CLUSTER REPORT

PADERBORN

27 June 2006

DOCUMENT PROPERTIES

Document No.:	FP6-022551/2/WP2/D4		
Document Title:	Cluster Report		
Work package:	WP2 – Regional & Comparative Analyses		
Author(s)/editor(s):	Martin Lüttke, Uwe Schoop		
Dissemination Level:	PU - Public	Nature:	R - Report
Status of Document:	Final Version		
Version:	V1.1		

REVISION HISTORY

Revision	Date	Issued by	Description

ABSTRACT

In this document the results of the conducted cluster analysis are described. It covers information on the region, the ICT sector, cluster policies and the cluster management in the region Paderborn.

CONTENT

EXECUTIVE SUMMARY 3

1 THE REGION 4

2 ICT SECTOR 7

2.1 Overview over the national ICT sector 7
2.2 Overview over the regional ICT sector 8

3 ICT-CLUSTER 10

3.1 Evolution of the ICT cluster 10
3.2 Status Quo 12
3.2.1 Cluster's Structure & Competitive Position 12
3.2.2 Factor conditions 19
3.2.3 Firms' Strategies, Structures and Rivalries 22
3.2.4 Strengths & Weaknesses 24
3.3 Organisational framework & Cluster Management 26

4 POLICIES 30

5 CONCLUSIONS 34

EXECUTIVE SUMMARY

Paderborn can be designated as the location for information technology. Through the existence of about 280 companies, Paderborn has the highest IT-density in North Rhine-Westphalia. This way of development can be ascribed to the life and work of Heinz Nixdorf. Nowadays, both world market leaders and globally acting suppliers for niches are based in Paderborn. The university's faculty of computer science is one of the best in Germany. An innovative scene of founders as well as various platforms for the transfer of technology and knowledge top off the image.

Both in Paderborn and in OWL the economic actors have begun to understand the formation of networks, the cluster management and the promotion of transfer structures as an important task for the future. Many of the 280 companies, which belong to the Paderborn cluster, are organised in sub-clusters. These clusters are mainly informal and similar to a company network trying to achieve common goals. In most cases this does not include a specific cluster management institution. In fact, each sub-cluster has its own cluster management structure: n some cases rather formal, in most cases informal, relying on personal contacts and former co-operations. There are of course exceptions. InnoZent OWL bundles technological know-how and competencies of the region and tries to promote enterprises from global players to SMEs from all over East Westphalia. It therefore contributes to the idea of professional ICT cluster management. The Regional Development Agency (Wirtschaftsförderung) and the Science Park Association (Technologieparkgesellschaft) also take over responsibility regarding cluster management.

Sticking to the cluster definition that was agreed on in the Prelude Meeting on 13 December 2005 in Gelsenkirchen, we find out, that the sub-clusters can be allocated by two criteria: There are local clusters and thematic clusters. The framework for professional and successful ICT cluster management is extraordinary good. The sector is growing, many young SMEs would prefer professional promotion and organised contact management. Private companies and public research organisations are also keen on expanding their co-operations.

From the viewpoint of a formal co-ordination and control, the organisation level of the Paderborn cluster can be regarded as hardly present or non-existent. Yet there are active players which are accepted by the enterprises, and these players are initiating and transferring topics under various aspects. In addition to addressing specific industries, the contents and/or the target groups addressed in many respects also include companies from the ICT sector or approach them directly (e.g. knowledge transfer from research / companies). The dominating presence of this industry in Paderborn has the effect, for example, that an increasing number of IT enterprises is represented on various contact platforms.

Yet the cluster analysis leaves some questions unanswered. These may be taken into the project partners joint workshops:

- Which level of homogeneity / heterogeneity must / may clusters have and what are their effects on cluster management?
- Is the formalisation of cluster management a process running parallel to the development of clusters?
- Is there something like a "critical" cluster size requiring a formal management?

1 THE REGION

North-Rhine Westphalia, which has the highest population of all the German states (approximately 18 million inhabitants), is situated in the west of Germany and is, regarding its area, the forth largest of the 17 German federal states (approx. 34,080 km²).

The city of Paderborn with a population of approximately 143,000 is situated in East Westphalia–Lippe (OWL) and is the centre of the districts Höxter and Paderborn. OWL is a region in North-Rhine Westphalia and is congruent with the administrative region of Detmold (NRW is subdivided into 5 regions). The region consists of 6 districts and one city which is an independent city.

With a population of 2.07 million inhabitants (2005) and an area of approx. 6,500 square kilometres about one ninth of the population of NRW lives in an area which makes up one fifth of the North-Rhine Westphalia area of this region. Whereas the north and south of OWL is rather of a rural nature, a concentration of population can be registered alongside the A2 motorway in the cities of Bielefeld, Herford and Minden.

The most important industries in the OWL economy are **Engineering, Comestible Goods Industry, Furniture Industry** and the **IT Sector.** The Furniture Industry of OWL is particularly significant since around 70% of German kitchen furniture is produced here (this is also why a large number of trade associations are located in OWL).

Apart from 13 universities, the Fraunhofer Institute has 2 branches in Paderborn in the field of **Science and Research.** Among other things, Computer Science and the Commercial Information Technology at the University of Paderborn have achieved a ranking in the top group with regard to research.

The extensive area and the heterogeneous nature of the region, have lead to the formation of a lot of **Industrial initiaves**, **cooperations** and **overall initiatives**, in order to combine and visualise existing skills and interests. The companies involved (mostly associations) include, among others: “Kunststoffe OWL, Biotech OWL, Energieimpuls ZIMI (furniture industry), OWL Maschinenbau, OWL-Marketinggesellschaft and the Bertelsmann-Initiative”.

The strategic areas of activities defined by the red-green provincial government (Materials and their applications, Traffics systems, Medical and biotechnical applications, IT supported system integration, Specific services, and Sustainable resource management) and the federal initiative deriving from them also led to an increase in creating networks and increased endeavours for cooperation. In the course of this development, the coordination of cluster activities in OWL was considered. Paderborn's wider community (region Paderborn) extends across eastern North-Rhine Westphalia and encompasses 10 cities with a total population of about 0.3 million, the majority of whom live in the more rural outlying villages. There are 143,000 inhabitants (as recorded in March 2006) living within the city of Paderborn which is the biggest out of the ten. The automotive industry is represented by some important international components suppliers which are settled down in Paderborn. The location is characterized by large-scale enterprises with a network of suppliers. Co-operation with the university on highly intensive research and development-activities brings economic success. Subcontractors to the automotive industry gain synergy-effects from using the supplier-park of Benteler, the biggest manufacturer.

The electronic industry is characterized by flexible medium-sized enterprises with a broad sphere of competence. The development of diverse manufacturers of office machines or computers as Nixdorf and Peacock is said to be the point of origin. Nowadays, electronics/electrical engineering cannot exist without information and communication technology that is visible in a common faculty and a multitude of overall research activities at the University of Paderborn.

The manufacturing of food has a long tradition in Paderborn. One can assume that beer and bread from Paderborn are well-known. However, it is also for good, that the "Europe's biggest manufacturer" of juice is located in Paderborn. Furthermore, diverse meat and frozen food manufacturers have settled down in Paderborn as well.

In Paderborn engineering does have advantages both in distribution to the main components suppliers and in special forms of engineering. Special machines stand for accuracy, quality and high-technology in Paderborn. Companies that are involved in mixed engineering belong to the leaders in their market segment. Besides that, there are many niche suppliers with a range of products starting from bond automates to stereo lithographical systems. Company-friendly service providers of measurement, control, information and automation engineering etc. have been developed around this cluster. A deeper look at the development of industries clearly shows potentials of mechatronics for the future. In Paderborn the future has already started. Both university and companies do have competence and quality in the interdisciplinary field of mechanics, electronics, and IT. So far, hidden champions of the world market and excellent researchers have settled down in Paderborn.

Paderborn can be designated as the location for information technology. Through the existence of about 280 companies, Paderborn has the highest IT-density in North Rhine-Westphalia. This way of development can be ascribed to the life and work of Heinz Nixdorf. Nowadays, both world market leaders and globally acting suppliers for niches are based in Paderborn. The university's faculty of computer science is one of the best in Germany. The university puts its emphasis on the idea of being "the University of Information Society" according to the philosophy of IT. Both in Paderborn and in OWL the economic actors have begun to understand the formation of networks, the cluster management and the promotion of transfer structures as an important task for the future. Thus the Initiative for Occupation (IfB) estimates that the past structures of the transfer have (too much) been orientated on the direct cooperation between research and individual enterprises. In many times, personal, informal contacts are the basis that a transfer takes place at all. Logically the IfB has requested a project in the interest of the universities and the economy in OWL. Aim of the project is to optimize and structure the transfer within and between the universities in OWL and the economy and to use possible synergies by means

of cooperations. Further information, also concerning the efforts, to establish a plastics cluster in OWL, can be taken from the website www.ifb owl.de

There is a similar situation in Paderborn if we look at the ICT cluster. As Jürgen Zirke, management board of Pavone AG, explained in an interview with "competence site":

> “Competence networks enable an access to resources, the competence of which is beyond ours, as well as an access to current topics. We cannot and also do not want to cover everything. Particularly in the area of OWL we unfortunately have to learn that we do operate world-wide but are represented only low-key in our region. This has surely been a consequence of the existing competition in the past but could also be attributed to the fact that certain networks, such as InnoZent OWL, have been founded quite late and need a certain period of time to establish.”

Andreas Keil, Managing Director of InnoZent OWL e.V. says to the same topic, i.e. the existing competences and competence networks in OWL:

> "... Particularly the research results from the connection of classical mechanics, like in mechanical engineering and the vehicle construction, and computer science have to be highlighted. In this connection, the “new railway engineering Paderborn” has recently made the headlines and has attracted international attention... The cooperations with the industry are considered to be exemplary. In particular, the common institutes of university and Nixdorf/Siemens (C-LAB) and Hella and the University (L-LAB) have to be mentioned, which are a surplus for both sides. In this connection the industrial projects in the fields of logistics and microsystems technology have to be emphasised, which are carried out by the two Fraunhofer societies in Paderborn... The Innovation Centre for Internet Technologies and Multimedia Competence in OWL (InnoZent OWL e.V.) is heterogeneous enterprise network founded at the end of 1999. In the booming phase of the IT industry it was mainly supposed to build a bridge to enterprises, to industry sectors, science & research and above all to smaller enterprises. Market places were to be organized, innovation projects to be planned and contributions to be made for competence development... InnoZent OWL sees itself as a catalyst for the enterprises and the region. We assign topics, organise meetings and events, market places, conceive and are involved in projects and as a consequence develop network competences.

