entered the Western market in 1995. In that year the company got the first assignment to develop software for a western company. Until now, the offices are however limited to the Eastern countries, although Alna is growing continuously by acquisition of Lithuanian or Eastern European companies: Infovita UAB for example, the leading IT company in the Klaipeda region with an annual turnover of about 1 Mio. €, was one of the companies which were acquired by Alna.

Beside acquisitions, Alna was also actively involved in start-up activities. In cooperation with another large IT company Microlink, Alna established DocLogix, which received in 2006 the award as the knowledge economy company of the year in Lithuania. Alna is also actively involved in building an information society in Lithuania and Vilnius: The company was one of the co-founders of the Knowledge Economy Forum, which aims to develop the national knowledge economy. Furthermore was and still is Alna with other members of the Knowledge Economy Forum actively involved in the establishment of Sunrise Valley which has the intention to link science and business by increasing entrepreneurial activities and create a stimulating environment for innovations.

UAB Penki kontinentai is seen as one of the oldest and largest IT companies in Lithuania and Vilnius. The company was established 1992 and has nowadays different branches in Azerbaijan, Latvia, Russia and Ukraine. From its establishment on, the company could slowly but continuously increase its annual turnover, but the years 2005 and 2006 were especially successful: the annual turnovers were more than tripled. The main drivers for this rapid growth are the international recognition of the company's banking products and technologies. Over the last few years Penki kontinentai was present in most of the conferences and trade fairs like the annual CEBIT in Hanover, the world largest showcase for information and telecommunication technology. According to the company the presence on these international events was very helpful in attracting new contracts from international companies. The company has now clients in 56 countries all over the world although the office locations are still limited to Eastern Europe.

TEO LT, the largest TC company in Lithuania and Vilnius, was established in 1992 under the name Lietuvos Telekomas as a state enterprise, but already six years later Swedish-Finnish TeliaSonera acquired 60% of the company's shares. The state company was after that privatized, which seemed to have an extraordinary positive effect on the company: In the light of the company's privatization, monopoly rights on fixed phone services were granted to the enterprise. In return, large investments of about 500 Mio € were made by the company in order to modernise the old infrastructure and to build up a digital network. Only a few years after, the company was developed from a state-owned company into nowadays one of the most modern telecommunication enterprises in Central and Eastern Europe. TEO LT had over the last years only quite moderate growth rates, since its income from fixed telephone services

decreased due to the increasing importance of cell phones and the stronger competition related to the end of the monopoly in the fixed line network.¹²¹

Omnitel is the second largest telecommunication company with an annual turnover of 143 Mio € in 2001. In 2003 the Swedish-Finnish company TeliaSonera increased its share in Omnitel to 90% and possesses now the majority of the two largest TC enterprises. TeliaSonera is furthermore strongly involved in the telecommunications sector of the other two Baltic Tigers: The Scandinavian company holds 60% of Lattelekom, the leading Latvian mobile operator and holds 49% of the Estonian Eesti Telekom. (Prime investment, 2003) Omnitel is the largest mobile operator in the Baltic Tigers and is responsible for around 60% of the total Lithuanian mobile revenue. Lithuania has the highest cell phone penetration of the three Baltic countries and mobile TC service is the fastest growing segment in the TC market. These circumstances in which Omnitel acts will therefore contribute to a positive growth rate in the next years. Omnitel developed into an equal competitor for TEO LT.

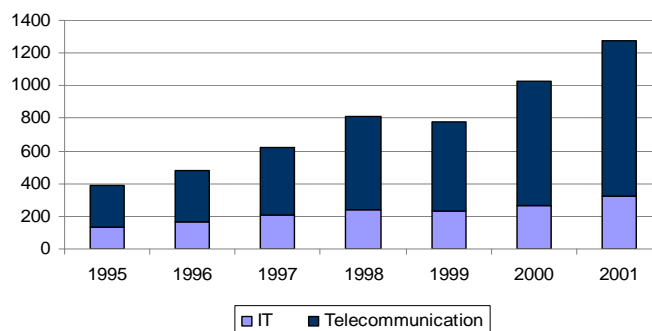
Lithuania has around 1'000 ICT companies, which employ over 15'000 people and is the largest ICT market of the Baltic Tigers. Of the top 20 IT companies in the Baltic Tigers, 13 Lithuanian IT companies are included. (IDC, 2005) However, the vast majority with 95% of the ICT companies are small and medium-size companies, which are not quite competitive. Due to the lack of financial resources and workforce these small and medium-sized enterprises are mostly excluded from international networks and projects as well as from export activities. These companies are facing a gradually increasing gap with no possibilities in identifying new market trends, participating in innovative activities or in establishing new business contacts with international companies.

The whole potential of the Lithuanian and Vilnius ICT cluster is therefore not exploited, although Vilnius houses of course a much higher number of large ICT companies than the rest of the country; so have Microsoft, IBM and many other international companies their offices in Vilnius. The presentation on the European and international arena are linked to great potentials: The company has the possibility to attract foreign capital and to be part of a comprehensive network. The ICT companies which received significant foreign investments in the past are nowadays the largest companies not only in Vilnius but also in Lithuania: LEO LT, Omnitel, Bite, Alna and Sonex are just some examples of companies which received significant foreign investments and are nowadays the largest ICT companies in the country. (VTT, 2002) Due to the close geographical distance it is not surprising to find that the Nordic countries and first of all Sweden were the largest investors. Of the largest eight TC companies in Vilnius and Lithuania six are owned either in total or to a majority of Western European enterprises. The domination of the telecommunication in the ICT sector is obvious. Between 1995 and 2001 the share of IT on the whole

ICT market reduced from 34% to 25%. This is aligned with the fact that the TC companies received the vast majority of the foreign investments and has also much higher annual turnovers in comparison with IT companies.

