COMPARATIVE CLUSTER ANALYSIS

FIVE ICT REGIONS IN EUROPE

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Abstract

This document subsumes the results of the comparative analysis of the five ICT clusters participating in the NICE project. First Europe's position in the worldwide ICT market is outlined against the position of U.S. and Japan's single markets. Based on the results from the regional cluster analyses and additional data source the ICT clusters in Berne, Paderborn, Tampere, Moravian-Silesian region and Ankara are compared from different angles: the sector, the cluster and the region.

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EXECUTIVE SUMMARY

With the Lisbon strategy Europe has set itself high targets, it wants to become the most competitive and dynamic knowledge based economy, to have sustained and accelerated economic growth and full employment. An innovation-friendly business environment and the stimulation of technology innovations are preconditions to achieve these goals. Clusters – understood as 'nodes' within a sector where companies, academia and public authorities have strong connections, are collaborating and exchanging knowledge and experience – are today recognised as an important tool for promoting firms development, innovativeness, competitiveness and growth and thus, regional development. Thus, clusters can contribute to the achievement of Lisbon goals. So does the Information and Communication Technologies (ICT) sector. From sector perspective the ICT sector makes a significant and growing contribution the European economy. On the one hand it is a dynamic sector and on the other hand it is one of the driving forces of innovative processes in all area of work and life. Against this background the present study compares the European ICT sector against the U.S. and Japanese markets and analyses five ICT clusters in Europe – namely Telematic Cluster Berne (Switzerland), padercluster (Paderborn, Germany), ICT Tampere Region (Finland), IT Cluster (Moravia-Silesia, Czech Republic) and Ankara (Turkey) – from different angles: the sector, the cluster and the region. The aim is to identify similarities and distinctions in cluster policies, the clusters' structure and the cluster management in order to identify good practice. The key findings can be summarised as follows:

EUROPEAN ICT MARKET

- In 2005, the overall value of the ICT market in Europe amounted €659 billion; its share of the worldwide ICT market was about 33.8% in 2005. Next to Europe the largest single ICT markets are the U.S. (28%) and Japan (14.7%).
- While the Japan's ICT market performance was moderate with a growth rate of only 2.1% Europe and the US performed well with growth rates of 3.7% and 3.9%. Taking a closer look at the ICT market by products Europe ranks top compared to U.S. and Japan in the fields of ICT equipment and Carrier services, and is below U.S. shares in Software and IT services.
- With respect to ICT penetration Europe still falls behind the U.S. and Japan. While IT spending calculated as share of the GDP amounted 3.0% in Europe, it was about 4.0% in the U.S. and 3.4% in Japan. Similarly, the number of PCs per 100 inhabitants is clearly lower in Europe than in U.S. and Japan. In Europe only 35.0% of households do have a PC while in U.S. 81 person out of 100 is equipped with a PC, in Japan it is 47 out of 100 persons.

NATIONAL & REGIONAL ICT MARKETS

- Across Europe enormous regional distinctions in national shares of the European ICT sector exist: About 70% of the market's total turnover is accounted for the top 5 Germany, France, Great Britain, Italy and Spain. The comparison of Germany, Finland, Switzerland, the Czech Republic and Turkey shows that although the national proportions of the total European markets varied in 2005 between 20.0% and 0.9% the national markets by product shares are quite homogenous and comparable to the EU-15 market. Carrier service clearly prevailed with

shares ranging from 37.4% to 49% followed by Software and IT services. An exception is Turkey where the Carrier service sector is with 67.1% well above European average whereas the Software and IT Service sector is with 10.4% somewhat 20% below. In all regions the service sector outranges the hardware and equipment sector.

- Switzerland and especially the canton Berne ranked top with an ICT sectors proportion of 7.0% respectively 7.6% of total national/regional employment, Finland and Germany fall behind with shares of 6.3% and 5.5%. While Pirkanmaa is with a share of 7.2% close to the canton Berne and well above the national average, North Rhine-Westphalia is with 5.1% even below national average.
- Taking ICT expenditure as proportion of GDP as a measure for ICT adoption, Switzerland ranks top with 7.7%, followed by Finland with 6.95% and Germany 6.59%. All three countries are above EU-15 (6.4%). Czech Republic is with constantly growth rates closing up and accounted in 2005 a share of 6.2%. The distinctions across Europe become most visible when taking the the number of PCs per hundred inhabitants as a further measure for ICT adoption. Here again Switzerland ranks top with 56 PCs per 100 population followed by Finland with 44 and Germany with 40. In contrast in Czech it is only 3 out of 100 who are equipped with PCs.

National and Regional Cluster policies

- In Turkey the integration of cluster policies at the national and regional level is at its very beginning. Hitherto, first cluster-related programmes have been launched (e.g. the National Development Programme), but neither on national nor on regional level any cluster policies have been implemented so far.
- In the framework of the 'New Regional Policy 2008' in Switzerland it is currently being discussed to redirect the solely indirect policy on national level to a supportive policy which gives more leeway to the regions. Cluster policy in the region Berne has evolved as bottom-up process and distinguishes between three main instruments to promote cluster: (1) Promotion of clusters on the national and/or international level (attraction of foreign investment), (2) direct support of SMEs and (3) partial financing of cluster organisations.
- In Finland the 'Centre of Expertise Programme' is basis for regional and local cluster policies. The eight-year programme has been launched by the government in 1994 and aims at supporting the further development of regional strength by bundling existing competences and to utilise those to create new jobs. The programme is reflected in the regional economic development plan of Tampere region as well as in the 'Tampere Region Centre of Expertise Programme'. Central instrument of the region's cluster policy is the launching of own cluster-related programmes.
- In Czech Republic cluster policies are organised as multilevel policy where the local level has almost no bearing on the policy, but only becomes active in terms of catalytic policies. Thus, the 'National Cluster Strategy 2005-2008' (NCS) defines the nationwide cluster strategy. The framework for cluster policies in the Moravian-Silesian region is set with the 'Regional Development Plan 2005-2008' which is geared to the national policy guidelines.

- In GERMANY national cluster policies are mainly of catalytic nature and are part of technology and innovation policies. Programmes launched in this context are located somewhere between catalytic and supportive policies. Rather than having its own cluster policy for the region PADERBORN it is geared to the cluster policies of the federal state North-Rhine Westphalia (NRW) and the wider region East Westphalia-Lippe (OWL). In NRW cluster policies are integral part of the regionalised structural policy which aims at strengthening the strength in means of regional growth, rather than on compensating regional weaknesses.

ICT CLUSTERS AND CLUSTER MANAGEMENT

- Clusters are dynamic and have a recognisable lifecycle. An ideal type of lifecycle distinguishes between embryonic, established, mature and declining clusters. Today the clusters in TAMPERE, PADERBORN and BERNE can be categorised as established, whereas the clusters in MORAVIAN-SILESIAN region and in ANKARA are categorised as embryonic clusters at an early development stage.
- The clusters in Berne, Tampere and Moravian-Silesian region are institutionalised, the one in Paderborn and Ankara are informal. TCBE, the Bernese cluster, was founded in 1996 as an association and has currently 191 paying members which represent 110.000 employees. The Tampere cluster ICT TAMPERE REGION has obtained official status with the launch of the ICT Tampere Region Centre Expertise programme in 1994 and comprises 321 members which represent about 17.340 employees. The Moravian-Silesian cluster IT CLUSTER has officially established by the beginning of 2006 and comprises 19 paying members out of 420 ICT firms located in the region and further 70 companies registered as non-paying members. Due to the cluters informal character the 421 members of the ANKARA cluster and the 280 members representing 10,000 employees of the PADERBORN are rather companies located in the region respectively in the science park than members in close sense.
- Concerning the clusters' composition the shares of entrepreneurial members in all regions the number of SMEs exceeds the number of large enterprises, whereas the allocation within the group of SMEs varies: In TAMPERE majority (76.6%) of companies are micro enterprises with less than 10 employees, whereas in the other regions the share is somewhat around 50%, except for MORAVIAN-SILESIAN region where this group is only about 25:0%. Here the group of of small companies (10-49 employees) prevails (approx. 60.0%). The share of medium-sized companies is in all regions rather low with shares ranging from 5 to 10%. Moreover, in each cluster one or more universities and research institutes are participating. Concerning the key drivers for the clusters' development it is technology in the case of ICT TAMPERE, self-enforcing process among companies within PADERCLUSTER, while TCBE, IT CLUSTER and the ANKARA cluster are mainly customer-driven.
- A significant number of firms within the clusters is active in the field of 'Applications': In BERNE and PADERBORN enterprises active in this business area sum-up to approximately 45%. Contrary to TAMPERE where this business area is with a share of 33.3% less represented, in ANKARA and MORAVIAN-SILESIAN region the majority of firms is active in this field. Although

some focal points do exist in each cluster, there is no such thing like a regional product specialisation.

- The comparison of main fields of cooperation within the cluster shows that this is strongly determined by the clusters composition: One the one hand, the higher the competition among the clusters members, the less specific are the fields of cooperation. On the other hand, the higher the heterogeneity of entrepreneurial members, the less connecting factors may exist and the less likely is cooperation in core business areas. In both cases innovation potentials remain idle due to a lack of cooperation respectively a absence of pressure to innovate.
- Concerning clusters organisational structure both, TCBE and IT CLUSTER are organised as associations. ICT TAMPERE is structured into mini-clusters according to the cluster programmes launched. Neither in PADERBORN nor in ANKARA an administrative or legal body forming the organisational framework exists.
- Similar to the clusters' organisational structures the management of the five clusters varies: In Berne and Moravian-Silesian region the cluster management has been outplaced to independent organisations, whereas units of the regional/local development agencies are in charge in Tampere and Paderborn. In Ankara it is neither of those but a science park.
- With regard to the core competencies in cluster management a multitude of skill exists in the five regions: In BERNE it is long standing experiences in cluster management and the transfer of knowledge and technology. In TAMPERE it is in first instance the competences in programme preparation and implementation. Further fields of excellence are strategy formulation, in-depth market knowledge and long standing experience. In MORAVIAN-SILESIAN region core competencies lie in the field of acquisition of project funding and operation cluster management. Whereas in ANKARA it is cluster monitoring which is seen as field of excellence. Although PADERCLUSTER does not have a formal cluster management a specific strength of the economic development agency as coordinating organisation lies in the support of the self-enforcing processes of the single sub-clusters.

Summarising, in order to strengthen Europe's position in the worldwide ICT market one of the major challenges is seen in a large-scale adoption of ICT by companies from all sectors, especially as far as it concerns SMEs. Furthermore, strengthening differentiated competences at regional level by systematic cluster management could also contribute to the goals of the Lisbon strategy. Additionally, the regional distinctions and similarities concerning the sector, policies and the cluster could be further utilised to foster regional specialisation and collaboration across Europe. This sectoral division of labour could, if strategically developed, become a competitive advantage of Europe's ICT sector. Concerning the cluster management it has been illustrated that different types of cluster management exist and that one cannot draw generally conclusions form a cluster management organisational structure and clusters success. Albeit this fact, cluster management seems to be successful where it has well-defined institutionalised structures, is executed by at least one person in full-time and is financed by its members.

1 INTRODUCTION

Innovation is a complex phenomenon with several stages, ranging form basic research to market penetration by means of new products/services, and the introduction of new production processes within firms. It is a precondition to achieve the objectives of the Lisbon strategy. Therefore, the creation of a more innovation-friendly environment throughout the EU, and stimulation of technological innovation is important for the setting up of innovative technology business and thus, for the development of a high quality, lasting employment and sustainable economic growth.

First conclusions drawn from projects of the PAXIS and Gate2Growth initiatives show that networking and sharing of experience supports the process of innovation and the transfer of 'excellent' innovation management methodologies, tools and activities can be successfully fostered through cooperation at the European level. It becomes apparent that not the single business development itself is important, but also the surrounding: the sector and the region come to the fore. Being embedded in an innovation friendly environment, exchanging knowledge with suppliers as well as competitors and having strong connections with universities, research institutes and regional authorities is the perfect precondition for success. These 'nodes' within a sector, defined as CLUSTERS, are considered as one of the driving forces in innovation processes.

The question arising is how an innovative environment can be brought into being and what are the key success factors of prosperous clusters? Are there idiosyncratic patterns according to different sectors? Does the ICT sector and do ICT clusters have specific roles in the dual positions as an innovation sector itself but also as a driving innovation force for other sectors?

In the present paper we are taking a closer look at the European ICT sector and its clusters from different angles: the sector, the cluster and the region. According to this the aim of this analysis is twofold: Our first goal is to contribute to a better understanding of the heterogeneous ICT sector and its clusters in Europe. Secondly we explore the practice of cluster management in order to identify different types of cluster management which support the stimulation and therefore the innovating activities in the regions.

The remainder of this paper is structured as follows: In the next section, the analytical framework and the methodologies are described. The empirical results concerning the ICT sector and market are outlined in chapter 3. Next is the analysis of national and regional cluster policies as basic framework conditions. In chapter 5, we describe the clusters' evolution and status quo including the clusters' structures, firms' strategies and strengths & weaknesses. Furthermore, the cluster management approaches applied in the regions are compared and the results are outlined in chapter 5. Finally, we discuss the main results and draw some conclusions.

2 Definitions & Analytical Framework

According to the NICE rationale the three dimensions 'ICT sector', 'ICT cluster' and 'Policy' form the analytical framework of this analysis. In this context we distinguish between three geographic dimensions: Europe, nations (Czech Republic, Germany, Finland, Switzerland, and Turkey) and regions (Moravia-Silesia, Paderborn, Tampere, Berne, and Ankara). An in-depth cluster analysis has been conducted for each of these regions (see 'Reports on Regional Cluster Analysis').

In the context of this study we used two different definitions of the **ICT sector**: Firstly, the OECD definition of the sector is used to compare sectors performance on a European scale with its national/regional relevance.

> The ICT sector is a combination of manufacturing and service industries that capture, transmit, and display data and information electronically. [1]

Secondly, our own definition is utilised to describe the regional ICT sectors.

> The core sector consists of the sub-sectors Applications, Content and Core Services. While Infrastructure functions as a basis for Applications and Content, Core Services comprise cross-cutting ICT services. Amongst others legal and financial services are assigned to the Supporting Services

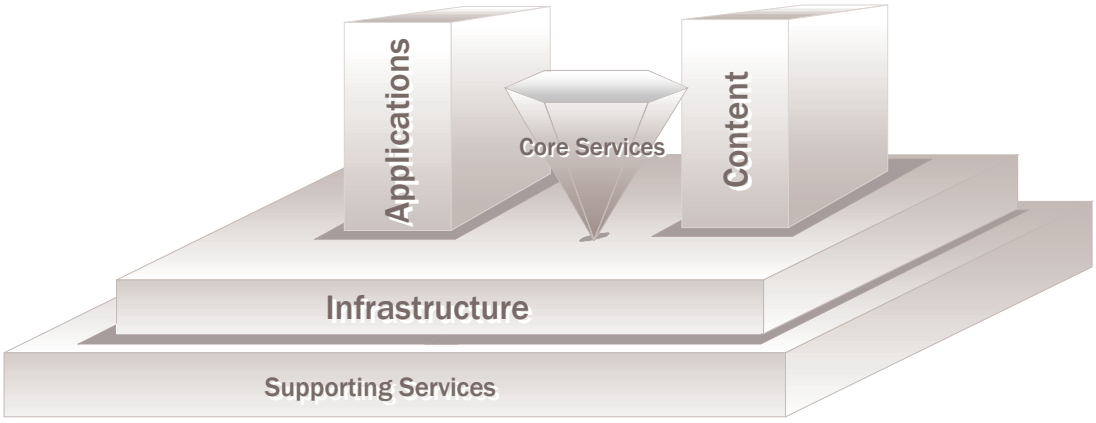


Figure 1: NICE definition of the ICT sector

When referring to **ICT clusters** we mean groups of independent companies and centres of knowledge (e.g. universities, research institutes, enterprise associations and other intermediary organisations) that are

- Collaborating and competing;
- Geographically concentrated in one or several regions, even though the cluster may have global extensions;
- Specialised in a special field, linked by common technologies and skills;
- Of a critical mass; this refers to fact that a cluster should include actors which together, have a certain weight in their sector in order to be able to build up momentum, which means to be able to establish self-supporting processes.
- Either institutionalised (having a proper cluster management) or non-institutionalised.

Cluster policies have been adopted around the world despite the lack of a common definition of clusters. A consequence of the diversity of definitions on clusters is that cluster policy is hardly an isolated, independent and well-defined discipline. Basically, cluster policy embraces all policies that affect the development of clusters, taking into account the synergies and interchanges between these policies. It 'is about stimulating the links to the local business environment through public-private dialogues, defining joint research needs, co-development between contractors and so on' (Boekholt/Thuriaux 1999: ii). In many industrial countries the promotion of clusters are a central part of regional, industrial and/or innovation policies (Isaksen/Hauge 2002; Raines 2002). Since the end of the 1990s especially industrial and regional policies increasingly concentrated on the stimulation of clusters and clustering processes (Einright 2000). But, one should keep in mind that cluster policy is not about creating clusters from scratch but rather putting in place framework conditions favouring cluster development. It often involves fostering interactions between actors based on trade linkages, innovation linkages, knowledge flows and providing specialised infrastructure support. Many policies labelled under different headings (regional, industrial, innovation policy etc.) are in fact cluster policies in the sense that they try to accomplish basic framework conditions favouring an environment conducive to business stakeholders work together on the local and/or regional level.

2.1 TERMINOLOGY

GDP – Gross Domestic Product is a measure of the results of economic activity. It is the value of all goods and services produced less the value of any goods or services used in producing them. The calculation of the annual growth rate of GDP volume allows comparisons of economic development both over time and between economies of different sizes, irrespective of changes in prices. Growth of GDP volume is calculated using data at previous year's prices.

ICT – Information and Communications Technologies (ICT) refer to information technology (IT) plus telecommunication (TLC).

IT – Information Technology (IT) refers to the combined industries of hardware and office machines, data processing equipment, data communications equipment.

Telecommunications – Telecommunications (TLC) refers to carrier services, end-user communications equipment and key systems, circuit switching equipment, cellular mobile radio infrastructure, transmission and other network equipment.

Productivity – ratio of volume measure of output to a volume measure of input use in producing goods or services.