How the Paderborn ICT cluster is presented in detail and whether there is such thing as a Paderborn ICT cluster at all will be described more detailed in the course of this report.

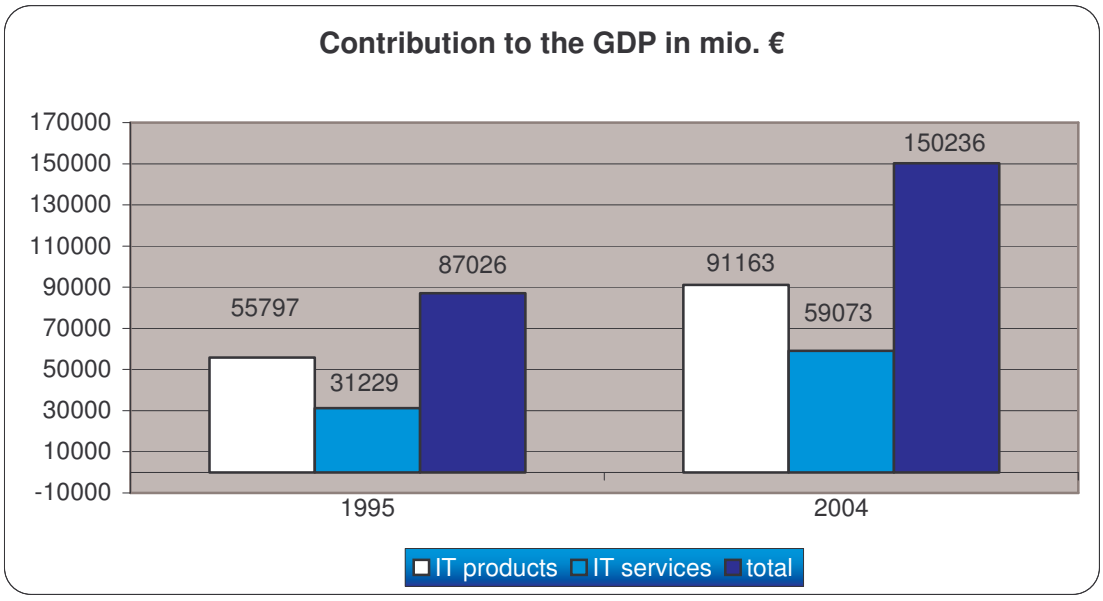
2 ICT SECTOR

Regarding the ICT sector in Germany it stands out, that most of the global or at least international players are caught in business process restructuring or have just completed such efforts. This often results in the discharge of labour forces that in some cases use this as an opportunity to become start-ups. This general process results in shrinking enterprises but talking about the big players, these companies still remain large compared to other ICT-businesses in the specific business locations.

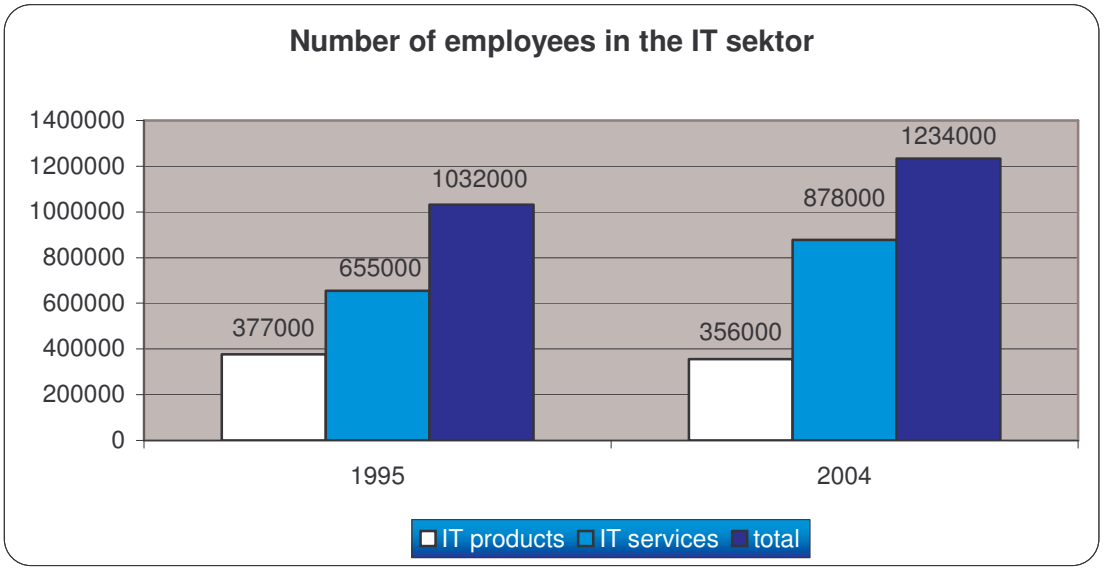
So the positive result is the increasing number of SMEs due to the above mentioned reason, the increase of start-ups. These companies are in most cases very well equipped with flexibility, a high degree of expert know-how and great innovative potential.

2.1 OVERVIEW OVER THE NATIONAL ICT SECTOR

The German IT-sector in figures (source: Federal Statistical Office Germany): In the time from 1995 to 2004 the value of the produced IT goods increased from 55,797,000 € to 91,163,000 €. The IT service sector grew from 31,229,000 € to 59,073,000 €. This corresponds to an increasing share in the gross domestic product of 4.7% (1995) to 6.8% (2004).



Within the same period the number of employees sank from 377,000 to 356,000 in the producing IT sector; however in the IT service sector it grew from 655,000 to 878,000 employees. All in all this corresponds to an increase in the share of all employees of 2.9% to 3.3%.



A further study of the Federal Statistical Office Germany for the year 2004 proves the fact that with the use of ICT Germany is not in a top position in Europe but is above the European average in using the Internet.

	Germany	EU
Usage of the Internet in enterprises with a ≤f 10 employees	95%	90%
Usage of the Internet of persons aged 16 to 74	60%	47%
Share of enterprises with broadband access	57%	61%
Share of private households with broadband access	30%	33%

As a whole the German ICT industry shows the most dynamic occupation development of all industries in Germany.

2.2 Overview over the regional ICT sector

Paderborn is the location of information technology. With 280 enterprises the city has the highest IT-density in North Rhine-Westphalia (NRW). Heinz Nixdorf gave the first impetus. Today both big world market leaders as well as globally-acting niche vendors are based in Paderborn. An innovative scene of founders as well as various platforms for the transfer of technology and knowledge top off the image. The university with its faculty Computer Science ranks among the best ones in Germany. The charm of Paderborn lies in the variety: from a broad product spectrum up to various types of enterprises and networking possibilities. The mission statement chosen by the university called "university of the information society" underlines the value.

The following table shows some important facts concerning IT in Paderborn:

Employees	About 10.000
Main focuses	Soft- and Hardware, service, training
Relation to other industrial sectors	Cross section industry for nearly all industries
University	Computer Science International Graduate School
Institutes	C-LAB, Fraunhofer IZM (Advanced System Engineering), Heinz Nixdorf Institut, PC² etc.
Networks	Meetings of the branch "Industry meets information technology", InnoZent OWL e.V., Technologiepark
Companies*	e.g. Flextronics, Fujitsu Siemens, Mettenmeier GmbH, Sagem Orga GmbH, Siemens Business Services, Webwasher AG, Wincor Nixdorf
Networking	Locally well, regionally expandable
Internationalisation	Above the trend of the sector
Potentials	Key sector, still high, among other things concepts for appliance and services (after sale), also for new target groups (e.g. trade)
IT in OWL	Third largest location in NRW

In Paderborn the number of employees subject to social insurance contribution amounts to approx. 61,200 (2004), approx. 10,500 (2004) of them being employed in the field of ICT. This equals a share of 17% or every 6th job. A potential survey from the year 2003, which was commissioned by the Initiative for Occupation in Gütersloh and the District Government Detmold (OWL), came to the following conclusions:

Within OWL, Paderborn and Bielefeld including Gütersloh were particularly outstanding. Depending on the definition of the term IT or ICT 25,000 to 50,000 people work in this industry in OWL. The missing precision results from the convergence of the industrial sectors telecommunications, information technology and media and the change accompanied by it from the IT sector to the ICT sector without already having any fixed definition on how to restrict these sectors. From its history it can be seen that IT in OWL is still stamped in a strong way by the names Bertelsmann and Nixdorf. In the surrounding area of these two enterprises resp. their successors a great number of companies have established that – apart from a few exceptions – are hardly noticed beyond the limits of OWL. There are some research groups and initiatives, which however represent isolated applications. Consequently there is no regional coordination for the branch, contacts and cooperations with other enterprises are rather informal. The authors of the study derive some recommendations for action. Grouping and coordinating the activities within the region are sensible and should be forced. In particular this concerns the fields:

- External presentation of the IT competences in the region
- Assuring the succession of skilled labour
- Support of Start-ups
- Support of young companies during process optimization
- Exhaustion of the cooperation potential with close-by branches
- Intensified orientation towards SMEs and trade

3 ICT-CLUSTER

The following chapters contain information on the development of the ICT-Cluster in Paderborn. First we take a look at the cluster's history, before we go deeper into economic matters. To finish it off we finally take a look at the framework for cluster management in the "padercluster".

3.1 EVOLUTION OF THE ICT CLUSTER

Today Paderborn is one of only two major large cities and economical players in east-westphalia. It's characterised besides other factors by a university, different research intitutions and an ICT cluster containing various sub-clusters. This was quite different some 50 years ago. Industrialisation had almost not taken place at all so it took a genius called Heinz Nixdorf to change all this. Starting off a small business producing calculators in Essen with 60 employees Heinz Nixdorf returned to Paderborn in the early 60s. With the rise of modern computer technology the Nixdorf Computer AG grew up to 25.000 employees in its prime. From 1970 to 1990 Nixdof grew with a rate of about 20% each year! The benefit for the city of Paderborn can easily be seen today. Paderborn has its own airport, has been connected to the highway network and has a university to name a few aspects.