Vilnius is beside the biotech and laser tech also the Lithuanian ICT education centre. In 2002, almost 40% of the Lithuanian ICT graduates were

Figure 26 ICT market of Lithuania in Mio. US\$



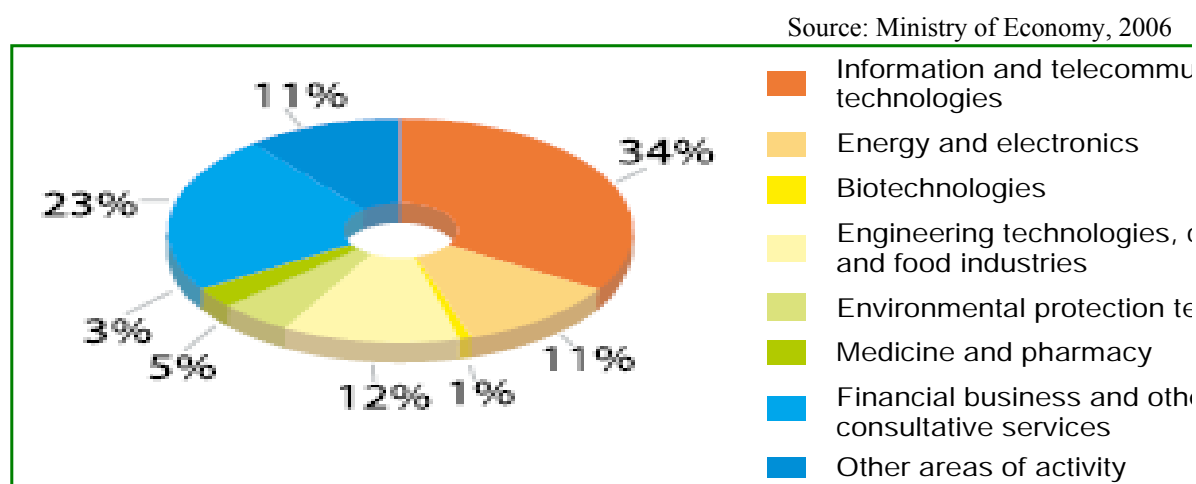
Source: Krukauskas, 2002

graduating in Vilnius and were also staying in the region. The number of ICT graduates is continuously rising: between 1998 and 2001 the number of graduates increased by almost 70% (Vilnius City Municipality, 2002). Vilnius is attracting more students in IT than Kaunas, which is indeed the second IT centre in Lithuania, but anyway far behind Vilnius. But not only in relation to IT students, Vilnius is ahead of Kaunas: the share of foreign direct investments as well as the number of new established Science Parks is increasing rather in favour of Vilnius than of Kaunas. The new Sunrise Valley in Vilnius is one of the latest Parks, which was implemented in Vilnius and is one element in the conception of establishing a knowledge economy. The larger companies are some of the drivers of the knowledge economy. The ICT companies Bitė and Alna are involved in the development and implementation of the Sunrise Valley knowledge economy cluster in Vilnius as well as the largest laser tech company Ekspla. In Vilnius the tendency can be seen that some of the larger companies are interested in the further development of their regional base.

The perspective of profiting from such a high-tech environment is certainly one of the main drivers for being involved in the development. Other new science parks in Vilnius with an emphasis on ICT are the Northtown Technology Park and Biotechnopolis/Visoriai IT Park. Most of these Science parks were established over the last few years and merely started their operations. The number of hosted enterprises is therefore pretty small, but in the next years it is expected that a strong growth will occur. The Northtown Technology Park however, also called Šiaures Miestelis Technology Park, was established in 2002 and in this relatively short time, 16 companies, which were operating in the Park, developed successfully into such strong companies that they could leave the Park facilities, while at the same time only four companies were forced out of business. (Ministry of Economy, 2006) Northtown Technology Park recently signed an agreement with several Lithuanian Universities and institutions to develop 'Vilnius Technology Valley'. The development is intended to take place between 2008 and 2018 and aims to create one of the largest and most efficient environments of studies, science and modern business in the East Europe. By concentrating the scientific potential and increasing the efficiency between the different industries as well as between private and public research institutions, Vilnius wants to become part of the European centres of excellence. (Northtown Homepage, 2007)

The new Science and Technology Parks declared to have a strong focus on ICT and biotechnology. Therefore it is interesting to see if this focus can be seen in the distribution of the companies, which are located in the Science Parks. The graphic to the left includes also the two Science Parks in Kaunas, since data for Vilnius alone was not available. Kaunas however contributes only to 14% to the companies

Figure 27 Distribution of companies in Science Parks by activity



included in the graphic and has therefore not such a strong influence on the distribution of the share. What can be seen is that the Science Parks host

mostly companies within the ICT industry, while only one percent of the companies are biotech companies. The Visoriai IT Park was just recently established and houses therefore at the moment only two companies. Once the IT Park is fully active, the share of ICT companies will certainly increase.

