Industrial Performance Center
Local Innovation Systems Project
Massachusetts Institute of Technology

Strengthening the Research and Educational Basis for Regional Development in Less-Favored Regions

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MIT-IPC-LIS-05-003

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A Local Innovation System Case Study Report

March 2005

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1. Introduction

In the era of knowledge-based economy the regional or local *knowledge environment* and *innovation environments* for specific business areas have become more important. In the knowledge-based economy the base of knowledge constantly evolves institutionally. The institutional evolvement actualizes itself by linking different kinds of knowledge-creation institutions to the knowledge-exploitation organizations and sub-systems through new kinds of knowledge-enhancing mechanisms, and mainly from R&D conducted in relation to regional capabilities (Cooke and Leydesdorff, 2004). Furthermore, new institutions are taking part in the local innovation networks, shaping the *technological change* and *transformation* in the region for the benefits of all parties, local businesses, universities or other higher education institutions and local/ national development authorities. If a region has only little formal and informal research and a few development institutions and particularly little interaction between them, actors find it more difficult to transform information (resources) into new knowledge and innovations.

In this study, Seinäjoki and Pori town regions are examples of the less-favored regions in Finland (either peripheral areas or areas without clear university-based education or research) which are building a strong institutional base for higher education (and research) institutions and university-based knowledge transfer systems to promote innovations and business development. The purpose of this chapter is to examine how the development actions taken in these town regions fit into the idea of strengthening the institutional capacity to support emerging industries and to strengthen the local *innovation environment*. Therefore, the following research questions have been included the case studies:

- *What kind of challenges Pori and Seinäjoki town regions as less-favored regions face when strengthening innovation environment for the concentrations of automation and embedded systems industries?*
- *How adequate is the concept of "institutional capacity" in aiming to make the respective less favored town regions more absorbent to new knowledge and technologies?*
- *What actual efforts have been taken in these regions to strengthen the institutional capacity, and more precisely, what efforts have been taken to 'bring new knowledge into' the region?*

The Pori and Seinäjoki case study categories of industrial development in this paper are a) diversification of traditional industries to technologically related industries (Seinäjoki) and b) upgrading the competitiveness of mature industries for the global markets (Pori). The

technology development processes under study are certain developments of automation technology in the region, more particularly the infusion of intelligent products and systems (smart systems), mechatronics and applied software[1].

The study is qualitative and based on written materials, statistics and reports gathered from these regions, relying heavily on 55 thematic interviews. The interviews can be divided into four different groups by parent organization of the interviewee: a) representatives of technology-intensive (automation, smart systems and software) firms (16); b) representatives of the Science Parks and Technology centers in Seinäjoki and Pori, Centre of Expertise Program (Satakunta, Seinäjoki and Tampere) and Technology Development Fund (Tekes) (13 representatives); c) representatives of university filials and polytechnics (16 representatives); and d) policy-makers in development agencies responsible for the promotion of economic development of Pori and Seinäjoki town regions and the regions of Satakunta and South Ostrobothnia (nine representatives). In the following sections, the ideas presented here are described in more detail and examined against the actions taken in Pori and Seinäjoki town regions.

2. Institutional capacity as a building block for regional competitiveness in less-favored regions (LFRs)

Changes in the world economy have had major implications for economic development strategies and territorial governance in securing or boosting regional economic success in the twin processes of globalization and localization (Goddard and Chatterton 1999). The technological infrastructure and the *institutional and organizational structure* of the locality have been of importance when a specific region has been capable of learning new ways in which to collect, produce and use knowledge. According to Maskell and Malmberg (1999), and Lundvall (1992, 1996 and 2002), a *learning economy*[2] indicates an economy in which the success of individuals, firms, regions and national economies reflect their capability to learn (and to forget old practices). Thus it is believed, 'learning regions' would be in a much better position than 'traditional' industrial districts to avoid a lock-in

[1] Automation, intelligence technology and embedded systems can be defined as "combinations of hardware and software whose purpose is to control an external process, device or system in order to provide intelligence to a larger system of which they are part". (Tekes Technology Strategy 2002 and "Building ArtEmIs 2004").

[2] The learning economy: An economy where change is rapid and where the rate at which old skills get obsolete and new ones become in demand is high, where learning includes the building of competencies, not just increased access to information, where learning is going on in all parts of society, not just high-tech sectors, and where net job creation is in knowledge-intensive sectors (Lundvall 1996, p. 2).

of development caused by localized path dependence. (Asheim 1995, Cooke and Morgan 1998, Goddard and Chatterton 1999, Virkkala 2003).

Therefore, innovation is an interactive process between firms and research institutions, between the different functions in the firm, between producers and users at the inter-firm level and between firms and the wider institutional milieu. In the institutional approach[3], the argumentation goes even further; it states that public organizations and institutions can have a significant role in promoting innovations. Institutional capacity is built on some institutional base in which the participants have certain abilities to also use these institutional settings. In general, researchers working on questions dealing with research and technology policy, regional economic development and competence building have stressed institutional elements which are meaningful in the economic development especially in less-favored regions. (Cooke 1998, Cooke & Morgan 1998, Morgan 1997, Lundvall 1992, 1996, 2002; Landabaso et al. 1999, Oinas & Malecki 1999, Kautonen & Sotarauta 1999, Kosonen, 2001 and 2004, Sotarauta & Kosonen 2003 and 2004, Sotarauta et al. 2002 and 2003, Virkkala 2003.)

The new thinking about *institutional capacity* focuses on the webs of relations involved in regional development policies, which interlink public development agencies, firms, and educational and research institutes in collective action. (Healey et al. 1999.) Once networks or coalitions are created and formed, actors in networks are able to create new spaces and common arenas to interact and manage the resources of institutional capacity. (Healey et al., 1999). This is stressed partly in the work of Storper and Venables (2002; see also Bathelt et al., 2002 and 2004; Sotarauta, Linnamaa and Suvinen, 2003) about the importance of a set of activities called the 'local buzz'[4]. Therefore, the existence or creation of "*public spaces as shared arenas"* (arenas in the form of 'local buzz') are the crucial element of the economic development of LFRs (see Healey et al., 1999; Bathelt et al., 2002; Sotarauta, Linnamaa & Suvinen, 2003; Amin and Thrift, 1995; Henry & Pinch, 2001) as presented in Table 1.

[3] The study strongly relies on the empirical findings from Pori and Seinäjoki, but also slightly follows the themes highlighted in the "innovation systems" and "institutional thickness" approaches in the (European) regional science and economic geographic literature.

[4] 'Buzz' is used to refer to the information and communication ecology created by face-to-face contacts, co-presence and co-location of people and firms within the same industry and place of region. (Storper and Venables 2002; see also Bathelt et al., 2002 and 2004.)

TABLE 1. The elements of institutional capacity

	Institutions	**Resources**	**Networks**	**Shared arenas**
Elements of institutional capacity in less-favored regions	Technological infrastructure	Visible, exchangeable resource base	Local and non-local innovation networks	Public forums, places to interact
	R&D&E organizations (HEIs)	Knowledge-related resources	Nodes and key individuals	Knowledge communities
	Non-org. institutions	Competencies	Interaction	Local buzz

Therefore, institutional capacity is understood in this article as a combination of the local needs of *knowledge resources* and the *partnerships* (coalitions and networks) made by individual actors (e.g. entrepreneurs, development agencies, university units, municipalities, technology centers) in certain institutional settings and certain spaces, in which development processes take place simultaneously. If the institutional base is 'thin', firms in the emerging sector do not get the appropriate assistance in their growth and internationalization processes and actors widely find it more difficult to transform information (resources) into new knowledge and innovations. These kinds of regions are called here "less-favored regions".