SME – The term 'Small and Medium Enterprise' defines a business unit with less than 250 employees, annual turnover not exceeding €50 million, or an annual balance sheet total not over €43 million which is less than 25% owned by larger organisations (unless they are financial investors, such as banks or venture capitalists). According to the indicators number of employees, annual turnover or balance sheet total are further divided as follows:

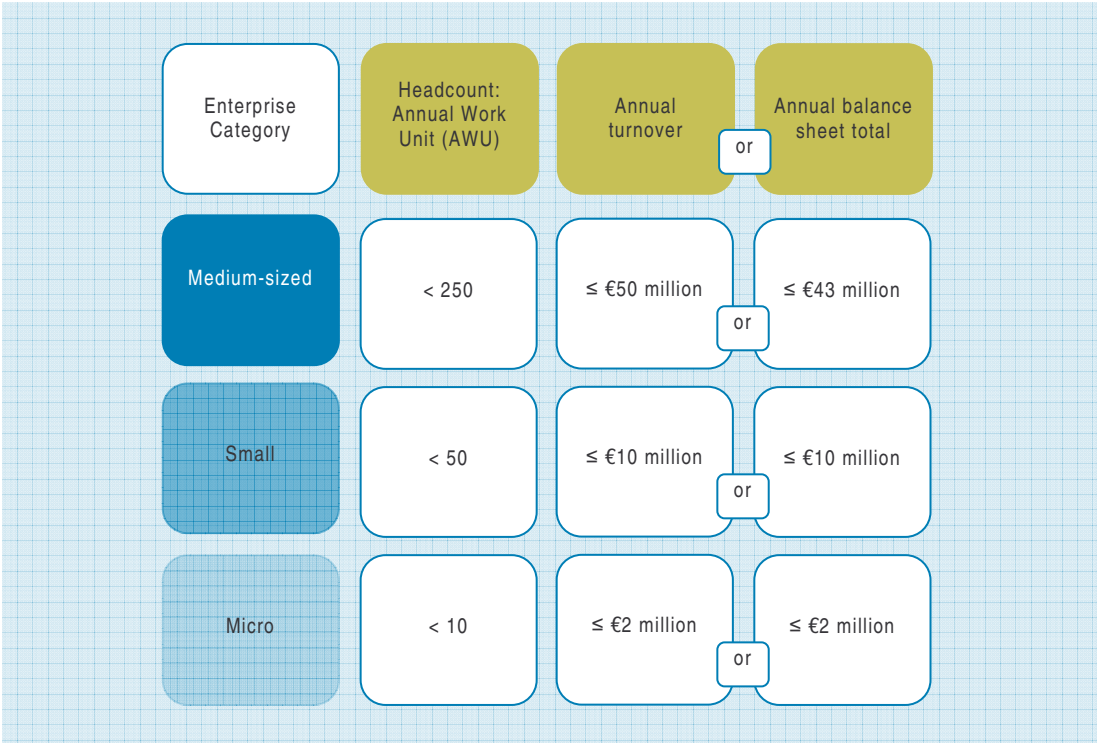


Figure 2: SME definition (DG Enterprise and Industry 2003)

2.2 DATA

The data used in this study were on the one hand collected as part of the regional cluster analysis conducted in the five participating regions. On the other hand secondary analyses of regional, national and European studies have been conducted.

The former was based on two questionnaires, one concerning the cluster management, the other the networking activities within the clusters. For the latter, the firms participating in the cluster were asked to fill-in a questionnaire on their inter-firm relationships and outward linkages (see Appendix A). The response rates vary from 6 to 30 replies per cluster which reflects the different size of the clusters and their position in the cluster lifecycle (embryonic, established, mature, and declining).

2.3 PROCEDURE

In the present, we compare

- the development of the European ICT sector with those of the U.S. and China;
- the role of the ICT sector in the national economies compared to the single European market
- to role of the ICT sector in the participating regions, its size and composition compared to the national data
- the size, development and current status of the regional ICT clusters;
- and, different types of cluster management and core competencies.

In the first step, a cluster analysis was performed in each of the participation regions. This analysis was based on a standardised questionnaire developed with the context of NICE (see Appendix B), and to be answered by the cluster management respective the regional development agency. The questionnaire also covered the analysis of the cluster management and was structured according to the NICE rationale.

3 MARKET & TECHNOLOGY CONTEXT

In this chapter, different aspects concerning the ICT market on European, national and regional level are analysed.

3.1 EUROPEAN ICT MARKET

According to the latest EITO report, in 2005, the overall value of the ICT market in Europe amounted €659 billion, which is about 6.5% of the total GDP. While the IT market accounted for €312 billion, the telecommunications market achieved a total of €348 billion.

Figure 3: International ICT markets (2003 – 2007) Source: EITO 2006

Europe's share of the worldwide ICT market was about 33.8% in 2005. Next to Europe the largest single ICT markets are the U.S. (28%) and Japan (14.7%). While Japan's ICT market performance was moderate with a growth rate of only 2.1% Europe and the US performed well with growth rates of 3.7% and 3.9%. If one compares the relative growth of market shares it becomes visible that Europe, Japan and the US are loosing market shares in favour of the 'Rest of the World', both, in telecommunication and IT sector (see Figure 4). This is because countries like India and China are more and more able to overhaul the existing technological gap.

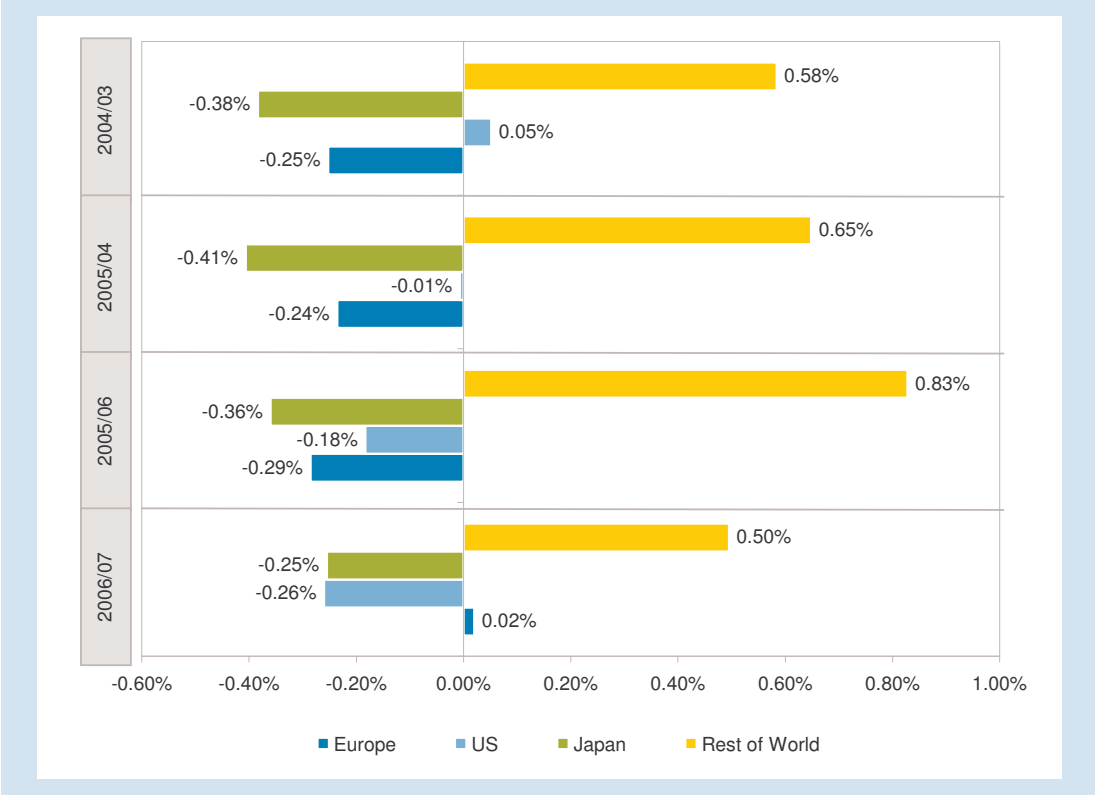


Figure 4: Change in market shares

As shown in the figure above the shift in market shares towards the rest of the world is not significant in means of a thread for the European ICT industry, but it has to be observed if this trend will continue during the next years.

Figure 5 shows the major ICT markets by products and the regional shares for each product category. Europe ranks top compared to U.S. and Japan in the fields of ICT equipment and Carrier services, and is below U.S. shares in Software and IT services.

Figure 5: Major regional ICT markets and market shares by product 2005 (€ million) Source: EITO 2006

A more detailed picture concerning the structure of the European, U.S. and Japanese ICT market is shown in Figure 6 which illustrates the product categories as share of the total regional market. The advantage of telecommunication industry over the rest of ICT industries in Europe is obvious. Its share of the total market was in 2005 about 44%, which is approx. 10% above the related share of U.S. market.

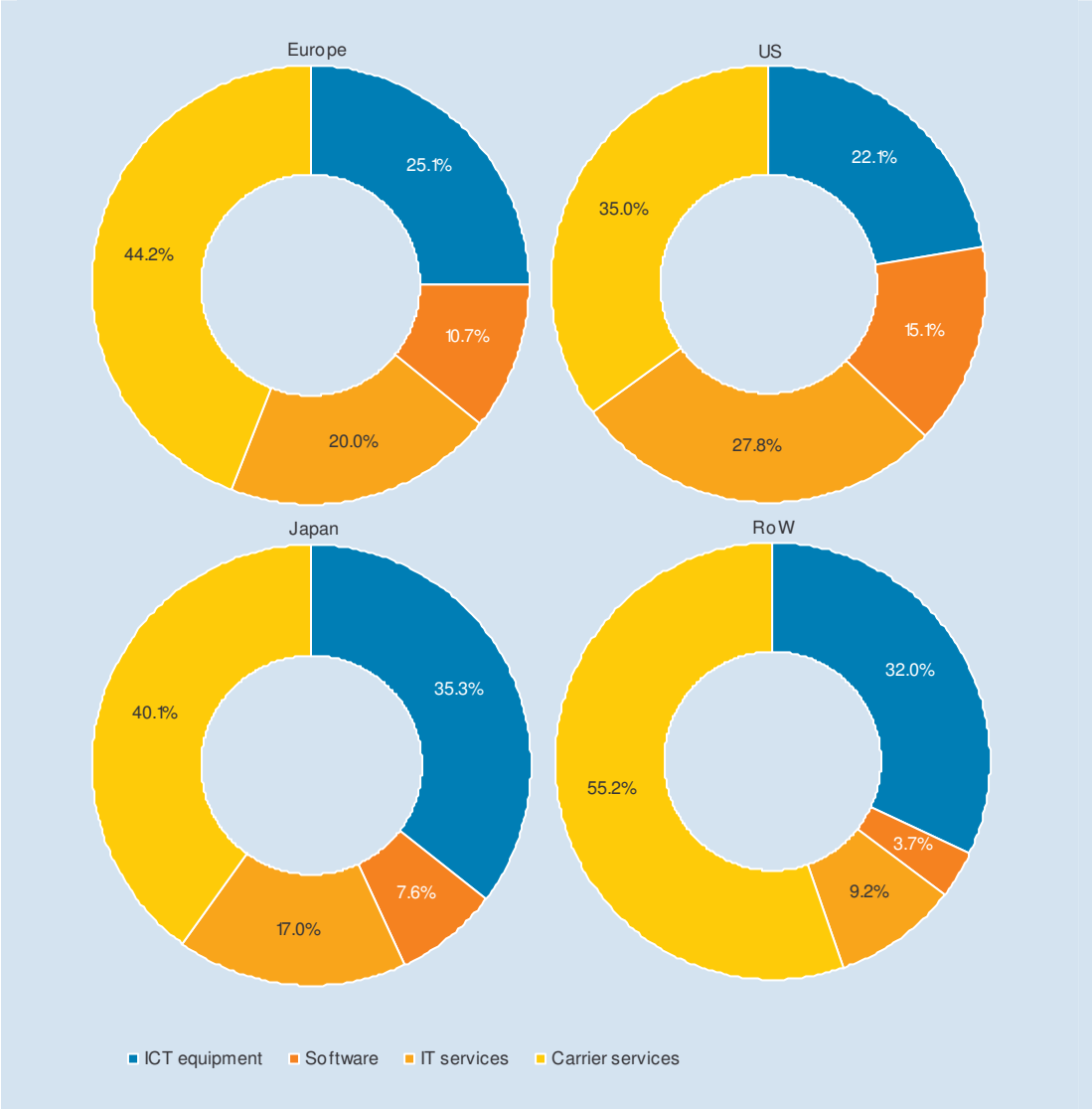


Figure 6: Products as share of regional ICT markets (2005)

With a share of 42.9% of the total turnover Software and ICT service industries in the U.S. perform better than in Europe (30.7%). ICT equipment industries are top-ranking in Japan. In 2005 its share was about 35.2% and transcended Europe (25.1%) and U.S. markets (22.1%).

A further aspect which has to be taken into account is the regional distinctions in national shares of the European ICT sector: About 70% of the market's total turnover is accounted for the top 5 Germany, France, Great Britain, Italy and Spain.

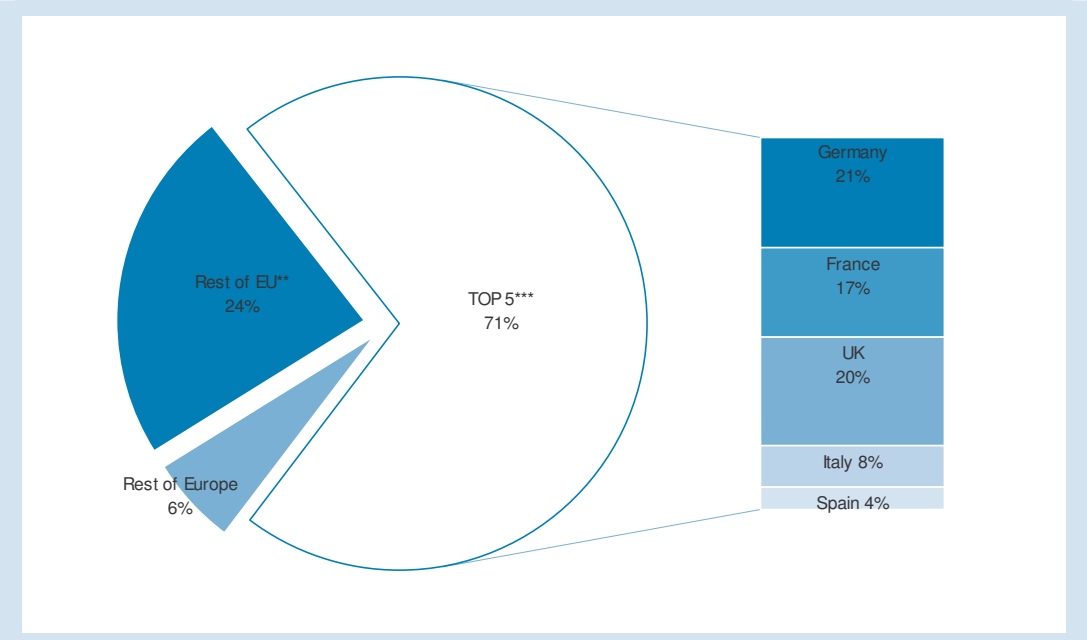


Figure 7: Europe – Market Shares by Regions (2005) Source EITO (2006)

Concerning the number of persons engaged in the ICT sector the U.S. was ahead of Europe for almost six years. With about 6 million people being engaged in the ICT sector Europe rose above U.S. for the first time (see Figure 8).

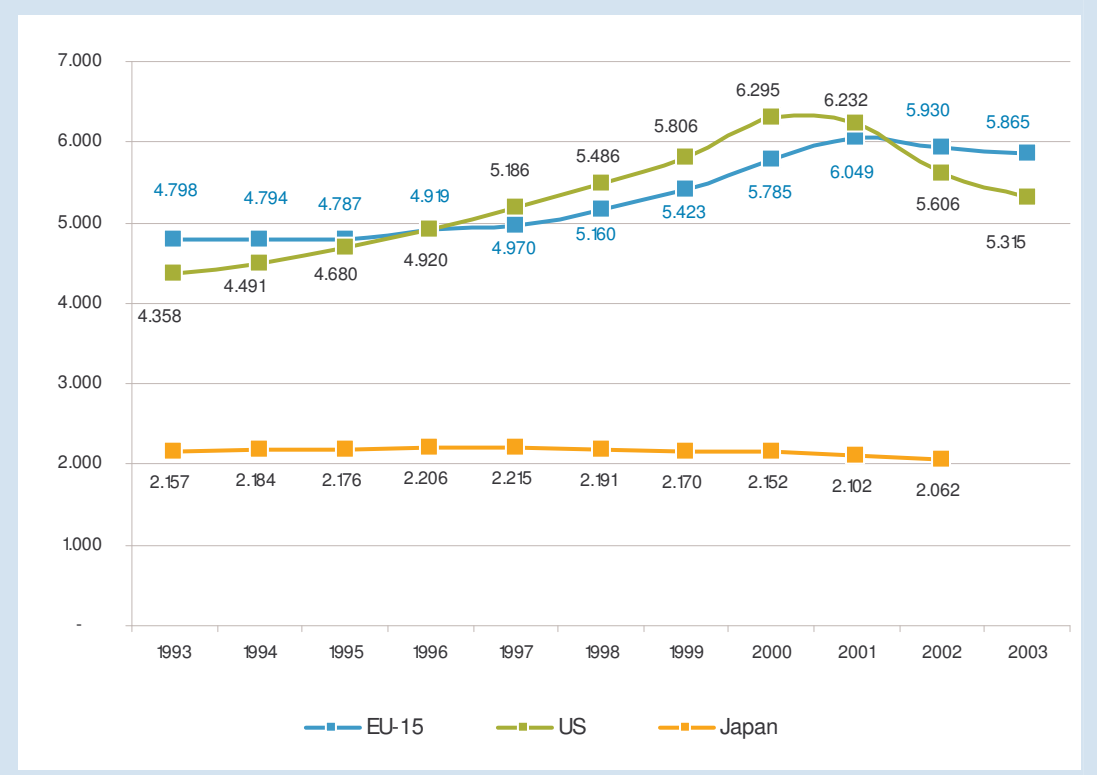


Figure 8: Persons engaged 1993-2003 (in thousand persons) Source: GGDC (2005)

On a closer examination of the demand side of the ICT sector it becomes apparent that there is still a gap in ICT penetration between Europe, the U.S. and Japan. While IT spending, calculated as share of the GDP, amounted 3.0% in Europe, it is about 4.0% in the U.S. and 3.4% in Japan. Similarly, the number of PCs per 100 inhabitants is clearly lower in Europe than in U.S. and Japan. In Europe only 35.0% of households do have a PC while in U.S. every 81st person out of 100 is equipped with a PC, in Japan it is every 47th person (EITO, 2006). Moreover, European countries show different dynamics, for example in Sweden 63 out of hundred inhabitants do have a PC at their disposal, it is only 3 out of hundred in the Czech Republic.

Despite these weaknesses Europe takes a lead position in the innovativeness of the ICT sector. Figure 9 gives a first indication. It shows the share of ICT patents registered at the European Patent Office (EPO), according to the residence of the inventors in 2004. With somewhat-38% the EU was in 2004 9% ahead the share of the U.S. and 15% ahead of Japan. Admittedly, it has to be mentioned that this leading position is also result of different business philosophies. The number of patents registered is only one indicator for the innovativeness of a sector. Further indicators are for example the number of companies founded and R&D expenditure.