In the 80s the ICT sector faced dramatic changes. Computers became standardised and were used no longer exclusively in business but more and more in private as well. Finally in the 90s computer and information technology started melting to become the ICT sector as we know it today. Expecially after the death of Heinz Nixdorf in 1987 the Nixdorf Computer AG was no longer able, to successfully beat the challenges of a restructured ICT market and was finally taken over by the Siemens AG in 1990. The new enterprise was called Siemens-Nixdorf-Informationssysteme AG (SNI).

Until 1995 SNI kept on struggling, facing various business reorganisations and finally ended up divided into 4 major companies.

- PCs and Notebooks are manufactured by Fujitsu Siemens
- Electronic parts are produced by Flextronics
- Cash machines are manufactured by Wincor Nixdorf
- Siemens-Business-Services (SBS) provides IT- related services

Since 1995 the rate of startups grew rapidly in the ICT sector. The split up of SNI and the extraordinary good ICT-research in Paderborn encouraged many ICT-specialists who either just graduated or until then worked for SNI or one of its successors to start their own business. The history of the Paderborn ICT-Cluster can easily be explained by the illustration shown below.

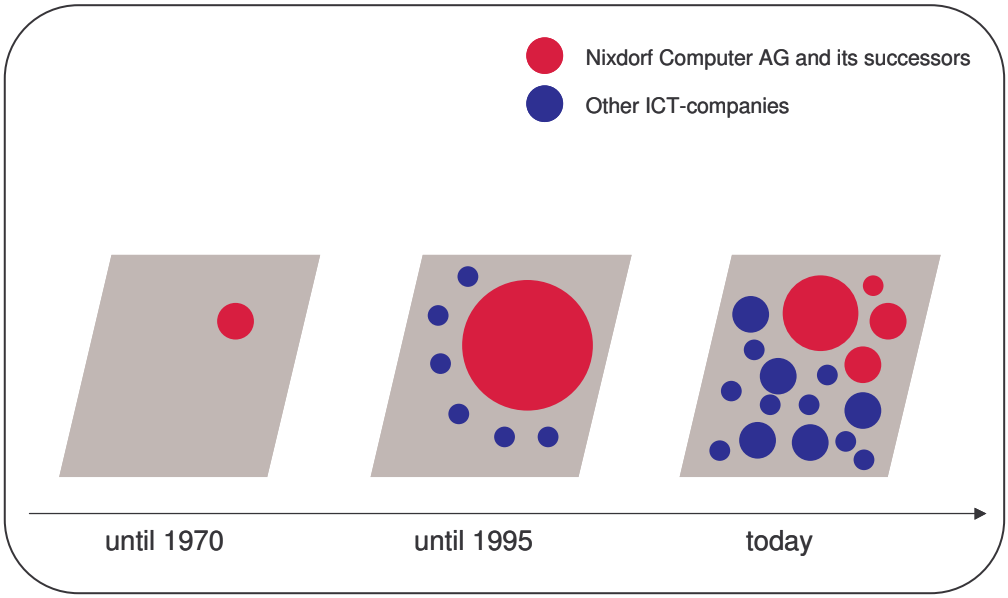


Figure: The development of the ICT cluster in Paderborn since 1970

Until 1970 there was mainly the big player Nixdorf dominating ICT in Paderborn. Until 1995 Nixdorf grew bigger and "satellites" working for or with Nixdorf were founded. Today Nixdorf is split up into 4 companies and beside Nixdorf there are many players in ICT from global players to very small start-ups.

The split-up of the Nixdorf complex and the extensive reduction in jobs were accompanied by a perceptible increase in foundations within the field of information technology. As a result the number of employees almost remained unchanged on the one side, and on the other side a structural shift in this sector could be registered. On the basis the employment figures a decrease in the production of hardware and an increase in employment in the IT service sector and software development can be ascertained for the period of 1990-1998. Analyses show that the foundation dynamics are to be attributed to different causes. The increasing number of foundations in the designated period of the split-up gives rise to suppose a connection, as does the positive competitive environment of the IT-industry in the 90's. Furthermore a highly-qualified labour force potential had developed at the location of Paderborn and a high technological level of competence had originated. This development was accompanied by pro-foundation local politics. Also the spin-offs from the faculties Computer Science, Computer Science Engineering, Commercial Information Technology or Electrical Engineering from the University of Paderborn play a substantial role.

Fortunately the city had at that time succeeded in creating a balanced structure of industries and company sizes, as it had already done in the years before, so that redundant workers found a new job in the region of Paderborn. On the one hand numerous companies developed from spin-offs on the initiative of former Nixdorf employees; on the other hand also companies of other industrial sectors extended or established their production capacities in the preceding years. In the 90s there was a real foundation boom of companies working in the IT-industry in Paderborn. This was facilitated by the fact that for small enterprises developing software or offering services around the computer and the Internet the necessary investments kept within

reasonable bounds. In addition the city always tried to comply with the needs of new or expanding enterprises.

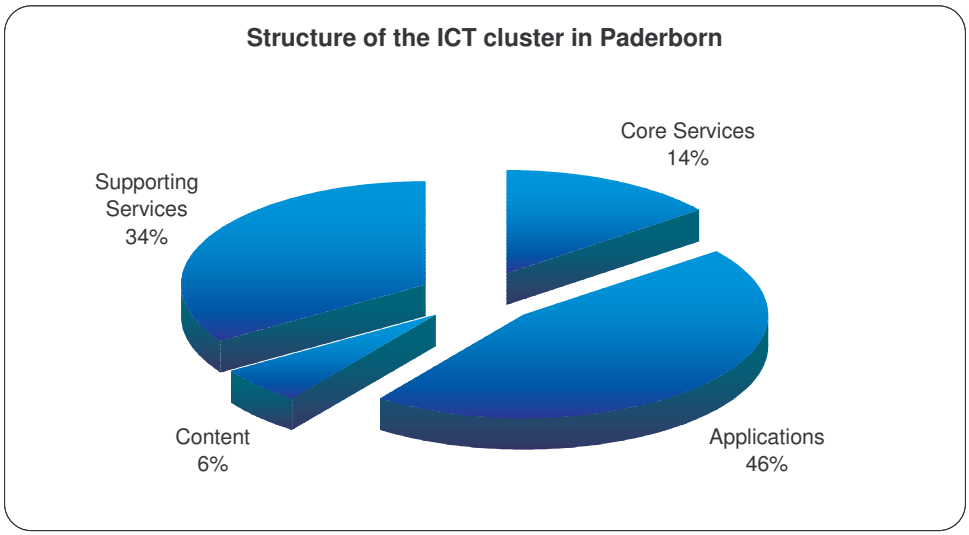
3.2 Status Quo

Cost savings, achieved by physical proximity and the possibility of a more frequent, straightforward coordination and information exchange are among the most substantial advantages attributed to clusters. Also, clusters are supposed to facilitate the access to specialised knowledge, to improve qualification of staff and to make special services and products available. The reasons for this are the basic conditions, which are determined by the cluster by means of permanence and reliability. Furthermore it can be assumed that the physical proximity creates more confidence and that the steadiness/permanence of the basic conditions strengthens and favours the relationship between the parts involved in the clusters. This proximity also creates a framework which facilitates the informal exchange of knowledge. This tacit knowledge, which is bound to persons and organizations, is usually not made available third parties.

The following chapters are about the structure of the ICT cluster in Paderborn and contain information on the clusters structure as well as the status of cluster management and its level of centralisation, professionalism and institutionalisation.

3.2.1 Cluster's Structure & Competitive Position

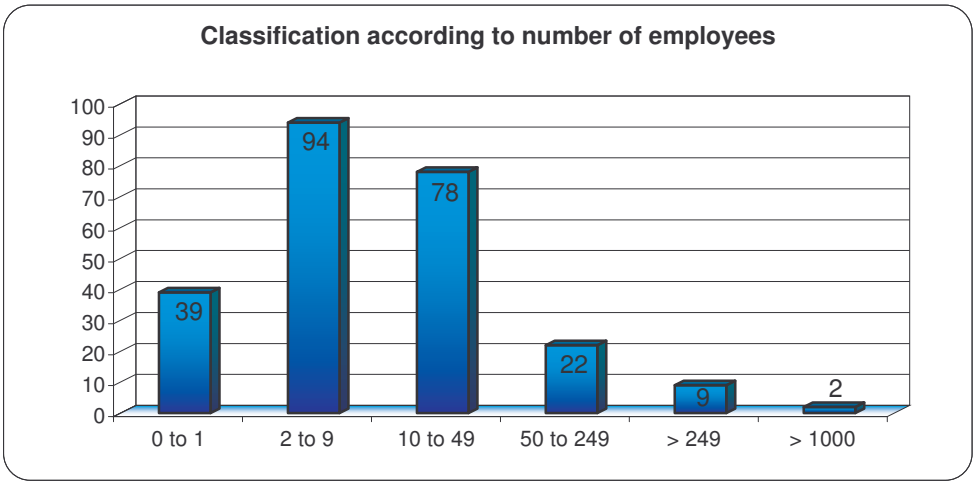
The ICT cluster in Paderborn today is made up of a few big enterprises with more than 500 employees and a wide variety of SMEs. As mentioned above many of these companies have come to life only within the last 10 to 15 years. All together there are about 280 companies belonging to the ICT cluster in Paderborn. They represent all four sub-sectors mentioned in the questionnaire according to the following chart:



Many of the companies which belong to the Paderborn cluster are organised in sub-clusters. These clusters are mainly informal and similar to a network of companies to organise trade fairs commonly or to join

competencies to meet certain requirements of their customers. This does not include a specific cluster management institution or any kind of cluster management on a regular basis, except for InnoZent OWL as mentioned above.

Looking at the number of employees the ICT cluster is made up of 2 huge global players, 9 which may be called big companies some of which are global players and all the rest belong to the group of SMEs.



Taking into account the large number of SMEs and their steps towards networking and cooperation it becomes obvious that Paderborn does very well with a rather insitutionalised kind of cluster management for sub-clusters, which usually unite a small numer of companies who want to participate, benefit and have an active part in it.