3. LFRs face many challenges as innovation environments for automation and embedded systems industries

In this study, *Seinäjoki and Pori town regions* are examples of less-favored regions (later LFRs) in Finland. Often these are regions that build their institutional base by forming collaborative knowledge institutions and models through networking. In the report on the regional roles of the universities by the Working Group of Ministry of Education (2001), the Finnish administrative regions were divided into three categories according to the effects of the national higher education institutions (HEIs) system: 1) growing and innovative, 2) neutral and 3) lagging behind. On this list, Satakunta (the main city Pori) and South Ostrobothnia (Seinäjoki) were among the *neutral regions* in which the knowledge infrastructure is supposed to be strong enough to get some positive outcomes for the local and national economy, but not as strong and effective as those defined as most

innovative growth regions in the country[5]: In the regions of the last two types, polytechnics play an essential role, particularly in the regions that do not have independent universities (Ahmaniemi & Setälä 2003, Lievonen & Lemola 2004, Ministry of Education 2001 and 2004, Rantanen 2004). As an outcome of this many regions induced universities to launch university filial consortia in 2001–2004 in Kajaani, Kokkola, Lahti, Mikkeli, Pori and Seinäjoki (see locations in figure 1). These concentrations of small filials were called "university filial centers".

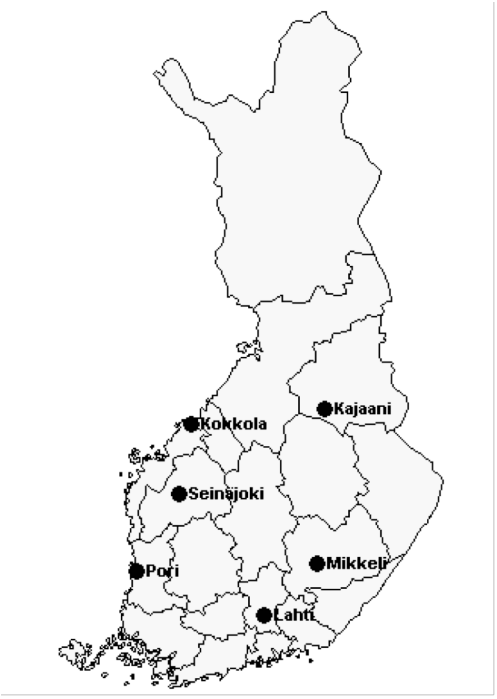

FIGURE 1. The six university filial centre locations in Finland

The term *'university filial center'* itself stands for local structure (a building or other concentration of academic institutions), where several campus universities have established branch units in the same town or the same town area, in close proximity to the science parks, technology centers, polytechnic facilities, for example. The very basic feature of these filial centers is that they consist of several academic institutions, ranging from three (Kokkola) to six (Seinäjoki). Another common feature of all these small and medium-sized cities is that a) they are the central cities or towns for their larger regions and b) they still do not equal to the 'growth centers or regions' in Finland. The first university filial center was officially nominated in the town of Lahti in 2001. The most recent nominees are the

[5] Uusimaa/ Helsinki, Varsinais-Suomi/ Turku, Pirkanmaa/ Tampere, Pohjois-Pohjanmaa/ Oulu, Pohjanmaa/ Vaasa and Keski-Suomi/ Jyväskylä. These university cities are also cities or towns with at least decades- or even centuries-long (e.g. Turku) history of academies.

towns of Mikkeli and Seinäjoki. By the end of the year 2004, the university filial center network was 'frozen' to the level of these six towns and their filial centers at least for a while to see the impact of these centers on the respective regions, universities and the national higher education system. In the peripheral regions, the universities offer local students several Master's Programs at the expense of local authors (e.g. regional councils, district governments, the municipalities, health care districts). The recent evaluation of Master's Programs (Puukka 2004, Raivola et al. 2002) still encouraged universities.

4. Challenges for automation industry and embedded systems providers located in LFRs as Pori and Seinäjoki

The automation industry relies heavily on the *Finnish information and communication (ICT) cluster*. By the end of the 1990s, the economic importance of the ICT cluster grew rapidly. However, in the less-favored regions, the development process was much slower and the ICT cluster did not play a remarkable role in the local industrial or business life. (See e.g. Ministry of Education 2001 and 2004). As a realization of this phenomenon, local development agencies in the Seinäjoki and Pori town regions enhanced the use of high-tech applications in all industrial production and created new future possibilities for local companies as a breakthrough for new emerging industries[6]. Recent reports (Ministry of Education 2004, Ministry of the Interior 2004) show that the Finnish growth cities are mainly the capital region (Uusimaa), southwest region (Varsinais-Suomi), Tampere Region (Pirkanmaa), Oulu Region and Central Finland Region. Of a total of 19 Finnish regions, 14 are mainly stagnated or have lost their respective competitiveness. (See the appendices.). For the LFRs, the starting point may not be encouraging, as Pori and Seinäjoki town regions and their surrounding regions -- Satakunta and South Ostrobothnia, for example -- suffer from a low level of higher education and research, brain drain characteristics, and cutbacks in educational and research resources (see figure 2). (Regional Development Programme for South Ostrobothnia 1994 and 2002, Ministry of Education 2004, Ministry of the Interior 2004).

[6] These are, for example, whole system providers and controlling system providers, industrial robots and process machines developers, automation component manufactures, entertainment technology providers, medical information systems providers as well as automation designers and software companies.

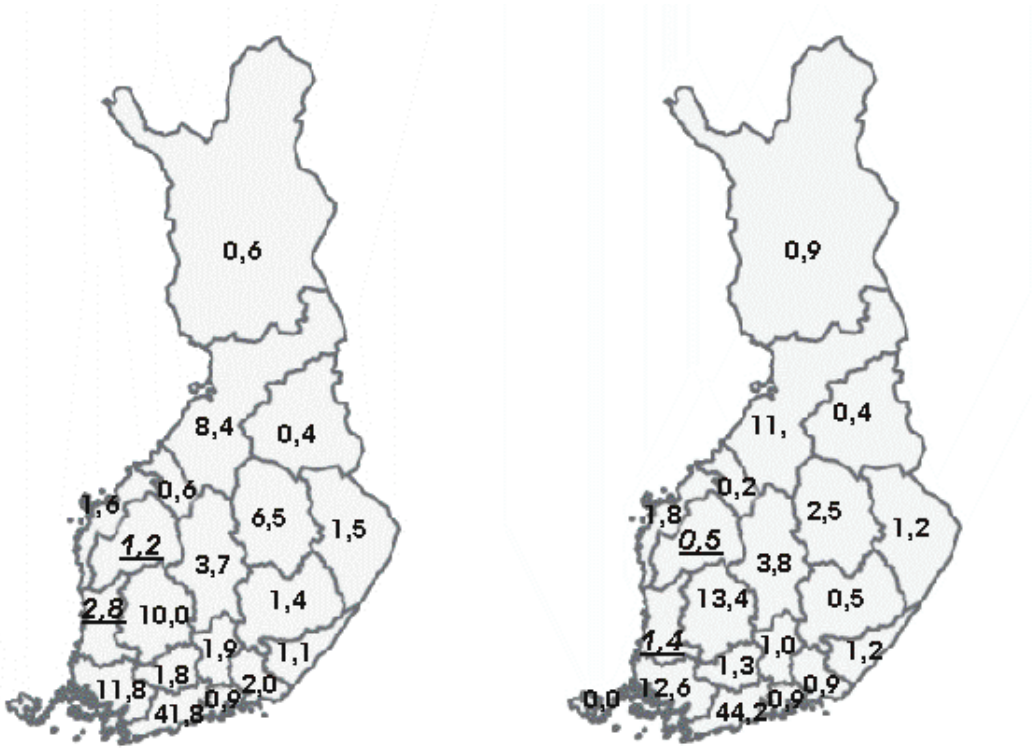

FIGURE 2. The share of Finnish regions in TEKES funding for companies in 2003 (left) and the R&D share of respective regions in 2002 (right). (Sources: Statistics Finland and Tekes 2004). *Figures for South Ostrobothnia and Satakunta Regions in italics.