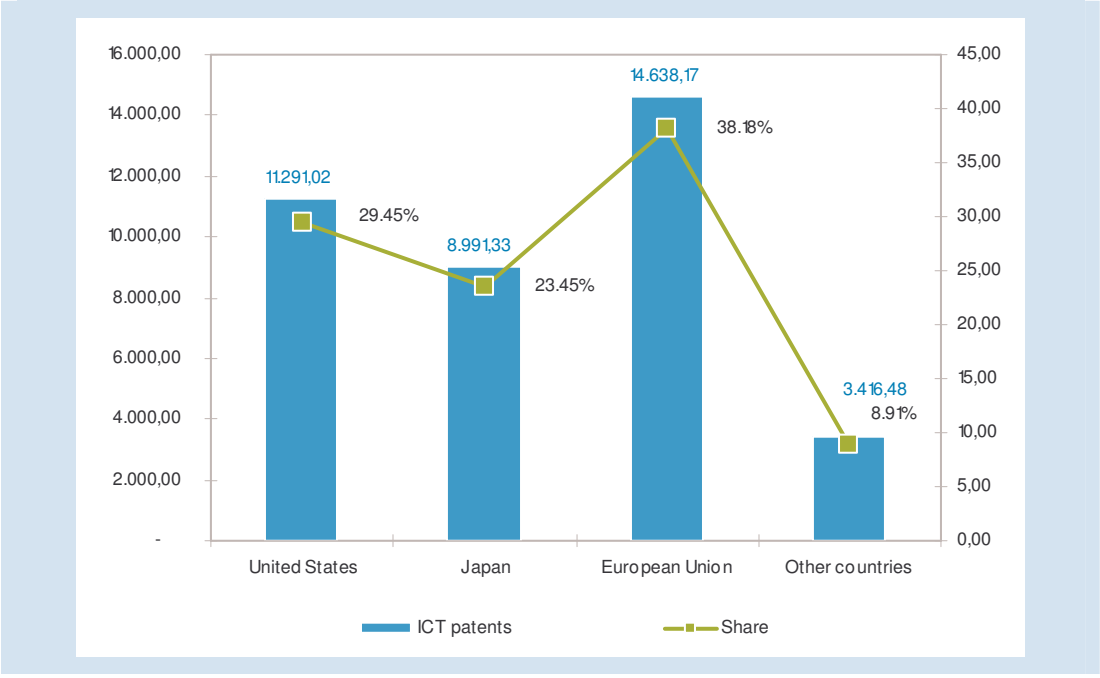


Figure 9: ICT patents' at European Patent Office (2004) Source: OECD (2004a)

As key drivers for future growth of the ICT sector mainly the public sector and the healthcare industry are seen. Concerning the latter key objectives for further investment in ICT include better quality of service, cost reductions and growth of productivity, transparency and reduction of medical errors as well as integration of patient information. Opportunities in the public sector are seen to rise through the need to enhance effectiveness of operations, to become more productive, and to set the stage for more transparency.

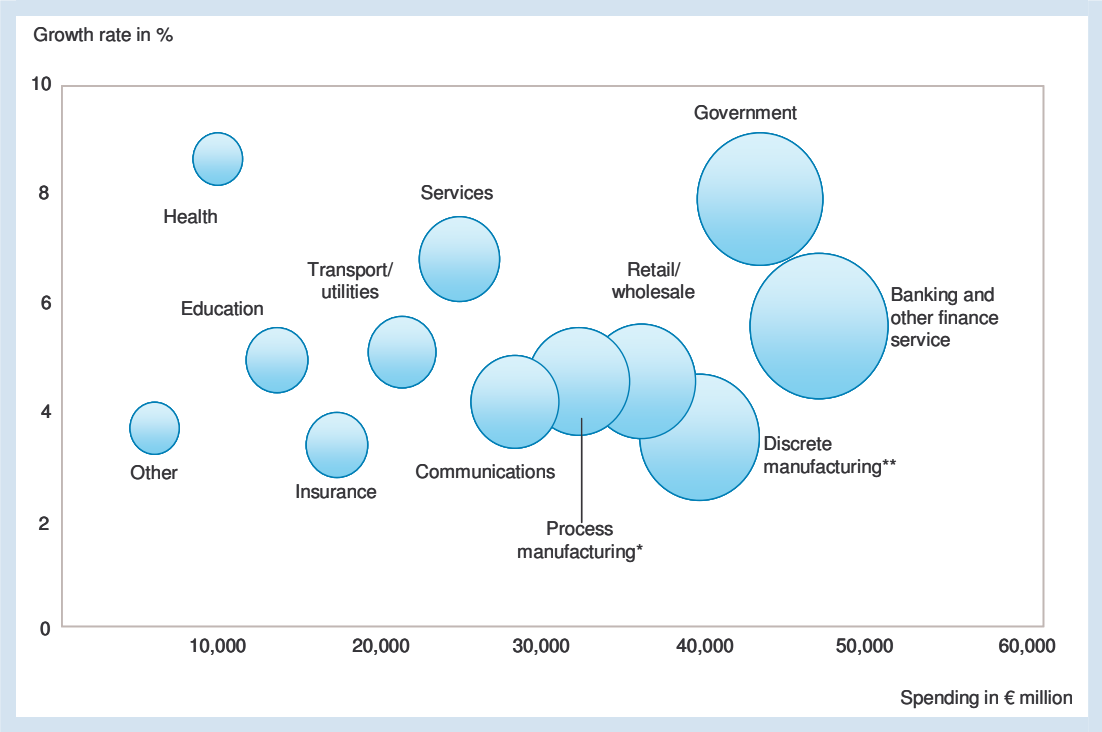


Figure 10: Future drivers for ICT market growth Source: EITO (2006)

The analysis of Europe's IT sector conducted by KPMG, finds that, when compared against firms form North America and Asia-Pacific, *'the competitive weaknesses of European technology firms outweigh their strength'.*[1] This result corresponds with KPMG's IT Sector Competitiveness Index, which compares suppliers of IT hardware, software and services from the three regions against a range of attributes. Each region is scored on a scale form 1 to 10 where one is poor and ten is superior.

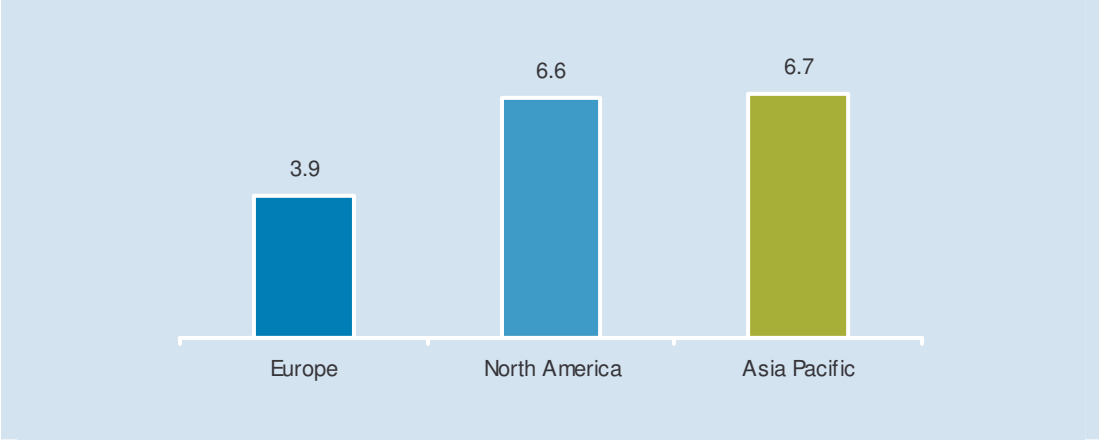


Figure 11: IT Sector Competitiveness Index (2006) Source: KPMG 2006

[1] The findings are based on a survey of 126 IT manager around the world, conduct in September 2005.

3.2 National ICT Markets

Due to the limited availability of comparable data for Germany, Finland, Switzerland, Turkey and the Czech Republic it has shown to be quite difficult to compare the national ICT markets. Therefore, in some cases only those countries for which the relevant data was available will be compared.

With a share of 21.0% of the European ICT market Germany ranked top of the five participating countries, followed by Switzerland with 3.0% and Finland with 1.5%. The Czech Republics share of the single market is with 0.9% rather low. In all countries the ICT sector holds a significant portion of the value added.

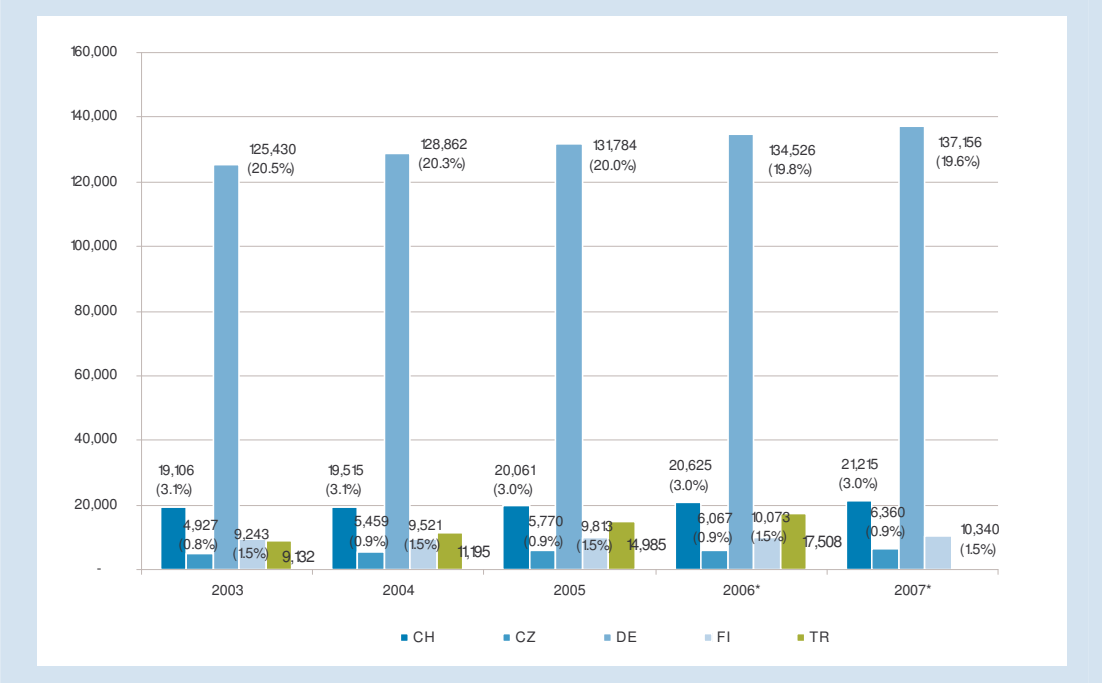


Figure 12: National ICT market values in MEUR (2003 – 2007)[2] Source: EITO (2006), Ökten (2006)

When comparing the value added as share of the GDP a quite different picture can be drawn: As shown in Figure 13 Finland ranked top with a share of 11.5%, followed by Switzerland with 8.6%. Germany and the Czech Republic achieved shares of 7.6% respectively 7.2% (EITO 2006). In Turkey the sector's share was with 5.6% slightly lower (Ökten 2006).

[2] Source for the data for Germany, Finland, Switzerland and the Czech Republic is EITO (2006); the data for Turkey has been collected by Interpro (a Turkish company) and is therefore, suitable to only a limited extend for comparison. Numbers shown in brackets are the national proportions of the European single market.

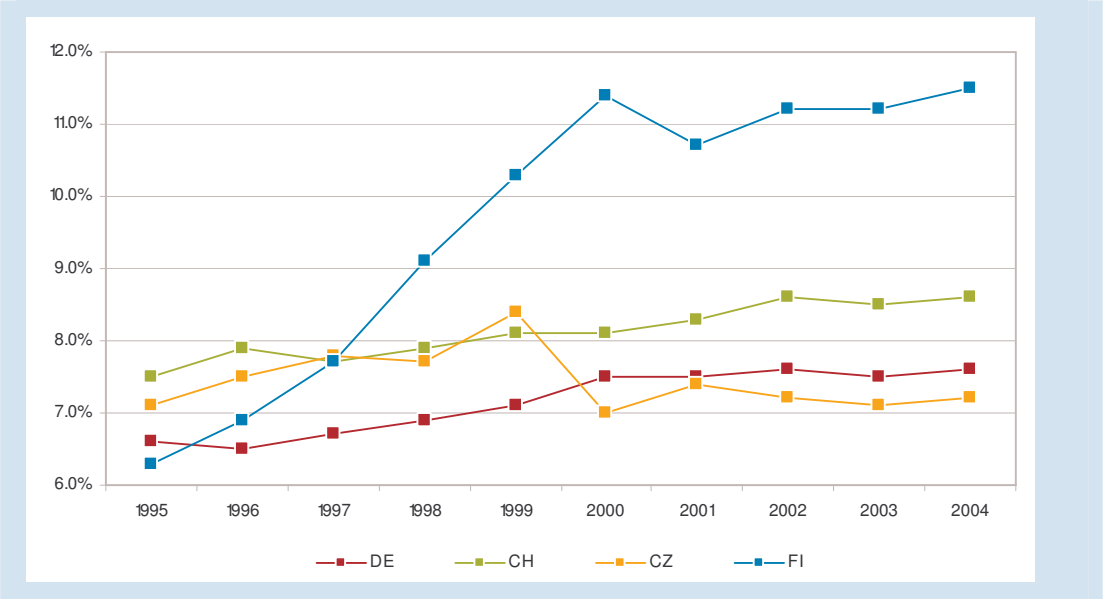


Figure 13: ICT value added as percentage of GDP by Nation Source: EITO (2006)

As shown in the chart below the ICT market structures in Finland, Germany and Switzerland are akin: The strengths are clearly in the communication service industries with market shares ranging from 37.0 to 42.0% of the national markets which is compared to the European single market slightly below average. IT services are ranked second with market shares of approximately 20.0%, which corresponded with the European market. Software industries are represented in Finland, Germany and Switzerland 3.0% above the single market. In the three countries hardware and equipment industries are substandard.

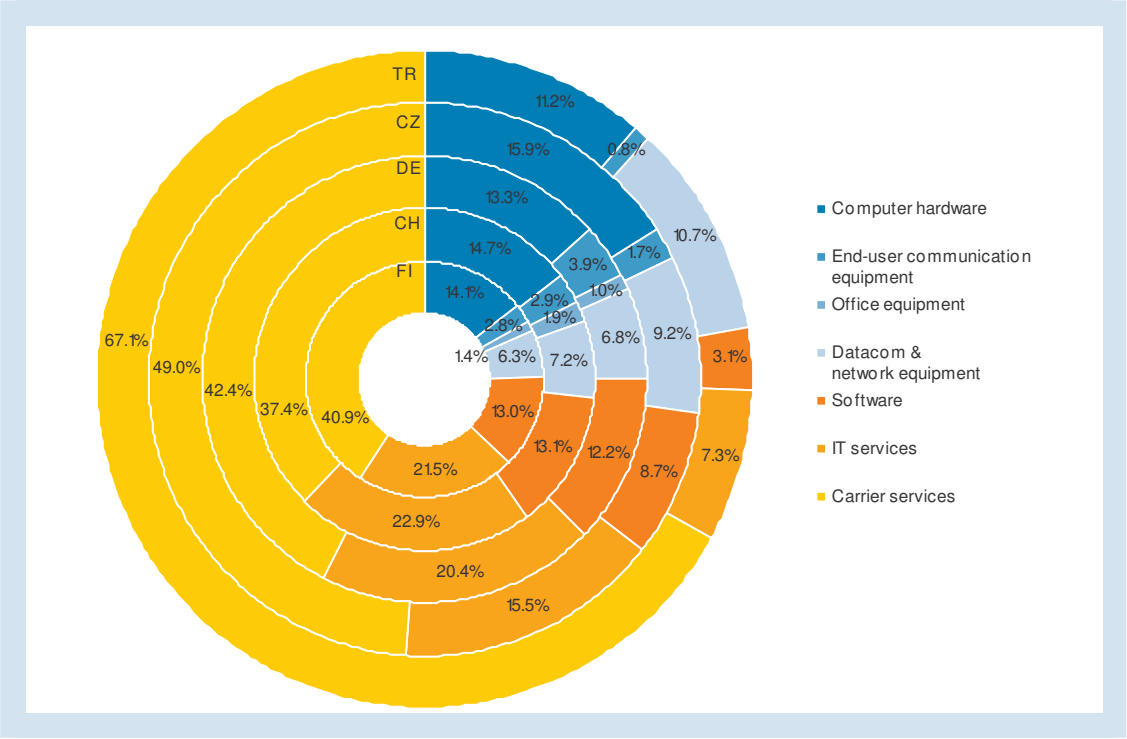


Figure 14: Structure of the national ICT markets

In the Czech Republic it is also the communication service industry with ranks top with a share of 49.0 % of the national ICT market (EITO 2006). Contrary to the other countries, Computer hardware industry ranks second with a share of 15.9%, followed by IT services (15.5%). The Software industry is with a proportion of 8.7% two percent below EU-15 average. With a high share of communication services (approx. 67%) and a very low share of software industry (3.1%) the Turkish ICT market structure is strongly diverging from the other countries (Ökten 2006).

Taking a closer look at the ICT penetration in the single countries, the regional distinctions across Europe become apparent. While in Switzerland 56 of 100 persons are equipped with a PCs which is well above European average, in Czech Republic it is only 3 out of 100. Finland and Germany range with rates of 40% respectively 44% somewhat above European standard.

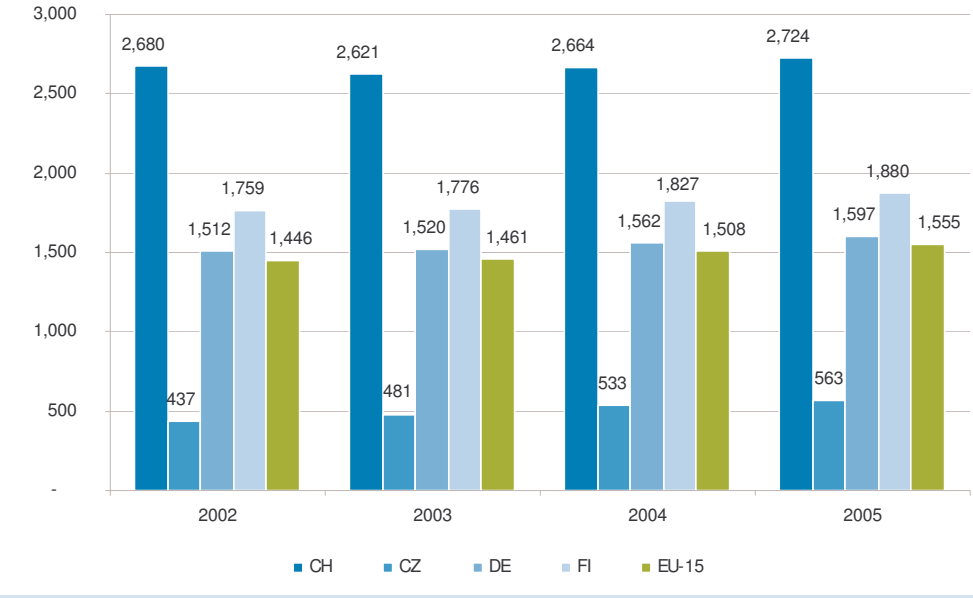


Figure 15: Per capita ICT expenditures (bill. €) Source: EITO (2006)

The amount spent on ICT in all countries except Czech Republic exceeded the EU-15 expenditure. Out of the four countries Switzerland ranked first in 2005, followed by Finland, and Germany. A similar situation is reflected by the ICT expenditure as proportion of the GDP: Again Switzerland ranks first, followed by Finland and Germany (approx. 6.6%). The share in Czech Republic is with approximately 6.2% below European average of 6.4%, but is steadily closing up.