Extracts from the NICE questionnaire on cluster analysis:

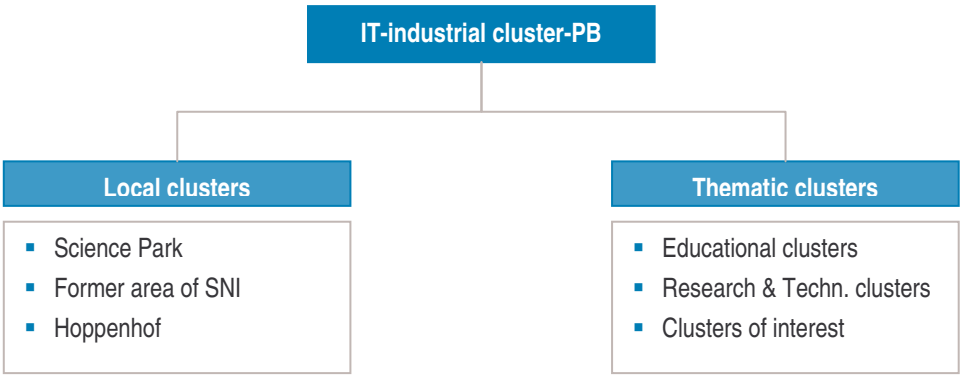
Q-2-3: How is the cluster structured?

		Total Number	Share of Total
ICT companies	Applications	107	43,32%
	Content	14	5,67%
	Core Services	34	13,77%
	Supporting Services	80	32,39%
	Infrastructure		
	Other (please specify)	5	2,02%
Knowledge Centres	Research Institutes	4	1,62%
	Universities, Colleges	2	0,81%
	Other (please specify)		
Other Members	Incubators		
	Public Authorities	1	0,40%
	Chamber of commerce		
	Other (please specify)		
	TOTAL	**247**	**100.0 %**

Some ideas about the location of companies were just mentioned in the chapter above when we were talking about local sub-clusters. As far as infrastructure is concerned Paderborn is in a very comfortabel position. Research is very well done at the university as well as in other private and public research institutes and off course by the ICT companies themselves.

The University of Paderborn, which changed its name to “university of the information society”, offers its students a variety of IT-related study courses such as computer sciences, computer sciences for engineers, information management and some more. Over the last ten years more than 50 startups were university spin-offs. There is a number of associated partners and research institutions working close together with the university. To name a few of them we got the C-lab (Cooperative Computing and Communication Laboratory), the worldwide known Fraunhofer Institute, the PC2 (Center for parallel computing) and some more.

In addition many private institutions for advanced vocational training exist. Partly they were also founded in the times of Heinz Nixdorf to provide Nixdorf with the best specialists to secure its market position. According to different surveys, Paderborn is ranked 4 of all large cities in Germany when start-ups were asked about the attractiveness of their business location. We stick to the cluster definition, as it was defined in the Minutes of the Prelude Meeting on 13 December 2005 in Gelsenkirchen, but we leave the level of the complete cluster, consisting of approx. 280 companies, and start looking for sub clusters. Very soon two criteria for allocation become clear:



Historically the clusters in the North-West of Paderborn on the former SNI area as well as Hoppenhof have developed due to the existing SNI-infrastructure resp. the physical proximity to it (approx. 1 km). The local cluster in the Technologiepark in the South of Paderborn has emerged as a booster for foundations coming from university, making it obvious that a large number of enterprises in the Technologiepark have their origin in IT technologies. After all Paderborn and its university are well-known for this and are highly appreciated by students and founders of new businesses. Amongst its historical growth the physical concentration has mainly practical reasons: existing infrastructure, cooperation partners in order to broaden the own area of competence and the own range of articles, joint research and development. And all this combined with short ways. The organisation of these clusters mainly takes place informally in historically-grown tracks, with the Technologiepark (Science Park) having its own administrative and marketing company. However, these do not take over any cluster management functions. The cluster management structures and competences become clearer when turning to thematic clusters. In doing so we will exemplify the members of the clusters and regard the clusters according to the following criteria:

- rate of organisation and representation of interests
- way of cooperation
- range

Educational cluster

The most important actors in the educational clusters of the IT-industry of Paderborn are the Fachhochschule der Wirtschaft (University of Applied Economics = FHDW), the b.i.b. (Educational Centre for Information Processing Professions), the InBIT, the training academy of Siemens AG (Paderborn), the FGE TrainingsCenter of Mettenmeier GmbH.

What combines all members of the educational clusters as regards contents is the concentration on IT relevant occupational areas or those closely connected. Cooperation within the clusters and its organisation has grown historically. There is no centre of coordination in the conventional sense which is entitled to claim the cluster management. Except the FGE all cluster members directly or indirectly evolve from the initiative of the pioneer Heinz Nixdorf. Soon he realised the need to professionalize the vocational as well as further training for jobs being close to IT. All cluster members are listed nationwide to various extends.

Brief information about the individual actors:

- **Training academy of Siemens AG:** For more than 20 years the Siemens Professional Education Paderborn has supervised more than 15,000 trainees. Not all of these had Siemens as their company of apprenticeship. Many cooperation partners also send their trainees to Siemens in order to grant them a highly-demanding training with regards to quality, matching the needs of the new IT-jobs.

- **FHDW:** The University for Applied Economics (Fachhochschule der Wirtschaft) is a state-accredited university of the b.i.b. The specialty of the FHDW concept is the dual study course. In a coordinated rotation of theoretical lessons and practical phases in the company the FHDW leads the students to a Bachelor's degree after 3 years in an achievement-orientated way, accepted in the whole of Europe: Diplom-Kauffrau (FH)/Diplom-Kaufmann (FH) und Diplom- Informatikerin (FH)/Diplom-Informatiker (FH).

- **b.i.b.:** The "Bildungszentrum für informationsverarbeitende Berufe" - b.i.b. is a private, state-approved educational institution. The b.i.b. is divided into the vocational school, technical school, vocational college, Institute for Applied Information Sciences, FHDW and Multimedia Academy for Economics (MADW).

- **InBIT:** Already in 1979 the pioneer Heinz Nixdorf realised the great importance of company organisation and information techniques and founded the InBIT in Paderborn. Due to a growing demand for educational services and advisory projects the InBIT became one of the leading educational enterprises in Germany within the 90s and now operates in 16 places nationwide.

Research and technology cluster

The most famous and most important actors in the research and technology clusters are the University of Paderborn, the Heinz Nixdorf Institut, Paderborn Forum „Industry meets informatics", the C-Lab, S-Lab, L-Lab, the International Graduate School, the Fraunhofer Institut and the PC2. With their activities the cluster members want to develop marketable sustainable technologies, ensure their own high standards and, in doing so, ensure their remarkable position within the international research competition. The cooperation between the individual institutions takes place in various manners. The cooperation is mainly institutionalised without the existence of a management responsible for all actors. Nevertheless this cluster comes closest to the ideal of a well-led and organised cluster. Brief information about the individual actors:

- **University of Paderborn – The University of the Information Company:** In the latest CHE-university ranking, which has recently been published in the ZEIT-study guide, the information technology of Paderborn has been in the top group again. Of the 77 informatics locations researched only 3 more colleges achieved a ranking in the top group.

- **Heinz Nixdorf Institut (HNI):** The Heinz Nixdorf Institut is a research centre of the University of Paderborn. It originated from the initiative and support of Heinz Nixdorf in 1987. Doing so, he intended to combine engineering and information technologies to create substantial impulses for new products and services.

- **Paderborn Forum „Industry meets information technology“:** The Forum of Paderborn was founded by IT-Professors of the university with the support of the Wirtschaftsförderungsgesellschaft and representatives of local companies. In the focus of the dialogue between university representatives and the industry is the intensification of the practical orientation of research and the training of the students.

- **International graduate school:** The International Graduate School *Dynamic Intelligent Systems* at the University of Paderborn is one of seven NRW Graduate Schools which are initiated and supported by the Ministry of Innovation, Science, Research and Technology of the federal state North Rhine-Westphalia, Germany.

- **Fraunhofer Institut:** The Fraunhofer Application Centre for Logistic-Orientated Business Administration (ALB). The Fraunhofer Application Centre for Logistic-Orientated Business Administration, founded 1 April 1998, has the mission to organize production and logistics processes and the business administrative optimization of these processes. Main objective is the implementation as well as the development of trend-setting concepts and methods together with commercial partners.

- **Center for parallel computing - PC 2:** The Paderborn Center for Parallel Computing, PC^2, is an interdisciplinary institute of the Universität-GH Paderborn, Germany. It's specialised in distributed and parallel computing for research, development and practical applications and for the investigation of new fields for its clients, partners and itself.

- **C – Lab:** The vision of C-LAB is a close combination of university research and industrial development under one roof. The main aims of C-LAB are to provide innovative basic technologies, prototypes and preliminary products, the scientific qualification of staff as well as the direct cooperation in industrial projects (transfer of Know-how).

- **S – Lab:** The Software Quality Lab (s-lab) is a scientific institution of the university of Paderborn. The S-Lab is faced with the challenging task to develop and improve methods, concepts, techniques, languages and tools in the area of software techniques, to carry out interdisciplinary projects, especially with industrial partners and to consult and train users.

- **L –Lab, Projekt Forschung Licht:** The Hella KG Hueck & Co. and the university of Paderborn have installed a joint research centre for lighting engineering and mechatronics (L-LAB), being run as a Public Private Partnership. Aim is the fast realisation of new research results into marketable products.

Clusters of interest

Amongst all sub cluster categories the group of the clusters of interest is the most heterogeneous. This is due to the fact that they represent the interests of the respective member companies. The emphasis lies on different areas such as improved public relations work, joint marketing, coordinated transfer of knowledge and technology or politically-motivated commitment. The following briefly-outlined sub clusters are all active in the region, some of them are organised nationally, Europe- and world-wide. In most cases different internal structures are connected with it, which means that a (sub) cluster management is realised either by volunteers or specially hired and paid managers. All sub clusters offer their members regular events which are partly for members only and in many cases also open to the public. The following list and short characteristic trait gives an overview of the sub cluster landscape of Paderborn without making the claim of completeness.

- **InnoZent OWL:** The society InnoZent OWL e.V., is a fusion of innovative companies in the region Ostwestfalen–Lippe. InnoZent sees its task in joining up companies and technologies, supporting promising technology projects and organising transfer of knowledge and communication. For this task InnoZent has a fixed number of staff.