The main challenge for the these industries located in LFRs like Pori and Seinäjoki is how to use local, national and international innovation support tools actively to meet the increased requirements for designing, producing and marketing complex and interactive (embedded) systems in global markets. Globalization highlights the resurgence of certain localities, regions through the integration of production at a regional level and the decentralization of large corporations into clusters of smaller units (through outsourcing) and smaller businesses: e.g. sub-contractors, suppliers, franchises. (Goddard 1999, Goddard and Chatterton 1999, Goddard et al. 2003).

In both case regions, the concentration of automation and electronic production firms are linked to each other in many ways, either through sub-conducting or by ownership. The firms in the field have specialized expertise in certain very narrow areas of mechanical engineering, automation and intelligent engineering solutions[7], whose main market areas are global. Therefore, the flexibility and set of innovation

[7] "The development of intelligent products, processes and systems involves the cross-technological application and development of various technologies and application targets, including learning and anticipating systems, systems that adapt to the operating environment, well functioning and bio-compatible materials, personal and natural interfaces, systems and services based on positioning and identification as well as solutions based on remote diagnostics, remote operations and virtual reality". (Tekes Technology Strategy 2002, p. 10).

capabilities (capacity) of local as well as national knowledge based 'system' are crucial for these companies classified merely as industrial SMEs. Figure 3 presents the development path from the by-production of metal and machinery sectors with simple techniques to closely collaborating whole system providers with highly complex applications and technology.

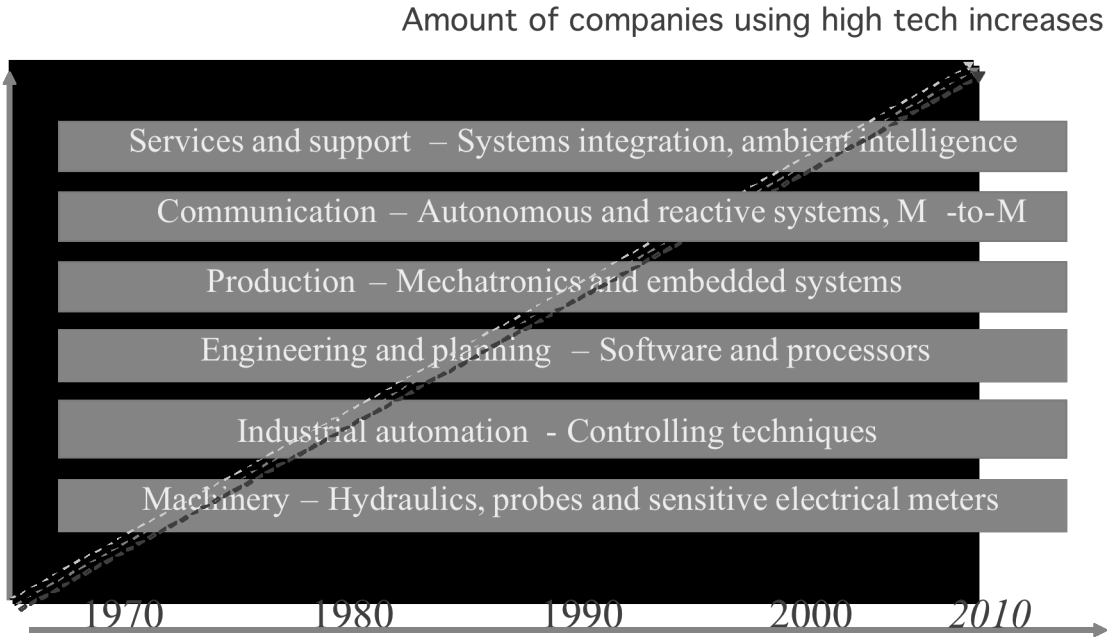

FIGURE 3. Emerging industries and technologies of special interest in Pori and Seinäjoki town regions[8].

Most automation and intelligence technology enterprises in the case regions were internationalized already in the 1990s, or their main market areas or alliances are regarded to be international from the very beginning of the company's lifetime. The leading companies and especially the main contractors (customer companies) produce most of their products for exports. The main market areas for the leading companies are the EU countries, China and other rising Asian economies, as well as Finland, Nordic Countries, the USA and some of the so-called transition countries in Europe.

Pori - Automation and embedded systems

The Pori town region is the eighth biggest city region[9] in Finland and one of the four administrative sub-regions (town regions) in the larger region of **Satakunta**.

[8] Adapted from Tekes Technology Strategy 2002 and "Building ArtEmIs" by European Commission 2004 but based on LIS interviews.

Satakunta is located on the southwest coast of Finland (by the Gulf of Bothnia). The Pori town region had 115,870 inhabitants and the town of **Pori** 75,955 in 2001. The town of **Ulvila** (founded in 1365), where most of the automation technology firms are located, and the town of Pori together had approximately 90,000 inhabitants in 2001, thus forming the urban centre for the region.[10]. The Satakunta region in its turn represents 4.7% of the nation's population, but as much as 8% of the total industrial production of Finland. There are about 93,000 workplaces in Satakunta; the majority of those are located in the Pori town region (45,600), although the unemployment rate in the region is one of the highest in Finnish regions: 16.1% in the year 2001. At the same time, the total unemployment rate in Finland was 12.5%. The education level of the active workforce was lower than the Finnish average in the biggest Finnish cities, as the 56.3% of the people older than 15 years had a degree; on the average, the figure was 57.7% in the whole of Finland.

The leading firms in the automation field are classified as whole systems and machinery providers (conductors), as they sell their products directly to other industrial companies. In the Pori–Ulvila area, if the local agglomeration is defined strictly as consisting only of technology-intensive automation and electronic companies (electronics and automation), it includes only 55-60 firms (with approximately 450 employees in 1999 and 650 employees in 2003). Still strictly defined, the field has an annual turnover of approximately 50.7 million euro (in 2000). More broadly defined (incl. automation technologies, ICT with welfare technologies and electronic production technologies), the field has approximately 1,400 employees with approximately 150 plants and an annual turnover of 380 million euro in the early twenty-first century[11]. The history of the local agglomeration of automation firms originates dates back to 1853 to the newly established Rosenlew family business in Pori. The Rosenlew company started its agricultural machinery in 1900 and combined harvesters in 1957, but the actual starting point for the automation field was the opening of Rosenlew Tool Factory ("Rosenlew Työkalutehdas") in the 1970s. The boom of small automation, software, robotics and electronics companies were in the late 1990s and the beginning of the twenty-first

9 Source: Ministry of the Interior, Kunnallistilasto 6/2002. (Statistics on the Finnish municipalities) Suomen Kuntaliitto.
10 Sources: The Regional Council of Satakunta, and Regional Development Centre Program Pori Town Region, Statistics Finland, Ministry of the Interior, Kunnallistilasto 6/2002, Suomen Kuntaliitto.
11 Sources: The Vision of Satakunta Region 2010 (2003), and The Regional Technology Strategy Satakunta 2001.

century[12]. Generally, biggest companies that have their offices or plants in the region also belong to the biggest R&D investors of Finnish industry and very often operate globally. They also have private R&D departments with relatively high-scored R&D outcomes; for example, Pori town region performs better in patenting (domestic patent applications) than many other Finnish town regions (Oksanen, Lehvo & Nuutinen 2003).

