# Understanding the Competitiveness of the Finnish ICT Cluster in the Context of Nokia's Decline in Recent Years

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Abstract
The study of clusters and competitiveness has drawn considerable attention of the academics as well as the policy makers in recent times. The Finnish ICT cluster, with Nokia in heart, has been instrumental in making the Finnish economy as a competitive one. Nokia, in particular, contributed significantly to the astounding growth of the Finnish economy – in exports, GDP and the total R&D expenditure. However, Nokia has left its prime time behind and already seen its descent since 2008. The study at hand scrutinizes the competitiveness of the Finnish ICT cluster in the context of Nokia's decline in recent years.

To carry out the study, a case study method using multiple sources of data was applied. In the first place, Emerald model was used to observe the changes in the competitiveness of the ICT cluster within a certain time frame. Secondary data were collected from different statistical databases, namely Statistics Finland, OECD Stat, World Bank data and UNCTAD data among others. Moreover, telephone interviews were conducted to find out information about the knowledge dynamics existing in the cluster. In addition, three face-to-face interviews, using semi-structured questionnaires, with the industry experts were conducted to gain further insights about the relationship between Nokia's downfall and the competitiveness of the Finnish ICT cluster. Last but not least, triangulation was made with the aid of relevant secondary data obtained from existing empirical studies as well as media coverage on the issues.

The results suggest that the decline of Nokia significantly affected the ICT cluster. The cluster, however, still appears to be competitive, but the competitiveness is certainly eroding in a number of dimensions. The cluster constituents, nevertheless, have been taking several initiatives, such as reinventing ICT related education, to raise the competitiveness level. The ICT firms are also diving in narrower fields. A lot of money is being poured in R&D and innovation. Consequently, a large number of start-ups have been established. The future success of Finland and its ICT cluster relies heavily on the growth of these companies.

Keywords
Cluster, Competitiveness, ICT, Finland, Nokia, Attractiveness, Emerald Model, Global Knowledge Hub, Industrial attractiveness, case study and triangulation.

Miscellaneous

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# 1 INTRODUCTION

## 1.1 Background of the study

The motivation for the study stemmed from three seemingly disparate phenomena. To begin with, Nokia, the driving force behind the Finnish ICT cluster's impressive growth over the last two decades, has been witnessing its descent phase since 2008. A number of production plants have been shut down with R & D facilities shrunk and thousands of employees laid-off during these years. Nokia's supply chain networks in Finland have not been unaffected either. On top of that, it has, very recently, been announced that Nokia's devices and services businesses are being acquired by Microsoft (Microsoft News center, 3 September 2013). Even though the deal might not have a direct impact on jobs, on the position of the staff or on the tax revenue in Finland, it would certainly have a horrendous psychological impact on the Finns as a whole (Vapaavuori, Ministry of Employment and the Economy, press release, 3 September, 2013). It would also be really interesting to see Microsoft's approach and commitment towards the Finnish ICT cluster and Finland in the longer term. All in all, there are reasons to be concerned about the Finnish ICT cluster and its competitiveness.

On the other hand, Finland has been consistently finding itself among the top countries on the lists of a range of competitiveness rankings. For example, Finland has held its position among the top four countries for the last three consecutive years in the Global Competitiveness rankings by World Economic Forum (See The Global Competitiveness Report, years 2013-2014, 2012-2013, 2011-2012). From the ICT point of view, the picture is even rosier. Finland topped among 144 countries in the Network Readiness Index 2013 (The Global Information Technology Report 2013, 9). This rise in the rankings has been a very consistent one – from 6 in 2007-8 to 1 in 2013 (See The Global Information Technology Report, years 2013, 2012, 2010-2011).

These two contrasting trends are somewhat puzzling to the authors. The zest for solving this puzzle has been fuelled by the JAMK Centre for Competitiveness, a

dynamic wing of JAMK University of Applied Sciences and a new member of the Microeconomics of Competitiveness (MOC) network developed by Professor Michael Porter at Harvard Business School's Institute for Strategy and Competitiveness (JAMK Centre for Competitiveness 2013). The Centre, aiming at actively contributing with its expertise gained from the international network to the Finnish economic development and industrial competitiveness, has been trying to identify and analyze a variety of clusters across Finland. In this process, the Centre is very interested in understanding the competitiveness of the Finnish ICT cluster, particularly in the context of Nokia's descent in recent years.

The outcome of the aforementioned phenomena is this research project assigned by the Centre for Competitiveness to the authors.

## 1.2 Purpose of the study

The purpose of the study is to conduct an exploratory research on the ICT cluster in Finland in order to gain insights into its competitiveness level in the context of Nokia's collapse in recent years.

The objectives of the research are to increase the understanding of the competitiveness of the Finnish ICT cluster and identify the relationship between Nokia's downfall in recent years and the level of competitiveness of the cluster. To achieve these objectives, a number of research questions have been drawn up.

The main research question is –

1. How has the competitiveness of the ICT cluster in Finland changed in the context of Nokia's descent in recent years?

The supplementary questions are –

2. What is the current competitiveness level of the Finnish ICT cluster?
3. How has Nokia's decline in recent years affected the ICT cluster?
4. How has the cluster been responding to the changing situation?

5. What could be the future development?

## 1.3 Structure of the report

The second chapter of this report provides its readers with a brief overview of the entities involved in the research questions, namely Finland, the Finnish ICT cluster and Nokia. It also sheds some light on the economic relevance of Nokia in Finnish economy. The next chapter, through the literature review, tries to elucidate the key concepts associated with the research questions in addition to selecting and describing a theoretical framework suitable for the study.

The chapter four focuses on the research design incorporating the choice of research methodology along with the data collection methods and the implementation of the study. The results appear in the next chapter followed by a discussion, whereby reliability and validity of the study are checked, implications of the study discussed and suggestions for further research made.

# 2 OVERVIEW

This chapter provides brief overviews of Finland, the Finnish ICT cluster and Nokia.

## 2.1 Finland

Finland, a country of forests and lakes, is located in the far north. According to the country profile in EUROPA, European Union's official website, the population of Finland is very small (5,3 million) compared to its total area (338 000 km²). It became independent after the Russian revolution in 1917. Finland has been a member of the EU since 1995 and Schengen since 1996. The country entered Eurozone in 1999. The Finnish economy, with its telecommunications industry, is treated as a competitive one. (Finland. Europa, 2013)

TABLE 1. Key economic indicators: (2011 figures)

(source: UNdata)

| | |
|---|---|
| GDP per capita (current US$) | 48 887 |
| GDP: growth rate at constant 2005 prices (annual %) | 2,7 |
| Unemployment (% of labor force)(15 - 74) | 7,8 |
| Internet users (per 100 inhabitants) | 89,4 |
| Exports (million US$) | 78 794,2 |
| Imports (million US$) | 83 861,7 |
| Major trading partners (% of exports) | Sweden (11,8), Germany (9,4), Russian Federation (9,3) |
| Major trading partners (% of imports) | Russian Federation (18,2), Sweden (14,1), Germany (13,7) |

According to the World Factbook by Central Intelligence Agency (CIA), Finnish economy, characterized by a high level of industrialization and a largely free-market model, has been treated one of the best within the European Union in recent years. Finland's GDP is composed of agriculture (2,8%), industry (27,1%) and services (70,1%). Key industries in Finland include metals and metal products, electronics, machinery and scientific instruments, shipbuilding and pulp and paper. Exports constitute more than a third of the total GDP. Machinery and transport equipment, electrical and optical equipment, paper and pulp are among the major export commodities. On the other hand, major import commodities include machinery and transport equipment, petroleum and petroleum products, chemicals, and iron and steel among others. (FINLAND. The World Factbook 2013.)

## 2.2 ICT cluster in Finland

The ICT cluster in Finland has evolved around telecommunications equipment manufacturing, network operation and service provision, which comprise the 'key industries'. The 'supporting industries', which typically represent highly evolved electronics industry, include companies involved in parts and component manufacturing as well as contract manufacturing in order to meet the needs of the key industries. Higher educational institutions and research communities also fall in this category as they provide valuable human resources and research support for the key industries. (Paija 2000, 2.)

Paija explains that 'Related industries', considered to be the most prominent factor in increasing cluster demand, encompass a range of industries as well as organizations. On the one hand, there are traditional media, entertainment, advertisement and consumer electronics industries; on the other hand, there are public services, financial services, booking and health care services. She describes that the associated services, important for enhancing the preconditions of the cluster growth, include consultancy, venture capital and distribution channels. (Op. cit. p. 2.)