- **Paderborn is information technology:** Three companies of Paderborn, the S-Lab, the IT-faculty of the university and the Wirtschaftsförderungsgesellschaft of the city of Paderborn have set themselves the target to give the broad public an understanding of information technologies in an informative, exciting and entertaining way in the Informatikjahr Wissenschaftsjahr 2006. The small group organises itself and prepares for events like „open house“ on regular meetings.

- **Wirtschaftsförderungsgesellschaft Paderborn and Technologieparkgesellschaft:** An important measure in order to support research- and development-orientated foundations of companies was the establishment of the Technologiepark Paderborn (TPP) in 1992. An exemplary climate for foundation and attractive service offers to the local economy are created together with the Wirtschaftsförderung of Paderborn.

- **BVMW – Bundesverband mittelständische Wirtschaft:** The BVMW is the political lobby of the medium-sized businesses. It consults its members with a net of more than 160 industrial sectors nationwide, offers events and workshops as well as practise-relevant information concerning questions arising from the everyday life of an entrepreneur. The BVMW works internationally, is financed by membership fees and has locally-operating „cluster managers“, who work on their tasks full-time.

- **IVMW – IT for medium-sized economy:** Aim of the 11 members, who administer and organise their network together, is to act as an agent for „IT-inquirers“ and help them to quickly find the right partner for solutions and to use the synergetic effects. At regular meetings of network partners new ideas for cooperation are developed, discussed and realised.

- **BJU/ASU – Bundesverband junger Unternehmer/Arbeitsgemeinschaft Selbständiger Unternehmer e.V.:** The BJU is a lobby operating Europe-wide for young self-employed entrepreneurs

up to 40 years of all industrial sectors. The ASU, founded in 1949, represents the interests of its members in the sense of a liberal economy.

- **MEIM – Mehr Erfolg im Mittelstand:** The MEIM is a congress taking place once a year which especially refers to small and medium-sized IT companies. Organised and carried out professionally recommendations are given and best-practise examples are introduced to combine bromides („You have to improve processes, decrease costs, increase productivity ...") with decision-making and responsibility.

- **Wirtschaftsjunioren/-club:** Economic Juniors and Economic Club see themselves as the lobby of the companies and act both nation-wide and regionally. Organisationally the Wirtschaftsjunioren Paderborn-Höxter are allocated to the Chamber of Commerce of Ostwestfalen in Bielefeld. The members can take part in joint events (partly open to the public) and workshops and maintain the exchange of experience.

3.2.2 Factor conditions

In this chapter the factors of competition, the areas of settling of the companies, potential of the skilled employees and managers and the infrastructural situation are described.

First it has to be mentioned that Paderborn is a clearly structured city with short distances from end to end, the infrastructure is good and the traffic is unproblematic even during rush hours in the mornings and afternoons.

Therefore the location of a company within Paderborn is secondary when wanting to do a quick, spontaneous personal exchange "face-to-face". As mentioned above local clusters exist in Paderborn, which have grown historically. These local sub-centres are not obligatory for the formation of the sub clusters described in chapter 4.2.1.

Important for a location like Paderborn, which correctly regards itself as a technology location, is the availability of qualified skilled employees and managers. Thereby three factors play a special role:

- Installation of the occupational training including the possibility to study as well as advanced vocational training
- Population development
- Quality of life in the Paderborn region

Training and further education

The training and further education landscape of Paderborn was mainly characterised by Heinz Nixdorf. Many of the institutions (described in 4.2.1) for research and study were initiated by him and have secured themselves top places in a national comparison. Thanks to the existing high number of IT companies in Paderborn a very fertile interchange between first-class training and the following occupational possibilities in IT companies or research centres in Paderborn has been established. Surely this is a reason for the close connection of research, study and companies. Here, too, can be seen that contacts and cooperations up to

the formation of sub clusters are based on informal, historically grown, social contacts. The attractiveness of the region for research, study and skilled employees is also increased by the fact that a great number of businesses are resident here, which are close to IT or better: relying on IT. An example for cooperations resulting from this is the L-Lab as a fusion of the University of Paderborn and Hella KGaA Hueck & Co.

Population development

The population development of Paderborn as well as the forecast contributes immensely to optimistic expectations concerning the development of potential of managers and skilled employees. Paderborn is already one of the youngest regions of Germany and will stabilise this position. Reason for this is mainly the integration of many young new inhabitants who have moved to Paderborn from the former Eastern Bloc. Paderborn is also a "young"-city concerning the age structure. The number of people under the age of 20 (23.6 %) is above the number of the Federation and state (20.7% / 21.6%). In comparison there are fewer seniors of 60 years and above though (20.5%, Federation: 23%, state: 23.9%).

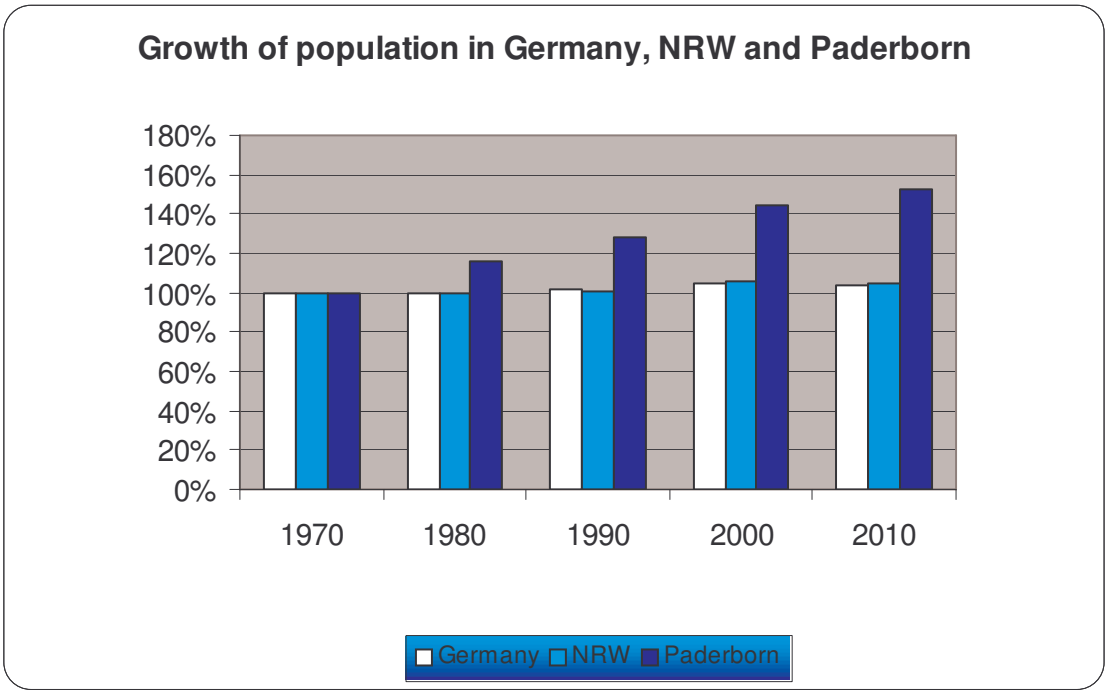


Chart: Comparison of population growth

As the chart above shows, the growth of population proceeds a lot faster than in Germany or NRW. Thereby the growth of Paderborn can be led back to a surplus in births in more than a quarter, while Germany and NRW have an excess of deaths over births since the beginning of the 70s. The considerably slower growth there is almost exclusively a result of migration. Also in comparison to other cities Paderborn grows above average and loses clearly less inhabitants to the hinterland.

Another criteria which influences the availability of skilled employees and managers is the attractiveness of the city of Paderborn, especially its quality of living and leisure as well as the costs of living. Paderborn has

developed erratically in theses areas over the last 30 years. The offer of sports is wide-ranged, even playing golf or windsurfing is possible in Paderborn. Imbedded in the Teutoburger Wald, you will only need 15 minutes by car to forget the big city and be able to enjoy hiking in the countryside. The cultural offer is excellent for a city of this size, last but not least thanks to the very committed cultural office. The annual Libori fun fair, this years' Canossa exhibition, long museum nights, Music and Theatre events of all kinds in the Paderhalle and the Kammerspiele, Cabaret in the Kleinkunstsaal or alternatives in the Kulturwerkstatt – Paderborn has the matching offer for everyone. Thereby the cost of living are moderate compared to other cities and might be an argument for some to stay in Paderborn for good after studying.

Infrastructure

The infrastructural frame conditions consider three levels:

- Technological infrastructure
- Infrastructure of traffic
- Frame conditions of the economic policy

Technological infrastructure

In the previous chapters we have already stated the institutions and networks which are allocated to high technology, research and studies. To be one of the most important IT locations nationwide an appropriate, state-of-the-art communicational infrastructure is required. This is exceptionally good in Paderborn, as there are research establishments which develop, test and use corresponding technical/ technological basics. On the other hand a quick transfer into the companies takes place due to the close connection of research and economy, which they use themselves or generate marketable products from them. In many cases even both.

Infrastructure of traffic

Also in this field Paderborn has caught up immensely over the past 30 years and overtaken most of the cities of the same size. The most important characteristics of the transport connection are:

- Connection with 5 junctions to the motorway
- Connection with the IC and ICE railway of the Deutsche Bahn with good connection to the main railway meeting points Kassel and Hamm.
- The airport of Paderborn-Lippstadt as Paderborn's gate to the world. From here scheduled flights quickly get you to national and international economy centres as well as to the main national turnstiles Frankfurt and Munich

Concerning the traffic infrastructural setting Paderborn leaves nothing to be desired for its inhabitants or companies. Only the connection of the railway concerning the city as an ICE location is still upgradeable.

Municipal economy policy

The city of Paderborn soon realized the importance of an efficient support of the economy and therefore established the Wirtschaftsförderung of Paderborn, whose aim it is to enhance the attractiveness of Paderborn for the settling of new companies, relocation of companies and business star-ups. Thereby it acts as an agent between the public administration and the companies to simplify processes for the companies.

So there is a service agent at hand for the companies, where they can get many services virtually at one location. Not for nothing Paderborn is said to have one of the best start-up communes of Germany according to a research of Focus in 2000. So the offer of services to the companies covers the fields start-up-service, location management and public administration with the function of seeing them through.