Seinäjoki – Embedded systems and intelligent technology

The Seinäjoki town region (approx. 70,000 inhabitants) is a central service center for a large traditionally agricultural area called **South Ostrobothnia** (approx. 200,000 inhabitants). South Ostrobothnia accounts for about 4% of the total population of Finland and its population density is 15 inhabitants per square kilometer. The Seinäjoki town area has been growing steadily for the last 40 years, while the whole of South Ostrobothnia has been losing its population. In the Seinäjoki town region, the education level is higher than in Finland on average, but in the whole South Ostrobothnia, the education level is one of the lowest in Finland.

The innovation-supporting structures and innovation culture have been weak until the turn of the century, and most of the firms in the region operate on short time horizons. The best firms in the region, however, are technologically at a high level, but their number is estimated to be very low (The Technology Strategy of South Ostrobothnia 2003). Most of the region's firms are micro-firms employing less than three people, and most of the micro-firms and even the larger ones are not particularly well suited to meet the challenges of the knowledge economy (see Kautonen & Sotarauta 1999, Regional Development Programme 1994 and 2002, Sotarauta & Kosonen 2003 and 2004).

The leading companies in the field of embedded systems are technology developers (innovators), supporters and service providers (technology transfer and consultancy), or appliers and utilizers[13]. The agglomeration of metal manufacturers and software service providers is the second strongest industrial sector after the foodstuffs sector in the South Ostrobothnia region. The representatives of the Seinäjoki Centre of Expertise for Intelligence Technology calculated 770 companies (with 3,380 employees) operating in the region, either applying or developing

[12] Sources: LIS interviews, and in the case of Sampo-Rosenlew, http://www.sampo-rosenlew.fi/english.htm (accessed 28.4.2004)
13 Source: LIS case interviews, SeiTek 2002 report: Mechatronics and embedded systems. Seinäjoki Polytechnic.

intelligence technology in the year 2002 (Statistics Finland, 2002[14]). The embedded systems and intelligent solutions (largely defined) sector is also the largest exporting sector of the industrial branches and enterprises located in the region. The combined annual turnover of the leading 40 companies in the field of intelligence technology amounts to approximately 600 million euro. Their production reaches about half of the value of the biggest industry sector in South Ostrobothnia, the food-processing industry, which employed approximately 3,000 workers in 2001 in 145 production plants or companies.[15].

5. Strengthening the elements of institutional capacity in Pori and Seinäjoki

What actions were taken in the Pori and Seinäjoki town regions to[16] create and strengthen the innovation environment in emerging industries? The turning point for this type of development activities was in the late 1990s, when the local leaders and managers (e.g. the company, the polytechnics, the university units, the regional development agencies and the chamber of commerce managers) realized the challenging situation and started to strengthen the local innovation environment: "Something has to be done…." The steps and strengthening actions were taken mainly through local efforts (with EU funding) by a) building and strengthening the knowledge-intensive *institutional base* (institutions), b) strengthening the local *resource pools* (competence), c) creating and intensifying knowledge *networks* and c) creating *shared arenas* (later the EPANET network and the Automation R&D Consortium). The management-level awakening towards grass-root level development actions continued when it was realized what advantages networking (nationally and internationally), on the one hand, and the usability of EU Structural Funds, on the other hand, could bring. The main strategy was to *bring knowledge into* the town region by a) inducing universities (and polytechnics) to found new units and creating university filial centers and by b) creating shared arenas (public spaces and

[14] The industrial areas are metal product manufacturing, machinery, electronics and optical instruments (manufacturing), vehicles, PC consultancy, software design, programming and consultancy, research.
[15] Source: Seinäjoki Technology Centre, Seinäjoki Centre of Expertise for Intelligence Technology 2002, 2003 and 2004.
[16] The findings are drawn from the LIS Pori and Seinäjoki case interviews, previous research reports, regional strategy papers and development programme papers and 'glued' together with the authors' experiences of local development work in action.

networks). Examples of this are the EPANET network in Seinäjoki and the Automation R&D Consortium in Pori.

The following sections depict the actual steps of strengthening the innovation environment in more detail, first presenting the development efforts achieved in the region generally, such as strengthening the local institutional capacity, and second, presenting the actual steps taken in the processes of 'bringing knowledge in'.

PORI REGION – Strengthening the elements of institutional capacity via building up institutions, resources and networks

Strategically leaders in Pori put emphasis on the wider higher education network – they created and strengthened the Pori University Filial Centre. In their visions, research was seen as a "logical outcome" from the investments in university units and Pori University Campus. After many years of heavy investments in the higher education infrastructures and especially to the university center, the messages from the local industry and business life have stressed the need for increased cooperation between the Polytechnic, Pori university units and PrizzTech Ltd (see e.g. Ahmaniemi, Kautonen and Tulkki 2001, Poijärvi-Miikkulainen 2004, Satakunta Visio 2005 and 2010). In principle, the TUT Pori Unit and TSEBA Unit are *the* units for basic research and higher technical education in specific fields, while the polytechnic is a local educational unit with applied R&D functions. The main development lines in strengthening the institutional base and technological infrastructure of the Pori town region and can be summarized as follows[17]:

To induce universities to open branch units in Pori and to form a "university filial centre"

- Tampere University of Technology, TUT, The Pori Unit
- Turku School of Economics and Business Administration, TSEBA, The Pori Unit
- University of Turku, UTU,
- University of Tampere, UTA,
- University of Art and Design (Helsinki), UIAH,
- Have together about 1,250 graduate students and 180 employees.
- The Pori University Filial Centre is specialized in certain sectors and works in the growth sectors of society (at least at the local level) and therefore have close linkages to the local economic life, are well networked at the local and national (some also at the international) level. The Pori University Filial Centre specializes in technology, economics and business management, the humanities, welfare research, arts, short sea studies and visual art.

[17] The similar type of classification of the Seinäjoki town region is presented in Sotarauta, M. & Kosonen, K-J. (2003) and in Cooke, P. & Piccaluga, A. (2004).

To build technical infrastructure in Pori

- PrizzTech Ltd Technology Centre and Science Park (built in 2000–2003) include the PrizzTech Technology Centre, HC-ICE Health Care Development Office, Energy (technology) Office and collaborative technology clinics with the Town of Rauma. PrizzTech Ltd is an incubator and a facilitator, and has business development services for knowledge- and technology-intensive start-ups and/or spin-offs.
- To found and strengthen the *Satakunta Polytechnic* as the main locally owned and independent higher education institute in the region (gained the status of a polytechnic in 1997 and is composed of earlier independent colleges). Research and Development Centre O'Sata® and O'Sata Enterprise Accelerator® together with the Satakunta Polytechnic and the Department of Engineering and Maritime Management, and Porin Tekniikka-Opisto (Technical College of Pori)

To found new arenas for knowledge and innovation creation

- Pori University Filial Centre -- TUT, TSEBA, UTA, UTU and UAIH Pori Units or R&D project organizations. The Tampere University of Technology (TUT) is in charge of the functions of the consortium. The idea is to establish new branch units for several Finnish universities in the Pori University Filial Centre and to link those to the Pori University Consortium. The estate holding of Pori University Consortium is organized through PrizzTech Ltd.
- **Institute of Automation and Information Technologies**/ Research and Development Centre O'Sata. Broadly defined, The Automation Consortium includes the following partners: the Satakunta Polytechnic, automation industry (+ chambers of commerce), PrizzTech Ltd (+ the Satakunta Centre of Expertise), Pori University Filial Centre and other university partners, the Town of Pori and the Town of Ulvila and Porin seudun kehittämiskeskus Oy (The Pori Region Development Centre Ltd).