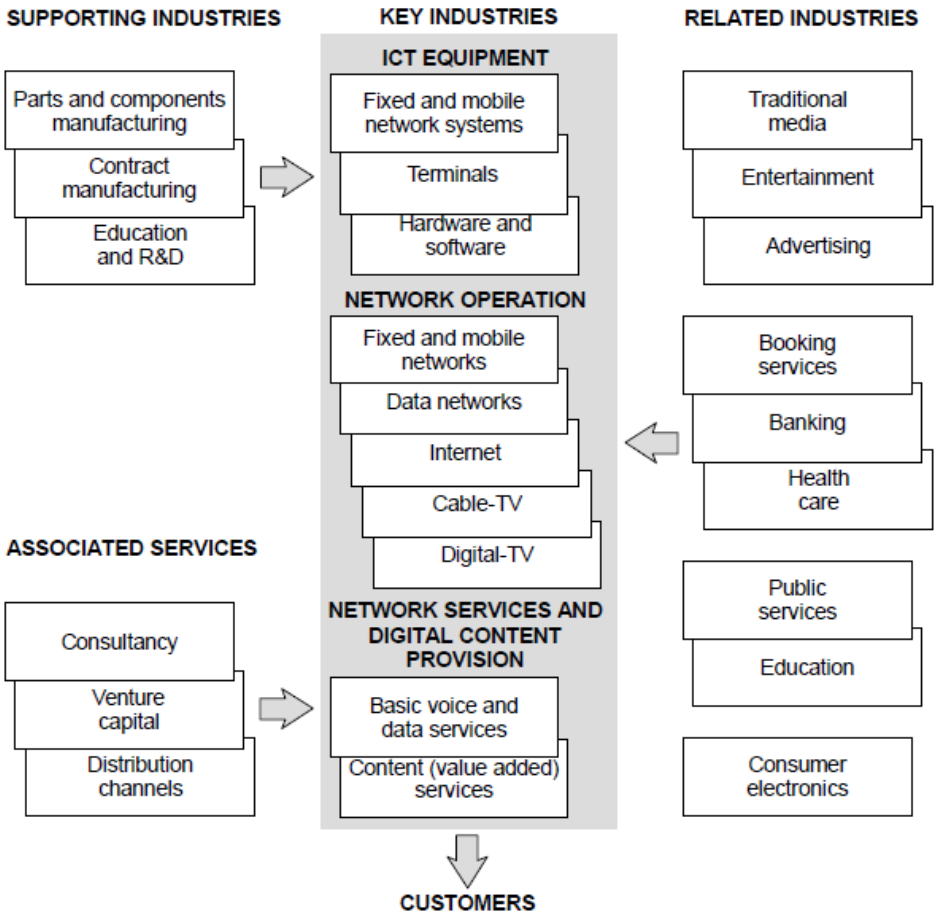



FIGURE 1. Finnish ICT cluster chart

(Source: Paija 2000, 2)

Paija finds out that placing different actors categorically in the cluster chart is becoming increasingly difficult as a consequence of three megatrends, namely convergence of networks, terminals and services, digitalization, and deregulation. Cluster constituents are penetrating each other's domains, resulting in a blurred competitive environment. In addition, the actors within the cluster merge vertically in order to grab a wider part of the value chain. (Op. cit. p. 2.)

Nikulainen and Pajarinen (2013) divided the ICT sector, in particular, into three broad categories, namely ICT-related manufacturing, ICT-related services and software. TABLE 2 presents standardized industry classifications and their concordance with the subsector definitions. ICT manufacturing encompasses a range of manufacturing

actvities, including manufaturing of communication equipment, electronic components, computers and peripheral equipment among others. It also takes in repair work of computers and communication equipment. ICT services, on the other hand, involve telecommunications, data processing, hosting & related activities, and also web portals. Finally, software activities take account of software publishing, computer programming, consultancy and related activities. (p. 9.)

TABLE 2. Definition of the ICT industry

(Source: Nikulainen & Pajarinen 2013, 9)

| Main sector | Industry name | Industry code |
|---|---|---|
| ICT manufacturing | Manufacture of electronic components and boards | 261 |
| | Manufacture of computers and peripheral equipment | 262 |
| | Manufacture of communication equipment | 263 |
| | Manufacture of consumer electronics | 264 |
| | Manufacture of magnetic and optical media | 268 |
| | Repair of computers and communication equipment | 951 |
| ICT services | Telecommunications | 61 |
| | Data processing, hosting and related activities; web portals | 631 |
| Software | Computer programming, consultancy and related activities | 62 |
| | Software publishing | 582 |

The authors' definition of ICT sector also conforms to the one by Nikulainen and Pajarinen. In this paper, ICT cluster and ICT sector (despite acknowledging the fact that they are different) will be used interchangeably for avoiding complexity and simplifying the issue.

## 2.3 Nokia

Nokia's brief history along with its current focus is taken from its official website. According to the information provided by Nokia, it, originally established as a paper mill in southwestern Finland in 1865, has evolved over the years into a forerunner in the global telecommunications industry. Nokia Corporation, nevertheless, was

officially established in 1967 following a merger of three independent business entities (even though they had been under combined ownership since 1922), namely Nokia Ab, Finnish Cable Works and Finnish Rubber Works. The newly formed Nokia Corporation had diversified business operations, incorporating wood, power generation, rubber products, cable and consumer electronics. (The Nokia story 2013.)

Nokia began its mobile era in 1979 with the creation of Mobira Oy, a joint venture radio telephone company. In the following years, Nokia brought about a range of innovations – from international cellular network with international roaming, car phone, digital telephone switch to handheld mobile phone. Nokia also invested in the development of GSM, which revolutionized global mobile technology. Nokia took full advantage of GSM and launched its first digital handheld GSM phone in 1992. (Op. cit.)

During the same year, Nokia made a strategic decision to gradually get rid of its rubber, cable and consumer electronics division and focus exclusively on manufacturing mobile phones and telecommunications systems. The decision proved to be a momentous one and Nokia's business was booming – its turnover grew from EUR 6,5 billion in 1996 to EUR 31 billion in 2001. The business shot up in 2002, when Nokia launched its first 3G phone. In 2007, Nokia formed Nokia Siemens Network, a joint venture in telecommunications infrastructure, with Siemens. In 2013, Nokia acquired Siemen's 50% stake and made NSN a wholly-owned subsidiary of Nokia. Similarly, in 2008 Nokia acquired NAVTEQ, an American maker of digital mapping and navigational software. Nokia then created its own HERE brand to provide location based services to its customers. (Op. cit.)

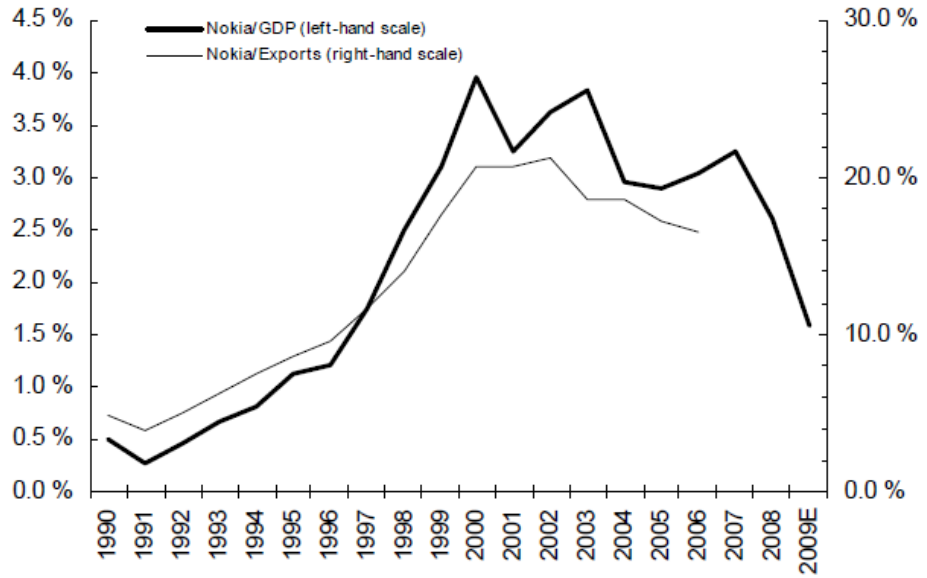
In 2011, Nokia announced that it would be using Microsoft's Windows operating system for its smartphones. The joint efforts produced first Widows Phones in October 2011 (Op. cit.). Despite having a full portfolio of Windows Phones, the market share remained very small. As a consequence, Nokia's board of directors had to consider various alternatives. After taking a range of issues into consideration,

Nokia decided to sell its phone businesses to Microsoft, and the deal made between the two companies was announced on the 3rd of September, 2013. (Sajari 2013.)

It appears that no single business has remained as a core business of Nokia for good. In coming days, Nokia is expecting to concentrate on its established businesses in the areas of network infrastructure and services (NSN), mapping and location services (HERE), and technology development and licensing (Advanced Technologies). (Nokia today 2013.)

## 2.4 Nokia in Finnish economy

This part of the chapter has been adopted from Jyrki Ali-Yrkkö's work (2010) in 'Nokia and Finland in a Sea of Change'.




Note: including NSN. Sources: Author's own calculations (Sources: Nokia Corporation, Statistics Finland, National Board of Customs)[2]

FIGURE 2. Nokia as a share of export and GDP, %

(Source: Ali-yrkkö 2010, 10)

According to the line graph, Nokia had contributed significantly to Finnish GDP over the years. At the outset of 1990s, Nokia's contribution to Finnish GDP stood at less

than 0,5%. This proportion had increased gradually to above 1% by 1997, since then the share grew substantially to as high as 4% in 2000. The input fluctuated between 3% and 4 % from 2000 to 2007. Since 2007, Nokia's share to the GDP plummeted.

A similar trend can be observed regarding export share. In its prime time in early 2000s, Nokia contributed as much as 20% to the total Finnish exports, and since 2003, the share had been falling.