All factors of competition mentioned and described in this chapter play an important role to make Paderborn interesting in general for companies and boosts the forming of clusters to a different degree. So the physical concentration of companies is not obligatory for the formation of clusters but it may simplify it. The availability of skilled employees and specialists from research and economy is an essential element for the foundation and growth of clusters, which, as we have already seen, mainly emerge from informal contacts. The frame conditions of the economy policy can help to simplify the forming of clusters, but cannot enforce them.

3.2.3 Firms' Strategies, Structures and Rivalries

As far as employment is concerned it is obvious that the ICT cluster makes up for about 17% of the total amount of jobs in Paderborn. This means, that each sixth job is ICT related. Bearing in mind that half of all these employees are on the payroll of only two global players, which are basically involved in core services, a certain structural economic threat can not be dismissed. Concerning relationships between cluster members the above mentioned remains unchanged. There are different informal networks and initiatives serving some of the concerned companies. Such networks and projects are for example, Firmenforum (platform for contacts and exchange), startup network, etc. The following table shows the results of the NICE – survey regarding interaction between cluster members as presented in Gelsenkirchen in May 2006.

	Core Services		Applications		Content		Supporting Services	
	in the region	outside the region	in the region	outside the region	in the region	outside the region	in the region	outside the region
How many companies do you know in the single sub-sector?	6	58	9	70	4	19	5	79
With how many of those companies are you in informal contact?	2	11	2	18	2	2	2	3
From how many of those companies do you purchase products/service?	1	8	1	12	1	1	1	2

An ICT cluster analysis conducted by Christof Klöpper in 2003 revealed that the most intense contact exists between companies of the same sector. In his survey he found out that this applies to 35.3% of all firms. Only 12% keep up relationships with companies of other sectors. In his survey he also revealed that 28.9% of the cluster members make business with or at least stay in contact with one of the four Nixdorf successors (Fujitsu Siemens, Wincor Nixdorf, Flextronics and SBS).

This leads us to the conclusion that, despite naturally existing rivalry within companies of the same sector, there is a remarkable amount of cooperation and informal interaction.

Before we get from the total cluster of Paderborn to the exemplary view of some sub clusters, we pick up some considerations first, which already exist in the relation to the cluster and their origin. We will examine

the following statements afterwards on the basis some sub clusters. If you wonder about the decisive factors for the spatial concentration of similar enterprises and why regional innovation activity increasingly concentrates on some few substantially innovative regions, you have to go back to some models of the new growth theory. They stress that innovative knowledge rather spreads on a small-scale: Spatial proximity offers the possibility of an intensive cooperation and the exchange of knowledge and experience. Particularly when submitting new ideas and non-codified knowledge between enterprises, research establishments, regional politicians and administration “face-to-face” contacts are important, in order to realize synergetic effects. Certainly openness inwards and outwards is important. The empirical research shows that clusters exist at different places throughout the world and in almost every branch of industry. These clusters, which predominantly developed spontaneously by the self initiative of local actors, are quite diversified, each of them being heavily stamped by local conditions so that it seems hardly possible to carry out a general systematisation of innovative clusters.

Thus clusters develop from a close regional limitation due to the possibility of intensive cooperation, the necessity of face-to-face contacts and the chance to start the cluster spontaneously and on one’s own initiative.

When considering the sub cluster "Paderborn is computer science!" we get the exact confirmation for these thoughts. This initiative is an informal fusion arisen from the idea of the enterprises involved as well as the Wirtschaftsförderungsgesellschaft of Paderborn. On the occasion of "informatics year - science year 2006" the small group thought about possibilities of organising this event. Ideas were born, discussed and realised together. The small cluster does not have any institutionalized form, but a common aim: to increase the public relations work for each individual member by common activities. So at first the idea was born to simultaneously organize an „open house day“ amongst all members. During another two informal meetings the series of events called „days of open house“ and a jointly-arranged flyer emerged. Starting from June, every month one of the enterprises involved opens its gates to the interested public. At the same time a series of press articles will appear which have been written by one member.

In the meantime the actors consider institutionalizing their cooperation by firmly hiring a cluster manager in order to increase the net workers’ publicity inside and outside OWL. Within a short time a lot could be developed and realised. The reasons for this are obvious. The parties involved already knew each other and there was a necessary measure of confidence. In addition, the spatial proximity enabled some meetings, which could easily be realized by all parties involved. In conclusion an already initiated action concept and the intent to institutionalise and professionalize the cooperation stronger than before emerged from a rather spontaneous idea.

The sub-cluster “iTMW” developed in a similar way. Eleven entrepreneurs who knew each other from their membership in the "BVMW" or due to existing bilateral co-operations put the idea into practise to create a small, regionally limited spin-off out of "BVMW", which is acting Europe-wide. Today the self-organized circle meets regularly in order to force the exchange of experience and to acquire larger projects than the individual partners could do alone. The members do not think about a further institutionalization at the moment.

3.2.4 Strengths & Weaknesses

Having discussed the state of the IT industry in total in Paderborn we will take a closer look at the core competences of the individual clusters and sub-clusters and identify their strengths and weaknesses in the following sections:

- **Research and technology clusters:** University of Paderborn, Heinz Nixdorf Institute, International Graduate School, Fraunhofer Institute
- **Educational cluster:** Siemens Academy, FHDW, b.i.b., InBIT, PC2, C-Lab, S-Lab, L-Lab
- **Interest clusters:** InnoZent OWL, Initiative „Paderborn ist Informatik!“, BVMW, iTMW, BJU/ASU, MEIM, Wirtschaftsjunioren/-club (association/club of junior business professionals).

The following table gives an overview of some exemplary interest sub-clusters without explicitly naming individual cluster members. The active players within the research and technology clusters as well as in the educational cluster are listed below without claiming the list to be complete.

Research and technology clusters
Active players: University of Paderborn, Heinz Nixdorf Institute, International Graduate School, Fraunhofer Institute

Competences	Strengths	Weaknesses
Proven research and training competences on national and international level for high-technology professions within the information and communication technology sector with a close link to companies from neighbouring lines of business which integrate ICT into their products and services.	▪ High degree of networking on numerous levels. ▪ High degree of co-operation with private companies. ▪ Historically sound co-operation. ▪ Numerous informal contacts: - on regional level, - on national level, - on European and global level. ▪ Numerous event formats for involving the “public/private co-operation partners”	▪ No central co-ordination or organization body. ▪ Limitations due to the intricateness of activities. ▪ Lack of transparency for the cluster members.

Educational cluster
Active players: Siemens Academy, FHDW, b.i.b., InBIT, FGE/Mettenmeier Group

Competences	Strengths	Weaknesses
Highly reputed institutions providing competent services to all areas within IT training and further education.	▪ High degree of networking with public and private clients. ▪ Expert know-how regarding the process of procuring funding for innovative projects. ▪ High market transparency for all active players. ▪ Intensive formal and informal contacts due to the low number of players.	▪ No central co-ordination or organization body.

Interest clusters
Sub-cluster: InnoZent OWL, Initiative „Paderborn ist Informatik!“, BVMW, iTMW, BJU/ASU, MEIM, Wirtschaftsjunioren/-club (association/club of junior business professionals).

Competences, strengths and weaknesses for several sub-clusters taken as an example

Competences	Strengths	Weaknesses
InnoZent OWL		

Established cluster for technology transfer and exchange of information. Clear focus on enterprises acting as technology supporters, in particular for the IT industry and related IT sectors.	▪ High degree of networking extending beyond the region of OWL. ▪ High level of organization, formal management. ▪ Regular events organized for member businesses.	▪ Dependent on public funding. ▪ Regional focus of the members on Paderborn/OWL. ▪ The entire IT industry of Paderborn is not represented.
Initiative: "Paderborn ist Informatik!" (Paderborn is information technology)		
Small, high-impact network with focus on the sectors banking solutions, graphics & design, economic development.	▪ Small, high-impact cluster with a clear know-how profile. ▪ Short decision-making paths possible. ▪ Fast implementation of shared decisions. ▪ Utilization of the economic development management competence.	▪ No formal organization profile. ▪ Only consent decisions can be supported.
iTMW		
Interest clusters for shared marketing and the individual solution competences according to the motto: Everything from one hand! A focus on special ICT areas does not take place.	▪ Small, high-impact cluster. ▪ Clearly defined, common targets and objectives. ▪ Individual competences can be combined to create a shared service offering.	▪ No formal management.

Conclusions

Cluster management appears to be functioning particularly well where a co-operation between businesses evolves from existing informal contacts with the businesses agreeing upon and pursuing mutual targets. The capacity to act and the flexibility of clusters tend to decrease with increasing cluster size, whereas their common impact increases with increasing volume where bundling of competences is concerned.

Basically all clusters have an organization or management unit promoting the interests of the cluster members. For small, mainly regionally acting clusters these organization units can be informal and not institutionalised. For clusters acting on cross-regional, national or international level we always find a management unit employing full-time staff to represent the interests of their members.

In order to "create" high-impact clusters one is advised to initially look for existing co-operations which often result from informal contacts. In the next step suitable active players must be brought together to define shared targets. If this is done successfully, an action plan will be drawn up to take first common steps and to support the functional and cooperative capabilities of the partners and to be able to regulate the process where necessary. Finally all partners must come together to define whether and in which form a professional cluster management is to be established and whether the cluster is to represent a "closed shop" or can be extended by suitable partners.

In the course of the process the question will arise as to whether there are "critical" cluster sizes requiring a mandatory formal management and whether there is the equivalent of an "optimum" cluster size within the information and technology industry. This question is also of interest for Paderborn. "Optimum" in this context is to be understood as an ideal combination of cluster impact and versatility of cluster competences on the one hand, and on the other hand the intensity applied by the members to pursue their individual interests. In

general it can obviously be assumed that individual cluster members feel that the level of representation of their interests by cluster management will decrease with an increasing number of cluster members. A possible consequence of this is the sinking engagement shown by the members affected which, in turn, can lead to a weakening of the overall cluster.

3.3 Organisational framework & Cluster Management

From the viewpoint of a formal co-ordination and control, the organisation level of the Paderborn cluster can be regarded as hardly present or non-existent. Yet there are active players which are accepted by the enterprises, and these players are initiating and transferring topics under various aspects. In addition to addressing specific industries, the contents and/or the target groups addressed in many respects also include companies from the ICT sector or approach them directly (e.g. knowledge transfer from research / companies). The dominating presence of this industry in Paderborn has the effect, for example, that an increasing number of IT enterprises are represented on various contact platforms.