THE SEINäJOKI REGION – Strengthening the elements of institutional capacity via building up the institutional base

In the Seinäjoki town region, new institutions were formed and some universities induced to establish branch units in Seinäjoki. The Seinäjoki University Filial Centre is among the latest "university filial centers", as it was officially formed at the end of 2003 and opened as a "center" from the beginning of 2004 (Kinnunen et al. 2004). The center was formed from already existing units and university functions running in the Seinäjoki town region. Leaders in development agencies and the municipalities in the Seinäjoki town region put emphasis on applied research -- created the EPANET research network, as the 'research path' was seen as a "faster way" to fill major gaps in the region's knowledge infrastructure. The network focuses on *applied research*, is the main research activity under the university filial centre "umbrella" and a main research "community" in South Ostrobothnia[18]. The EPANET research network is working especially on themes found in the local business environment.

[18] See: Kinnunen et al. 2004, Sotarauta et al. 1999, Sotarauta & Kosonen 2003 and 2004.

Therefore, the network is largely accepted and directly invested in among local companies, also in the field of *Intelligence Technology*. The main development lines in strengthening the institutional base of South Ostrobothnia can be summarized as follows:

To induce universities to open branch units in Seinäjoki and to form a "university filial centre"

- University Association of South Ostrobothnia (11 employees in 2003), founded in 1960
- University of Tampere, UTA, Institute for Extension Studies in Seinäjoki (approx. 25 employees), founded in 1981, and Research Unit for Urban and Regional Development Studies (Sente), founded in 1998. The university is also the leading partner in the consortium called the 'University Filial Centre'.
- University of Helsinki, UH, Institute for Rural Research and Training in Seinäjoki (approx. 35 employees), founded in 1988
- Sibelius Music Academy Training Centre in Seinäjoki (approx. 5 employees), founded in 1991
- University of Vaasa, VY, Seinäjoki Unit (approx. 10 employees), founded in 1998
- Tampere University of Technology, TUT, Digital Media Institute DMI/ Telemedicine Laboratory – Medical Information Technology research unit in Seinäjoki (7+5 employees), founded in 2003

To build technical infrastructure in Seinäjoki

- TRIANO Seinäjoki Science Park (built in 2000–2003) includes Mediwest Technology Park, Frami and Foodwest Ltd. The investors are local municipalities, the Seinäjoki Polytechnic, South Ostrobothnia Hospital District (hospitals and municipalities), private companies, and a German investment bank. Investments amoun to a total of 43 million euro for Mediwest and Frami in 2001–2003. (Frami 25 million euro.)
- To found and strengthen the *Seinäjoki Polytechnic* as the only locally owned and independent higher education institute in the region (gained the permanent status of a polytechnic in 1996, it was build up from earlier independent colleges).
- Seinäjoki Technology Centre Ltd (owned by the Town of Seinäjoki and the Seinäjoki Polytechnic). The Seinäjoki Technology Centre Ltd is an incubator and a facilitator, and has business development services for technology-intensive start-ups and/or spin-offs.

To found new communication arenas for knowledge and innovation creation – creating shared arenas

- The establishment of the university consortium called the 'University Filial Centre', in which the University of Tampere is in the lead. The status was gained in the beginning of the 2004.
- The establishment of a research network, **South Ostrobothnian University Network EPANET**. It is a cooperation network of six Finnish universities in the Seinäjoki town region.

6. 'Bringing knowledge in' as a development strategy

A) Inducing universities to found new institutions for university filial centers

From the national point of view, serving the needs of undeveloped communities from the early 2000s was the turning point in strengthening the knowledge infrastructure in the less-favored regions. The third strand tasks made it possible for the universities to "review" and start to expand their institutional structures *internally* but also spatially, namely with other regional and local partners in the surrounding or neighboring communities. As an outcome of this many universities launched university filial consortia in 2001–2004 with less-favored towns regions. Soon after these umbrella organizations in Kajaani, Kokkola, Lahti, Mikkeli, Pori and Seinäjoki were called "university filial centers" (See Katajamäki et al. 2002, Kinnunen et al 2004, Kosonen 2004, Lievonen & Lemola 2004,). [19].

Under the University Filial Center Network there are approximately one thousand employees, mainly researchers and project workers, almost 3,200 degree students and 25,000 students (short courses included). The annual budget of all the six filial centers amounts to nearly 70 million euro[20]. Compared to the smallest Finnish campus universities, these figures are substantial: it can be concluded that together the six university filial centers equal one small Finnish university (see the appendices). The main functions of these academic institutions seems to be a) expand the *student recruitment area* for the main university and to b) expand the collaboration *network with 'customers'*, public institutions or firms located in these regions, and therefore to be able to enlarge the sources of research funding.

In Pori and Seinäjoki the connections to the higher education institutions have been (perhaps surprisingly) close during the 35-year history of the university education in Pori and Seinäjoki. All the actions taken in these regions were rapidly reflected and sometimes rejected at the national level. The first universities to establish educational units to the case LFRs acted in the mid-1980s. The next active period saw the light of the day at the end of the 1990s and the beginning of the new century, when the neighboring universities in particular activated to reach out to the

[19] The Finnish way to express the organizational mode is to call it the 'university consortium, UC'.
[20] Source: university filial centers and the forthcoming report by Palmenia/ Helsinki University. The official statistics do not know term university filial center so far. The students, personnel and outputs are listed under the respective campus university statistics.

academically peripheral regions. At that time, the 'third role' of the universities became an obvious task for universities, as their financial possibilities for such reach-out activities increased remarkably, especially compared with staying only in one's 'own' region. The timeline of activities in case locations in Pori and Seinäjoki town regions is presented in Figure 4

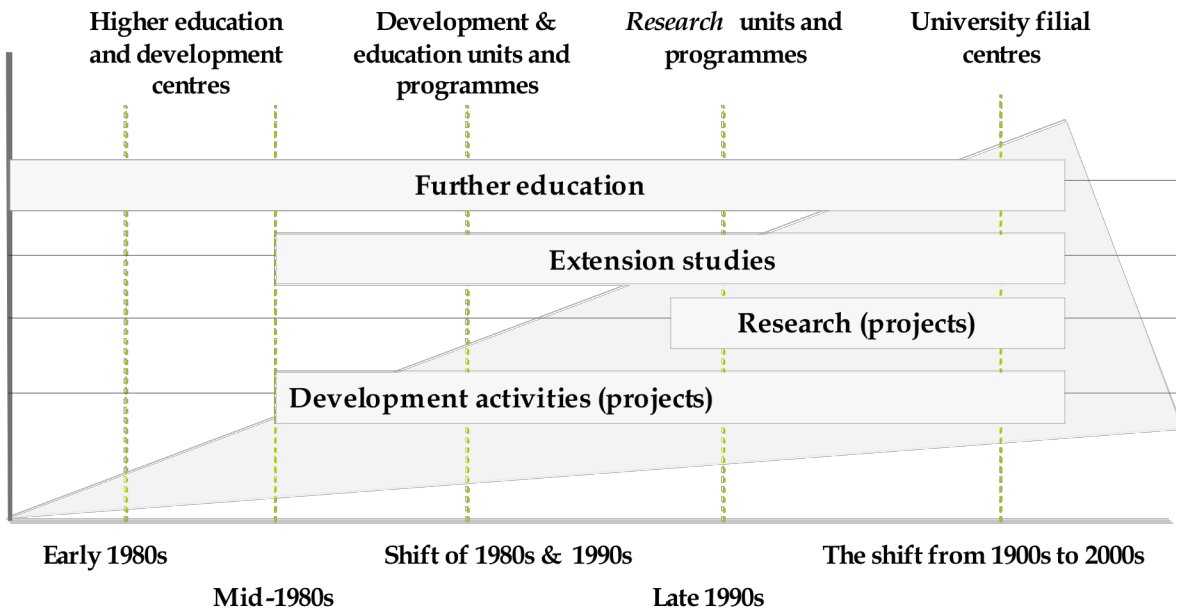

FIGURE 4. The academic activities in University branch units in Pori and Seinäjoki town regions