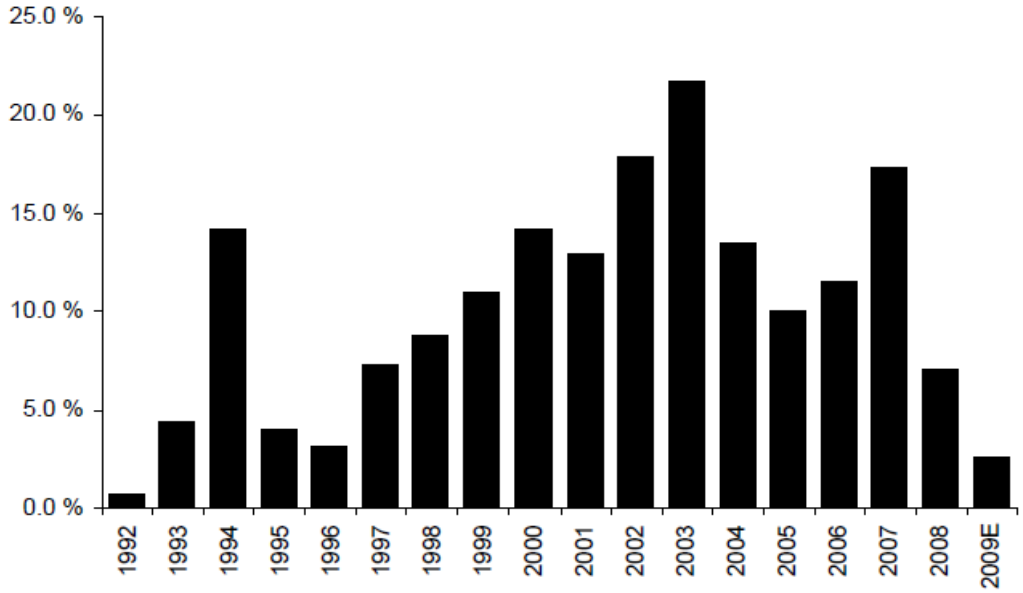



FIGURE 3. Nokia's annual share of corporate taxes

(Source: Ali-yrkkö 2010, 16)

According to the column chart presenting annual share of Nokia's corporate taxes in Finland, Nokia comprised a significant portion of total corporate taxes in Finland. Nokia's share of corporate taxes remained rather small (under 5%) between 1992 and 1996. Year 1994 was an exception, when Nokia's contribution leapt to almost 15%. However, since 1996 the share grew remarkably and peaked at around 23% in 2003. In the subsequent years, however, there was a declining trend and by 2009, the share fell to nearly its 1992 level.

# 3 CONCEPTS AND THEORETICAL FRAMEWORK

In this chapter, attempts have been made, through literature review, to understand the key concepts involved in the research questions and identify a relevant theory to answer those questions. In doing so, the authors first tried to understand what clusters and competitiveness mean and then they sought for a relevant theory that could answer the research question(s).

## 3.1 Cluster

The concept of cluster dates back to the end of 19th century, when Alfred Marshall, an English economist, observed that firms from the same industry tend to group together in the same geographic area in order to optimize their business activities. This concept was developed further by Italian professor Giacomo Becattini in 1979 and then popularized by the American professor Michael Porter at Harvard University since 1990, when his book 'The Competitive Advantage of Nations' was published. (Gascon, Pezzi & Casals, 2010, 12.)

Boja (2011, 34) terms cluster to be an economic phenomenon placed in a competitive context whereby a number of businesses compete and, at the same time, collaborate to gain different economic advantages, while Porter (2000, 16) defines cluster as a ''geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities''. Based on Porter (1996, 1990), Ketels (2003, 3-4) outlines clusters as ''groups of companies and institutions co-located in a specific geographic region and linked by interdependencies in providing a related group of products and/or services''.

The Institute for Strategy and Competitiveness (ISC) articulates clusters as ''geographic concentrations of interconnected companies, specialized suppliers, service providers, and associated institutions in a particular field that are present in a nation or a region'' and claims that clusters increase the level of productivity with which the firms involved can compete. (Competition and Economic Development 2013.)

In the Community Framework for State Aid for Research and Development and Innovation (2006, 10), innovation clusters are defined as:

> *groupings of independent undertakings – innovative start-ups, small, medium and large undertakings as well as research organizations – operating in a particular sector and region and designed to stimulate innovative activity by promoting intensive interactions, sharing of facilities and exchange of knowledge and expertise and by contributing effectively to technology transfer, networking and information dissemination among the undertakings in the cluster.*

According to Sölvell, Lindqvist & Ketels (2003, 18), clusters are compositions of five sets of actors – co-located and interconnected industries, government, research community, financial institutions and institutions for collaboration (IFCs). This model has been further modified by Sölvell including media as an actor (2008, 16).


FIGURE 4. Actors in the cluster

Source: (Sölvell 2008, 16)

## 3.2 Competitiveness

The term competitiveness has different definitions in different contexts. Martin (2003, 2-1) points out that at microeconomic or firm level, competitiveness refers to a firms' ability to generate product and/or services in a consistent and profitable way so that it can survive in an open market. He also maintains that there is a positive correlation between productivity and market share.

On the other hand, at national level, Porter (1990, 76) states that competitiveness of a country refers to its productivity (the value of the output produced by a unit of labor or capita), which determines a nation's long time standard of living and national per capita income. This is reflected in the following definitions as well. The World Economic Forum defines ''competitiveness as the set of institutions, policies, and factors that determine the level of productivity of a country'' (The Global Competitiveness Report 2013-2014, 4), whereas according to European Competitiveness report 2000, competitiveness of an economy refers to its ability to offer rising standards of living and high employment to its population on a sustainable basis.

Porter (1990) mentions that the competitiveness of a nation depends on the ability of its industries to innovate and upgrade, and identifies some determinants of national competitive advantage that create the national environment where the firms are born and learn how to compete. The first set of determinants is *factor conditions*, which shape the factors of production, such as labour force (low-cost and/or skilled) or infrastructure (geographic advantage and/or modern facilities) for a particular industry. The second is *demand conditions*, which indicate domestic demand for the products and/or services of the industry, and how demanding and sophisticated local customers force the industry to innovate and drive forward. This is followed by *related and supporting industries*, referring to competitive and high quality suppliers and other related industries, including universities, business and public authorities, and how well the entire system is coordinated. Finally, *firm strategy, structure and rivalry* illustrate how companies are created, organized and

managed, and what is the extent and nature of domestic rivalry, and how that rivalry leads the companies to innovate and upgrade. (pp. 76-78.)

## 3.3 Emerald model

Sasson and Reve (2012, 2) presents Emerald model, a six-dimension framework, for measuring competitiveness in the form of industrial attractiveness, incorporating educational attractiveness, talent attractiveness, R&D and innovation attractiveness, ownership attractiveness, environmental attractiveness and cluster attractiveness, all of which create the environment for and, consequently, benefit from knowledge dynamics.

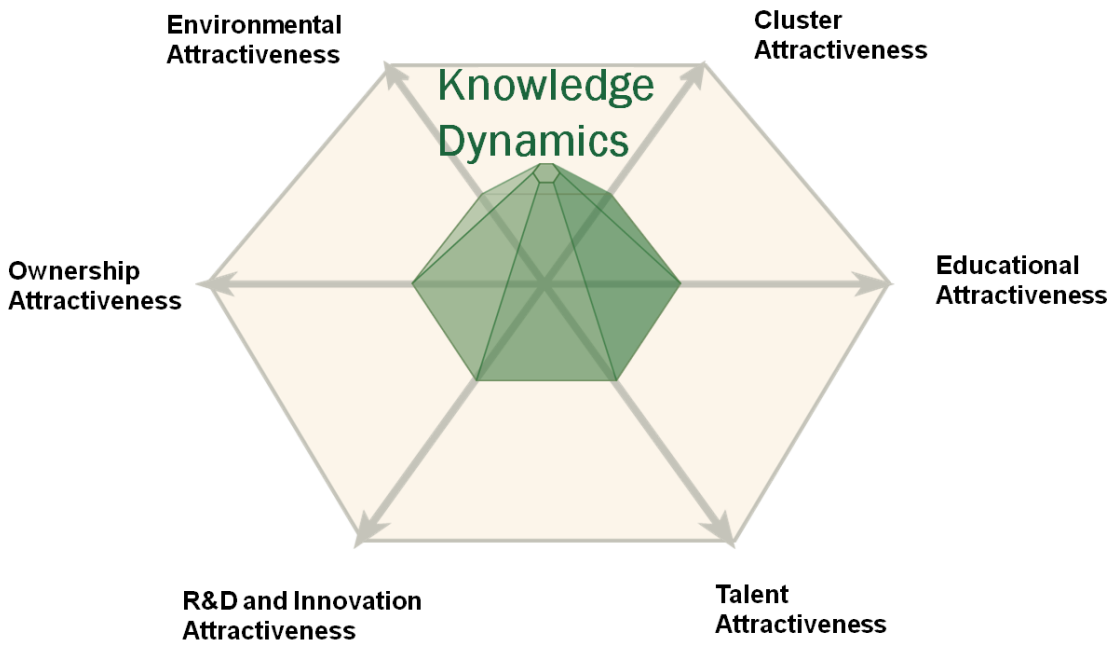



FIGURE 5. Emerald Model of Industrial Competitiveness

(Source: Sasson & Reve 2012, 2)

### 3.3.1 Educational attractiveness

Education is extremely important in a knowledge economy. Every cluster or industrial sector, which is predicated on certain knowledge or skills, requires human capital that can be provided by certain educational institutes. Universities, polytechnics and

other educational institutions generate the basic foundation of human capital by offering a variety of educational programmes and specialized training to their students. This prerequisite knowledge, subsequently, is cultured, made sophisticated and ultimately exploited by the cluster firms. (Op. cit. p. 5.)