The local players mainly include the Wirtschschaftsförderungsgesellschaft (association for the economic development) and the Technologieparkgesellschaft (company running the technology park) of the city of Paderborn, the non-profit organisation InnoZent OWL, Uniconsult (transfer organisation of the university), and the Paderborn forum “Industrie trifft Informatik” (industry meets computer science).

Wirtschaftsförderungsgesellschaft of the city of Paderborn

In addition to carrying out traditional tasks of economic development, the following activities are of high importance:

- Topic transfer from research / science in the direction of companies and vice versa.
- Initiation of dialogues, e.g. between companies, between science and companies, on regional level.
- Creation of communication platforms for companies on regional level.
- Support / organisation / co-ordination of processes with the aim of forming a continuous exchange of information, experience and knowledge.
- Initiation of and contribution to various workgroups and networks on local, regional, and national level.
- Numerous memberships (Technologie Forum Paderborn, InnoZent OWL, etc.).

One example for a successful communication platform is the Paderborner Firmenforum (forum consisting of Paderborn companies). In 1997, five companies located in Paderborn and the Wirtschaftsförderungsgesellschaft mbH joined up to found the Paderborner Firmenforum under the motto “promoting competition by strengthening the location”. This initiative aims at strengthening the Paderborn location as well as improving the employment situation and the competitiveness of companies by promoting the co-operation between enterprises located in Paderborn and increasing the order volume from the region for the region. The benefits of the Paderborner Firmenforum mainly lie in the initiation of business relationships by giving potential partners the chance to meet on a personal level and by supplying a diversity of information provided by the companies involved either as a host or as a lecturer. The forum provides a personal contact platform with five to six in-house events per year taking place on the premises of larger companies from the Paderborn location. By now three to four small and medium enterprises (SME) always

use these events as an opportunity to introduce themselves. With approximately 6 events in 2007 the 50th meeting will be organised. In addition the forum has initiated an electronic corporate information system, the UIS, located in Paderborn which can be used by companies from Paderborn to present their profile and introduce their products, services and specific know-how.

TechnologiePark operating company of the city of Paderborn

In addition to the typical tasks carried out by an organisation managing a technology park there are activities which can be positioned close to an "informal" cluster management. Common targets are achieved by means of topics or by addressing target groups:

- Co-operation in / contribution to an exchange of experiences and a knowledge transfer within the framework of launching start-ups from within the University of Paderborn.
- Creation of information / communication platforms for companies located in the park or for external companies.

Projects in the context of the university

As a major partner of UNICONSULT (the technology transfer organisation of the University of Paderborn) the Technologie*Park*Paderborn GmbH is involved in the **"EXaM" project**. "EXaM" is used as a tool to analyse the specific situation of intermediate supervising staff from the areas of mechanical engineering, electrical and information technology, industrial engineering, business data processing and computer science at the University of Paderborn under the aspect of funding start-ups.

In 2005 the **SIGMA project** has been continued in cooperation with UNICONSULT, the transfer organisation of the University of Paderborn. The project was financially supported by the Sparkasse Paderborn and the Technologie Forum Paderborn e.V. During the summer semester 2005 workshops were held which dealt with topics such as the simulation of the formation of businesses. An interdisciplinary series of lectures was again offered at the university of Paderborn during the winter semester 2005/2006.

The "business update 2005" competence programme for students and junior staff has been implemented successfully in co-operation between a consulting firm residing in the park and Uniconsult. On five training days the participants were trained in various competence fields by a professional coaching team.

Projects for companies residing in the park

Another ongoing project is the "Unternehmensübergreifende Unterricht" (cross-business teachings) for trainees in the Technologie*Park*. 33 trainees currently employed in the Technologie*Park* are participating in the "Unternehmensübergreifenden Unterricht" to acquire specific technical competences for their career in addition to the skills taught at vocational school.

With the "breakfast briefing" series of lectures for companies residing in the Technologie*Park,* this platform has been continued to improve the internal communication. 2005, too, saw the evolving synergy effects within the Technologie*Park*.

Projects for companies residing in the park / external companies and the public

In October the SmartHomePaderborn e.V. was founded with the support of the Technologie*Park*Paderborn GmbH with the aim of building a low-energy house within the Technologie*Park*. All technical and media areas of the house are interlinked in a digital network and operated as an information and sales platform.

Non-profit organisation InnoZent OWL

InnoZent OWL brings together business and technology. The non-profit organisation aims at focussing knowledge and competences from the region to provide them to all interested users. Events and workshops, know-how and project platforms are used to facilitate the deployment of new technologies for small and medium enterprises. These activities include, for example, the co-operation and co-design of the OWL forum for technology and innovation called “solutions”. Supported by seven other regional organisations (e.g. the chambers of commerce and industries as well as industry networks) the organisation pursues the common goal of exposing the technology-oriented service potential of the region and creating incentives for innovation. Numerous events are used to present and discuss topics from various technology sectors. These events serve to address technical and management staff, in particular, from companies, research institutions and economy-related organisations. The forum has been active since 2003. Further activities of the non-profit organisation include the project “Semikon” (acronym for “Seminarkompass OWL” = seminar guideline for the region OWL) supporting people interested in further education in their search and decision regarding the appropriate educational offer, and offering education providers an orientation for their programmes in addition to providing a sales channel. The non-profit organisation is also involved in the national initiative “Seminar-integration” (integration of seminars).

Paderborn Forum “Industrie trifft Informatik” (industry meets computer science).

In order to intensify the dialogue between commerce and science, the computer science professors at the university of Paderborn founded the forum “Industrie trifft Informatik" in cooperation with the Paderborner Wirtschaftsförderungsgellschaft. […] Computer science plays a central role for securing and further developing technological locations such as Paderborn. Resident companies are increasingly expected to quickly detect new developments within computer science and assess and implement them to develop new projects and improved processes. In Germany the University of Paderborn is one of the leading institutions with regard to teaching computer science. What matters now is to use this top position as a major locational advantage for the benefit of the regional economy. This is one of the most important objectives for the forum. Within the scope of the initiative “Industrie trifft Informatik” the university representatives intent to intensify the practical orientation of research and student education in a dialogue with industry, and to support companies in implementing the results as far as their commercialisation. In addition the forum is also intended to create a network of companies where business representatives exchange ideas and information about similarly positioned issues. The computer science department at the University of Paderborn offers industry traineeships, project groups, summary lectures on current topics, etc. to enable co-operation with the industry. The lectures offered by the research sector comprise, among other things, tools studies, current topics, know-how transfer and launching of spin-offs.

> ”The forum “Industrie trifft Informatik” has been integrated institutionally into the Technologie Forum Paderborn since the beginning of 2002. “Industrie trifft Informatik” is one of the forum’s main activities which are aimed at promoting the dialogue between economy and science.”
>
> (Source (in German only): http://wwwcs.uni-paderborn.de/cs/kooperation/iti.html)
>
> The Technologie Forum Paderborn is focussed on “intensifying the dialogue between all social groups regarding technology and future issues, to identify opportunities in co-operation with them and to strive for benefiting from the opportunities identified by applying concrete actions. In this process the support of communication between economy and science is of particular importance: Utilisation of the innovative potential of science is a major contribution to increasing the innovative power of the local economy.”
>
> (Source (in German only): Website http://www.technologieforum-paderborn.de)

The activities include, among other things, the Paderborner Technologiegespräche (Paderborn technology discussions) and the project SIGMA.

4 POLICIES

Federal level

For the German economy, information- and communication technologies have gained in importance, and the significance of this branch for the overall economy has constantly grown during the last few years.
The value-added potentials of ICT and digital media are great and therefore represent important factors for growth and employment. This can, for instance, be gathered from the gross value added of the ICT-branch which is meanwhile with 87 billions in first place before the Mechanical Engineering and Automotive Engineering (1994:4.7% of the GDP, 2004: 6.8%). This trend will continue since the ICT-branch has a substantially stronger growth than the overall economy. The German Association for Information Technology, Telecommunications and New Media (BITKOM) has forecast a turnover of approx. 137 billion Euros (2005: 143 billion Euros) for the sector of information and communication technology and the Organisation for Economic Co-operation and Development regards the ICT sector to be the leading innovation sector world-wide. About 50 % of the industrial production and approx. 80 % of German exports are directly associated with the information and communication technology. A further evidence for this development are the employment figures in the ICT sector, offering about 750,000 people a job, and the number of employees in the application branches, which has been numeralised with approx. 650,000 by the ICT specialists. In order to comply with this significance the Federal Government has provided in its programme for the modernisation of the legal and technological basic conditions with the aim to promote development processes in this branch (keywords are convergence, mobility, networking). On the part of the Federal Government information and communication technology is regarded to be an innovation booster for the German economy. Of all expenditures made in the field of the economy's research and development about 25 % are used by the ICT sector. If you take the indicator of all patent applications you will discover that about 20 % of all patents will be granted in this sector. The Federal Ministry of Education and Research will therefore centre its political orientation on information and communication technologies during the next years. They will act according to the principles Excellency (including among other things the national and international comparison with the best of their branch), Preference for Innovation (Usage and extension of top positions, stronger integration of this technology in other branches, development of new fields of application and promotion of interdisciplinary approaches) and bundling of powers (even stronger combination of powers from politics, science and economy).
The Federal Government understands its programme as a part of the reorientation of the Lisbon strategy and will support the European Union with the realisation of the strategy "i2010 - A European Information Society for growth and employment". In 2006 the Federal Ministry of Economics and Technology will elaborate an action programme by the Federal Government called "Information society Germany 2010" (in short iD2010) and coordinate its realisation.

More concrete and political approaches for promotion within the frame of cluster policy are, apart form an increasing orientation on innovation of the regional policy, a stronger regionalisation of the innovation and technology policy. So far these have been:

BioREGIO The aim is to promote the usage of knowledge and cognition in the field of biotechnology – i.e. convert ideas into products, production processes and local services – and to maintain and create qualified jobs with a high added value in Germany.
InnoREGIO The aim is to establish self-supporting innovation networks which consolidate the innovation potentials of their region to a competitive achievement-orientated profile by new ways of cooperation.