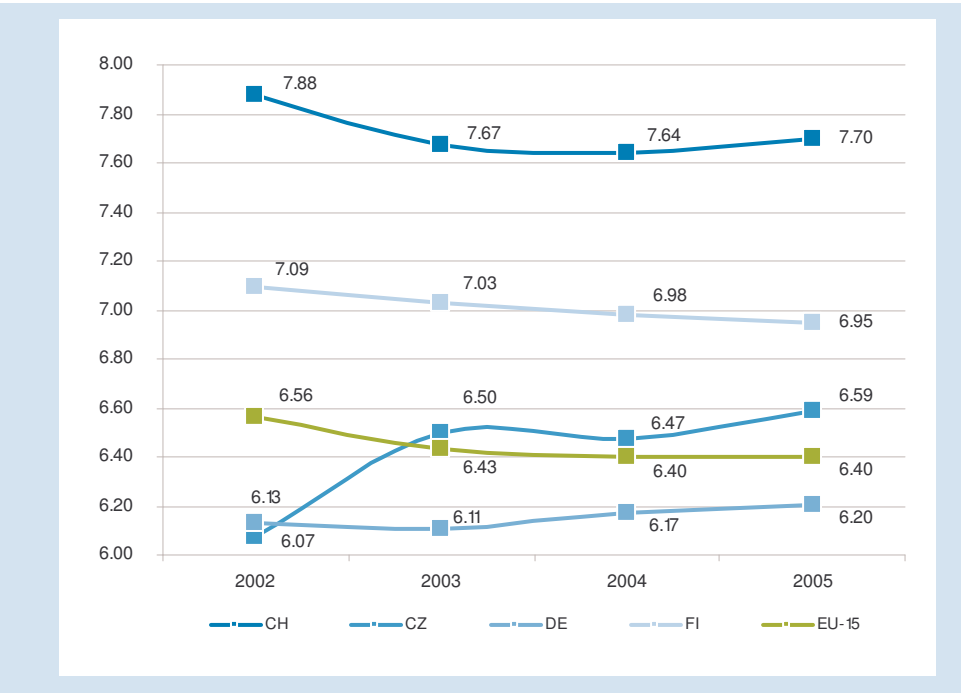


Figure 16: ICT expenditure as percentage of GDP Source: EITO (2006)

In the 2006 e-readiness ranking, a comparison of 68 countries' 'state of play' of a country's ICT infrastructure and the ability of its consumers, businesses and governments to use ICT to their benefit, Switzerland holds position 3, Finland is ranked 6, Germany 12, Turkey 45 and the Czech Republic 32 (Economist Intelligence Unit 2006) .

Taking the absolute number of patents' registered at EPO as measure for the innovativeness of the national ICT markets, Germany ranks top and exceeded the registration of EU-15 for the last five years. As a result of different business philosophies the number of patents registered by single countries differs widely across Europe. While inventors from Germany registered 1,249 patents in 2004, Finnish and Swiss inventors registered 55 respectively 210, Czech and Turkish inventors only 3 respectively 2. Figure 17 shows the share of ICT patents as percentage of all patents registered at EPO by the single countries in comparison to registrations of EU-15. It also shows that Turkey and the Czech Republic are performing better than it seemed at the first glance. In 2004 Turkey's share of registered ICT patents was almost as high as Germanys. Surprisingly Finland ranked top, way ahead of the other countries. From this the conclusion can be drawn that Finish ICT companies tend to register patents more often than firms form other sectors.

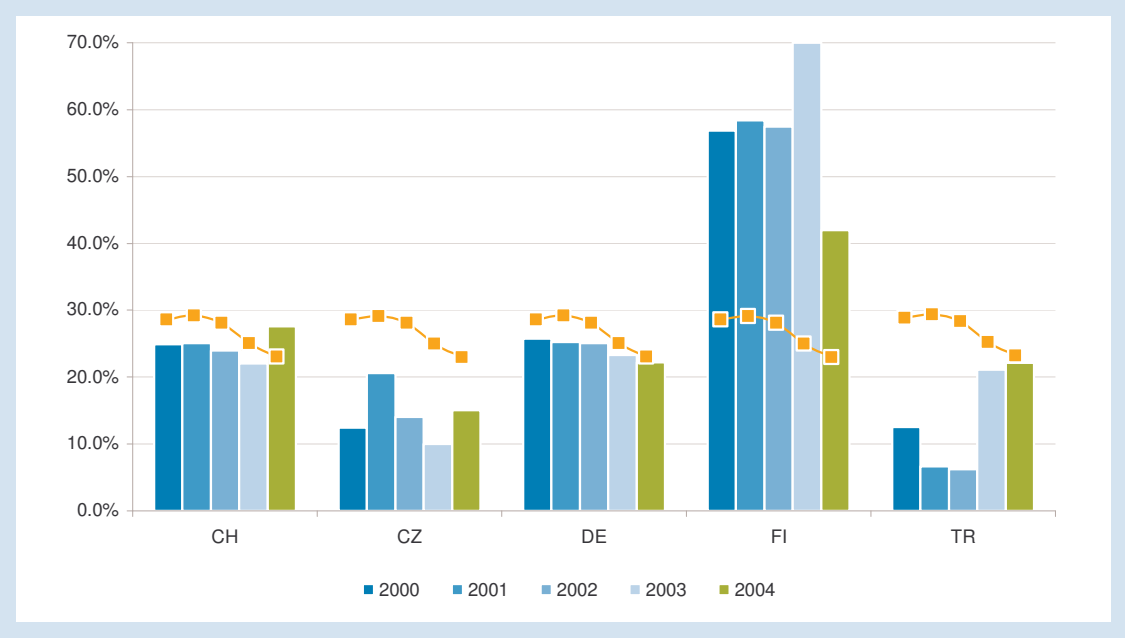


Figure 17: National ICT patents' as proportion of total patents registered at EPO compared to EU-15

So, recapitulating, the national ICT markets are characterised by homogeneity which means that it is almost impossible to identify unique selling propositions on the national level. Against this background it is assumed that competition on the national level is driven by price-performance ratio and valued added for the customers.

3.3 REGIONAL ICT MARKETS

The availability of data on the regional ICT markets differs across the five regions: While for Berne and Tampere related statistical data is available, it is not for Moravia-Silesia. Concerning Paderborn and Ankara some data is available others are not.

A measure for the relevance of the ICT sector for the regional economy is its share of the regional GDP. As shown in Figure 18, Tampere ranks top with a proportion of 12.5% in 2004, followed by Berne (9.8%) and Paderborn (7.2%).

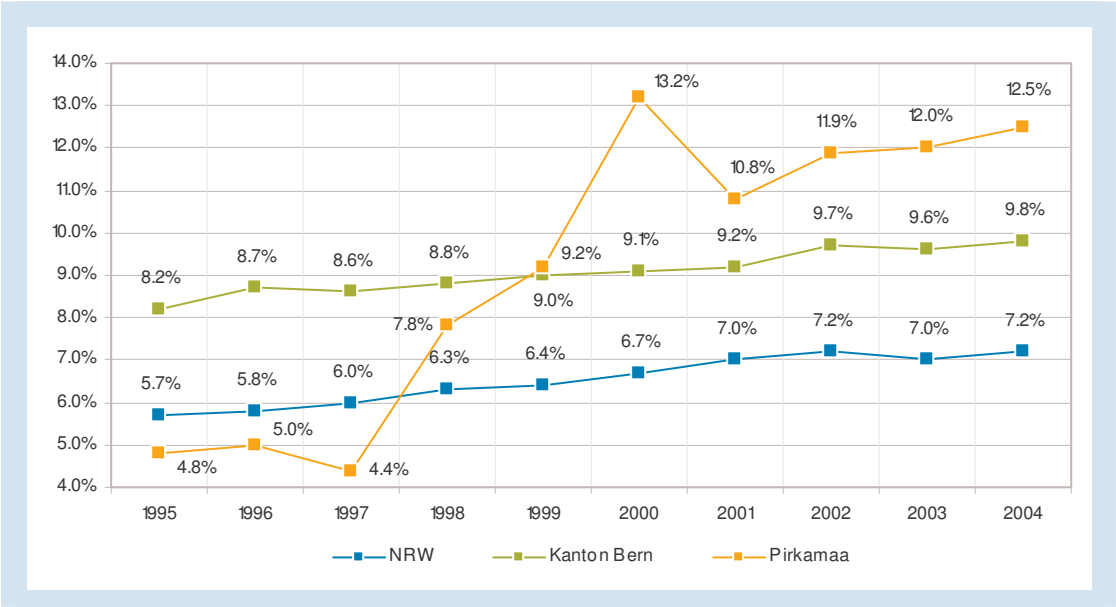


Figure 18: ICT sector's share of regional GDP Source: BAK 2006

While PIRKANMAA[3] region was undergoing a consolidation phase in 2000/01 after a period of considerable increase between 1995 and 2000, the relevance of the ICT sector in the canton BERNE and NORTH RHINE-WESTPHALIA (NRW) has increased constantly, but at a lower level. Neither for Moravia-Silesian region nor for Ankara comparable data is available.

A further measure for the relevance of the ICT sector for the regional economy is its share in employment. Figure 19 shows that the ICT sectors share in regional total employment in the canton BERNE has been above the ICT sectors share of the total employment of Switzerland for the last ten years (7.6% in 2004). That is to say the relevance of the regional ICT sector for the regional economy is higher than the sectors relevance in total Switzerland. The same applies to the region PIRKANMAA, here the regional proportion of 7.2% in 2004 was 0.9% above the national value. In

[3] Since there was no such data available for the region Tampere the wider region Pirkanmaa has been taken as basis for comparison. The same applies to Paderborn where the wider region is North-Rhine Westphalia.

contrast the ICT sectors share in regional employment in North-Rhine Westphalia is compared to the sector's national share substandard.

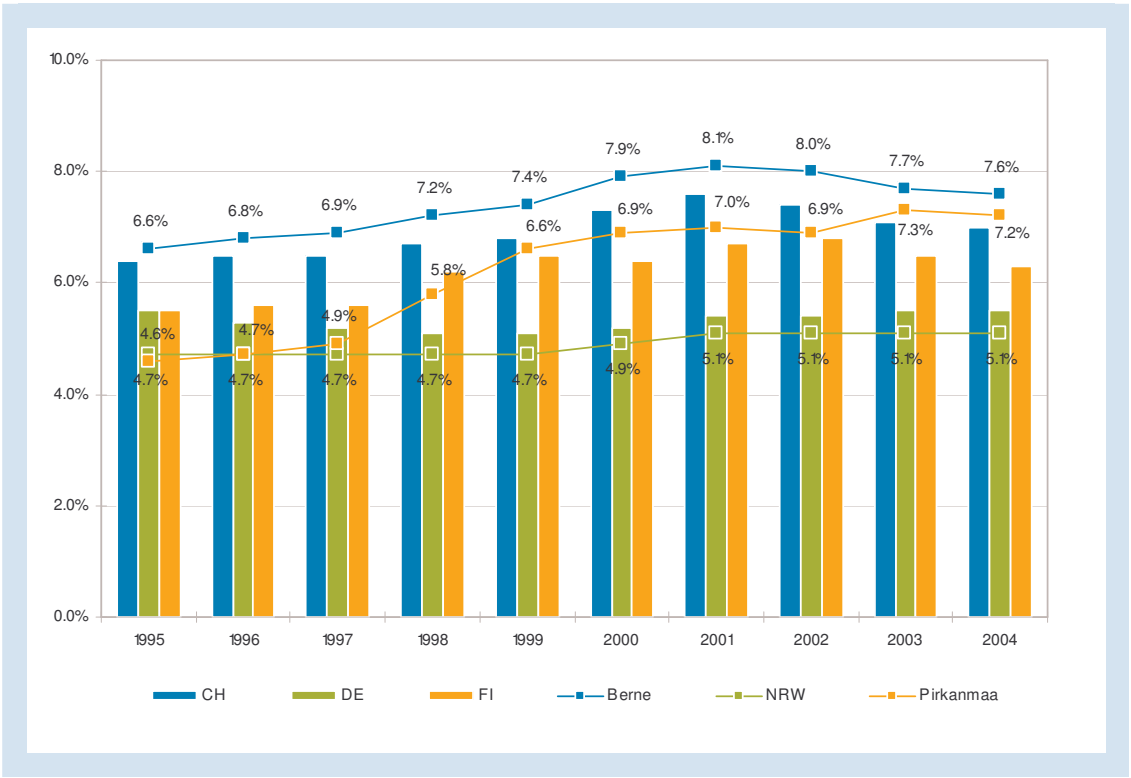


Figure 19: ICT sectors share of national & regional total employment

Source: BAK 2006

4 CLUSTER POLICIES

The evolution of clusters is not only affect by the sector itself and the regional actors, but also by national and regional cluster policies. Although clusters are no new phenomena, their advantages for boosting countries' and regions' competitiveness has been put under the spotlight and influenced policy thinking. The concept owes its current popularity for various reasons: In the first instance, policymakers are aware that membership in a cluster can enhance the productivity, innovativeness and competitive performance of companies. Furthermore, structural changes in the global economy play a role and offer regions the chance to concentrate on their sustainable and qualitative competitive advantages. In addition the cluster approach offers a starting point for a strategic bundling of the ever decreasing resources of public support. In this context, the cluster approach is regarded by the European Commission as one of the most promising strategic directions for future oriented structural policy. However, due to the fact that the cluster concept is a competition model based on regional competencies it runs the risk to be used 'inflationary' because every region has its competencies.

Cluster policies have been adopted around the world despite the lack of a common definition of clusters. A consequence of the diversity of definitions on clusters is that cluster policy is hardly an isolated, independent and well-defined discipline. Basically, cluster policy embraces all policies that affect the development of clusters, taking into account the synergies and interchanges between these policies. Basically 'cluster policy is about stimulating the links to the local business environment through public-private dialogues, defining joint research needs, co-development between contractors and so on' (Boekholt/Thuriaux 1999: ii). In many industrial countries the promotion of clusters are a central part of regional, industrial and/or innovation policies (Isaksen/ Hauge 2002; Raines 2002). Since the end of the 1990s especially industrial and regional policies increasingly concentrated on the stimulation of clusters and clustering processes (Einright 2000; Glasmeier 2000). But, one should keep in mind that cluster policy is not about creating clusters from scratch but rather putting in place framework conditions favouring cluster development. It often involves fostering interactions between actors based on trade linkages, innovation linkages, knowledge flows and providing specialised infrastructure support. Many policies labelled under different headings (regional, industrial, innovation policy etc.) are in fact cluster policies in the sense that they try to accomplish basic framework conditions favouring an environment conducive to business stakeholders work together on the local and/or regional level.

Furthermore, clusters are a contemporary policy issue on three geographic levels, namely the European, national and regional level. Concerning the European level the European Commission sees its key role in cluster policies in providing better data on clusters, convening joint research groups for clusters to study Europe-wide cluster-related topics, and in supporting regional cluster initiatives by specific programmes. At national level there is an increasing recognition of the potential benefits of using a cluster approach. Several countries in Europe have in recent years applied the concept of clusters in their strategies and policies (e.g. Finland, Sweden, UK, Ireland,

Denmark, Czech Republic, Slovenia and Portugal). Other countries (e.g. Germany, France and Spain) do not have an equivalent national cluster policy. Even in Italy where clusters are widespread and part of the traditional economic process, there is no specific cluster legislation, but overall policies for SMEs, independent from the fact that the SMEs belong to a cluster. Since clusters are mainly regional, a great effort has been taken in recent years to implement cluster policies on a regional level. Countries like Germany for example focus on regional cluster policies by the 'Bundesländer' instead of national policies; so do Sweden and the UK. The activities undertaken cover issues like empowerment, leveraging on existing regional assets, promoting a climate of trust and confidence, fostering regional appropriation and identity as well as enhancing smart and interactive connections and knowledge valorisation. Most such initiatives have been launched by local or regional government agencies trying to engage industry associations and individual companies in their efforts.

To summarise, across Europe the main players as regards cluster policies are the national and regional level (DG Enterprise 2003: 25). While national authorities mainly focus on designing and co-ordinating cluster policies (general framework, conditions, R&D programmes) regional authorities are in charge for its implementation. As far as the member states are concerned the EU and the local governments have less important influence on cluster development.

According to the final report of the expert group on enterprise clusters and networks published by the DG Enterprise policy priorities vary across regions. The expert group distinguished between five types:

(1) Non-existent, which means no cluster-based policies;
(2) Catalytic policies which aim at bringing players together, but provide only limited support;
(3) Supportive policy means catalytic policy plus cluster-specific investments in infrastructure, education, training or providing passive promotional support;
(4) Direct policy means supportive policies plus either governmental cluster programmes to reshape the economic structure, or the presence of fairly directive targeting programmes;
(5) Interventionist policies go beyond direct policies and include either the government making the major decision about the evolution of cluster rather than the private sector, or using active means to develop the cluster, or significant government ownership and control in the cluster.

4.1 National Cluster Policies

Relating to the five policy types the following picture can be drawn for Germany, Finland, Switzerland, Czech Republic and Turkey: In Turkey the integration of cluster policies at the national and regional level is at its very beginning. Hitherto, first cluster-related programmes have been launched (e.g. the National Development Programme), but neither on national nor on regional level do any cluster policies exist. Furthermore, the 'Technology Development Regions' act (law 4691), adopted by the Ministry for Industry and Trade, which focuses on the utilisation of

cooperation between Universities, research institutes and firms to foster technological innovations in order for the nation to be internationally competitive, increase productivity, introduce innovations in products and processes and to enable SMEs to adapt new and advanced technologies, is of relevance in this context. In contrast, in Switzerland, Finland and Germany cluster policies are to be found on all political levels. While cluster policies in Switzerland and Finland are mainly catalytic respectively supportive, in Germany the implementation of national and regional policies takes place on local level through direct measures (see Figure 20).

In the framework of the 'New Regional Policy 2008' in SWITZERLAND it is currently being discussed to redirect the solely indirect policy on national level to a supportive policy which gives more leeway to the regions. For this monetary resources will be provide to enable regional authorities to launch perennial programmes to strengthen cantonal innovation and competitiveness.

In FINLAND the cluster approach found its way into policy in 1993 when the Finnish Ministry of Trade and Industry published the National Strategy White Paper[4], which strengthened the focus of industrial policy towards development and promotion of a national innovation system in the context of industrial clusters (Koski et al. 2006). This was the start of 'new industrial policies', which focused on long-term policies '[...] to improve the general business environment for firms and industries, especially regarding knowledge development and diffusion, innovation, and clustering of industrial activities' (Koski et al. 2006: 39). In this context the ICT cluster was envisioned as one of the future strongholds of the economy. Today the 'Centre of Expertise Programme' is basis for regional and local cluster policies. The eight-year programme has been launched by the government in 1994 and aims at supporting the further development of regional strength by bundling existing competences and utilising those for job creation. The initiation of entrepreneurial cooperation, the linking-up of research institutes, educational institutions and firms as well as the 'Centres of Expertise' take centre stage.