According to Sasson and Reve, the educational attractiveness of a cluster can be measured by the level and growth of total graduate students as well as the foreign students in the cluster specific subject(s). It could also be measured by the popularity of the subjects, e.g. by calculating the proportion and growth of the graduates in the related subjects. The level and growth of doctoral students would also be a good indicator of the educational attractiveness. Another aspect is to measure the level and growth of total degrees and craft certificates conferred. (Op. cit. p. 5-6.)

### 3.3.2 Talent attractiveness

Educated workers working in a cluster, especially a knowledge-driven one, contribute significantly to its competitiveness. A knowledge hub always hungers after the best of the global workforces. Educational institutes provide the clusters with required human resources, but the successful clusters make the most of the resources by managing their talents – offering them the best possible work environment, job satisfaction and career paths with further training and lucrative incentives. (Op. cit. p. 6.)

Sasson and Reve suggests that the level and growth of educated and highly skilled workforces, including the foreign ones, imply the growing competitiveness of the cluster. Greater economic incentives, reduced employee turnover rate and positive media coverage also contribute to the talent attractiveness of a cluster (Op. cit. p. 7.).

### 3.3.3 R&D and innovation attractiveness

Research and innovation are pivotal to sustainable economic growth and competitiveness. For a knowledge-driven cluster, these weigh even heavier. Successful business enterprises have always allocated a significant share of their investment for research and development. Higher education institutions also form meaningful cooperation with businesses and public agencies and contribute significantly to research and innovation. (Op. cit. p. 7.)

As Sasson and Reve explained, R&D attractiveness can be measured by the inputs, such as the level and growth of R&D investments and R&D personnel (including the academics) in a particular cluster. The outputs, such as the level and growth of research publications and patent registration in the relevant subject areas, also indicate the increasing R&D and innovation attractiveness (Op. cit. p. 7.).

### 3.3.4 Ownership attractiveness

Successful clusters typically attract big, competent investors from home and abroad. Every business requires financing to run, and large and growing businesses necessitate greater investment. These investments can be made by public and/or private owner(s). Government policies, market characteristics and investment culture also have profound effects on ownership attractiveness. (Op. cit. p. 8.)

According to Sasson and Reve, the level and growth of foreign ownership and venture capital investment are good indicators of ownership attractiveness. (Op. cit. p. 8.)

### 3.3.5 Environmental attractiveness

The issues of climate change, environmental pollutions, biodiversity loss, and resource depletion along with other global and local environmental challenges have drastically changed in which businesses have been operated in recent times. Clusters, therefore, have to be really cautious about their environmental footprints. On the other hand, incorporating effective corporate environmental responsibility in the

business strategy can offer the cluster firms a competitive advantage and attract sustainable investment. (Op. cit. p. 8.)

Sasson and Reve believe that the criteria to evaluate environmental attractiveness of different clusters vary according to the nature and specification of the clusters, but, by and large, clusters with cutting-edge environmental solutions do much better in terms of environmental attractiveness than their counterparts do (Op. cit. p. 8.).

### 3.3.6 Cluster attractiveness

Sasson and Reve refer cluster attractiveness to the amalgamation of the cluster constituents, and suggest that cluster attractiveness can be measured according to the cluster size and specialization on a regional, national or global basis. Other indicators include cluster completeness and degree of internationalization. The existence of a healthy distribution of companies of different sizes and knowledge bases across the cluster and how they create value, both geographically as well as along the whole supply chain, make them more attractive to all the stakeholders. (Op. cit. p. 3-5.)

### 3.3.7 Knowledge dynamics

According to Sasson and Reve, Knowledge dynamics implies the extent of competition, collaboration and cooperation among different cluster constituents, and how they together contribute to productivity, innovation and internationalization. Cluster dynamism reinforces knowledge spillover and competence development through overlapping networks and intra- and inter-industry labour mobility. (Op. cit. p. 9-10.)

# 4 RESEARCH DESIGN, METHODOLOGY AND IMPLEMENTATION

The research design involved a number of steps. In the first place, a meeting was arranged with one of the representatives from JAMK Centre for Competitiveness to deliberate on the research topic. In that meeting, the authors' and the representative's ideas, thoughts and expectations regarding the project were exchanged. Subsequently, a preliminary study reviewing relevant literature and media coverage on the issue was conducted. After that, another discussion with the representative took place whereby research objectives and research questions were agreed upon.

The research objectives include increasing the understanding of the competitiveness of the Finnish ICT cluster and identifying the relationship between Nokia's downfall in recent years and the level of competitiveness of the cluster. To achieve these objectives, several research questions have been drawn up.

The main research question is –

1. How has the competitiveness of the ICT cluster in Finland changed in the context of Nokia's descent in recent years?

The supplementary questions are –

2. What is the current competitiveness level of the Finnish ICT cluster?
3. How has Nokia's decline in recent years affected the ICT cluster?
4. How has the cluster been responding to the changing situation and
5. What could be the future development?

The research method preferred was case study, which entails 'an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence' (Robson 2002, 178). This method suits the research objectives of the authors' as they wanted to increase the understanding regarding the 'competitiveness of the Finnish ICT cluster' (the case) in the context of 'Nokia's decline in recent years' (the contemporary phenomenon) using and triangulating multiple sources of data. In addition, according to Yin (2009, 13), case study is appropriate for the research, whereby the research question starts with

'how' or 'why' and involves a contemporary set of events allowing little control to the researcher. The study at hand involves a research question beginning with 'how' and dealing with contemporary events over which the researchers have little control. Therefore, the authors found case study as an appropriate research method.

In order to answer the main/first research question, the authors conducted a longitudinal analysis collecting both secondary and primary data to fit into the theoretical framework, i.e. Emerald model. Secondary data was collected from various data bases, e.g. Statistics Finland, OECD statistics, World Bank data among others, whereas primary data were collected using survey questionnaire through structured telephone interviews with personnel from different segments across the industry.

On the other hand, the authors conducted three semi-structured interviews using self-administered questionnaires to gain further insights and obtain data to answer the remaining research questions. They also collected data by reviewing relevant literature as well as other secondary sources, such as media, in order to make triangulation for the reliability and the validity of their research.

The Emerald model has been preferred and used as a theoretical framework, as it mainly deals with the chronological data and illustrates general development or change in the situation. This model suits the corresponding research as the authors needed to observe the change in the cluster within the context of Nokia's descent over a certain period. The relevant literature search (Pajarinen & Rouvinen 2013, 3) provided evidence that the downfall of Nokia began during 2008. Therefore, the authors decided to collect data from 2007 to the latest available year. In the first place, the authors tried to find out some general information, e.g. how many employees have been working in this sector, in addition to finding out the number of enterprises and total annual revenue in this sector. In order to obtain data regarding these, the authors used Statistics Finland website.

The first dimension of the framework is educational attractiveness. According to Emerald model, educational attractiveness can be measured using a variety of indicators. These dimensions include the number of graduate students – mainly at Master's Level and Bachelor level, the number of foreign students, popularity of the subjects in relevant fields, the level and growth of Licentiates and doctoral graduates, the number of degrees conferred and craft certificates. To collect these data, the authors used different Finnish websites such as Statistics Finland, KOTA ONLINE and Vipunen – Finnish Ministry of Education and Culture websites among others.

The challenge appeared was to find out specific courses in ICT field as these websites did not provide specific data about ICT. Therefore, the authors had to choose those subjects which are related to ICT, such as Communication and information sciences, Information and communication technology, Graphic design and communication, and Other technology and communication training.

As regards talent attractiveness, the authors needed to find out how many educated workers work in this ICT cluster, the average salary in various fields and also information about foreign workers. Similar to that of educational attractiveness data, the collection of the talent attractiveness data involved limitations. There were no specific data about the education levels of the workers in the ICT cluster. For this reason, the authors had to choose educated workers in general from the Statistics Finland website assuming that the ICT cluster would not be drastically different, given that the education level in Finland is generally high. The educational levels included upper secondary, bachelor, Master's and doctorate levels. On the other hand, as regards the inclusion of foreign workers in the ICT cluster, the authors found data only for the years 2010 and 2011. The foreigners were divided into professionals and technicians.

Another stumbling block for the authors was the measurement of the average salary, since in Statistics Finland website, every year the number of professional levels varies. Therefore, the authors decided to choose those occupations which are related to ICT, such as Manufacture of computer, electronic and optical products,

Telecommunications, Computer programming, consultancy and related activities, Information service activities, Repair of computers and personal and house hold goods, data processing, Other data processing services, Database and network services, Computer and peripheral equipment, Manufacture of communication equipment, Manufacture of consumer electronics, Software publishing, Wired telecommunications activities, Wireless telecommunications services, Other telecommunications activities, and Manufacture of electronic components and board. However, in order to make necessary comparisons, the authors preferred illustrating the categories (namely manufacturing, telecommunications, programming and repairing), which had data for the years 2007 and 2011, assuming that it would be sufficient to give an overview of the salary structure.

To measure R&D and innovation attractiveness, the authors needed to find out the number of researchers working in the ICT cluster, and the level of domestic and international patenting and Investment in this area; and to collect these data, they used Statistics Finland, OECD statistics and research.fi website. There were difficulties to find out actual data about the ICT cluster. The authors collected the data from research.fi website, which had obtained the data from Statistics Finland on Finnish science and technology information society. For ICT related patents, domestic data were retrieved from the Statistics Finland website, while international data were collected from the OECD Statistics.