The development of an ICT cluster in Vilnius is strongly expressed as one of the objectives in the Vilnius City Strategic Plan 2002-2011. The objectives 1.2.2 and 2.1.3 aim *'to advertise and disseminate information about current and future projects involving Information Technology clusters'* as well as *'to create favourable conditions for the formation and development of the IT cluster'*.¹²² Two of the objectives were therefore explicitly dedicated to the ICT technologies. The reason for this strong interest of the municipality lies in the expressive growth rates of the ICT industry. Since several years the Lithuanian GDP is increasing rapidly and was identified as the fastest growing economy in East and Middle Europe. The industry which contributed the most to this positive development of the national economy was the ICT industry, which shows the highest growth rate with about three times higher growth than the national economy: *'Since 1993, the Lithuanian market of information technology and telecommunications has been expanding annually by 30%'*.¹²³ It is expected that by the end of the year 2007, the ICT industry will be responsible for around 10% of the Lithuanian GDP. ICT is therefore a motor for the growth of the national economy.

The Worldwide Black Book of IDC identifies the Lithuanian ICT sector as the largest of the Baltic Tigers and Lithuania spends more on IT than the other two countries. It is predicted that Lithuania will remain the fastest growing IT market of the Baltic Tigers. Although Lithuania has the largest ICT sector of the Baltic Tigers, it can be seen that in comparison with Western countries, the size of the sector is still quite small. For comparable reasons it should be mentioned that Denmark alone is spending 10 times more on IT than the three Baltic Tigers together. The European ICT market was identified in one of the prognosis from European Information Technology Observatory (EITO) to be a market with an annual growth rate of about 3% in the next years. It is however predicted that the Lithuanian market will show an annual growth rate of between 6 to 10%. Due to the relatively young free-market economy and the late development of the ICT industry in comparison with the Western countries, the Lithuanian ICT industry faces a long process to catch up to the Western countries. The Lithuanian ICT industry however was earlier discovered by Western enterprises as a field of interest than the other two Baltic Tigers and receives also larger amount of foreign investments. Therefore Lithuania has a strong advantage in comparison with its peer competitors.

Different Lithuanian institutions and the government relating to the three high-tech industries formulate clear objectives: ICT, biotech and laser tech. The formulated intention is that these three industries should in the year 2015 contribute together to 25% of the national GDP and that the export should increase from nowadays 175 Mio. € to 6 billion € in 2015. These quite positive numbers show the expectations, which are related to the three high-tech industries. ICT products and services should here have the highest share of the export and is therefore of special importance for the Lithuanian economy. The Lithuanian office of Ernst&Young sees even the potential of a snowball effect from 2007 on: due to the increasing investments of the state, the private households will follow and also increase their expenses. If these prognoses will become reality remains to be seen, but fact is that large EU funds will enter into the country of which many are related to public e-services and information systems. The ICT industry will profit from these EU funds and also from the increasing foreign investments. In the past, it turned out to

¹²² Vilnius City Municipality Administration *Vilnius City Strategic Plan 2002-2011*, Vilnius 2002

¹²³ *ibid.*

be an advantage to be present on the European and international arena. The TC companies, which are mainly acquired by Western European enterprises will therefore profit from their international network. 2006 however was the first year when the Lithuanian IT sector showed higher growth rates than the telecommunication sector. Great hopes are connected with future EU projects, which will take part in Lithuania. The EU projects should stimulate co-operations between different ICT enterprises, which on the other hand should lead to an extension of the financial base. This could cause a stronger competition on the ICT market since projects with large funding will attract more companies, which so far were not involved in Lithuania.

3.3 The creative class

Lithuania has one of the highest shares of the creative class in Europe and shows also high economic growth rates. Based on a thesis report at Blekinge Institute at Technology which deals with the 'Creative City Assessment of Riga, Tallinn and Vilnius', the creative class of Lithuania is estimated to have a share of around 37%. The city of Vilnius as the governmental and economical centre of the country has the highest share of the creative class. The report compared the capitals and nations of the three Baltic Tigers concluding that '*Vilnius is the most competitive city among the capitals of the Baltic States according to Talent*'.¹²⁴ (Dzene, Kula; 2007) The study came to the result that Vilnius has the highest proportion of the super-creative core among the Baltic capitals contributing to a higher application of the creativity than a high share of creative professionals. In comparison with other Western European cities the proportion of the super-creative core however is quite low in Vilnius and Lithuanian in total. In opposite to the Øresund Region the motor for the Lithuanian economy is still the manufacturing sector, especially the oil and food production. Western European companies discovered the Baltic States and hereby also Lithuania as a production location offering large advantages. The labour costs might not be as low as in Asia, but Lithuania is geographically close located to the consumer market in Western Europe.

The manufacturing industry is still receiving the majority of the FDI in Lithuania showing that especially the manufacturing industry attracts the most interest of foreign investors. This industry is most likely not offering jobs, which are considered as creative class occupations. The Lithuanian economy will still be based for the next years to come on the manufacturing industry, especially the oil and food production. The present economic structure in Lithuania is not yet allowing using the whole potential of the creative class, since it is still based on the old manufacturing industry. Vilnius, as the governmental and economical centre of Lithuania however is currently in a beginning stage of transformation from a mostly industrial economy to a knowledge and service based economy. In Vilnius alone, only 10% of the FDI is flowing into the manufacturing industry, but especially the telecommunication and financial sector received large funding. This shows that a shift is going on, at least in the capital. In the case of Vilnius, the furthest region in the transformation process, the economy of the capital is less dominated by the manufacturing sector offering good circumstances for the creative class to find employment in one of the research institutes or emerging high-tech cluster.