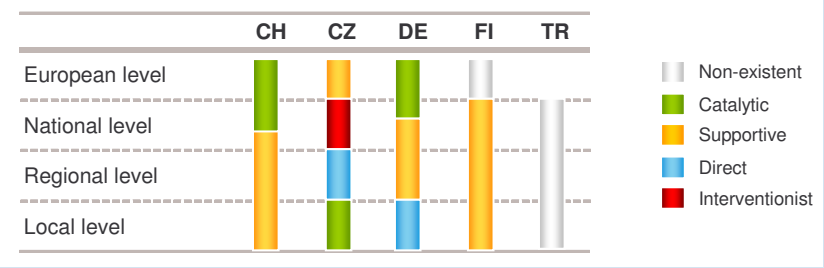


Figure 20: Cluster policies by policy type

In CZECH REPUBLIC cluster policies are organised as multilevel policy where the local level has almost no bearing on the policy, but only becomes active in terms of catalytic policies. Thus, the 'National Cluster Strategy 2005-2008' (NCS) defines the nationwide cluster strategy, which is

[4] The paper included a short review of future competitive clusters that served as rough guidelines for innovation and industry policy formulation; it was no attempt to have a rigid planning control (Koski et al. 2006: 40).

divided into three measures: (1) Development of clustering concepts, (2) moderation of clusters and (3) cluster mapping. Moreover, with the 'Operational Programme Industry and Enterprise' (OPIE) another important programme for cluster development exists. The programme is accompanied by the Ministry for Industry and Trade and implemented by CzechInvest, an organisation which has been founded just for this purpose (MIT 2004, 2005)[5]. Especially the measure 'Klustery' targeted on fostering economic growth and competitiveness by clustering is of interest. In the framework of OPIE clusters can either be developed on regional, national or cross-border. In order to guarantee a sustainable development clusters are being supported for a period of three years after establishment. In general two types of projects are being financed by OPIE: Firstly, cluster mapping projects and secondly, projects targeted at establishment and development of clusters, including the cluster management (Břusková 2006). The project's success will be measured against pre-defined criteria. In order to do so the cluster management has to hand in activity reports every three month.

In GERMANY national cluster policies are mainly of catalytic nature and are part of technology and innovation policies. Programmes launched in this context are located somewhere between catalytic and supportive policies. Examples are BioREGIO (sector: biotechnology), InnoREGIO (establishment of regional self-supporting innovation networks) or ProINNO (promotion of innovativeness of SMEs). One exception the initiative 'Aufbau-Ost' of the Federal Ministry for Transport, Construction and Urban Development (Bundesministerium für Verkehr, Bau und Stadt-entwicklung) which focuses on clusters in the context of the regional economic development in Eastern Germany.

4.2 REGIONAL CLUSTER POLICIES

The region BERNE has been one of the first movers in Swiss regional cluster policies. The evolution of regional cluster policies was a bottom-up process. In this context the initiative 'Espace Midland', which aimed at establishing an intercantonal cluster support, can be considered as a starting point for the regional cluster policies in the mid 1990s. At that time the cantons were not able to find a common ground and this triggered Berne's own cluster policy. Subsequently, all cluster organisations and programmes have been established by the Berne Regional Development Agency. While the cluster activities initially had no thematic focus, since 1998 the canton follows an active cluster policy approach. Today the regional cluster strategy aims at strengthening the local and regional economy through linking-up of enterprises, educational and research institutions (Beer/Brandt 2006). It distinguishes between three main instruments to promote cluster: (1) Promotion of clusters on the national and/or international level (attraction of foreign investment), (2) direct support of SMEs and (3) partial financing of cluster organisations. The cluster activities are focused on the telematik/ICT sector, medical engineering, technical devices (e.g. sensor technologies), environmental engineering & energy and design. Central selection criterion for these sectors was their contribution to the regional GDP. Thus, the clusters were defined on the stratum

[5] The programme is with a share of two-third by the European Structural Fond (ESF).

of existing companies and instead of being initiated as development policies. The Berne Economic Development Agency is actively involved in the cluster strategy, for which the basis was established with the 'Wirtschaftsförderungsgesetz' (economic development act 1998) which was adopted in January 1998. Since then the Economic Development Agency has companied 512 projects which have contributed to the creation of about 8,500 new jobs. Approximately 90% of these projects were related to one of the six regional clusters (Beer/Brandt 2006).

Rather than having its own cluster policy for the region, PADERBORN is geared to the cluster policies of the federal state North-Rhine Westphalia (NRW) and the wider region East-Westphalia Lippe (OWL). In NRW cluster policies are integral part of the regionalised structural policy which aims at strengthening the strength in means of regional growth, rather than on compensating regional weaknesses. The NRW cluster policy is characterised by the counter flow principal: Through the launch of cluster-specific programmes in the framework of Objective 2 Programme top-down elements are integrated. By supporting organically-grown clusters which have developed independently from public funded programmes, bottom-up elements included. Starting point for the development of the cluster policy in NRW first experimental programmes in the mid 1990s have been. The implementation of cluster policies on NRW level is due to the decentralised implementation structures always a compromise of the interests of the federal state on the one hand and the regional actors on the other. Cluster policies in OWL are element of integrated labour and economic policy since 1994. Basically it aims at the development and expansion of regional competencies. In this sense the region functions as transpose instance of the state-wide cluster policy.

Cluster policies in the TAMPERE region are based on the 'Centre of Expertise Programme', which is reflected in the regional economic development plan as well as in the 'Tampere Region Centre of Expertise Programme'. Different from the other regions the focus is not on a specific sector, but on fostering existing regional competencies. Central feature of the region's cluster policy is the launching of own cluster-related programmes based on defined strategic goals. Thus, a wide range of programmes exists which differ regarding aims and target groups. For example, four programmes have been launched only for the ICT cluster: (1) Neogames, (2) COSS, Centre for Open Source Software, (3) UBIQ (Ubiquitous Computing) and (4) ICT Centre for Expertise. Each programme focuses on a specific area of the ICT sector (Miettinen 2006).

The framework for cluster policies in the MORAVIAN-SILESIAN region is set with the 'Regional Development Plan 2005-2008'. Due to the rigid cluster policy on the national level there is barely any scope for development of bottom-up activities. Accordingly the 'Regional Development Plan' is geared to the national policy guidelines. Here the measures also focus on cluster development and cluster mapping. According to the plan cluster policies are supported in terms of priority 1 – Competitive Enterprise, Strategic Goal and priority 2 – Create Conditions for Enterprise and Investment Development (Břusková 2006). No funding for cluster-specific activities results from this plan. Rather, regional financial support is provided by the Moravian-Silesian regional authorities' budget based on individual applications for specific projects.

Because of the centralised administration in TURKEY no regional governments exist. Thus, there are no organisations responsible for regional policies, only non-governmental organisations (e.g. chamber of commerce) try to influence these policies at the regional level. Although, there is no such thing like regional cluster policies, first programmes which aim at fostering entrepreneurial cooperation have been launched. These are rather technology-oriented than explicitly cluster-oriented. As an outcome of the Urgent Action Plan (UAC), which declared in the Public Management Reform Section information society as one of the highest priority issues, the e-Transformation Turkey Project was launched (Ökten 2006). The project aims at fostering the evolution and coordinating information society activities, which previously have been carried out under different topics by various institutes. The State Planning Organisation (SPO), affiliate of the Prime Minister, is responsible for the overall co-ordination of the countrywide economic and social development programmes, allocation of funds, and consulting of the government. Other areas of interest are the participation in EU programmes like eContent Programme or Interchange of Data between Administration (IDA). In the course of EU harmonisation a package of reforms concerning the public administration has been adopted in 2004, which among others includes the law providing guidelines for the reform of the public sector and the regional administration act. Main focus of these regulations is the rearrangement of responsibilities and tasks. Thus, it is to be expected that in future there will be some changes concerning the regional 'cluster policy'.

The comparison of the national and regional cluster policies illustrates the heterogeneity and range of cluster-related policy approaches. While in Finland the national government has set only the conceptual framework, its concretisation is in the hands of the regions, which launch their own cluster-related programmes, in the Czech Republic the regions are tightly bound to the national policy and there is only little scope left for bottom-up activities. Germany's national cluster policies are somewhat comparable to Finland but include less supportive activities. Like in Finland the federal states in Germany are defining their own cluster policies and launch related programmes. Ankara by contrast is at a very early development stage. Both, on national and regional level no explicit cluster policies do exist, but it is to be expected they will be implemented within the next couple of years.

Moreover, it becomes apparent that the relevance of single policy types for the development of clusters is appraised different depending on the regional framework conditions (see Figure 21). While for example direct governmental support of firm's projects was rated as irrelevant in Paderborn, it is of high relevance for the other four regions. Other policy types like the provision of information concerning market and export issues are of high interest in all regions, the provision of technology related information is from Berne's view of low relevance for the cluster development but important from the other regions perspective.

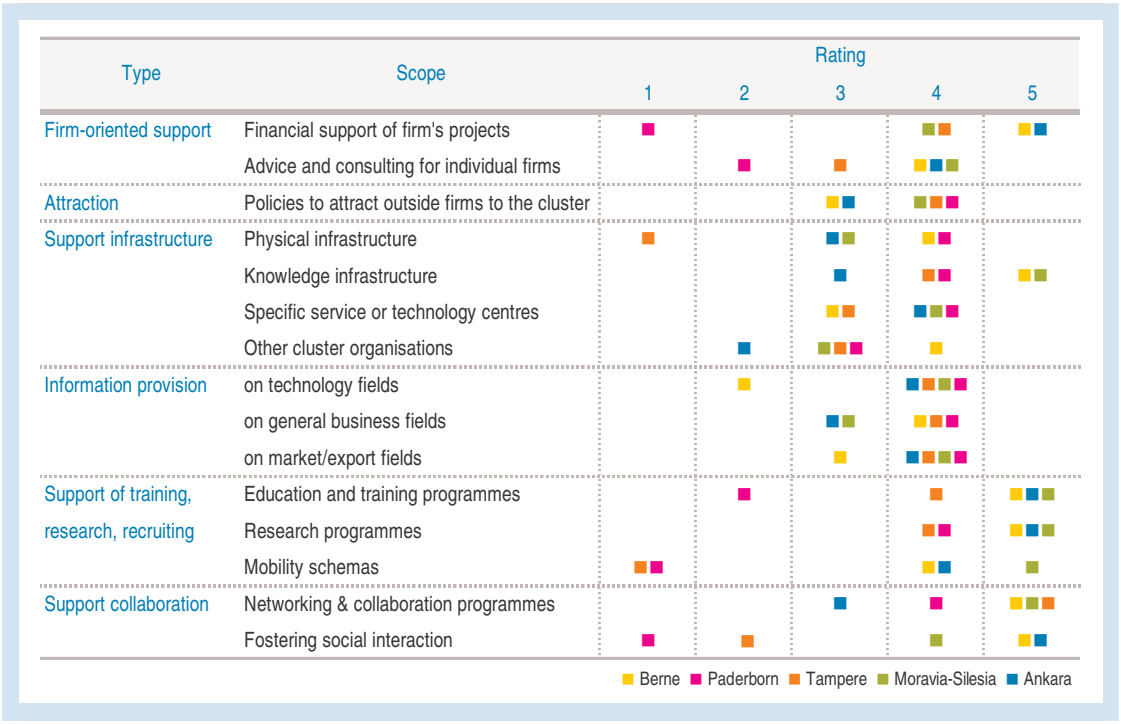


Figure 21: Rating of government policies relevance for the cluster development (1 = not relevant, 5 = high relevance)

As is shown in the following chapters the specific political framework is also reflected in the evolution of the regional clusters and their management.

5 ICT CLUSTERS & CLUSTER MANAGEMENT

The chapter describes the regions and outlines the evolution and status quo of the five ICT clusters. Furthermore, firms' strategies and networking behaviour cluster policies and the cluster management are being compared.

5.1 OVERVIEW

As shown in the table below the single clusters vary in their size, structure, current stage and cluster management.

Table 1: Overview ICT cluster

		Berne	Paderborn	Tampere	Ankara	Moravia-Silesian
	Name of Cluster	tcbe	padercluster	ICT-Tampere	-	IT Cluster
	Foundation	1996	-	1988	-	2006
	Stage of Development	Established	Established	Established	Embryonic	Embryonic
	Number of companies forming the cluster		280		391*	420
	Number of paying Members	191	-	321	-	19
	Employees**	110.000	10.000	17.340	n/A	926
Structure	Companies***					
	Applications	55,84	107	100	230	11
	Content	9,31	14	60	2	1
	IT Services	40,31	34	60	6	1
	Supporting Services	19,92	80	40	12	
	Infrastructure	46,62		40	22	2
	Other		5			
	Knowledge Centres					
	Research Institutes	1	4	6	101	
	Universities	3	2	5	4	1
	Other	7		3		2
	Other Members					
	Incubators	2		2	3	
	Politicians / Administration	2	1	4	115	
	Chamber of Commerce	1		1	1	
	Other	3				1
	Cluster Management (foundation)	Formal (1996)	Informal	Formal (1994)	Informal	Formal (2006)

* Excluding public and governmental bodies

** Number of persons employed in companies that are member of the cluster

*** Decimal places are result of the fact that the companies allocated their business activities with different weighting to the vari4us areas.

5.2 THE REGIONS

The region BERNE is equivalent to the Canton Berne which comprises next to the Swiss capitol and surrounding the five economic regions Biel, Oberaargau, Berner Oberland und Berner Jura. The Canton is located west-central Switzerland. With its population of approx. 1 million inhabitants, of which 300,000 live in Berne and its surroundings (127,000 in the city of Berne), it is the second largest of all Swiss cantons. In 2001 of the 38,106 resident companies about 99.1% had less than 250 employees. With a share of 86.4% the number of micro-enterprises (>10 employees) preponderate in the group of SMEs (BECO 2006). In May 2006 the unemployment rate was about 2.4% (Swiss in total: 3.3%), the GDP 2005 accounted 33.9 million Euro. The economic structural development of the region Berne and Switzerland has been mostly identical since the 1970s: Increasing employment shares in the service sector are opposite of declining proportions in the agricultural sector and in industry. Nevertheless, with 8.7% the share of employees in the regional agrarian sector is clearly above Swiss average of 5.5% (BECO 2006). The industrial sector employs 22.3% of all workforces which contribute with approx. 23.8% to the regional GDP, while in the service sector the share sums-up to 71.8% with a contribution of 74.2% (BECO 2006).

The region PADERBORN is located in eastern North Rhine-Westphalia and comprises 10 cities and municipalities with a population of 0.3 million inhabitants. With approx. 143,000 inhabitants, of which 8% are students at the local university and 10,000 are members or former members of the British armed forces, the city of Paderborn is the second largest city in the wider region East Westphalia-Lippe (OWL). Engineering, furniture, food and ICT industries are counted among the most imported sectors in the region. The unemployment rate was in 2004 with 9% slightly below the national average of 9.5%. The regional GDP accounted 2003 6,718 million Euro, to which the service sector contributed with a share of 63.5%, followed the industry with 27.9% (LDS 2006).

Tampere is a city in southern Finland. The region TAMPERE is with a population of 455,000 inhabitants, of which approx. 305,000 live in the city of Tampere, after Helsinki the second most important urban centre in Finland. Of the 175,000 companies resident in the region 80% employ less than 10 persons (City of Tampere 2005). The unemployment rate is about 12% and slightly above the countries average. The GDP per head accounts 24,000 Euro. Tampere's economic development is comparable to other former industrial regions (e.g. Essen or Manchester); to date once important sectors like textile, shoes, leather, paper and wood industries have been largely replaced by information technology and telecommunication industry during the 1990s. The number of persons employed in the industry sector decreased between 1980 and 2001 from 42.1 to 27.1 percent, while the proportion of persons employed in the service sector rose by 17% up to 70.9 percent.

The same applies to the MORAVIAN-SILESIAN region located in the north-eastern part of the Czech Republic. The region borders Poland to the north and Slovakia to the east. The region is subdivided into 22 ridings ('Municipalities with extended Competence'), which are sometimes referred to as 'small districts', with 302 municipalities, of which 39 are towns, 16 with population over 10,000

inhabitants and 5 tows with over 60,000. The largest is the region's capital Ostrava with approx. 312,254 inhabitants. With a total population of almost 1.3 million inhabitants the region is the populous of the Czech Republic. Moravian-Silesian region is characterised by far-reaching structural change, which left its marks after the breakdown of the communist regime in 1989 and the industrial restructuring (especially the cut back of mining industries). One of the major problems is the high structural unemployment; with a proportion of 16.8% clearly excesses the countries average of 10.3% (Břusková 2006). From an economic perspective the region is characterised by strong divide in economic performance of the single 'districts': While on the one hand districts like Bruntal, Ostrava and Kraviana – both in comparison to the other districts and the country – with regards to their prosperity rank top, others like Opava or NovýJičín rank at the very end. Nevertheless, the region still accounts to one of the most important economic regions of the Czech Republic.

The region (province) ANKARA is located in the northwest of Central Anatolia. Its capitol is the city of Ankara, which is also the capitol of Turkey since 1923. The region comprises 24 counties and 926 villages with a population of 5.1 million inhabitants (2005) of which about 80% (4.3 million) live in the city of Ankara. Thus, the city is not only administration centre, but next to Istanbul and Izmir one of the largest economic centres of Turkey. With about 128,000 companies the regional economic structure is characterised by trade and services. Approximately 60 percent of the regional work forces are employed in these sectors. Further important economic sectors are the industry (12,700 firms) and the agrarian sector with employment shares of 20 respectively 19% (Ökten 2006). The regional GDP per head accounted 2.3 billion Euros in 2005 which is almost 10% of the national GDP. In 2005 the unemployment rate was with 10.6% slightly above the national average of 10.3%.

5.3 THE CLUSTERS

In the following chapters the cluster's evolution and status quo will be described and the cluster management compared.

5.3.1 Evolution of the Clusters

The first cluster initiatives as well as the starting point for ICT-SMEs in BERNE arose in the mid 1990s when the ICT boom swept from the U.S. to Europe after liberalisation and deregulation policies had been implemented. Rapidly changing regulatory environment coupled with fast-evolving technological developments opened up opportunities for young companies and gave this development a boost. Home to various applied technical colleges as well as a large university the initial Berne cluster was fuelled by ideas emanating from these institutions and was soon home to a palpable number of start-up companies. Furthermore, deregulation, privatisation and liberalisation in the field of telecommunications and postal services generated a spin-off boom with large companies like Swisscom and Ascom shedding young firms. The number of potential customer grew

when the public sector in general but also hospitals or railway companies began to recognise the usefulness of new ICT technologies. This along with the fully developed ICT infrastructure in Switzerland created an attractive market in the canton Berne for well known global players in the field of IT, Telco Services and Infrastructure like IBM, SAP and T-Systems, Orange, Siemens, Cablecom as well as for the former PTT monopoly companies like Swisscom IT Solutions and Post Information Technology Services (Beer/Brandt 2006).

Compared to Berne the roots of the ICT cluster in TAMPERE reach back to the early 1960s. ICT found its way into business through, an 'early' market for computer-aided process control, which stimulated innovation existed (Paija/Palmberg 2006). Further aspect for the development of today's ICT cluster was and still is the availability of high qualified work forces. The cornerstone for this has been laid with the foundation of the Technical University Tampere. Moreover, the development was positively affected by the traditionally close cooperation between users and producers of ICT. Further milestones in the evolution of today's cluster were high investments in ICT-related R&D and the sector in general in 1997-2001, the foundation of the Nokia Research Centre (1990) and the Digital Media Institute (1995) as well as the eTampere Programme (2001-2005)[6]. In the 1990s Tampere advanced to one of Finlands IT centres, alongside with Helsinki, Oulu and Espoo. Although special cluster activities have already been taking place since 1998 the cluster got official status not until the establishment of the 'Tampere Region Centre of Expertise Programme', in which ICT is one of three competence areas, in 1994 (Miettinen 2006).