To measure ownership attractiveness, it was needed to find out the extent of foreign ownership and venture capital involved in the ICT cluster. The authors did not find ICT cluster specific data, and therefore relied on the general, cluster independent data assuming that these data could draw some picture about the ownership attractiveness. The data regarding venture capital were collected from the EVCA Europe and Country yearbook 2013 via European Commissions' official website, whereas inward foreign direct investment data were obtained from the UNCTAD stat website.

As regards environmental attractiveness, the authors collected the data from the OECD stats website. They collected data about Green house ($C0_2$ equivalent) emission, environmental treatment and investment on environmental R&D projects for the latest available years.

For cluster attractiveness, the data regarding the agglomeration of the cluster in the forms of size and specialization were obtained from the European Cluster Observatory. Instead of the ICT cluster, there were separate entries for the IT and the Telecom clusters.

The authors also needed to collect data of ICT exports and outwards FDI of Finland. They found the data of ICT exports (both goods and service) of Finland from World Bank data, but unfortunately ICT specific outward FDI data was unavailable. The cluster-independent data regarding outward FDI (stock and flow) were retrieved from the UNCTAD stats.

To find out data about cluster dynamics, the authors had to collect primary data through structured telephone interviews. The telephone interviews were conducted between mid-May and mid-June, 2013. A range of ICT companies, 40 in number, were selected randomly. Subsequently, according to their business functions, they were placed into different categories, namely telecommunications, software and services among others. Their contact information – phones and/or email addresses – was collected from their websites. The survey questionnaire, which comprised 8 questions asking mainly for expressing the nature and extent of competition and cooperation (mostly in numeric values out of a 5-point scale, where 1 referred to extremely low level, and 5 referred to extremely high level) between different cluster constituents, was sent to those email addresses along with the information about who were conducting the study and what the purpose of the study was.

The authors, unfortunately, received only one response. Therefore, they followed up with reminding emails, yielding no further response. Then they decided to call and,

therefore, tried to make a representative sample out of the companies reducing the number to 30. Their aim was to collect at least 15 responses representing all the categories. The authors confronted with many refusals; some of the samples were busy, some had situations, and some were not interested at all. In some cases, the authors could not contact the right person, whereas in others, they were requested to send emails again. In the end, they somehow managed to collect 12 responses.

On the other hand, to gain further insights and answer the remaining research questions, the authors had to conduct semi-structured face-to-face interviews using a self-administered questionnaire. To conduct these face-to-face interviews, they carefully selected 8 people – 4 of them were from Nokia, and 4 were ICT experts. The authors collected the contact information of the samples and sent them emails mentioning the authors' identities and the purpose of the study. The authors received in total 6 responses – 3 of them agreed to give them an appointment and 3 of them politely refused to do so owing to their hectic schedules. Two people did not respond at all, even after being called.

The first interview was held at IT Dynamo, JAMK University of Applied Sciences on the 23rd of September from 14:15 to 14:45. The interviewee, ES, was a senior lecturer in Software Engineering at JAMK University of Applied Sciences. He worked as a Certified Scrum Master (CSM), an Application Architect and Developer, a Database Administrator as well as a Project Manager in a wide variety of business applications.

The second interview took place at Agora Building, Mattilanniemi, Jyväskylä on the same day between 15:15 and 16:00. The interviewee, PN, was a scientist as well as a professor in the Department of Mathematical Information Technology and the respectable Dean of the Faculty of Information Technology at the University of Jyväskylä.

The final interview was also held at Agora building, but on the 3rd of October from 10:00 – 10:30. The interviewee, SH, was working for the University of Jyväskylä as a

project researcher. He had previously worked for Nokia for around 11 years at 7 different positions, including R&D environment, project management, logistics, manufacturing and outsourcing among others.

All the three interviews were video recorded using the authors' smart phones. The interviewees were requested for the permission to record and use their identities for the research purpose. The interviewees, by virtue of their long research experiences and understanding of the methods and objectives of this particular research project, gleefully accepted the request.

After conducting the interviews, the authors first transcribed them in their entirety. They thoroughly went through all the three transcriptions a number of times to identify the key information needed for answering the corresponding research questions. First they tried to answer the interview questions summarizing the contents of the interviews. In other words, at the beginning categorization was done according to asks of the interview questions. In doing so, priorities were given to those pieces of information that were common (provided and supported by all three of the interviews) or at least more common (provided and supported by two) than others. However, the data belonged to and stemmed from the interviewees own area of expertise also weighed heavy. Apart from the interviewees' explicit answers, implicit indications, including their intonations and body languages, were also taken into account. The condensed forms of the answers were then placed into the categories. Subsequently, all the categories were reshuffled to discover any general trend; finally 8 categories, corresponding to the interview questions, were restructured and placed into 4 broader categories, which were more in line with the research questions.

# 5 RESULTS

The results section is put into two general categories. The first category encompasses the data required to answer the first research question. The second category exhibits results from the face-to-face interviews, and other secondary data from other

literature and media to answer the remaining research questions and make triangulation to achieve the validity and the reliability of the study.

## 5.1 Competitiveness as industrial attractiveness

In this chapter, the changes in the competitiveness of the Finnish ICT cluster will be measured using Emerald model. Before presenting the details of the specific dimensions of the Emerald model, it would be more insightful to have a glimpse of the general information of the cluster itself.

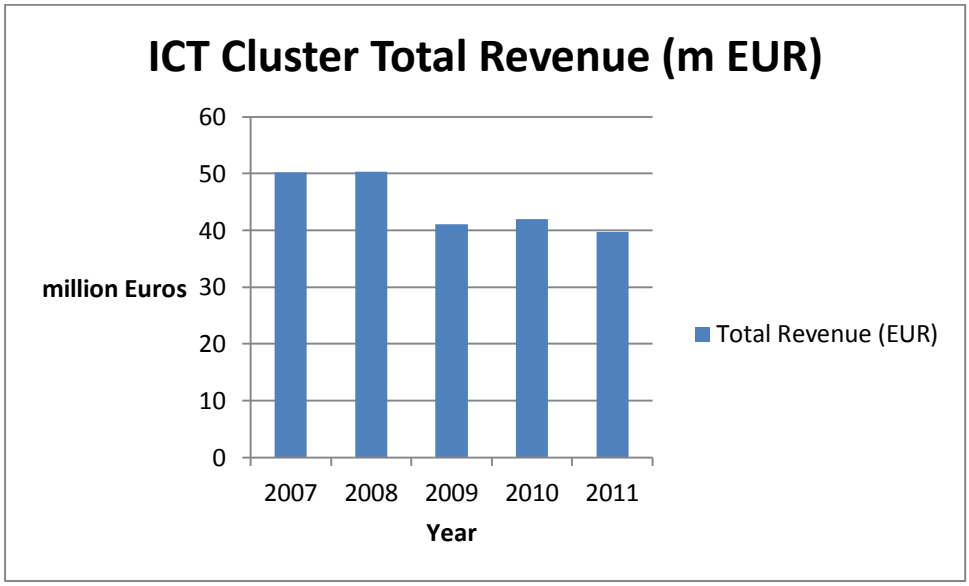



FIGURE 6. Total revenue in the ICT cluster in Finland

(Source: Statistics Finland)

As it can be seen from the bar chart, the total revenue within the ICT industry was EUR 50 million in 2007. While maintaining the amount of revenue at a similar level in 2008, the industry witnessed a huge drop in revenue generation in the following years. The revenue dipped to just over 40 million euros in 2009 and, after a slight recovery next year, to even under the 40 million figure in 2011.

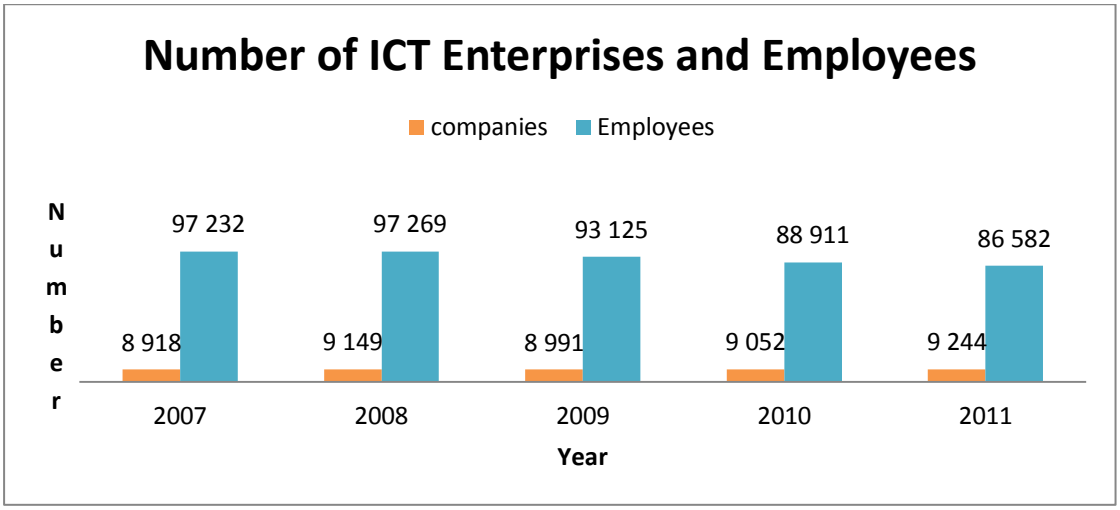



FIGURE 7. Total number of the ICT enterprises and the workers employed in Finland (Source: Statistics Finland)

As the bar chart illustrates, there was a negative correlation between the numbers of employees and enterprises between 2007 and 2011. Whereas the number of employees declined substantially from over 97,000 in 2007 to around 86,500 in 2011, the number of companies went up from approximately 8900 to almost 9250 over the period.