The just recently emerged challenge for Lithuania and Vilnius is the discussed brain-drain. Western European and also North American countries offer the Lithuanian creative class, like researchers and engineers, higher salaries, mostly better research environment with larger funds and a higher quality of

¹²⁴ A. Dzene & A. Kula *Creative City Assessment of Riga, Tallinn and Vilnius*, Master thesis at Blekinge Institute of Technology 2007.

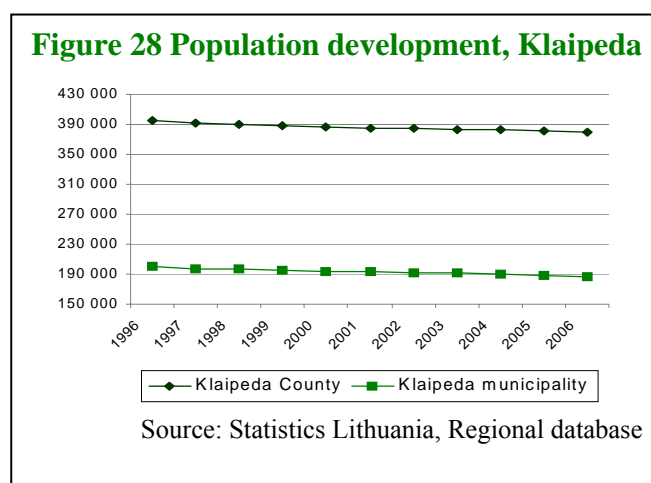
life. In the case of the laser tech cluster such migration tendencies of young, well-educated people is perceptible. The challenge for Lithuania is now to find possibilities how to keep these people in the country.

3.2 Klaipeda in the outskirts of the Vilnius region

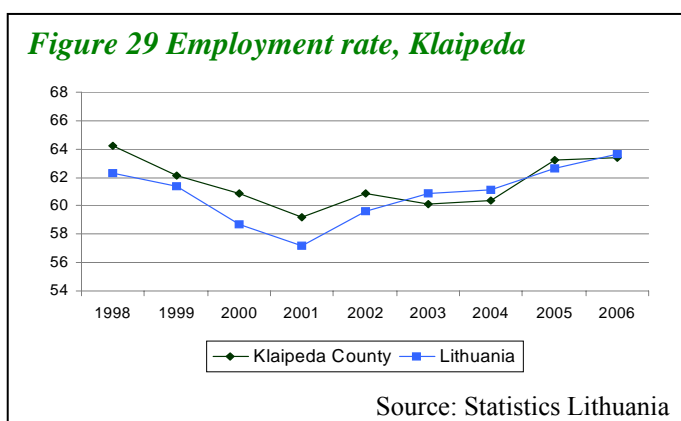
Klaipeda County houses the third largest city in Lithuania by size with around 190'000 inhabitants and is the only County which has a coastline. For that reason Klaipeda accommodates the only seaports in Lithuania, which play an important role not only for the economy in the County, but also for the national level itself. Klaipeda is therefore also called the Sea gateway to Europe and the world and as an ice-free port, the exchange of goods can be guaranteed all year around. Klaipeda County is considered to be the third thriving economy in Lithuania, behind Vilnius and Kaunas Counties. The large seaport of Klaipeda contributes certainly to a large extent to this positive development.

Klaipeda is the Lithuanian winner in terms of exports of goods, which are produced in Lithuania. Klaipeda shows by far the highest growth rate here and over speeded even Vilnius lying currently on third place, behind Telšiai and Kaunas County. While Telšiai's export is still as twice as high as Klaipeda's, it is soon to be likely that Kaunas will fall behind Klaipeda. If the trend does not change, this might occur latest in two to three years. Within the last 10 years Klaipeda and especially its port experienced a growth to an extraordinary extent. The port of Klaipeda is responsible for a large part of the exports, which are going mainly to European Union countries first of all to Germany, which are therefore the most important trading partners for the port, while Russia with a share of 5,1% in 2003 only ranks on sixth place. The port is seen as an important infrastructure facility not only in the County, but also for Lithuania as a country, since almost 20% of the Lithuanian GDP is connected with the Klaipeda port.

For Klaipeda County the population number looks negative development for the Since over ten years the declining. But in opposite to municipality as the third largest can not balance the negative rest of the County: also the municipality shows a negative comparison with the population numbers for Klaipeda County and the a much lower declining rate. In Klaipeda case, one might also stagnation with a slightly negative tendency, while Lithuania as a total struggled over the last ten years



development of the similar to the Vilnius County. number is slowly Vilnius, Klaipeda city in Lithuania, development in the Klaipeda rate. But in development of Lithuania in total, municipality show the Vilnius and speak about with a considerable lost of inhabitants.



Concerning the employment rate for Klaipeda County, it can be seen that the development is not quite following the almost stable positive development of Vilnius County since 2001. There is not the same clear trend recognisable as in the

case of Vilnius, but the employment rate of Klaipeda is rather characterised by several ups and downs. There is however the overall tendency of an increasing employment. Also in comparison with the Lithuanian average, no clear trend can be identified. For both Counties and the Lithuanian average in common is the fact that there was a constant decline in employment rate until 2001 and afterwards, the rate increased in Vilnius more stable, while Klaipeda is characterised by a more inconsistent development.