The Pori town region: The Pori University Filial Centre consists of five university institutions or units such as the Tampere University of Technology (TUT), The Pori Unit, the Turku School of Economics and Business Administration (TSEBA), The Pori Unit, the University of Turku (UTU), the University of Tampere (UTA) and the University of Art and Design Helsinki (UIAH) but, in fact, two polytechnics and the technology center PrizzTech Ltd are involved in the center. There are also the Pori Science Library and the Pori Graduate School, which are organized by the Tampere University of Technology/Pori Unit, but are open for other post graduate students in the region as well as for the full-time teachers of Satakunta Polytechnic. Adult and extension studies in different fields have been offered since 1987, but in the recent five years, the university units in Pori (Pori University Filial Centre) started to offer the entire degree education in Pori for high school graduates.

The Seinäjoki town region: The Seinäjoki University Filial Centre is among the latest "university filial centers", as it was officially formed at the end of 2003 and opened as a "center" at the beginning of 2004 (Kinnunen et al. 2004). The center was formed from already existing units and university functions running in the Seinäjoki town region. The universities joining the center are the University of Helsinki (Makes), Sibelius Academy, the University of Tampere, Tampere University of Technology (Digital Media Institute), the University of Vaasa and the South Ostrobothnia Summer University/South Ostrobothnia University Association (EPANET). The center is coordinated by the University of Tampere in the period 2004–2006. According to the Seinäjoki University Filial Centre representatives, the centre works currently as an 'umbrella' for all the university functions the above universities actually organize in Seinäjoki. The aim of the center is to coordinate the classical university tasks mentioned (research, education and the 'third strand' activities). More concretely, the center's task is to strengthen collaboration between university units and between Seinäjoki units and other universities and research institutions in Finland.

B) Creating shared arenas

THE AUTOMATION R&D CONSORTIUM IN PORI

In the Pori region, it is understood in many reports (especially in Satakunta Vision for 2010 and Satakunta Region Technology Strategy) that the region's automation industry with its related businesses is in need of extended R&D activities in order to increase its competitiveness. In addition, the university filial centre has been somewhat incapable of meeting the needs of local industrial agglomeration of *automation* and *robotics.* Therefore, *the industry* established together with Satakunta Polytechnic and the local municipalities an **Institute of Automation and Information Technologies.**

The starting point for realizing the importance of the automation industry development were perhaps the informal discussion sessions for local automation company leaders, which the Satakunta Polytechnic and its Department of Technology and Maritime Management organized for some years. In the beginning, these sessions were merely channels for exchanging thoughts about the content of the education that the polytechnic offers. The sessions called "*Morning Coffee for Automation Industry*" ("Automaation Aamukahvit"), were organized every one or two months for some

years. The next step in establishing permanent R&D activities in the automation industry branch was to start the '*Automation Research Project'* and the appointment of an *Automation Research Manager Project* in 2000 in the Satakunta Polytechnic. These projects and steps were stated as targets in the Satakunta Visio 2005 report and in its automation industry chapter discussed and written by local entrepreneurs. In the beginning, there were four automation companies involved in the Automation Research Manager Project, which were also responsible for most of the costs of the project. Later this function has changed its form; the activities are covered and funded by multi-source instances: the Satakunta Polytechnic itself, regional development and funding institutions with the EU Structural Fund, Towns of Pori and Ulvila, Tekes and the European Commission (through its Research Programs and Research Framework). The involved companies pay their shares out of individual project budgets.

The third step was to organize these activities in the form of Automation R&D Center (within the polytechnic organizational structure). The activities are still organized merely in the form of projects and R&D Programs. After a couple of first years of the automation projects, the Satakunta Polytechnic has also started to strengthen the center's resources internally. The management of the Institute belongs to the Polytechnic's temporary staff, and this educational institution also made an effort to appoint a nationally and/or internationally experienced manager for the job. During the building up process of the Institute of Automation and Information Technologies internally in the Polytechnic, the informal get-togethers with a larger representation of local automation company (morning coffees) almost stopped for three years. The tradition continued at the beginning of 2004, when the group invited to the discussions was also enlarged both by number and location. Now there are approximately 20 organizations involved, mainly automation, controlling systems, and engineering companies, also from the Rauma town region. Especially active organizations at this stage were *PrizzTech Ltd* (+ Satakunta Centre of Expertise Programme), *Porin seudun kehittämiskeskus* Oy (The Pori Region Development Centre Ltd, a local business development organization owned by the municipality), and *the Satakunta Chamber of Commerce*. They all organized a set of projects, development programs and discussion forums for automation industry.

The Pori University Filial Centre is involved in the automation field only *indirectly*. It has some collaborative projects, but its contribution is not very strong.

The university filial center's field of education and expertise do not meet the needs of the local automation industry very clearly now, and the university units may have some tendencies to regard the agglomeration as not very challenging or big enough to be highly interesting. Also the history of the agglomeration to collaborate more likely with the Satakunta Polytechnic and the former technical and engineering colleges might lead the university units to concentrate to other industries and business areas. In addition, the industrial branches in hand have substantially advanced development institutes in the neighboring region, Tampere (approx. 100 km away). However, it is stated in the strategy papers, reports and in interviews that the university filial centre has such a generic technical and business administration experience in programming, production technologies, signal processing, ICT network applications, marketing and strategic leadership in business management that it could be useful for the polytechnic and the local automation companies.

THE EPANET RESEARCH COMMUNITY IN SEINÄJOKI AS AN ORGANIZATIONAL INNOVATION

In the Seinäjoki region there is a new effort to create a higher educational and research network, *South Ostrobothnian University Network* (EPANET). The EPANET concept aims to a new kind of research culture in cooperation between universities, research institutes and enterprises. The core of the network is a loosely organized group of around 15 fixed-term research professors, who have gathered a group of researchers around themselves, but who all have their 'home base[21]' in South Ostrobothnia, and most of them in Seinäjoki. By the end of the year 2004, there were 14 full-time professors, around 40 other junior and senior researchers and around 50 Ph.D. students in the EPANET network as well as 38 undergraduates sharing the research task. In general, their fields of research and universities are as follows:

- Information technology applications (most of the intelligent solution studies discussed below are under this topic)
- Economics and business administration
- Regions and welfare
- Industry specific topics

The EPANET research network has formed a new kind of creative community, working especially on themes found in the local business environment. Therefore, the

[21] When the nominations of professorships are confirmed, the home base will be mentioned and entered.

network is largely accepted and directly invested in among local companies, as the network focuses on *applied research*. The network had an active network coordinator and background organization, which in this case is the University Association of South Ostrobothnia. The network also offers an independent training project (EDUEPANET), which involves the planning and implementation of training projects supporting mostly post-graduate education. Still, degree education still remains an open question in the EPANET model.