### 5.1.1 Educational attractiveness

The essentiality of a good flow of education in the ICT cluster, as a knowledge hub, cannot be stressed more. In Finland, the ICT cluster is built upon the top quality education provided by the universities and the universities of applied sciences. As the education is subsidized, access to higher education is generally high among the Finns. Tertiary level education in Finland is usually provided by the universities and the universities of applied sciences.

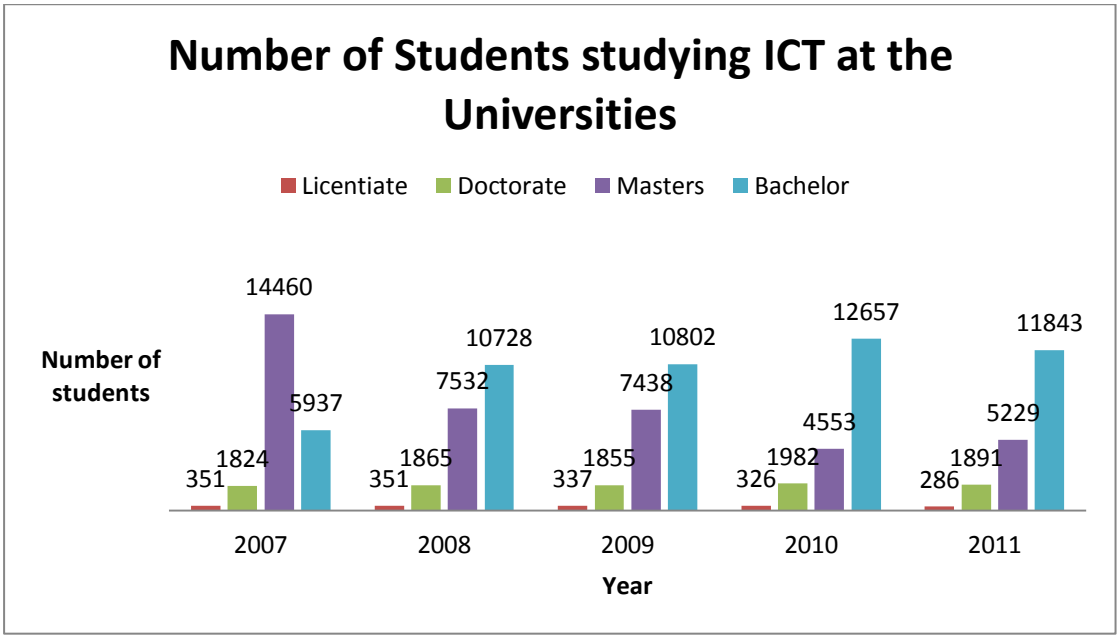



FIGURE 8. Total number of the university students

(Source: Statistics Finland)

As can be seen from the chart, there is a negative correlation between the numbers of Master's degree students studying ICT related subjects at the universities and their bachelor counterparts. In 2007, 14,460 students studied ICT related Master's degree programmes, as opposed to only 5,937 bachelor level students. By 2011, the number for master's students had fallen by 64% to 5,229, whereas the number for bachelor students had almost doubled, to 11,843. However, the changes in the numbers were not so dramatic for the research students. The number of doctoral students increased slightly from 1,824 in 2007 to 1,891 in 2008, whereas the number of students doing Licentiate degree dropped moderately from 351 to 286 over the years.

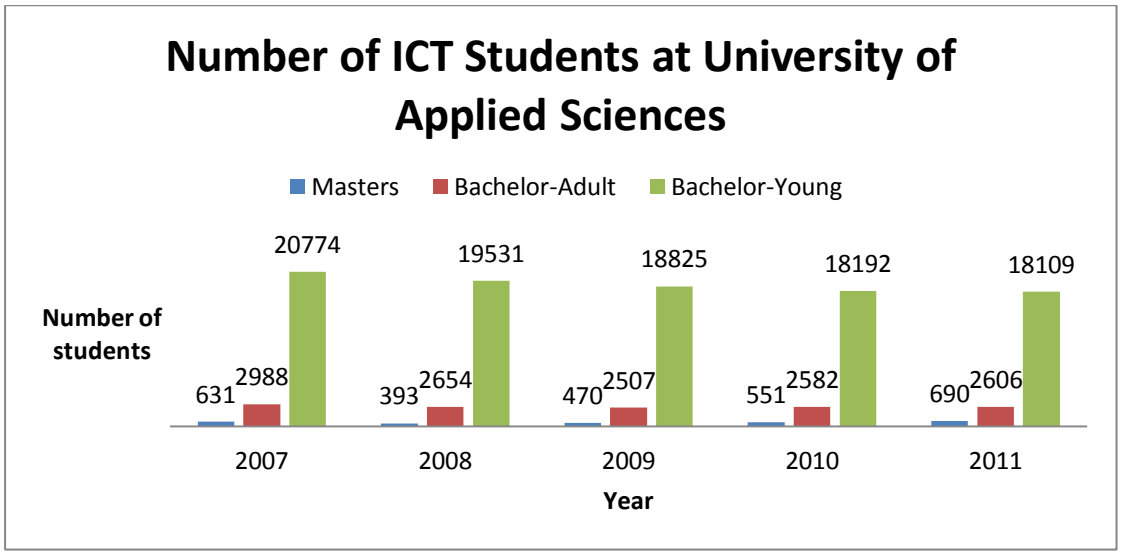



FIGURE 9. Total number of the ICT students at University of Applied Sciences

(Source: Statistics Finland)

At the universities of applied sciences, the number of bachelor students declined by 13% between 2007 and 2011 (from 20,774 and 2,988 to 18,109 and 2,606 for bachelor-young and bachelor-adult respectively). On the other hand, the number of Master's degree students fell significantly from 631 in 2007 to 393 in 2008, but since then increased steadily to 690 in 2011.

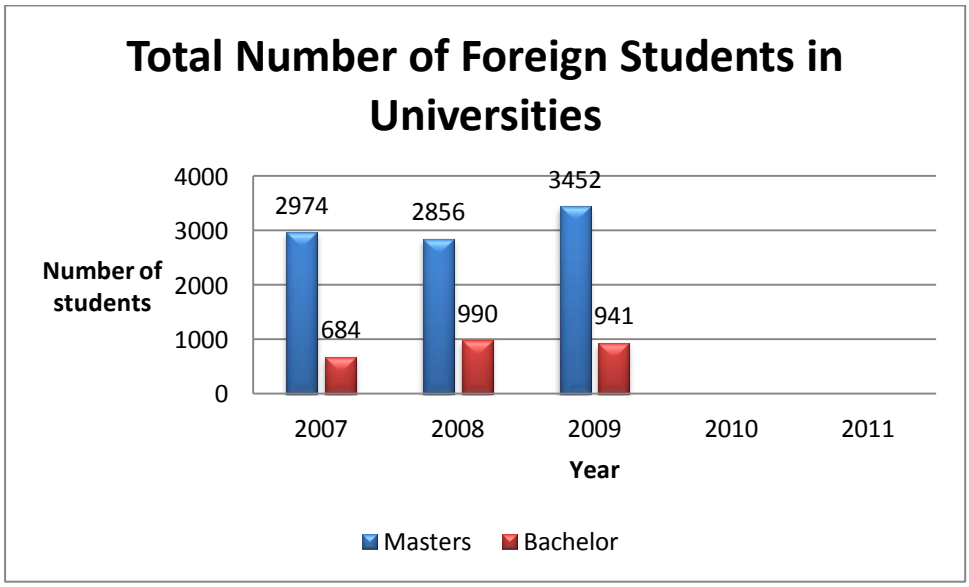



FIGURE 10. Total number of foreign students at universities

(Source: Kota Online)

As regards the inclusion of foreign students, the number of master's degree students was much larger than that of bachelor level students. In 2007, for example, 2,974 foreign students were studying at Master's level, as opposed to 684 at bachelor level. By 2009, the numbers had significantly increased to 3,452 and 941 respectively.