Comparing the population development with the development of the employment rate, it can be seen that although the employment rate is increasing strongly, the number of inhabitants is decreasing. This indicates that Lithuania and its regions have a certain attractiveness problem, since the people chose to emigrate although the economy is growing. This will raise the problem later on, that Lithuania will have a lack of young well educated workers. The population groups leaving Lithuania are not the older, less educated population group but young educated people, who expect to find better work environments outside their country. In Vilnius the population number are stabilised, which is no surprise, since Vilnius as the capital is the city in Lithuania with one of the best possibilities in terms of employment and attractiveness.

Klaipeda County is the only county in Lithuania, which houses ports. The port of Klaipeda is hereby the largest handling all sorts of cargo, while the Butinge port handles exclusively refined oil products due to its ownership by the Mazeikiai refinery. The ports play therefore an important role for Klaipeda as the only port city in Lithuania. In order to understand the development of the port city over the last years since the independency, the Russian heritage and the new Baltic perspective for the Baltic ports in general, but also for Klaipeda in specific will be presented.

The port cities in the Baltic States were in the past of great importance for the Soviet Union and Russia. Baltic States and Lithuania as part of Soviet Union secured Russian access to ice-free ports and naval bases in the past. With the independence of the Baltic States, Russia was insulated from the Baltic Sea, with the exception of the Russian enclave Kaliningrad, and therefore the Russian inland is depending on the Baltic ports for exporting by ships. Many of these ports played an important role during the late 19th century, when Russia was exporting large amount of agricultural products to Western Europe.¹²⁵ Until the Second World War the activities of the Baltic ports decreased significantly and due to the changing occupants with heavy fights all Baltic ports were suffering from severe damage or even total demolition of their infrastructure. The infrastructure was rebuilt after the war, but it was not before the 60s and 70s when the ports gained their former importance within the Soviet Union. The highest peak of transit volume was reached, for most of the Baltic ports until now, in the late 80s. In the mid 80s, the world prices for raw materials and especially oil collapsed and in order to ensure the same level of income the Soviet Union met this challenge with increasing export volumes.

The dissolution of the Soviet Union some years later however had a negative impact on the importance of the ports. Being independent states, strict borders were established between Russia and the Baltic States, which caused different problems for the crossing of goods. The Baltic States were not able to compensate the loss of the goods exporting from the Russian inland regions due to the small size of the economy as

¹²⁵ B. Goodwin & T. J. Grennes *Tsarist Russia and the world wheat market*, in: Explorations in Economic History, Vol. 34 (4) 1998

well as the lack of raw materials. Other reasons, which influenced the ports in a negative way, were the declining Russian industrial production, new established and inexperienced governmental leadership as well as the instability of the national currencies.

Nowadays, it is estimated that around 80 Million t Russian transit cargo flows through the Baltic ports, mainly oil and oil products. In the case of the port of Tallinn, in the past 15 years 80% of the annual cargo turnover was caused by Russian transit cargos. (Port of Tallinn, 2007) Also the other Baltic ports are highly depending on Russian transit cargos. At least 70% of cargo turnover is still transit to or from Russia over the last years. In 1994 Lithuania started to charge higher fees for Russian transit cargos to Kaliningrad than to Klaipeda, which however did not lead to a significant increase in cargo turnovers in Klaipeda.¹²⁶ Since the enclave Kaliningrad can only be reached over Lithuania or Belarus/Polen, the Lithuanian government wanted to take advantage of the problematic situation of Russia to reach its enclave Kaliningrad. It however did not have the positive effect the Lithuanians hoped for, but the port of Klaipeda showed a quite modest growth rate. Later on Kaliningrad's growth rate over speeded even the one of Klaipeda. At least half of the Russian transit cargos, which flow through the Baltic ports, are oil products or oil.

The port of Ventspils in Latvia is the only port, which has a decrease relating to cargo volumes. This is a result of the Russian withdrawal of using the oil pipelines going to the port. Ventspils is a perfect example as a loser of the dissolution of the Soviet Union. The port was since a long time the leading port for the sea transport of Russian oil and oil products due to the established double oil pipeline to the port in the 60s. The port profited from the centralised division of cargo between the different Baltic Ports which resulted in the concentration of oil products in Ventspils. With the growing export of petroleum products, Ventspils eventually became the second largest port in the Soviet Union after Novorossiysk located at the Black Sea. With the dissolution of the Soviet Union, the end of the centralised and concentrated division of cargo followed leading to an increasing competition between the Baltic ports. All the Baltic ports tried to establish suitable infrastructure to handle all sorts of cargo, leading now to overcapacities. In the end of the 90s, Tallinn, Riga and to a certain extend also Klaipeda opened their own oil terminals, which was before exclusively a speciality of Ventspils alone. In 1999 a new oil terminal was opened in Butinge, Klaipeda County, which succeeded from the beginning to attract more and more oil cargo in the disadvantage of Ventspils.

The year 2003 was the first year when Butinge, although much smaller capacities, exported more oil products than its Latvian competitor. The reason for this is that Butinge established better relations with its Russian oil suppliers since the second largest Russian oil company Yukon became the largest shareholder of the Lithuanian port.¹²⁷ But Butinge was not the only rival about the export of Russian oil products. A strong fall could be seen right after the opening of each of the oil terminals in Tallinn in 1997 as well as in Primorsk, Russia in 2001. The idea of specialisation, which was strongly embedded in the Soviet Union, is vanishing slowly away and competition is established. Another Soviet heritage, which is fading away is the excellent integration of the Baltic ports into the railway system. Traditionally, freight transport in the Soviet Union was primarily organised through railway. During the Soviet Union each

¹²⁶ L. E. Kauppila The Baltic Puzzle: Russia's Policy towards Estonia and Latvia 1992-1997; Helsinki 1999

¹²⁷ EIA - Energy Information Administration (*Country Analysis Brief – Baltic Sea Region*; 2007available on: <http://www.eia.doe.gov/emeu/cabs/latvia.html>

Baltic port had therefore an excellent railway connection and most of the goods arrived by train. Transportation by railway seems convenient in the Soviet Union with such large geographical distances. Heavy traffic such as coal, timber, steel and many more needed to be transported cheaply, fast and safe through the Union. As a result of this tradition, the railway companies in the three Baltic States kept until now their prices for cargoes pretty low. Nowadays however, a major shift can be seen how the goods are transported to the ports.