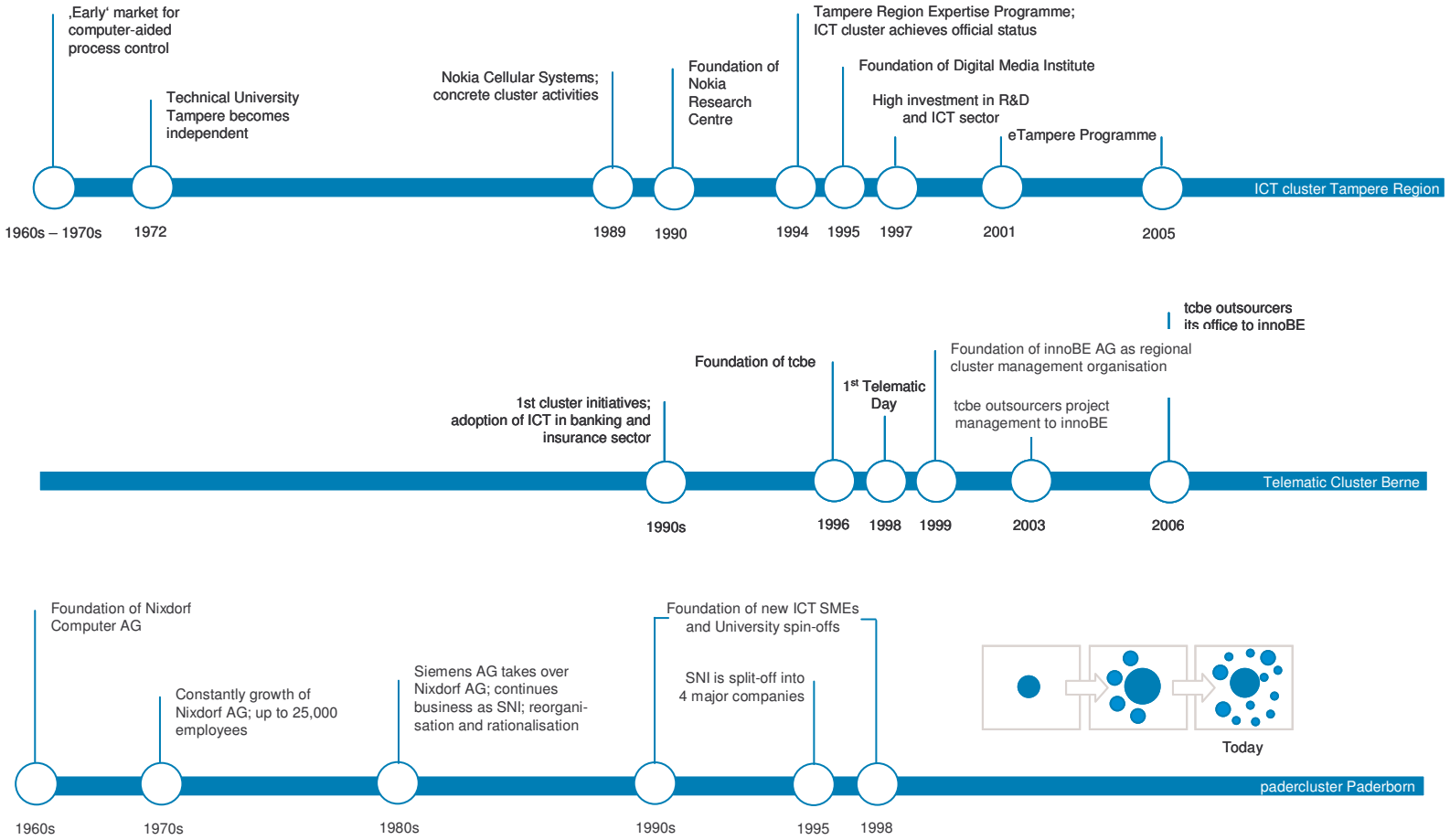
Similar to Tampere the basis for the development of the informal ICT cluster in PADERBORN has been laid with the foundation of Nixdorf Computer AG in the early 1960s. Until the mid 1970s the company grew with two digit growth rates and employed at its peak-period up to 25,000 employees. In the context of changing market conditions structural during the 1980s Nixdorf Computer AG turned out be no longer competitive, was taken over by Siemens AG and continued its business as Siemens Nixdorf Informationssysteme (SNI). The following five years were dominated by re-organisation and rationalisation. As a result of the dismissals at SNI many small ICT companies have been founded between 1990 and 1998. This trend was fortified by a large number of university spin-offs as well as the availability of high qualified work forces. This resulted in a structural change of the regional ICT market: While anciently the market was predominated by one large hardware producer, IT services and software offered by SMEs gained in importance (Lüttke/Schoop 2006).

Other than Tampere and Paderborn the ICT cluster in MORAVIAN-SILESIAN region is at an early stage of evolution ('embryonic cluster') and thus, does not have a long history. Here it was the a single person who gave the impetus: In 2004 the dean of the faculty electronic engineering and informatics brought the initiative 'ICT Club' into being by inviting regional ICT firms to an informal meeting in order to intensify the information exchange between university and companies (Břusková 2006). In 2006 the decision was made to start an official cluster initiative under the framework of

[6] The eTampere Program aimed at fostering the accessibility of modern technologies for everyone and its broad usage in daily life through the co-operation of companies, universities, research institutions and schools.

the 'National Cluster Strategy'. A preparatory study on the regional ICT market has been conducted to begin with, which covered both demand and supply-side. In doing so potential future cluster members and ICT users have been identified. Eight month later, in January 2006, the cluster has officially been registered at the Ministry for Internal Affairs.

In contrast to the Moravian-Silesian region the cluster in ANKARA evolved without any cluster-specific funding, but especially because of its position as the administrative centre of Turkey. The roots reach back to the 1970s when the Technical University of Ankara founded several faculties of technical informatics and thus, laid the basis for the availability of high qualified work forces. During the 1980s the demand for ICT equipment rose significantly and more and more ICT companies settled down in the region. Due to the establishment of a staff position of the defence ministry responsible for ICT procurement this trend was pushed. In the 1990s finally all large companies active in the field of application development for the defence industry had been settled down in Ankara. Because of the markets particularities the companies increasingly linked-up and a defence-oriented ICT cluster evolved. With increasing diffusion of ICT applications and the rising demand for ICT services, not only by the defence industry, more and more ICT start-ups settled down in the three newly founded technology parks. Basis for the foundation of the technology parks was the 'Technology Development Regions' act which has been adopted in 2001. Subsequently, increasing complexity of ICT application and services, proximity and the usage of a common infrastructure brought forward cooperation among the companies and formed today's ICT cluster.


‚Early' market for computer-aided process control
Technical University Tampere becomes independent
Nokia Cellular Systems; concrete cluster activities
Foundation of Nokia Research Centre
Tampere Region Expertise Programme; ICT cluster achieves official status
Foundation of Digital Media Institute
High investment in R&D and ICT sector
eTampere Programme
ICT cluster Tampere Region
1960s – 1970s
1972
1989
1990
1994
1995
1997
2001
2005
tcbe outsourcers its office to innoBE
Foundation of innoBE AG as regional cluster management organisation
Foundation of tcbe
1st Telematic Day
1st cluster initiatives; adoption of ICT in banking and insurance sector
tcbe outsourcers project management to innoBE
Telematic Cluster Berne
1990s
1996
1998
1999
2003
2006
Foundation of Nixdorf Computer AG
Constantly growth of Nixdorf AG; up to 25,000 employees
Siemens AG takes over Nixdorf AG; continues business as SNI; reorganisation and rationalisation
Foundation of new ICT SMEs and University spin-offs
SNI is split-off into 4 major companies
Today
padercluster Paderborn
1960s
1970s
1980s
1990s
1995
1998

5.3.2 Status Quo

The clusters member structure, factor conditions, strength and weaknesses as well as the companies' strategies, structures and rivalries will be described in the subsequent chapters.

5.3.2.1 Clusters Structures

Regarding the clusters composition the share of entrepreneurial members, knowledge centres and other members is different in each cluster and is a result of its evolution (see chapters 4.2 to 4.6).

The TELEMATIC CLUSTER BERNE (tcbe) was founded on December 13, 1996 as non-commercial organisation. With its 191 members the cluster is well established and enjoys the confidence of politics, public authorities, media, industry representatives and users. With respect to the cluster lifecycle TCBE can be considered as an established cluster. Concerning its member structure is characterised by a high degree of heterogeneity: The 191 members represent approx. 110,000 employees[7] including universities, politicians, representatives of industrial federations, regional support organisations and other organisations active in the ICT sector as well as entrepreneurial associations. The majority of the members, about 80 percent (157 firms), are SMEs with less than 250 employees, but also affiliated groups like Swisscom, T-Systems and SAP (Beer/Brandt 2006) are members. Of which Swisscom is the largest with approx. 16,000 employees.

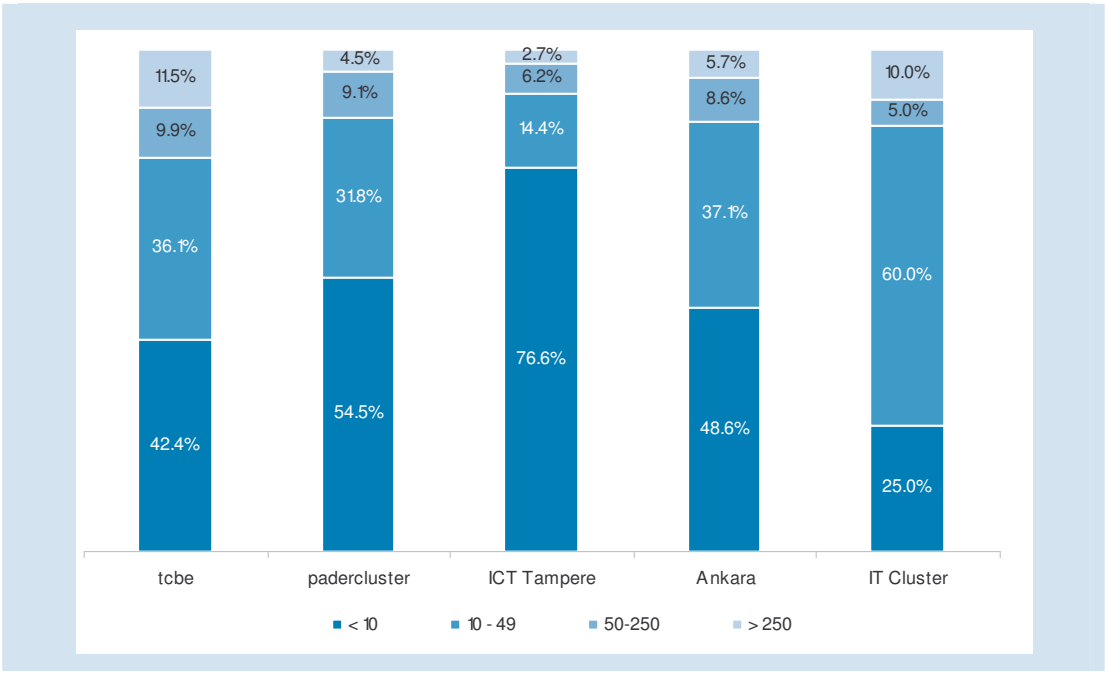


Figure 22: Share of ICT cluster member companies by number of persons employed

[7] It has to be mentioned that the number of employees are not based on statistical data but on information provided by the companies. Thus, in some cases the total number of employees has been specified and not only those employed in the region.

The cluster ICT TAMPERE REGION was officially established in 1994, two years earlier than tcbe. Presently, the cluster has 321 registered members: 300 companies, 6 research institutions, 5 universities, 3 science parks and 2 incubator centres as well as 4 public authorities and the chamber of commerce. Despite the size the cluster's structure is comparable to tcbe. The ICT companies, of which 90% are SMEs, represent about 16,000 employees. In the group of SMEs the largest proportion (76.6%) amounts to small firms with less than 10 employees. The ratio of employees per member is lower than in Berne because some of the tcbe members are affiliate groups with a high number of employees and the portion of SMEs in Tampere is almost twice as high as in Berne. A major difference of the Tampere cluster compared to TCBE is its division into sub-clusters, also referred to as 'mini-cluster'. According to the regional cluster programmes launched three main ICT sub-clusters exist: Neogames with 100 members, COSS (70 members) and UBIQ which started in April 2006 with 25 members (Miettinen 2006). Each cluster typically has members from key industrial companies, university laboratories and SMEs. 'These clusters are not only local but also national leaders in these business fields.' (Miettinen 2006)

About 420 ICT companies form the base of the MORAVIAN-SILESIAN cluster (IT Cluster). Due to its embryonic stage the cluster currently is composed by 20 paying members, of which 16 are companies. Additionally 3 knowledge centres, namely the Faculty of Electrical Engineering and Computer Science, the Secondary Technical School of Electronics and Informatics, and the Institute EuroSchola as well as the founder of the ICT Club as an individual are members of the cluster. In the context of the preparatory study further 70 firms have been identified as potential cluster members. Comparing the number of paying cluster members to the Bernese cluster tcbe which has been founded 10 years earlier, the region is performing well. The typical member company has been founded between 1990 and 1992, is in solely Czech ownership, has an annual turnover up to 1 million Euro, and employees up to 50 persons (Břusková 2006). With a proportion of 90% the number of SMEs is equal to the one in the Tampere cluster. The cluster members represent about 926, including the non-paying members it are 2,398 employees.

As the clusters in Ankara and Paderborn are of informal nature one cannot speak of members in a common sense, but as of ICT companies located in the science park respectively in the region. It is not clear to what extend the single companies are involved in cluster-related activities, but nevertheless in the following these companies are referred to as 'members', too. While the PADERCLUSTER accounts 280 members which represent approx. 10,000 employees the ANKARA cluster comprises 496 members, of which are 272 companies. In both clusters the majority of companies are SMEs, but the shares vary: While in Ankara there is a ratio of 70:30, in Paderborn it is 96:4; in the group of SMEs 50% are small companies with less than 10 employees. Further difference in the clusters' structures concern the number knowledge centres and public authorities: Due to its status as administrative centre of Turkey the Ankara cluster counts 115 public authorities members, while in Paderborn it is only the Regional Economic Development Agency. Similarly the number of research institutes in Ankara adds-up to 101 plus 4 universities. In Paderborn region 4 research institutes and 2 universities are located. The PADERCLUSTER bears a resemblance with the TAMPERE CLUSTER since both consist of thematic sub-clusters. While in Tampere this is result

of the cluster-specific programmes launched, in Paderborn it have been informal structures which forced the evolution of the sub-clusters. In this context one can distinguish between location-based and thematic sub-clusters. Concerning the latter, the topics are education, research and technology, and so-called clusters of interest (for further details see Lüttke/Schoop 2006).

To summarise, concerning the shares of entrepreneurial members the clusters' structures in the five regions are alike: In all clusters the number of SMEs exceeds the number of large enterprises. However, according to the enterprise categories defined in chapter 2.1, the group of SMEs in the single clusters is diverse: In TAMPERE the majority of companies (76.6%) are accounted among micro enterprises with less than 10 employees. In all other clusters, expect for IT CLUSTER where the share is about 25.0%, the proportion of micro enterprises is about 50%. In MORAVIAN-SILESIAN REGION the group of small companies (> 50 employees) ranks first with a proportion approx. 60.0%. The share of medium-sized companies is in all regions rather low with shares ranging from 5 to 10 percent of all enterprises. Moreover, in each cluster one or more universities and research institutes are participating. And, with exception of the Moravian-Silesian region, each cluster has a public authority among its members. Concerning the key drivers for the clusters' development it is technology in the case of ICT TAMPERE, self-enforcing process among companies within PADERCLUSTER, while TCBE, IT CLUSTER and the ANKARA cluster are mainly customer-driven.

5.3.2.2 Firms' Strategies, Structures & Rivalries

By comparing the entrepreneurial members of the clusters it becomes apparent that most companies have their business base in the related region; only in few cases the members are subsidiaries of international or outside based companies. For example within TCBE their share accounts 4% (Beer/Brandt 2006: 67). As shown in Figure 23 a significant number of firms are active in the field of 'Applications': Among the members of TCBE and PADERCLUSTER enterprises active in this business area sum-up to approximately 45%. Whereas within ICT TAMPERE this business area is with a share of 33.3% less represented than in the latter regions, in ANKARA and MORAVIAN-SILESIAN region the number of companies active is well above three-quarter of all firms. This can stand for different assumptions: Firstly, the clusters are focused on companies active in application development. Secondly, firms active in this area are more open to cooperation and thirdly, due growing complexity of ICT services and products they increasingly rely on collaboration with other firms in order to meet customer's needs/demands.

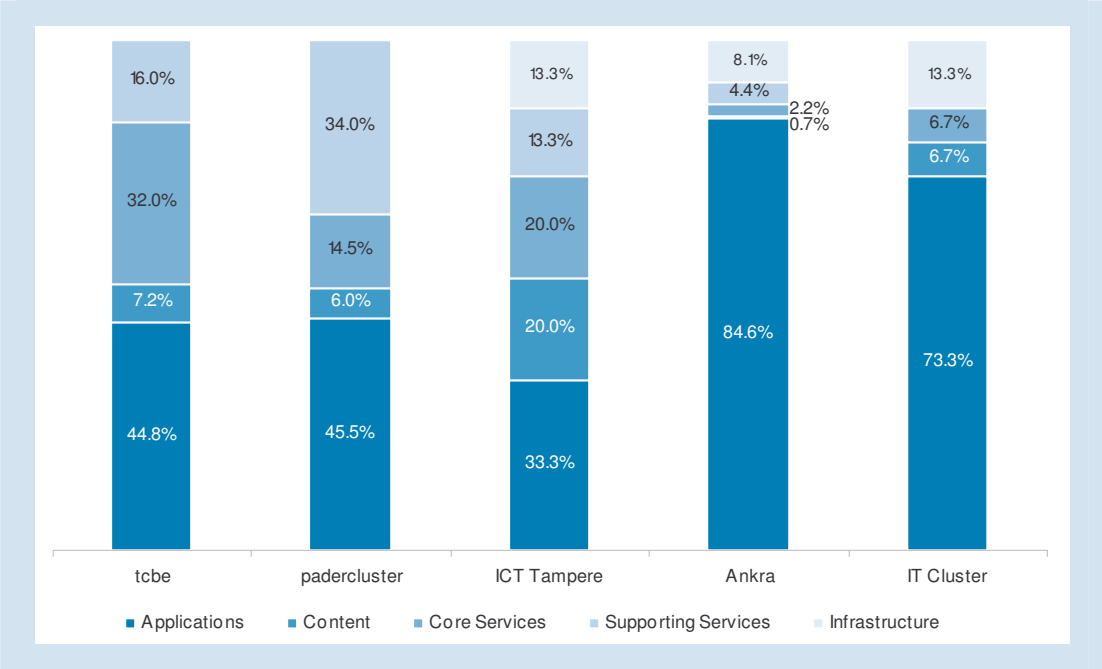


Figure 23: Share of companies by business areas

When comparing the single sub-sectors in the regions some more differences become apparent: In BERNE the SMEs active in 'Application Development' focus on standard business software, while in ANKARA it is on e-government, e-learning and simulation. Nevertheless in both regions the public sector plays a vital role in the firms' client base due to the cities status as capital. Independent of the single sub-sectors within ICT TAMPERE one can distinguish mainly between (a) Telecom-oriented businesses and those who are (b) partners and sub-contractors of large industrial companies, primarily in the machinery and automation industry. In BERNE most of the SMEs do have a regional client base consisting of SMEs from other sectors, so do the ICT companies in Tampere, while in ANKARA governmental institutions form an important client base. In MORAVIAN-SILESIAN region in contrast ICT companies are more export-oriented (Břusková 2006). Like Nokia's cluster membership in Tampere, it is the cluster membership of Swisscom and several related companies in TCBE which makes 'Communication' another important business field within the cluster.