Funding is organized mostly by local sources (1.5 million euro per year), including leader companies. The complexity of the funding of the EPANET can be illustrated by following figures: there are altogether 85 funding organizations (including 58 firms and 27 municipalities), approximately 200 contracts between a donor and University Association of South Ostrobothnia that channels the funds to the involved universities. Each professorship is an individual project and thus the division of funding bodies varies significantly between professorships. Enterprise shares of the costs are around 20% (from 11% up to 35%) of the individual professorships[22].

TABLE 2. Funding of the EPANET network in September 2003 (Source: University Association of South Ostrobothnia/EPANET co-ordination office)

	Euro	*%*
European Union and State of Finland	3,038,000	43.4
Municipalities	2,429,000	34.7
Firms	1,127,000	16.1
Other public sector funding (universities and polytechnics)	406,000	5.8
Total	7,000,000	100.0

The EPANET network is expected to fill many gaps in the applied research resources of the region caused by lack of research traditions and absence of any independent (especially technical) university. The EPANET professorships contribute mostly to applied research in the field of intelligent products and systems (smart systems), such as virtual technology (mechatronics and machinery production processes), embedded systems, *e*Business, entrepreneurship in traditional industries, production systems and logistics, medical information technology and ICT. The idea

22 Source: University Association of South Ostrobothnia and the case interviews.

was to get a broad understanding of the characteristics and problems of regionally based industry by combining tacit knowledge with theory and by combining the approaches of different disciplines. The idea was not, however, to function as a direct problem-solving and research transfer institution to companies, but to merely seek and find new research questions arising from traditional industries (agriculture, foodstuff, forestry, machinery, furniture, carpets) and culturally a quite fragmented environment.

Unquestionably the EPANET network is strengthening the institutional academic infrastructure in South Ostrobothnia by allocating new knowledge and relational resources and forming a new type of research community. In this perspective, it is an *organizational innovation* at the regional level as well as at the national level. In spite of its obvious success in creating and putting together the EPANET concept and network, and getting funding for it, three questions are frequently raised[23]: a) is the EPANET a project of a definite duration or is it a long-lasting institution; b) is it contributing to business and regional development in the long or short run; and c) should the professors carry out more basic and applied research or should they become pragmatic problem-solvers for firms? Further, is there enough cooperation between professors and their research groups, between professors and their host universities and departments and between professors and external partners?

7. Final Remarks

The LIS Pori and Seinäjoki study was about how to create and intensify knowledge linkages between the automation and embedded systems industry (smart systems) and the universities through new types of innovation networks in the less-favored Finnish regions like Pori and Seinäjoki town regions. Further, the study examined what actual efforts were taken in these regions to strengthen the institutional capacity, and more precisely, what efforts were taken to 'bring new knowledge into' the region? In other words, the main idea of the study was to examine how the development actions taken in these town regions fit into the idea of strengthening *institutional capacity*[24] so that

[23] The development of the EPANET concept in Kinnunen et al. 2004, Sotarauta & Kosonen. 2003 and 2004.

[24] In this study, the institutional capacity was understood as a combination of the local needs of *knowledge resources* and the *partnerships* (coalitions and networks) made by individual actors (e.g. entrepreneurs, development agencies, university units, municipalities, technology centers) in certain institutional settings and certain spaces in which development processes take place simultaneously.

they would support emerging industries and to strengthen local innovation environment.

The LFRs face major challenges in a) how to link local actors to national and global knowledge networks, b) how to mobilize scarce resources and competencies of the region to create a local innovation environment, c) how to compensate a thin institutional environment by networks and d) how to strengthen the local institutional base and knowledge structure by creating new organizational types to avoid lock-ins. There are a variety of development-oriented models, which are merely based on the *local strengths*, *capabilities and awareness* to stimulate the local economic change and strengthen the local innovation environment. In the case locations, the way to create and strengthen the innovation environment in emerging industries was to *bring new knowledge into* the town region by a) *inducing universities (and polytechnics) to found new units and creating university filial centers* (institutions) and by b) *creating shared arenas* (spaces and networks for 'local buzz'). In this study, the examples of shared arenas are Automation R&D Consortium in Pori and the EPANET University Network in Seinäjoki.

The idea of a local 'university consortium' (including university filial centers) has been forming gradually and almost simultaneously at the national level and the local level (regions). In spite of the difference between the academic institutions being interested in different regional strengths, the timing of the starting point for the reach-out activities is quite the same. The 'third role' of the universities became an obvious task for universities, as their financial possibilities for such reach-out activities increased remarkably at that time, especially compared with staying only at their 'own' region. At the same time, the (case) industries raised their awareness of the need for new, often scientific, and internationally competitive knowledge. Operating globally in the knowledge economy, industries faced increased challenges in their knowledge capabilities and rapidity regarding the integration of new knowledge into their processes and productions faster and more flexibly than their competitors in Asia (China), USA and Europe in particular.

As the local knowledge infrastructure was unable to offer such knowledge pathways, linkages and practices (innovation culture) to scientific knowledge, the industries became more and more interested in participating in the strengthening efforts of local institutional capacity through development programs, coalitions, science parks, technology center activities and, more recently, through local research

communities such as the **South Ostrobothnian University Network EPANET** in Seinäjoki, the **Institute of Automation and Information Technologies** and the larger Automation Industry Research and Development Consortium in Pori. These both communities may be defined as *organizational innovations*, through which many difficult borders and barriers between universities, between universities and polytechnic, between business and universities have been overcome. In addition, it was these research communities that have been able to induce the main campus universities in Finland (in the university filial center) to be more actively involved in the activities of case locations. In Seinäjoki, the EPANET has been able to transcend disciplinary borders by creating a research community of researchers from different disciplines and universities. In Pori, the initiative came from the automation agglomeration; soon after higher education and university institutions responded rapidly and municipalities started to assist in financing the institute.

To summarize the findings, the process of building up an innovation environment for emerging industries calls for new organizational modes, new technology and innovation culture as well as actual access to new technology and knowledge, as has been done in the case locations, Pori and Seinäjoki town regions. In general, high-tech-intensive industrial branches, such as robotics and intelligence technologies, may be considered to be *emerging industries* for LFRs, even though the actual technology is not new (a frontier technology). However, there are some aspects that may become *development barriers:* The key actors in LFRs may be incapable of avoiding lock-ins and past ways of strengthening the local innovation environment, as well as imaging the possibilities of future trends. In lock-in situations, *industries may take up the role of breaking the past paths*. In Pori, the automation industry was a very obvious initiator for new organizational modes and, in Seinäjoki, the 'smart systems' industry was one of the bravest to invest in the somewhat fuzzy and future-oriented research programs.