The share of goods arriving by trucks is constantly increasing, showing the direct opposite trend which the European Union wants to achieve concerning cargo transport: the shift from the road to the railway. Another challenge which needs to be faced by the Baltic ports are the new technologies and transport modes. The obsolete Baltic ports need to invest large sums to update their infrastructure to these new technologies. Klaipeda is here together with Riga in an excellent position: These two are the first Baltic ports, which possesses standard gantry cranes for handling container cargoes. This seems to pay off for Klaipeda: Klaipeda succeeded one year ago to reach the pole position in container turnover, although the port still lies behind in terms of the total cargo turnover. Currently the Baltic Ports are facing another challenge: their decreasing importance for the export of Russian cargo.

The Russian cargo volume is growing since several years and it is expected that this trend will continue in the future. The share of the Baltic ports in exporting these Russian cargoes is however declining and will do so also in the future. Reason for this is that Russia strengthened its own ports after the independence of the Baltic States in order to be less dependent on foreign ports. St-Petersburg is certainly the port, which profits the most of this trend. Klaipeda has here again an outstanding position, since it is the only port where the Russian transit cargo accounts to less than half of the overall cargo turnover. The cargo turnover of the Klaipeda port is growing due to the high share of Lithuanian export goods. In 2006, 67% of the cargoes handled in the port were Lithuanian products. It seems therefore that Klaipeda is less dependent on Russian transit cargo than the other Baltic ports. In the case of the port of Tallinn 80% of the annual cargo turnover was caused by Russian transit cargoes in the past 15 years. Due to the predicted decrease of Russian transit cargoes from 84 Million tonnes (2006) to 60 Million tonnes (2010) in the Baltic States ports, Tallinn will probably suffer from a much stronger effect on their cargo turnover than Klaipeda.

Major ports in the Baltic States are Tallinn, Riga, Ventspils, Klaipeda as well as the Russian ports Kaliningrad and St. Petersburg whereof the latter is ice bounded. Due to the decreasing significance of specialisation, which was strongly embedded in the Soviet Union, the Baltic Ports are now in a strong competition trying to attract all sorts of cargo. Oil terminals, which were before the 90s an exclusive speciality of the Ventspils port, were opened in many other Baltic ports like Butinge and Tallinn. Due to the high share of the Russian transit cargo, the Baltic ports are highly depending on the Russian industry. Klaipeda can be found here in a better position than the other Baltic ports. While most of the Baltic ports showed high growth rates due to an increasing Russian transit cargo volume, the growth rate of the port of Klaipeda is highly depending on an increasing cargo volume of products produced in Lithuania.

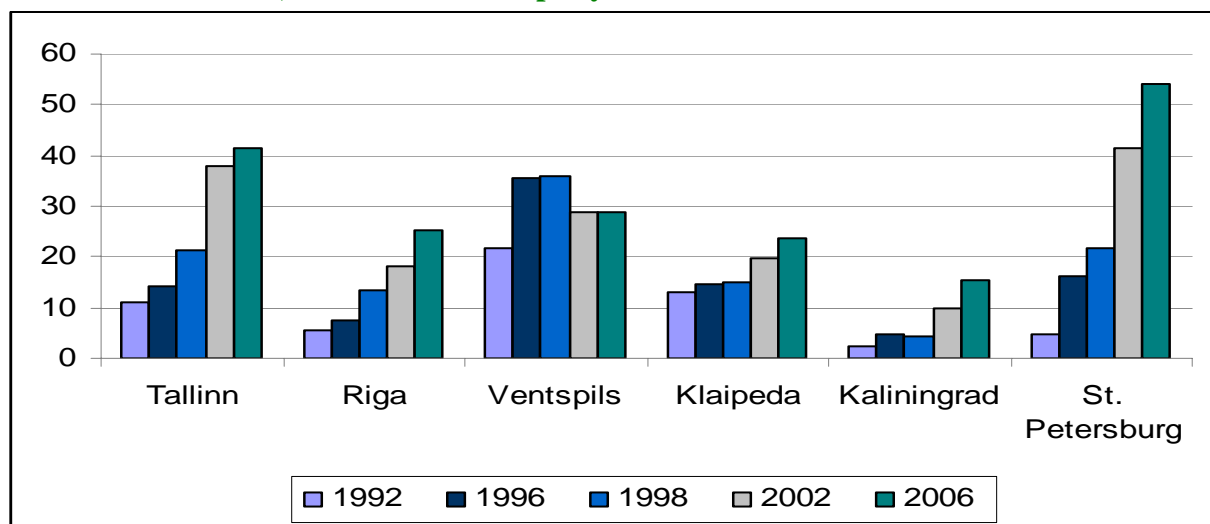
It can therefore be stated that Klaipeda is one of the most Russian-independent ports of the Baltic ports, which is quite a paradox knowing that Lithuania is the Baltic State with the tightest connection to the Russian economy. The quite moderate growth rates in terms of cargo volume for the Klaipeda port can also be explained due to the low dependency on the Russian transit cargo. In 2006, 67% of the cargo handled in the port was Lithuanian products. Lithuania with its quite small economy can not compete

with the volume of the Russian economy and contributes therefore only to a quite moderate growth of the cargo volume in Klaipeda.