The more detailed one analyses the single sub-sectors the more regional distinctions become apparent. But although some focal points do exist in each cluster, there is no such thing like a regional product specialisation. This is also reflected when taking the firms' core capabilities into account: In BERNE and PADERBORN the diverse field of 'IT Services' prevails while the field of 'Content' is underrepresented. In ANKARA and MORAVIA-SILESIA it is 'Application Development' which prevails, while among ICT TAMPERE members 'Content' and 'Core Services' are near-balanced, and again applications rank top, but only with a narrower margin.

Figure 24 shows the relationships between the entrepreneurial cluster members which differ within the single clusters: While in PADERCLUSTER the cluster members are mainly competitors, co-operative relations are preponderate in ICT TAMPERE and competition is rather rare. This is to some extend result of Nokia's lead position in the region. Admittedly, it has to be mentioned that though there is only limited competition in the cluster as whole, it is very dense among Nokia's suppliers. In ANKARA the cluster members are mainly related through client-vendor connections or subcontracts, whereas in the Moravia-Silesian cluster such relationships are unusual.

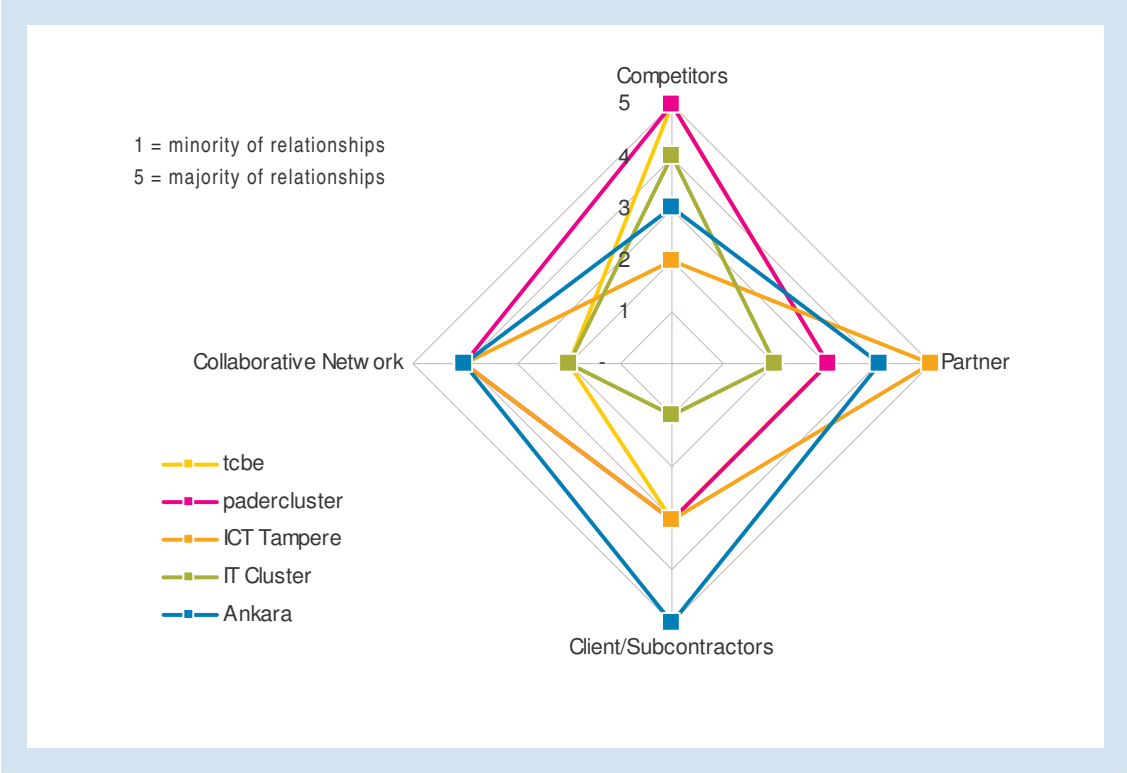


Figure 24: Relationships between the cluster members

As is shown in the figure above within tcbe most cluster members are competitors. Therefore, not surprisingly the areas of cooperation and collaboration are focused on common topics which are of high interest for most members like training/tuition, Marketing/PR, internationalisation and standardisation. Joint projects are likely to take place on the bilateral level among companies of the same size. Co-operative R&D takes place in PADERCLUSTER, ICT TAMPERE and ANKARA CLUSTER, whereas Human Resource Management is a speciality of the IT CLUSTER in the Moravian-Silesian region.

Comprising the interconnections of the cluster members a similar picture becomes apparent: Firstly, in all clusters the members are interlinked through periodic meetings and informal interactions. Management workshops and content-related events as connecting links are only to be found within TCBE respectively ICT TAMPERE. Whereas cluster members in ANKARA und BERNE are also

connected through the participation in training programmes and events like site-visits, conferences and fairs.

Table 2: Main areas of cooperation in the clusters

	tcbe	padercluster	ICT-Tampere	IT Cluster	Ankara
Information	**x**	**x**	**x**	**x**	**x**
Training	**x**		**x**	x	x
Standardisation					
R&D		x	**x**		x
Internationalisation				x	
Marketing & PR	x	x	x	x	
HR Management				**x**	
Projects					(x)

x = strong cooperation x = cooperation (x) subordinated field of cooperation

As the comparison shows the clusters' structures determine the relationships among the cluster members and subsequently the areas of cooperation: On the one hand it can be said that the higher the competition among the cluster members, the less specific are the fields of cooperation. On the other hand, the higher the heterogeneity of the entrepreneurial cluster members, the less connecting factors may exist and the less likely is cooperation in core business fields. In both cases innovation potentials remain idle due to a lack of cooperation respectively a lack of pressure to innovate. Therefore, a balance between competition and cooperation among the cluster members is needed in order to perpetuate the cluster's innovativeness. For example within TCBE the competitive density is high and as a consequence the major fields of cooperation are sector rather than specific cluster or business topics; the same applies to the ANKARA cluster. In contrast ICT TAMPERE cluster is more diverse and fields of cooperation also include R&D activities. All in all the cooperative activities are closer related to companies' core business, especially within the thematic sub-clusters.

5.3.2.3 Strengths & Weaknesses

As the regional cluster analyses have shown, each of the described clusters has its specific strength and weaknesses. Despite the lack of specialisation TCBE does have some distinctiveness: First, training and tuition with specific focus on apprenticeship. Second the clusters competencies in lobbying and standardisation activities of the most influential as regards federal departments and associations. Another field of expertise is cluster's experience in cross-clustering with other regional clusters. The specific strength of PADERCLUSTER is a successful and mutual university-company linkage, including the support of technology based start-ups. This applies similarly to the clusters in TAMPERE and ANKARA: In both regions a high density of research institutions exists,

which ensure on the one hand continuous research in the ICT market and technological development, and on the other hand the availability of high qualified work forces. Although both, the cluster in ANKARA and the one in PADERBORN are of informal character, only in the latter sub-clusters have emerged; so firms' willingness and ability to cooperate can be seen as further excellence of PADERCLUSTER. An additional strength of the ANKARA cluster is its proximity to governmental institutions especially with regards to its potential exertion of influence on the cluster policies to be developed. At the current stage of development the common understanding, profiled expectations of the IT CLUSTER members and the willingness to cooperate are considered the most important strength.

As one of the main weaknesses of PADERCLUSTER and the ANKARA cluster the informal cluster management which makes it difficult to coordinate the clusters' activities, can be seen. In this context the question arises how much coordination a cluster needs. While in Paderborn to some extend a formal cluster management on the sub-cluster level exists, in ANKARA there is none at all. A further weakness of the ANKARA cluster is a lack in communication among the cluster members.

The deficits in internationalisation are one of the weaknesses of ICT TAMPERE. The SMEs do not utilise their reference cases of globally known companies to act on the international markets. To foster these activities is seen as a major challenge for the clusters' future. Moreover, the number of SMEs is quite high in ICT TAMPERE nevertheless the amount of venture capital funding is, as a result of companies' performance, still low. Further shortcomings are result of the strong local competition among the suppliers of the lead companies, which to some extend prevents cooperation and limits firms' innovativeness and thus, future growth.

Because of its early stage of development one weakness of IT CLUSTER the missing experience with the cluster approach and the resulting scepticism of companies towards the expected outcomes and benefits, can be seen as a temporary weakness. But the cluster's development stadium also bears the chances, especially concerning the evolution and positioning a cluster brand on regional and national level.

One of the major threats to PADERCLUSTER is a fragmentation of the cluster and thus, a non-marketable profile which is counterproductive to the positioning of the region as an ICT region. In ANKARA a similar thread becomes visible: Insufficient strategic development of the cluster may have negative effects on the future development of the cluster. Since the companies do not tend to cooperation in sense of a self-enforcing process it might become difficult to position the cluster in the international competition of regions. Also it might be difficult to prepare them to go global.

Figure 25: Clusters' main strengths, weaknesses, opportunities and threats

5.3.3 Organisational framework & Cluster Management

The degree of formalisation, the organisational structure, financial and human resources and the services provided vary across the five clusters. While the cluster management in BERNE, TAMPERE and MORAVIAN-SILESIAN region is institutionalised, in PADERBORN and ANKARA it is of informal nature. One cannot say whether the one or the other are the better, this strongly depends on basic framework conditions and the clusters' history.

5.3.3.1 Clusters' Organisational Structure

TCBE is organised as an association and therefore has no shareholders. The organisation is structured as follows: At the top is the general assembly which defines the guidelines and the cluster strategy of TCBE. Every Member has the full right to vote and can bring in requests. Main tasks of the general assembly are the acceptance of the annual account, the release of the budget and the annually planning. Furthermore, the general assembly elects the management board. In doing so, the members can influence the future development and focal points of the cluster. The second level is the management board of 10 members and 3 observers without voting rights and the cluster manager. The board is responsible for the operational management of the cluster according to the defined cluster strategy. The third level is the cluster office. The members' participation is organised through four permanent task forces: (1) Education, (2) Business Networking, (3) Know how transfer and (4) Quality. The cluster management has been outsourced to innoBE AG (see chapter 5.3.3.2). Within the cluster three types of memberships is distinguished between: Firstly, the full membership for providers of ICT Services. They have access to all services provided by TCBE and have full voting rights at the member general assembly. Second the user membership for those applying ICT services. They have the same rights than the full members but do not pay the entrance fee listed bellow. And third, the formation membership for those who have been involved in the foundation of TCBE. They have only limited access to the services provided for which they have to pay only two third of the full membership fee. Their access is focused on services in the field of education and apprenticeship.

Table 3: Telematic Cluster Berne – Membership Fees

	Entrance Fee	Membership Fee	2/3-Fee
> 25 Employees	550,00 €	100,00 €	67,00 €
25 – 100 Employees	1.100,00 €	200,00 €	134,00 €
< 100 Employees	2.100,00 €	400,00 €	267,00 €

Through the clusters membership in the network for economic development, it becomes obvious that TCBE is not only interest in its own concerns, but also in the overall development of the region.

Like TCBE the IT CLUSTER is organised as an association and is structured as follows: At the top level is the general assembly, second is the executive board formed by five entrepreneurial representatives, responsible for the strategic management. The supervisory board consists of firm representatives, the regional development agency and research institutions. Any company active in the field of ICT and located in the region can become a member, but the focus are current stage is on acquisition activities especially concerning the 70 non-paying entrepreneurial members.

While in Berne and Moravia-Silesia clusters are organised by sectors, ICT TAMPERE REGION is structured into mini-clusters according to the programmes launched by Technology Centre Hermia (Hermia), which is the principle implementer of City of Tampere's and the region's industrial strategy and thus, responsible for cluster development. Hermia is a wholly owned subsidiary of the

city of Tampere. At the organisations top level is the Steering Group which has an advisory role and is focused on strategic issues and financing. The operational work is conducted by 1-2 employees per programme. The participation in a programme and thus, the mini-clusters activities is bound to the payment of membership fees, which vary depending on the company's size between 200 and 10,000 Euro. A particularity is that this fee is not a lump-sum or periodical payment, but an entrance fee which has to be paid for the participation in each of the mini-cluster. That is, if a company would like to take part in COSS and UBIQ the fee would have to be paid twice.

As stated earlier both, the PADERCLUSTER and the ANKARA cluster evolved as a result of informal networks. Thus, there is no administrative or legal body forming the organisational structure of the clusters. Nevertheless, in ANKARA it is METU-Technopolis who is acting as a managing organisation of the cluster. Teknopark A.S. is the management body of METU-Technopolis and the first degree juridical body in realising the vision and goals of METU (Ökten 2006). Teknopark A.S. was founded 1991 as a private non-profit organisation; its shareholders are the Middle East Technical University Development Foundation (65%), Middle East Technical University (5%), Ankara Chamber of Commerce (5%), Bleda A.S. (15%), EBI A.S. (5%) and TR.NET (5%). Teknopark is on the one hand responsible for the implementation of the strategies and programmes defined by the Executive Board of METU and on the other hand for the creation of synergies among the three science parks and in this context somewhat for the management of the ANKARA ICT cluster (Ökten 2006: 23). While in PADERBORN no formal pre-conditions for membership exist, in ANKARA the membership is bound to a formal application[8] which takes among others the following criteria for participation into account: Companies (1) should actively deal with R&D and software development activities or should have at least that necessary potential and capacity; (2) should have the effort and desire to strongly cooperate and collaborate with universities and research centres; and (3) should provide job opportunities for qualified university graduates.

Although an organisational structure in the sense of formal coordination is hardly present respectively non-existent for PADERCLUSTER there are some active well-accepted players who initiate and transfer topics under various aspects (Lüttke/Schoop 2006: 26). The extent to which these activities are being accomplished within the single sub-clusters rang from loosely connections for pooling short-term interests to nearly formal structures. The key players involved are the Regional Development Agency Paderborn, the Science Park Association of the city Paderborn, the non-profit organisation innoZent OWL (cluster organisation of the wider are East-Westphalia Lippe), the universities technology transfer association (Uniconsult) and the Paderborn forum 'Industry meets Informatics'.

5.3.3.2 Cluster Management

Similar to the organisational structure the management of the five clusters differ. In Berne and Moravian-Silesian region independent organisations are responsible for the cluster management,

[8] This application refers to Regulation No. 4691, Technology Developing Regions (see chapter 4.1).

whereas units of the regional development agencies are in charge in Tampere and Paderborn. In Ankara it is neither of those but a science park.

TCBE sourced out its management to the innoBE AG, which has been founded as centre for cluster management in the region Berne by the University of Berne, the University for Applied Science Berne and the innoBE Cooperative Society for Technology and Innovation and the Association for Manufacturing Technology. Following innoBE's self-perception the cluster management aims at supporting companies, training institutions, trade associations and local authorities in order to strengthen the ICT sector, whereas the focus is on the future development of the companies in the cluster. The cluster management is committed to improving basic conditions and to offer concrete measures in order to open new market opportunities or business channels on national and European scale.

In TAMPERE region the cluster management is assigned to Technology Centre Hermia (HERMIA). Cluster management is seen as a highly strategic activity, thus, HERMIA'S role is to strengthen the cluster by pointing out paths for future business development and provision of tools which enable companies to develop their business to new areas. The main distinction compared to the other cluster management organisations is that HERMIA launches its own cluster-related programmes. Thus, the cluster management is organised in accordance to the programmes launched. In contrast the cluster management in Berne is organised by sector.

Compared to HERMIA'S strategic role, in MORAVIA-SILESIAN as well as in the ANKARA cluster the management is of operational nature: In 2006 IT CLUSTER has assigned a cluster manager responsible for the operative management of the cluster. The cluster manager is bound to the strategic guidelines of the general assembly and reports to the supervisory board. The mission of TEKNOPARK as cluster management organisation of the Ankara cluster is to support companies in becoming competitive in global economy. Following this self-perception the focus is on the provision of value-added services at affordable prices.

In PADERBORN the regional economic development agency (WFP) takes over responsibility for the cluster management. Due to the clusters informal character this is not an official role, but an activity in the framework of the agencies public mandate. Examples for such activities are the initiation of and contribution to several workgroups and networks on local and regional level and the support, organisation and coordination of processes aiming at forming a continuous information, knowledge and experience exchange in the region (Lüttke/Schoop 2006: 27).

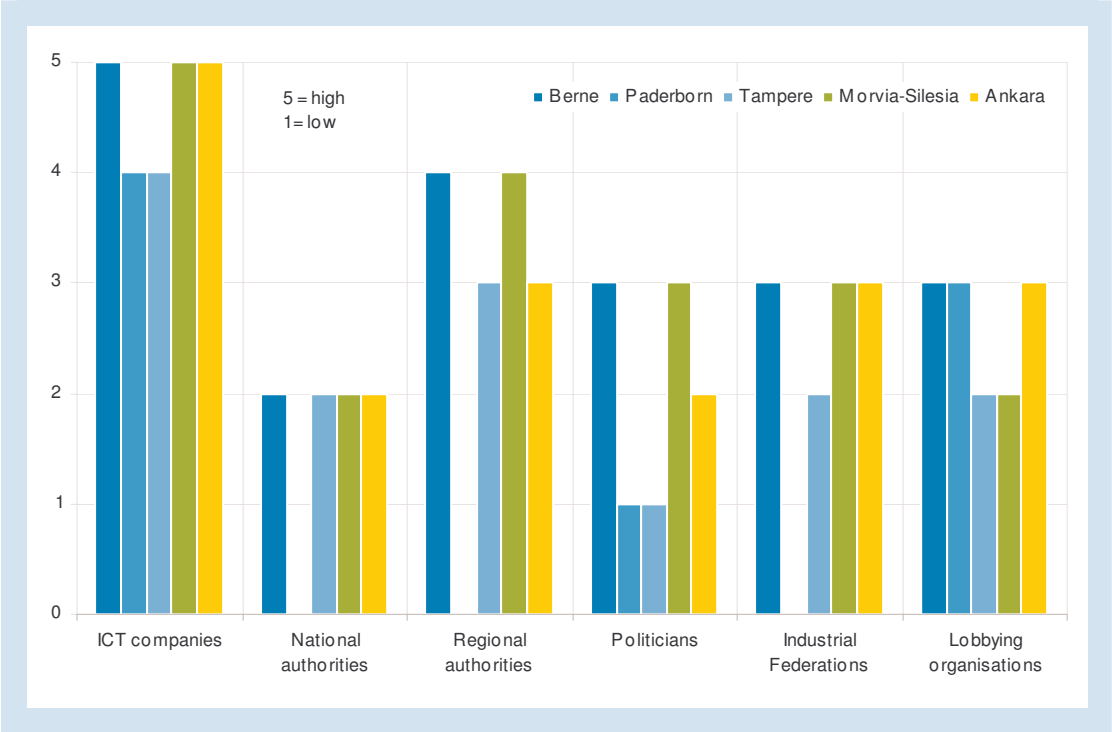


Figure 26: Relevance of regional Players for Cluster Management

Asked for the relevance of the regional players for the cluster management the ratings varied between the regions (see Figure 26). While in BERNE, MORAVIA-SILESIA and ANKARA ICT companies were ranked 5 on a scale from 1 to 5, were 5 is high and 1 is low, in PADERBORN and TAMPERE they were ranked only 4. In TAMPERE neither national nor regional authorities are of any relevance for cluster management, but the latter are of high relevance in BERNE as well as in MORAVIA-SILESIA. In PADERBORN and ANKARA they still play a role but are not of such importance. Politicians barely play any role in TAMPERE and PADERBORN; quite the opposite applies to the MORAVIAN-SILESIAN region where cluster policies are a new instrument of industrial policy and therefore, politicians are of high relevance, so much the same in BERNE.