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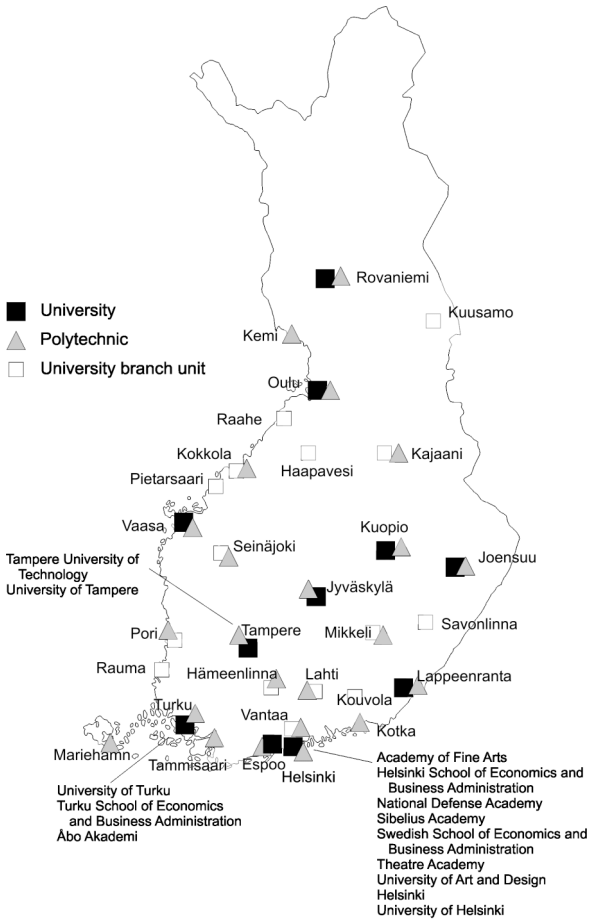
Appendices

Statistics, specialized development organizations in Pori and Seinäjoki town regions and a map of locations of Finnish universities, polytechnics and university centres.

Appendix 1. Finnish universities



Kimmo Viljamaa 2003.

- University of Helsinki, UH
- University of Joensuu, JoY
- University of Jyväskylä, JyU
- University of Kuopio, UKU
- University of Lapland, UoL
- University of Oulu, UO
- University of Tampere, UTA
- University of Turku, UTU
- University of Vaasa, VY
- Åbo Akademi University, ÅAU
- Helsinki University of Technology, HUT
- Lappeenranta University of Technology, LUT
- Tampere University of Technology, TUT
- Helsinki School of Economics and Business Administration, HSE
- Swedish School of Economics and Business Administration, Hanken
- Turku School of Economics and Business Administration, TSEBA
- Academy of Fine Arts
- Sibelius Academy (music), SiBA
- Theatre Academy, TEAK
- University of Art and Design Helsinki, UIAH

Appendix 2. Basic facts about the smallest universities in Finland (Source: KOTA database, 'Universities 2003': Ministry of Education).

Universities in 2003	*Under-graduates*	*Graduate School Students*	*Teaching Personnel (persons)*	*Other personnel (persons)*	*Research personnel (persons)*	*Total Budget (€Million)*	*External funding €(Million)*
Helsinki School of Business Administration	3,898	425	152	209	75	22.0	11.4
University of Lapland	3,864	349	192	306	73	25.7	10.5
Svenska Handelhögs-skolan	2,462	196	100	82	14	10.6	4.6
Turku School of Economics and Business Administration	1,960	259	100	120	61	12.9	5.7
University of Art and Design (Helsinki)	1,562	169	147	221	21	25.2	5.5
Sibelius Music Academy	1,347	128	239	134	2	21.6	2.0
Theatre University	383	35	55	93	3	10.0	0.9
University of Fine Arts	229	11	25	25	-	4.0	0.1
Total in Finland (all universities)	**147,375**	**22,960**	**7,933**	**13,961**	**5,933**	**1,185,2**	**639.1**

Appendix 3. Domestic patent applications by business enterprises in Finland, the proportion of the Tekes R&D funding for companies and the research personnel at the year 2001

Regions (their central cities/ towns)	% of applications in the whole country	Number of applications	Tekes R&D funding to companies in regions/ year 2001 %	Research personnel in the regions/ 2001
Uusimaa (Helsinki)	34.3	611	45.2	30,000
Tampere Region (Tampere)	17.4	310	8.8	9,096
South-West Finland (Turku)	8.4	150	9.7	6,684
Oulu region (Oulu)	7.7	137	8.4	7,917
Central Finland (Jyväskylä)	7.6	135	5.2	2,891
Satakunta (Pori)	*3.0*	*54*	*2.0*	*1,333*
Päijät-Häme (Lahti)	3.0	53	2.0	982
Northern Savo (Kuopio)	2.6	47	3.1	2,181
Kymenlaakso (Kotka)	2.0	36	1.4	700
Häme (Hämeenlinna)	1.9	33	1.8	1,193
Ostrobothnia (Vaasa)	1.3	24	2.3	1,402
Itä-Uusimaa (Porvoo)	1.3	23	1.8	612
North Karelia (Joensuu)	1.2	22	1.0	1,258
South Ostrobothnia (Seinäjoki)	1.1	19	1.6	468
Southern Savo (Mikkeli)	1.0	18	2.2	457
South Karelia (Lappeenranta)	0.8	15	0.4	1,044
Lapland (Rovaniemi)	0.8	14	1.6	1,016
Central Ostrobothnia (Kokkola)	0.8	14	0.5	225
Kainuu (Kajaani)	0.3	5	1.0	293
Åland (Mariehamn) (autonomous)	0.1	2	-	36
Domestic total	**96.7**	**1,722**	**100**	**69,788**
Foreign	3.0	54	-	Included in total
Total	**100**	**1,780**	100	**69,788**

Appendix 4. The education level of population in regions in 2001

Regions (their central cities/ towns)	% of the population in the region	Number of persons with degrees	% of the population in the major city/ town in the region	Number of *higher education degree* graduates	Graduates % of the population in the region	Population in the region at the end of 2002
Uusimaa (Helsinki)	65.0	699,924	66.7	339,763	31.6	1,329,004
Northern Ostrobothnia (Oulu)	61.8	179,075	70.2	64,249	22.2	369,974
Tampere Region (Tampere)	61.7	230,012	67.0	88,387	23.7	453,978
South-West (Turku)	59.7	222,323	63.8	86,428	23.2	450,968
Central Finland (Jyväskylä)	59.7	129,946	69.8	48,014	22.1	265,078
Northern Savo (Kuopio)	58.9	122,209	67.4	42,581	20.5	250,368
Kymenlaakso (Kotka)	58.6	91,462	61.1	31,100	19.9	186,111
Lapland (Rovaniemi)	58.4	90,475	67.3	30,464	19.6	187,777
Häme (Hämeenlinna)	58.0	78,873	62.6	29,710	21.8	165,886
Ostrobothnia (Vaasa)	57.8	81,542	65.2	31,450	22.3	173,006
North Karelia (Joensuu)	57.6	81,262	67.8	25,845	18.3	169,722
Päijät-Häme (Lahti)	56.9	93,285	59.1	32,971	20.1	198,088
South Karelia (Lappeenranta)	56.6	65,026	61.0	22,168	19.3	136,694
Itä-Uusimaa (Porvoo)	56.5	40,808	58.6	16,996	23.5	90,934
Kainuu (Kajaani)	56.4	41,320	63.3	12,978	17.7	87,371
Satakunta (Pori)	*56.1*	*110,316*	*59.2*	*38,425*	*19.5*	*235,416*
Åland (Mariehamn) (autonomous area)	56.0	11,883	62.4	4,546	21.4	26,257
Southern Savo (Mikkeli)	55.5	77,369	62.9	25,758	18.5	164,884
South Ostrobothnia (Seinäjoki)	*55.3*	*87,690*	*67.1*	*28,976*	*18.3*	*194,105*
Central Ostrobothnia (Kokkola)	54.8	31,188	58.9	10,109	17.8	70,674
Whole country	**60.2**	**2,565,988**	**60.2**	**1,010,918**	**23.7**	**5,206,295**