The other ports like Tallinn, Riga and St. Petersburg, all highly depending on the Russian transit cargo show much higher growth rates due to the larger Russian economy. It can however be expected that, in a long-term run, Klaipeda will have better economical circumstances than the other ports. It is expected that the Russians are relocating their transit cargos to Russian ports weakening their dependence on Baltic ports for export. This can be seen in the case of St. Petersburg. This Russian port has the highest growth rates and developed from an insignificant port in 1992 into the largest by cargo turnover in 2002.

Also Kaliningrad showed high growth rates after 1998 most likely to catch up soon with Riga and Klaipeda. While in the case of Klaipeda the transformation from a Russian depending port to a quite

Figure 29 Development of cargo volume over time by selected Baltic Sea ports, 1992 – 2006; in Million tonnes per year



Source: Data received from the respective ports

In Tallinn for example, the cargo volume is still to 80% Russian transit cargo volume (Port of Tallinn, 2007). Such a large percent of its annual turnover can not be compensated by the small Estonian economy alone. The future will show how successful the other Baltic ports will be in decreasing their dependency from the Russian economy, but it is quite sure that the Russian activities will decrease in the next years leaving ports behind which need to ensure new ways in attracting cargoes.

Klaipeda has two main links which connect the city and the County with Europe: First, the city is only 30 km away from the international airport Palanga, which offers daily two flights to Copenhagen and several flights per week to Bilund, Hamburg and London. Klaipeda is therefore located in a reachable distance to an airport with flights to the main foreign investors in Lithuania and Klaipeda: Denmark, Sweden and Germany. It is however the port, which is seen as an important infrastructure facility not only in the County, but also for Lithuania in total, since almost 20% of the Lithuanian GDP, is somehow connected with the Klaipeda port (Port of Klaipeda, Homepage). In order to maintain the important role of the port for the regional and national economy, large investments were made over the last years: between 1993

independent port took already place, the other ports in the Baltic States still need to face this challenge.

and 2006 more than € 300 Mio were raised and invested in modernizing the port, while another € 600 Mio should be invested between 2007 till 2013. The investments were used to modernise the terminals and the quays, but also to improve the access to the port.

Public and private research institutions in Klaipeda have a strong focus on marine and coastal research activities, which is convenient due to the geographical location of the Klaipeda County and due to the location of the only ports in Lithuania. The public research institutions are dominating clearly the research environment in the County mainly located at the University of Klaipeda.¹²⁸ Although the intentions of the City and the County of Klaipeda are clearly pointing towards a reorientation from a manufacturing centre to a more research based approach, the port and the manufacturing industry are still the main drivers of the Klaipeda economy. Klaipeda as the third largest city in Vilnius ranks on third place behind Vilnius and Kaunas in attracting Foreign Direct Investments. (Statistics Lithuania, 2007) In opposite to Vilnius the vast majority of the investments are going into the manufacturing industry. Large European companies are located in the county investing mainly into shipbuilding and repair. An event, which certainly drew the attention of investors was the privatisation of the sea port in Klaipeda. Klaipeda port is of special importance for the regional economy since it provides around 23'000 jobs and accounts for 4,5% of the Lithuanian GDP.

The port is currently in a status of growth and the latest numbers for October 2007 showed that the port is close to its annual 35 Million tonnes capacity. In order to stay competitive, public authorities discuss the possibilities to create an artificial island, which should be about 1,8 km long and 600 m wide extending the port area in the following years. (Archdeacon, 2007) How serious these first ideas have to be taken will be seen in the following years, it is however obvious that there is the need to act. As reasons for the extraordinary growth in cargo turnover are seen the excellent rail network allowing containers to be delivered from Odessa and Moscow, but mostly the increase of goods produced in Lithuania which are exported by the port.

Identified by the Klaipeda County administration as the most perspective industries in Klaipeda were: Shipbuilding and repairs, food industry as well as timber and light industry. Taking the largest 20 enterprises of Klaipeda County into consideration it becomes clear why the county administration chose these branches. The vast majority of the top-20 companies operate within the manufacturing industry: Shipyard and shipping companies, furniture manufacturing, food and beverage as well as oil manufacturers. The only top-20 company, which is not operating within the manufacturing industry is Klaipedos energija, the local heat supplier.

Just recently, Klaipeda municipality announced another objective: The so-called KUFA-project, intending to become the largest centre for creative industries in Western Lithuania. A former tobacco factory should be reused as a new place for the creative industry. Currently the feasibility study is under development and it is expected that the results will be available until the beginning of 2008. The intentions with this

¹²⁸ KEDA – Klaipeda Economic Development Agency *Science and innovations in Klaipeda region*, Klaipeda 2006

project are to maintain historical buildings and to reuse them positively influencing the development of the city and its economy.¹²⁹

The interest for creative industries emerged recently in Europe and the USA strongly connected to the creation or exploration of intellectual property. The Department for Culture, Media and Sport in the UK defines the creative industry as *'those industries which have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property'*.¹³⁰

This definition shows the expectations which are connected with the creative industry in Klaipeda: a positive contribution to the economic development and urban renewal. The interesting part in this project is the clear focus on creative industries differing from the competences Klaipeda had so far: Marine-related. Due to the large contribution of the manufacturing industry and the port to the regional economy it is however clear that for the next years to come, the economy of Klaipeda will still be rather based on these two branches than on the creative industry. Such profound changes in the base of an economy need time and can not happen over night. A decline of the manufacturing industry will have a direct impact on the cargo volume handled at the port of Klaipeda. But this development is still many years away. Currently the manufacturing industry in Klaipeda and in most of Lithuania is in a status of growth and attracts a strong interest from foreign investors resulting in growing cargo volumes for the port.