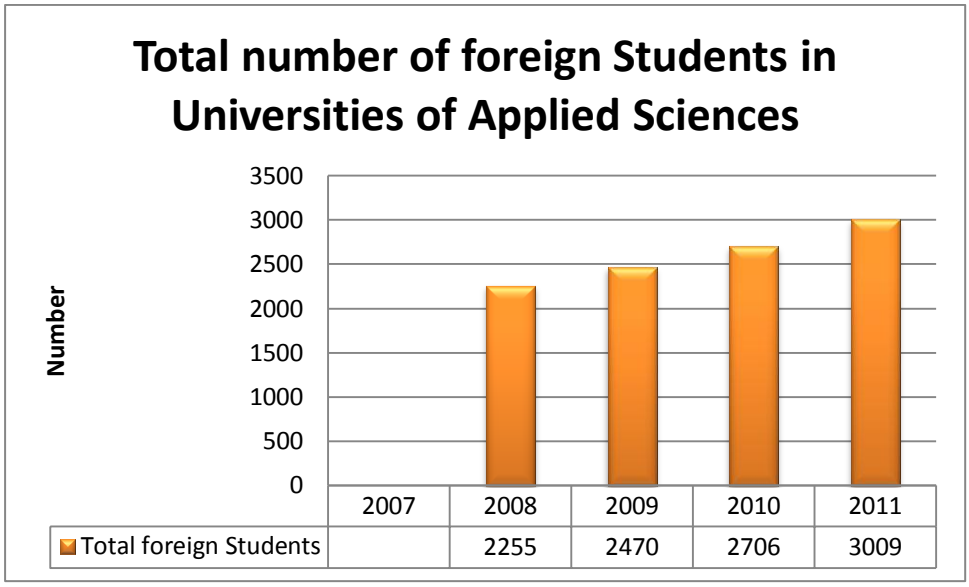
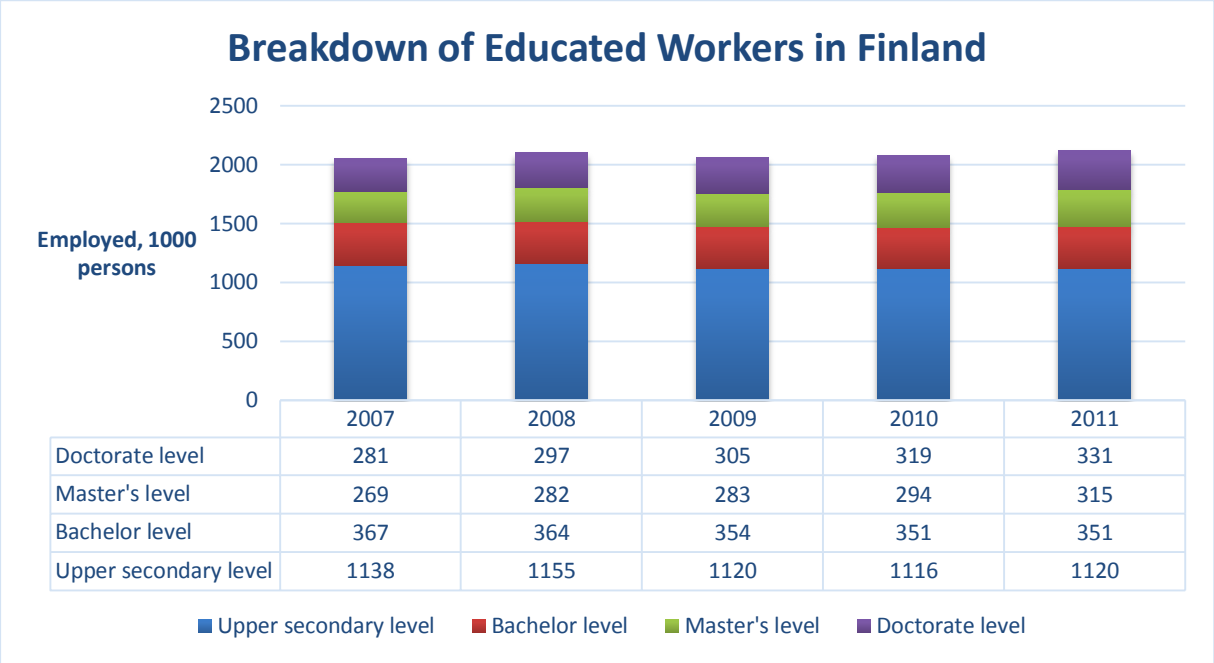



FIGURE 11. Total number of foreign students at the universities of applied sciences (Source: Vipunen)

At universities of applied sciences, the number of foreign students rose steadily from 2,255 in 2008 to 3,009 in 2011.

### 5.1.2 Talent attractiveness

Globalization has bred mobility in the talent pools of different clusters. This is especially true for the ICT clusters. Therefore, ICT clusters across globe are making enormous efforts to attract and retain global talents by offering numerous incentives. Skilled and educated workers are the ones that drive ICT clusters forward.

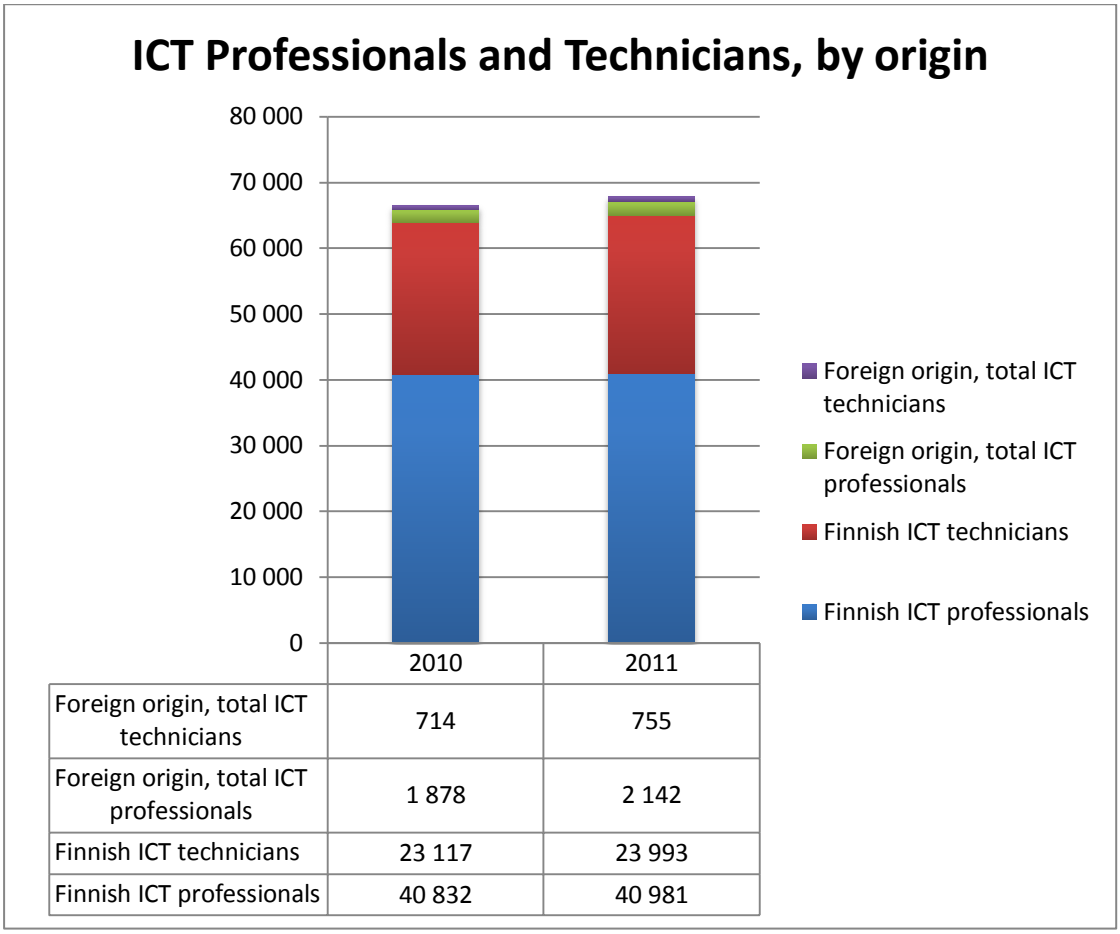



| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Doctorate level | 281 | 297 | 305 | 319 | 331 |
| Master's level | 269 | 282 | 283 | 294 | 315 |
| Bachelor level | 367 | 364 | 354 | 351 | 351 |
| Upper secondary level | 1138 | 1155 | 1120 | 1116 | 1120 |

FIGURE 12. Breakdown of educated workers according to the level of education (Source: Statistics Finland)

As it is shown in the chart, workers with upper secondary level education comprise the largest share (more than half) of the total workforce in Finland throughout the period, despite the fact that the size of this group was somewhat shrinking.

In 2007, approximately 367,000 workers had bachelor level education, but the number decreased significantly to around 350,000 by 2011. Interestingly, there have been more workers with doctorate level education than with Master's level. The size of the former increased from around 280,000 in 2007 to 330,000 in 2011, whereas that of the latter grew from over 270,000 to 315,000.




| | 2010 | 2011 |
|---|---|---|
| Foreign origin, total ICT technicians | 714 | 755 |
| Foreign origin, total ICT professionals | 1 878 | 2 142 |
| Finnish ICT technicians | 23 117 | 23 993 |
| Finnish ICT professionals | 40 832 | 40 981 |

FIGURE 13. Total number of foreign workers/entrepreneurs

(Source: Statistics Finland)

ICT professionals and technicians with foreign origin represented very tiny portions of the total population. In 2010, the number of foreign personnel stood at nearly 2,600, accounting for only 3,90% of the total, which increased by 400 and represented 4,27% of the corresponding population of 2011; most of the increase took place in professional level.