ProInno I / ProInno II With its promotion programme ProInno II the innovation power and competitiveness of small and medium-sized companies shall be supported. This is an effective contribution to the creation and maintenance of jobs.
EXIST (EXIST-SEED is a nationwide promotion programme for the direct support of technology-orientated foundations of enterprises in their starting phase. Future founders from universities will be supported in realising their idea of founding a company by means of a business plan)
Source: Corresponding web appearances of the BMBF

Regional level

At regional state level numerous attempts for clusters have been made in the various federal states, whereas especially in Bavaria a cluster offensive Bavaria (approx. 19 nationwide clusters referring to individual trade sectors and technology fields), the extension and promotion of regional networks between local authorities, local economy, academic facilities and the chambers and approaches for projects in the fields of automotive, logistics, mechatronics, financial services and the ICT sector have been combined in the name of Allianz-Bayern-Innovativ. Also the federal state of lower Saxony (Niedersachsen) strives, among other things, for an increase in cooperations and innovation networks with its Initiative Regionale Wachstums-konzepte (Initiative for regional growth concepts).
It is obvious that also for NRW information and communication technologies are of outstanding importance. On a national scale the ITC enterprises in NRW are amongst the most top-performing companies: more than 55,000 companies in the state employ approx. 350,000 people and made a profit of almost 120 billion Euros in 2003. For the future they focus on an increased usage of broadband: Networks, services and terminals will converge even better in this area, resulting in the formation of new markets for appliances, services and digital contents – the basis for further product and process innovations in all field of economy as well as a new phase of effective growth.
The federal state NRW has so far accommodated these facts more cautiously than for example Bavaria. The realisation that key technologies play more and more a key role initiated the state NRW to reorganise its structural policies. Whilst the previous structural policy was based on an attempt for competence fields (1999 determination of the competence fields for the Ruhrgebiet, 2003 expansion of these field to a total of 12 competence fields; promotion by the European Union of Objective 2-areas) there is now, regarding the reorientation of the ERDF-programme (combination of structural policy and Lisbon-strategy), the base of expanding the development of clusters and their management as an essential element for further advancing the innovation processes, including the competence field of the IuK-technology.

Participation in the promotion of cluster policies on a regional level

So far the promotion of the policies of competence fields / cluster policies has basically been orientated on the promotion by the European Union of the so-called Objective 2-areas. Predominantly this promotion is targeted on identifying structure-weak regions, on supporting them to form a profile in order to create starting-points for a better and quicker adaptation to the altered frame conditions.
OWL and Paderborn belong to the so-called Objective 3-development area and have so far only been able to participate in the promotion of competence fields indirectly. Via the Objective 3-promotion there have been starting-points from the so-called political field D-promotion, which centred exclusively small and medium-sized enterprises. Especially the promotion of joint projects has to be named. The aim of these joint projects is the support of operational modernisation processes in order to secure and expand competitiveness. In doing so, regional conditions

and needs are taken into consideration. Three to 10 companies working in the same or different branch of industry can take part in this project. These projects are organised and coordinated by experienced consulting organisations. Free from this promotion different industrial networks (among others OWL-Maschinenbau, InnoZent OWL, Zentrum für Innovation in der Gesundheitswirktschaft), regional networks (such as OWL-Marketinggesellschaft) and also educational networks have emerged, being promoted by federal and regional funds.

The reorientation of the ERDF-programmes 2007-2013 defines three basic focal points. The basic focus Innovation and Knowledge-based Economy is aimed for the promotion of research/development, of innovative services and the development of networks and clusters, among other things, in which the city of Paderborn sees a great chance to participate.

Extracts from the NICE questionnaire on cluster analysis:

Q-3-1: What cluster-related policies do exist on national/regional level and of what type are they?

Appellation	Policy Level		Type of Policy			
	National	Regional	1	2	3	4
Landesinitiative Systemintegration (InnoZent OWL, Uni-PB, Fraunhofer)	X					X
Kunststoffe OWL (Kunststoff-Cluster)		X				X
InnoZent OWL (IT-Cluster)		X				X

1=interventionist, 2=direct, 3=supportive, 4=catalytic

Q-3-4: Please rate the relevance of the following government policies for the cluster development (1=not important, 5=important).

Type	Scope	Rating

		1	2	3	4	5
Firm-oriented support	Financial support of firms' projects	☒	☐	☐	☐	☐
	Advice and consulting for individual firms	☐	☒	☐	☐	☐
Attraction	Policies to attract outside firms to the cluster	☐	☐	☐	☒	☐
Support infrastructure	Physical infrastructure	☐	☐	☐	☒	☐
	Knowledge infrastructure	☐	☐	☐	☒	☐
	Specific service or technology centres	☐	☐	☐	☒	☐
	Other cluster organisations	☐	☐	☒	☐	☐
Provide information	On technology fields	☐	☐	☐	☒	☐
	On general business fields	☐	☐	☐	☒	☐
	On market/ export fields	☐	☐	☐	☒	☐
Support training, research, recruiting	Education and training programs	☐	☒	☐	☐	☐
	Research programs	☐	☐	☐	☒	☐
	Mobility schemas	☐	☐	☐	☐	☐
Support collaboration	Networking and collaboration programs	☐	☐	☒	☐	☐
	Foster social interaction	☐	☐	☐	☐	☐

5 CONCLUSIONS

The current cluster management of the Paderborn ICT clusters can be regarded as functioning, and it seems to be a formal cluster management that can basically be extended. Following previous experiences made with cluster management, clusters can be initiated to a limited extent only. Clusters must grow from within themselves – which may take considerable time – and are partly tied to the people generating this process. For the Paderborn location these experiences have partly become reality, and current findings can be used to formulate initial assumptions to be verified in the future course of the project.

Paderborn ICT cluster

The structure of the Paderborn ICT cluster can mainly be characterised as follows:

- There is a "**technology-driven**" cluster at the Paderborn location.
- This cluster includes the **ICT sector as one of the competence fields** of the location.
- There are various identifiable **sub-clusters** within the ICT sector.
- These sub-clusters should mainly be characterised as **local** clusters and **topic clusters**.
- On the one hand, **local** clusters can basically be seen in the context of the historical development of the Paderborn ICT cluster; on the other hand they can be initiated by specifically creating a local closeness between science and economy (Technologie*Park*).
- The **topic clusters** include educational, research, technology and "interest" clusters. Here, too, the history of the location plays an important role.

Local clusters can be understood as the basis for the existence and development of the other clusters. In this context the structural advantages seem to be unified by a mixed form.

Major players within the framework of cluster management / "cluster players"

Apart from institutions and interest groups which are organised on a national level and are also active in Paderborn, cluster management within the ICT sector includes the following **main players**:

- the Wirtschaftsförderungsgesellschaft / Technologieparkgesellschaft of the city of Paderborn;
- the non-profit organisation InnoZent OWL (headquartered in Paderborn);
- the forum "Industrie trifft Informatik" (headquartered in Paderborn).

In the recent past two enterprise groups from the ICT industry have joined up to launch **initiatives**. While one of the two groups of companies aims at joined marketing under the motto "IT-Kompetenz aus einer Hand", the other group is mainly committed to increasing visibility in the context of Paderborn as an IT location. In addition to involving partly institutionalised players, this development can also be an indication for the fact that the framework conditions and the current cluster management approach seems to encourage companies to become active themselves. The membership of BMW in the first group and the integration of the Wirtschaftsförderungsgesellschaft into the other group are also an indication for this development.

Form and "level of formalisation" of cluster management

Form and level of organisation of cluster management can be described as follows:

- There is no formal cluster management in the shape of an organisation carrying out, for example, organisational, coordinating tasks for the cluster **on behalf** of ICT companies.
- There is, however, an **informal** cluster management which is provided by the various players within the economic location.
- The **variants** of informal cluster management differ very much in degrees and can be described in certain terms ranging from "is getting close to cluster management" as far as "joined up on the basis of short-term interests".
- The **highest "degree of formalisation"** and the most distinct institutionalisation can be noted within the topic cluster where the research / technology sub-cluster shows the most clearly defined content and target groups.
- The different forms of informal cluster management are currently reflected by the **various compositions** and **activities**.

The examples from Paderborn show that cluster management approaches seem to function very well if the idea to take joint steps evolves out of an existing informal context and is supported and implemented by some initiators taking responsibility for it. However, this does not mean that the existing management approaches are challenged by these activities; instead these actions can be understood as a supplement to the approaches.
Prerequisites for a functioning of (informal) cluster management, such as an acceptance of the cluster players, a certain degree of trust, approval of the management competences, embedding of existing structures, guarantee of a certain consistency, etc., seem to be fulfilled to a certain degree at the location.

Objectives, target groups and content of informal cluster management

For all players the core of cluster management is the creation of occasions building the foundation for the acceptance of business contacts in the closer and broader sense. To this end an organisational framework is usually made available. Topics and organisational framework vary to a certain degree, depending on the target groups addressed. Communication platforms can hardly be found unless the economic players are addressed across industries. If the focus is on players from the ICT sector, technical events with the aim of providing an exchange of knowledge and experiences are in the foreground.

Core competencies of cluster management and what can other regions learn from the experiences made?

The mix of partly rather institutionalised structures and processes, and structures and processes specifically kept informal seems to be tailored to meet the needs/requirements of companies for the time being and to a sufficient degree.

The mainly **supplementary co-operation** of the various players and the **offering** resulting from this co-operation are currently the measure for a "profitable" basis for preparing the ground for business relations.

It can be assumed that it is the very **diversity of players** carrying out activities similar to the range of tasks of a formal cluster management, which catches the interest of the cluster members.

This diversity of players and their various "interests" create a richer **information diversity**, a higher **information level** and, thus, an additional transparency regarding the players and their activities.

The diversity of the players and the structures / framework conditions ensure that companies, on the one hand, can enjoy a **high level of freedom** in their decision to participate in a cluster and, on the other hand, **benefit to a high degree** from becoming involved in the cluster if they regard the participation as sensible.

What are the relevant topics to be discussed?

The following list contains some topics (in the form of questions) which are interesting for a discussion from our point of view:

- Which level of homogeneity / heterogeneity must / may clusters have and what are their effects on cluster management?
- Which role does the life cycle of clusters play (institutionalisation vs. project form) with regard to cluster management?
- Is the formalisation of cluster management a process running parallel to the development of clusters?
- Is there something like a "critical" cluster size requiring a formal management?
- How much freedom do cluster members need to be able to look after their own interest or have them protected by appropriate regulations?