¹²⁹ KEDA (n.a.): *Tobacco factory – A new place for creative industry*, Klaipeda; available on: http://www.kepa.lt/en/docs/Tobacco_factory.ppt#256,1,TOBACCO_FACTORY – A NEW PLACE FOR CREATIVE INDUSTRIES

¹³⁰ DCMA Creative Industries Mapping Document 2001

4. A future East West development corridor?

The East West corridor consists of two separated parts divided by the Baltic Sea – The Baltic part and the Scandinavian part. These two parts can be knit together as a transport axis, but the sea will always function as an efficient barrier for interaction between nodes on the two parts of the corridor.

The Öresund region is the key factor if the ambition is to develop the East West corridor into a corridor characterized by interaction between the urban nodes along the corridor. If the ongoing integration process between Scania and Sealand will end up in one truly integrated trans-national metropolitan region this will have a size and attractiveness that will influence development far to the west and east. However, the Öresund region still has a long way to go before we can talk about an integrated metropolitan region. At present we can see a growing commuting between the sides of Öresund. In this phase of the integration process it seems that Malmö and its surroundings develop some suburban elements. Differences in housing cost between Sweden and Denmark makes Malmö an attractive alternative for people looking for not too expensive residential houses or apartments not too far away from downtown Copenhagen. From this point of view the integration process up till now has primarily made possible an enlargement of Copenhagen. The bridge has opened up for the expansion of Copenhagen eastward. To what degree that has increased the attractiveness of Copenhagen as an European metropolis is an open question. However, the last years' experiences teach us that there still are a lot of institutional obstacles that have to be removed if the ambitions are to develop a trans-national region. Institutional matters are often efficient tools to kill new options that follow from investments in infrastructure. Intensified efforts to harmonize Swedish and Danish institutions – tax system, labour market rules etc. – is therefore necessary.

As we have described in chapter 3 a lot of initiatives have been taken to create cross-border networks of organisations. These initiatives have primarily involved universities in the two countries or new knowledge-based industries like biotechnology and ICT. The long-term outcomes of these initiatives are crucial for the region's ability to exploit the future potential in these dynamic technology areas. The combined research resources in the two sides of the region are strong. The great challenge is to transform this stock of knowledge at the research institutes in the region into new products and growing corporations. The last step in this process, growing firms, seems to be the major obstacle. Small and medium-sized research based firms in Sweden seem to be growing slowly.¹³¹ The slow growth of research-based firms is not a problem specific for the Öresund region. The region shares this problem with other regions in most of Europe so in this case there is a need for changes in national institutions. For the development of the Öresund region such initiatives are important because the growth potential of the region is strongly linked to the development of knowledge-based production.

The importance of the knowledge-based production also means that the region's success in attracting talents to the region will be important. Traditionally, Copenhagen, like capitals in all small countries, has been a magnet for talents from all over Denmark, but in the globalized knowledge-economy the labour market for talents is international. In order to succeed the Öresund region has to compete successfully for talents with London, Paris, Munich, Stuttgart, Barcelona, Boston, Silicon Valley, etc. This is a

¹³¹ J. Brink *Accumulation, Boundaries, Capabilities and Dynamics- Explaining Firm Growth*. Chalmers Tekniska Högskola, Göteborg 2007.

competition in which reputation of universities, well-known high-tech corporations, social climate, attractive living conditions are important variables.

What we learn from this is that the Öresunds bridge was just the first step. Policy-makers face also a lot of other challenges if the vision of an integrated Öresund region shall be true, which in turn is a necessary conditions for the transport-axis to transform into a development axis.

It is a necessary but not sufficient condition. In order to create a development-axis there is also need for investments in infrastructure to support geographical spread effects of the dynamics in the Öresund region. The infrastructure on the Danish side is rather good with high ways and food railway connections from Jutland to Copenhagen. The introduction of high-speed train that reduced the travel time is the single most important measure to support an expansion of the influence area of Copenhagen in this direction.

On the Swedish side the needs are more far-reaching. The major connections in Sweden normally has a north-south direction, which means that the connection between Malmö/Lund and Gothenburg is much better, both when it comes to standard on the rods and the railway traffic, the connection between Malmö/Lund and Karlskrona. Without any new initiatives the spread effects of the emerging Öresund region will primarily be seen on the Malmö-Gothenburg axis. The quality of the existing infrastructure is one reason for this effects and the high population concentration along this axis is another reason. An East West development corridor will obviously not grow up by itself. Such a corridor must be supported by investment in infrastructure in order to reduce the travel time from the eastern part of Blekinge to the Öresund region. These demanded efforts include as well investments in upgrading the roads as investment in faster railway connections. Such investments would be an important support to a further expansion of the knowledge-based industry in Karlskrona/Ronneby. The small population in the region makes a strong connection to a large urban region necessary in order to sustain the dynamics of the knowledge-based production in the region.