5.3.3.3 Financial & Human Resources

As shown in the following table, not only the self-perception but also the financial and human resources differ across the regions. Concerning the annual budget it is distinguished between basic funding, project funding on regional, national and EU level, and member funding.

Table 4: Financing of Cluster Management

	INNOBE	WFP	HERMIA	IT CLUSTER	TECHNOPARK
Basic Funding					
(a) National government			x		x (2.5%)
(b) Regional government	x	x	x		
Project Funding					
(a) National government			x	x	
(b) Regional government	x		x	x	
(c) European Commission	x	x	x	x	x (50%)
Member funded					
(a) Membership fee	x		x	x	x (47.5%)
(b) Projects			x		

Source: Cluster Management Questionnaire

While the cluster management of TCBE is financed by 33% each through membership fees and projects funded by the regional government, the basic funding by the regional government accounts only 20%. Further 13% of the total budget has been generated through earnings from projects. The total budget for 2005 amounted 95,020 € of which approximately 43% have been spent on personnel. In contrast WFP is mainly financed by the regional government and only on a limited scale through European-funded projects. To IT CLUSTER quite the opposite applies: Here the cluster management is basically financed by membership fees and only project funded by the national and regional government for three years. The budget for management of the IT CLUSTER is in 2006 70,000 € of which 34% are bound to staff costs. Due to its role as programme executive HERMIA'S budget consists of a basic and project funding from both, national and regional government, membership fees and member projects. Furthermore, European projects contribute to the annual budget which summed-up to 1.2 million € in 2005. About two-third of the budget where spent on personnel. The cluster management in ANKARA is financed by 50% through European funding, by 2.5% basic funding of the national government and by 47.5% through membership fees. In 2005 the total budget accounted 2.2 million € of which 5.5% where spent on personnel.

Taking a closer look a the personnel assigned to cluster management measured in weekly hours, TAMPERE ranks top with a total of 170 hours/weekly: 47.5 hours/week are spent on each, the Neogames and the COSS mini-cluster, 37.5 hours/week each, for UBIQ and the ICT Centre of Expertise Programme. This also includes the programme management. Contrary in MORAVIAN-SILESIAN region, it is only one cluster manager with a working time of 37.5 hours per week and in PADERBORN the CEO spends about 15% of its working time for cluster management activities and one consultant 25%. While the personnel resources for the management of IT CLUSTER are to be explained by the early stage of development in the case of PADERCLUSTER they are result of the clusters informal nature. In BERNE there is one cluster manager with 10 hours weekly and an

assistant with 4 hours weekly responsible for the management of the cluster. Furthermore, the president of INNOBE spends approx. 1.5 and the board members 0.2 hours per week on cluster management activities. In ANKARA total of 146 hours per week is spent on cluster management activities: the president contributes 15% of his working time, 40 hours in total are spent on facility development and client relations, further 40 hours each are spent on public relations and accounting. Further 20 hours per week are spent on networking. Admittedly, it has to be mentioned that it is not quite clear whether these hours are directly linked to the cluster management or rather the general services of the science park, but have indirect influence to the cluster.

5.3.3.4 Services provided

In all five regions the services provided by the cluster management organisations cover a broad variety. As is shown in Figure 27 not only the type of services vary, but also there provision frequency: some services are provided on a daily basis others periodically or infrequent. With regard to its self-perception INNOBE takes over administrative and content-related duties. Concerning the former, INNOBE is responsible for the organisation of cluster events, workshops and is supporting different types of co-operation, internationalisation of ICT companies, the consulting of start-ups and the cluster's positioning in the national and international competition. As regards content the cluster management is actively involved in several of TCBE'S task forces. While cluster-related events, workshops etc. are provided by HERMIA, IT CLUSTER and PADERCLUSTER on a periodically basis, too, METU offers such events only infrequently. The same applies to supporting lobbying activities. In contrast to the other cluster management organisations, where the support of cooperation is of periodical nature, it is on the daily agenda of HERMIA. Furthermore, only within the embryonic clusters, IT CLUSTER and ANKARA, member acquisition is on the agenda.

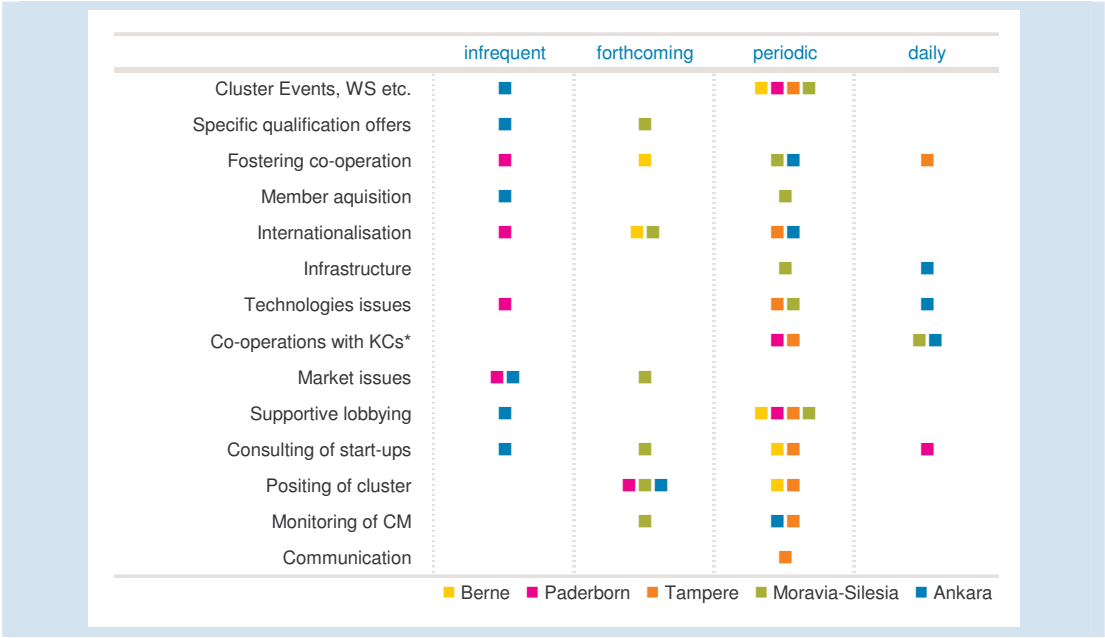


Figure 27: Services provided

Summarising, the accomplishment of cluster events, internationalisation, supportive lobbying, consulting of start-ups and cluster positioning are services provided by all cluster management organisations. Specific qualification offers are on the agenda of IT CLUSTER and ANKARA; in Berne a separate institution (i-Berne Ltd.) has been founded for these activities by tcbe. A monitoring of the cluster management will take place in MORAVIAN-SILESIAN region henceforth. In ANKARA it is rather the cluster members than the cluster management which is monitored periodically. In addition to the services described, HERMIA is providing a periodical cluster newsletter.

With regard to the core competencies in cluster management a multitude of skills exist in the five regions. INNOBES core abilities are, according to the statements made in the 'Cluster Management Questionnaire', its long standing experience with cluster management, the transfer of knowledge and technology and its role as facilitator between administration, policy, sector and academia. Concerning HERMIA it is in first instance their competences in programme preparation and implementation. Further fields of excellence are strategy formulation, the in-depth market knowledge, as well as their experience with cluster management. One of the key competences of IT CLUSTER regarding the cluster management is the acquisition of project funding, which is of specific interest at the current development stage of the cluster. Since the cluster is very 'young' and the cluster approach is new to the cluster members the operational competences also have been proven to be very useful. The linking-up of companies and universities is one of the major skills as regards cluster management by METU. The experience with cluster monitoring, as is shown in the following chapter, can be seen as a further core competence. In addition METUS high reputation at the administrational level, regional as well as national, may have at current stage, where cluster policies are being implemented on national and regional level a positive impact on the cluster's development. Regarding the management of PADERCLUSTERS it are WFPs competences in supporting the self-enforcing processes in the sub-clusters and its engagement in ICT-related networks in the wider region OWL, which are of high value for the development of the cluster.

5.3.3.5 Monitoring

Neither in BERNE nor in PADERBORN a monitoring of the cluster management takes place. In Berne INNOBE suggested implementing a cluster monitoring for all clusters in the canton Berne, but while TCBE was open-minded towards monitoring the minority of the other clusters declined such for two main reasons: Firstly, the basic problem of defining measurable targets and second, the question whether there is a neutral instance which can accomplish the monitoring.

In Ankara METU monitors not the cluster management but the cluster members. Against the goal of 'being a competitive ICT cluster in global economy' 160 companies are being monitored by selecting the following data quarterly: turnover, export, change in labour force (new jobs/layoffs), number of new projects started and those concluded, number of joint projects with cluster companies, IPO issued and research funds allocated/raised. The overall purpose of the monitoring

is to gain insight in the economic performance of the cluster members in order to obtain information what action/ activities are needed by single firms to achieve the defined goals (Ökten 2006a). In many cases it is difficult to receive this data from the companies, not so in Turkey because the law 4691 forces all companies located in science parks to provide these. The monitoring is based on so-called performance indicators each divided into several subtitles: (1) cooperation with universities, companies and government, (2) financial measures, (3) competition (technological excellence, IPR, standards) and (4) promotion (e.g. contribution to the cluster). Each performance indicator is weight with a specific value ranging from 45 to 5 percent. For example cooperation is weighted with 45% and promotion with 5%. The monitoring system has been developed by a group of 10 persons from university, companies and cluster managers. All in all the monitoring system can be seen as a form of 'Balanced Score Card'.

The aim of HERMIA'S monitoring activities is to measure the impacts and results of cluster management: (1) boost the region's economic performance and utilise national/ international financing sources, (2) support regional business development strategies, (3) open innovation and sharing information, and (4) spin-offs. Statistical tools are used to compare the Tampere region with other regions in Finland (regional perspective) and to capture macro trends. Furthermore, time-series on some key indicators (value added by ICT companies, ICT turnover in services and content production, and change in ICT employment) are being accomplished. The results are mainly used for external and financing purposes (Miettinen 2006a). Qualitative monitoring tools are used within the framework of the national Centre of Expertise Programme in order to benchmark the Centres of Excellence. An Intranet is utilised to register all projects. For each project the following data is collected: volume, financiers, short description, goals and objectives, qualitative measures. In addition estimated number companies foundations and new jobs provided are calculated. Next to this internet questionnaires for partners and interest groups, member questionnaires, both not on a regular basis, are being conducted. In order to reflect the clustering processes internal analyses of the seven clusters, which are in different development stages, concerning membership trends, fees and activities are being accomplished. On the strength of past experience the 'Balanced Score Card' approach has been proven to be useful for strategic questions, but heavy and time consuming, and therefore, has not been applied to ICT cluster (Miettinen 2006a). Although different instruments and methods have been utilised, up to now no continuous monitoring has been established. Hence, the development of organised and sound policies and practices for continuous monitoring is seen as a major challenge.

Concerning the IT CLUSTER no monitoring system has been established so far, but is being planned currently. The monitoring indicators (i.e. member companies growth in terms of employees, turnover, export, value added, investment in R&D) will be established nationally.

5.3.3.6 Success factors & Pitfalls

The comparison of the five ICT regions illustrates that there seems to be no such as the one perfect type of cluster management which guarantees the successful development of a cluster. Therefore, in the following some success factors and pitfalls are described, which have been identified by the NICE project partners during the regional cluster analyses.

Starting with the success factors a basic precondition for success is that the cluster members must present the sector, otherwise it may become difficult to position the cluster in regional competition. Furthermore, the cluster should be attractive for potential members and should bear chances for growth. Through palpable joint projects and services the additional benefit of being a cluster member becomes visible. In this context active networking in means of targeted projects and the ability to innovate are further factors of success. In addition achievable goals should be defined for the cluster in order to prevent frustration of the cluster members. Due to the fact that the development of clusters and their impacts on regional economy are long-term processes, persistence and perseverance in the cluster management are further success factors.

Main success factors at the management and organisational level are experiences with the management of clusters respectively financial and personnel resources. Concerning the former, this is especially true when the local/regional competition is dense and/or the firms are of different size (e.g. some international acting companies and SMEs) and trustfully relations are not established. In this context well organised and active communication can be seen as a further success factor. But not only the communication within the cluster, also the percipience of a bridging function between companies and policies can be of high importance for a cluster and thus, may foster the clusters success.

Contrary to the success factors some pitfalls have been identified: At the management level it starts with insufficient resources (financial and personnel), as well as inadequate moderation and communication skills. Lacking a joint vision within the cluster makes it difficult to target networking activities and actions. But only the vision is not enough, if there is no clear benefit at the practical level for the members the cluster will not sustain. Further pitfalls are on the one hand destructive rivalry within the cluster and on the other hand the absence of a critical mass. Concerning the latter no defined measure exists, in fact this strongly depends on the sector and its value chain, as well as on regional and national framework conditions. Also clusters will fail if there is no willingness to cooperate with each other. Cooperation and competition are two aspects to juggle with, if either one is missing the cluster will not be successful.

6 CONCLUSIONS

Summarising, although Europe holds the lead position in the worldwide ICT market compared to its size its shares are still rather small. With respect to the goals of the Lisbon strategy one of major future challenges is the adoption of ICT in other sectors, especially as far as it concerns SMEs. As has been shown in this study the adoption of ICT across Europe still lies behind USA and Japan. It is not a shortage of ideas and innovations, but a problem of transferring those into marketable products and services. Moreover, the regional distinctions across Europe's regions are a further reason for its current position on the worldwide ICT market. Nevertheless, there exist differentiated competences at national and especially regional level which need to be strengthened by systematic cluster management. Similarities in the national and regional ICT sectors refer to basic character of ICT and specialisation is mainly result of regional traditions in means of evolution of the sector and the cluster. Also these similarities could be seen as a low international division of labour, whereas possibly the potential of the European single market only has been exploited to limited extend so far. This is equivalent to the observation that relevant ICT sub-sectors (e.g. Software) show low export rates. Thus, NICE will among other focus on internationalisation in the context of business networking.

Furthermore, by comparing the five ICT clusters several similarities and difference on all three dimensions of the NICE rational, sector, policies and cluster became apparent. These regional similarities and distinctions could be further utilised to foster regional specialisation and collaboration across Europe, which could, if strategically developed become a competitive advantage.

It has been illustrated that different types of cluster management exist, and that one cannot draw generally accepted conclusions from its organisational structure in sense of successful cluster management. In fact, it are the regional framework conditions, the business environment, the historical background, the development stage and the regional players, firms as well as knowledge centres, which determine the cluster management and also the degree of formalisation needed. Nevertheless, if cluster management aims at positioning the cluster nationally and internationally an overall coordination of the cluster activities is needed to some extend. Moreover, such coordination may help to develop the cluster strategically. Taking into account the two dimensions 'degree of formalisation' and 'degree of integration', where internal refers to in-house and external to an independent organisation/person, one can distinguish between the following types of cluster management:

- Type I: informal – in-house
- Type II: formal – in-house
- Type III: informal – external
- Type IV: formal – external

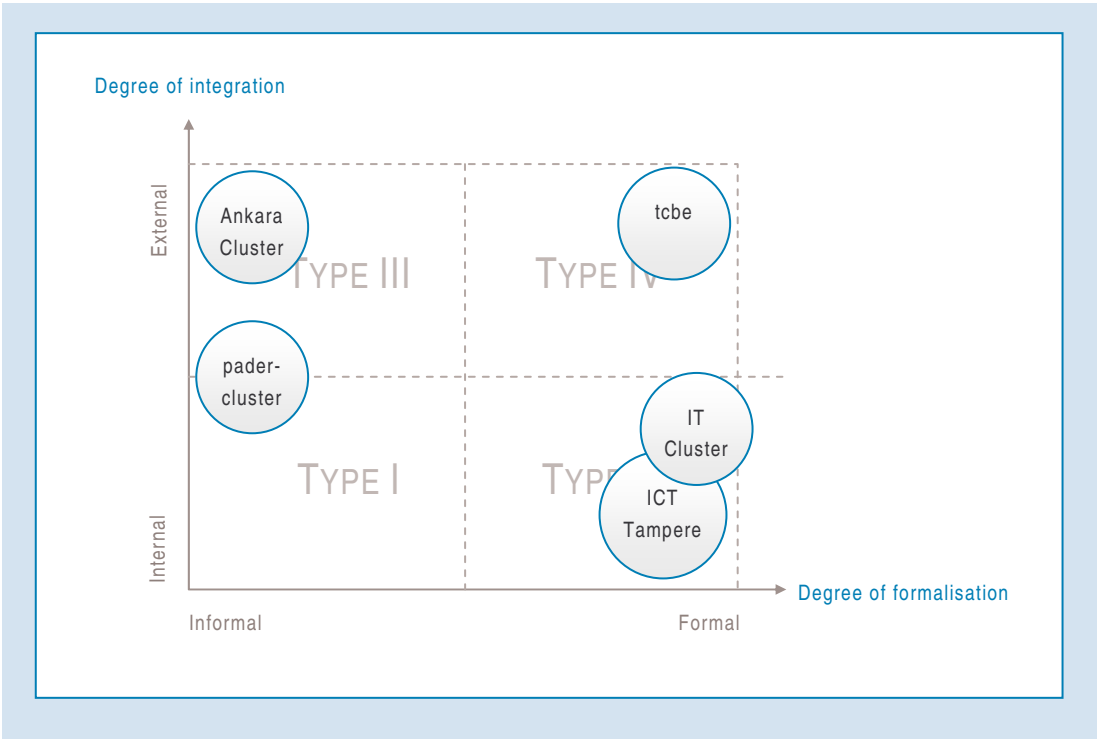


Figure 28: Types of cluster management

Albeit the fact that no generally accepted conclusions can be drawn concerning the most promising formalisation degree of cluster management, for the five regions compared, cluster management seems to be successful where it has well-defined institutional structures, is executed by at least one person in full time and is financed by its members. However, one should always be aware that successful regional cluster management approaches are not transferable one-to-one the regional setting always needs to be taken into account and the model adjusted accordingly, otherwise the intended effects might not come to bear.

Though clusters are associated with potential benefits, one should not underestimate that clustering also involves costs and risks. 'Some clusters turn stagnant, closed and counter-productive' (Andersson et al. 2004: 11). As has been shown in the comparison the clusters' evolution it takes long to develop from and embryonic to an established cluster. Therefore, it is important for the cluster management to recognised trends and major shifts within the sector early. ICT clusters evolving nowadays take longer to reach the latter stage and cannot 'spring up like mushrooms'. Thus, chances to improve Europe's position in the worldwide ICT market are seen in initiating learning processes. If Europe's regions succeed in establishing a continuous exchange of knowledge and experience among the clusters, evolving clusters might be able to avoid mistakes and catch-up with established clusters faster. In this context benchmarking is just one instrument in fact the learning process in the region itself is even more important. By reason of these result in addition to the planned knowledge exchange on cluster management level among the regions it is

intend to apply instruments and methods developed in the framework of NICE in the regions in order to test their practical capability and to initiate learning processes in the regions.

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