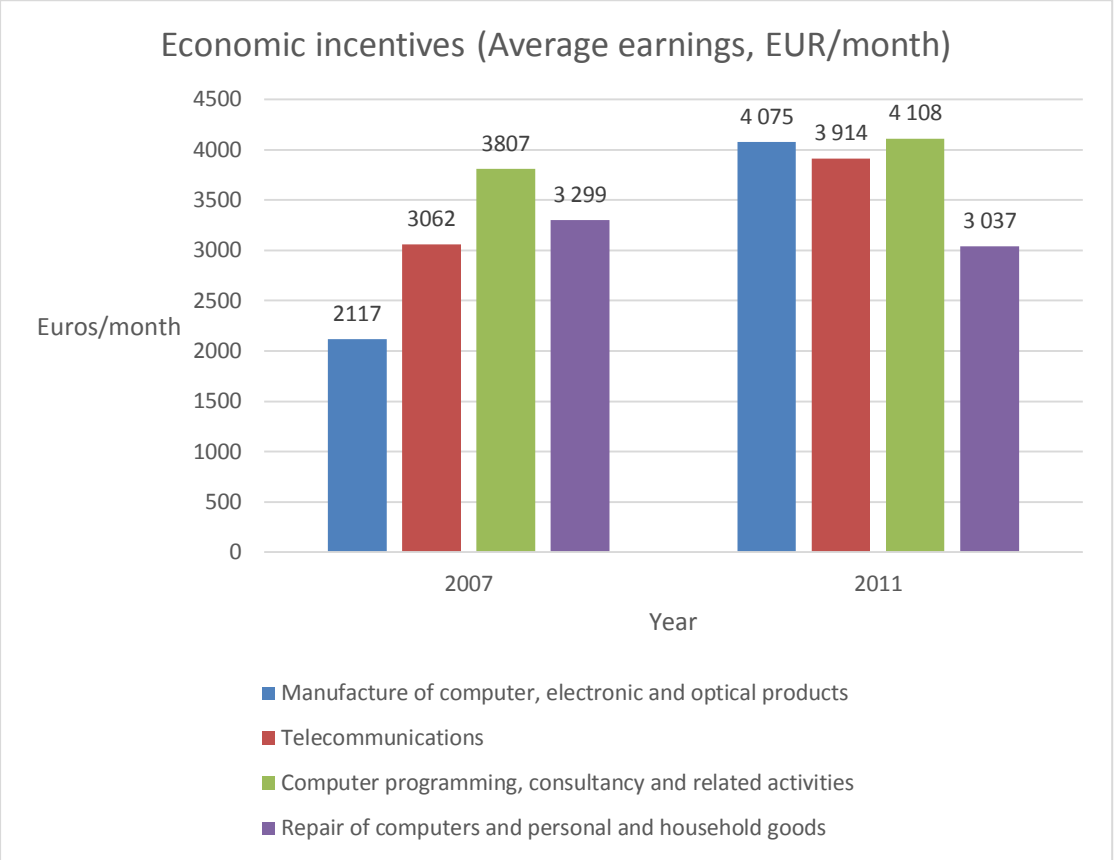


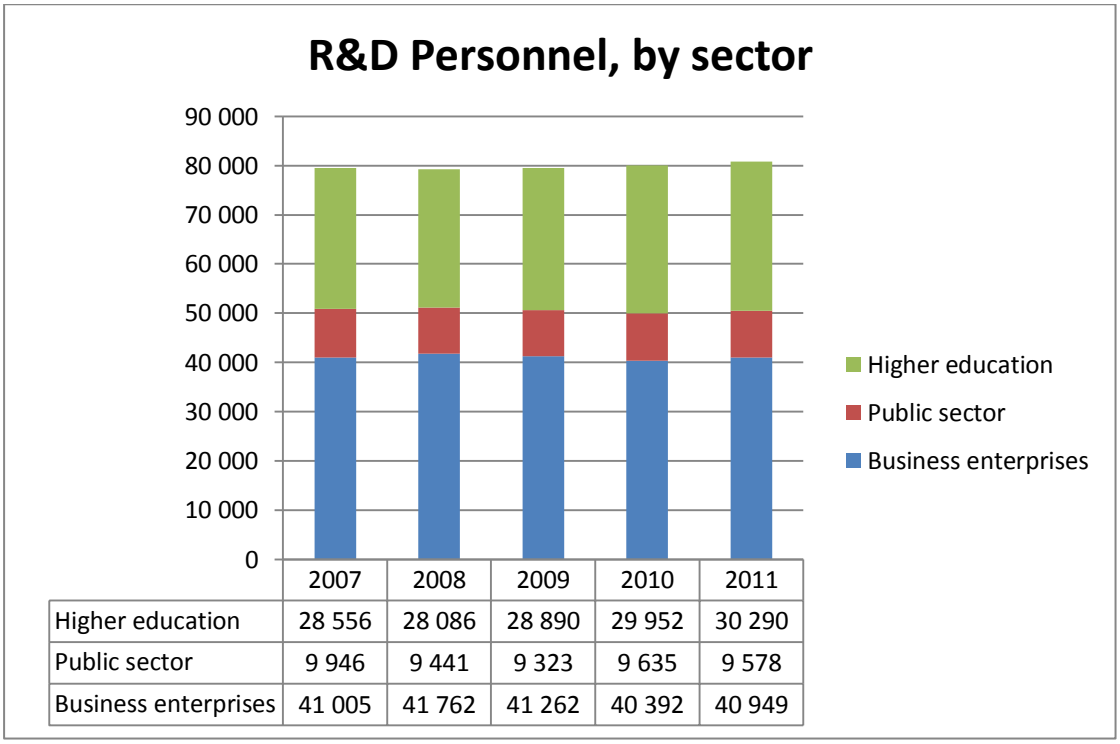

FIGURE 14. Monthly earnings by sector

(Source: Statistics Finland)

As far as economic incentives are concerned, it appears that the average monthly earnings were higher for those involved in computer programming, consultancy and related activities in 2007 and 2011. The average monthly figure for this category increased moderately from EUR 3,801 in 2007 to EUR 4,108 in 2011. Similarly, the amount for telecommunications grew significantly from EUR 3,062 to EUR 3,914 over the same period. However, the most dramatic jump took place in the average monthly earnings in manufacturing sector, almost doubling from EUR 2,117 to EUR 4,075. On the other hand, the sector where the average monthly earnings rather declined was repairing of computers that saw an 8% fall, from EUR 3,299 to EUR 3,037.

### 5.1.3 R&D and innovation attractiveness

The success of ICT firms is extremely dependent on innovation, and innovation typically stems from research and development. Finnish ICT companies usually make strategic partnerships with the higher educational institutions, research institutes and public agencies and thus make huge investments in R&D and innovation. Application for patents is one of the typical ways to keep the innovations secured.

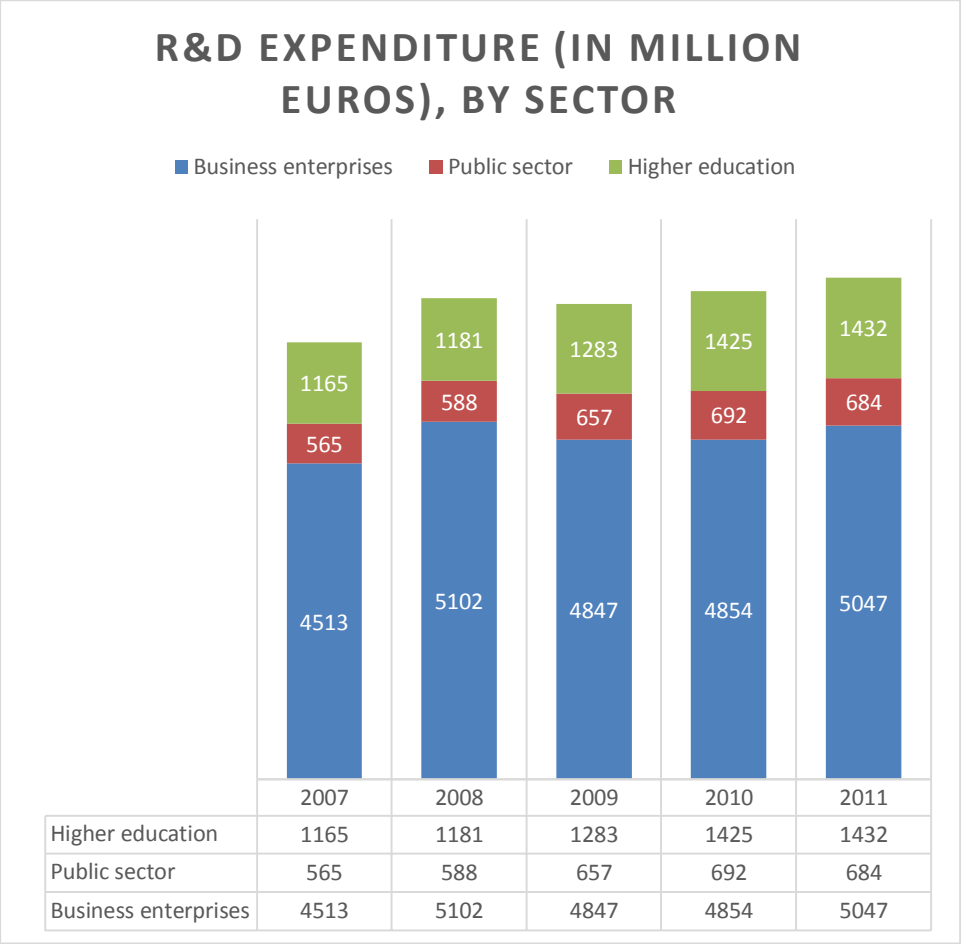



| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Higher education | 28 556 | 28 086 | 28 890 | 29 952 | 30 290 |
| Public sector | 9 946 | 9 441 | 9 323 | 9 635 | 9 578 |
| Business enterprises | 41 005 | 41 762 | 41 262 | 40 392 | 40 949 |

FIGURE 15. Number of R&D personnel

(Source: research.fi=>Statistics Finland: S & T and information society)

As it can be observed from the chart, more than half of the personnel worked for business enterprises (around 41,000), followed by higher education (approximately 30,000) and public sector (around 9,500) over the period. The total number of R&D personnel fell from around 79,500 in 2007 to roughly 79,300 in 2008. Since then, it recovered and grew substantially to nearly 81,000 in 2011, thanks to the remarkable growth in the number in higher education sector. Both business enterprises and public sector saw decline in the number of R&D workers, but the most noticeable drop (of 370) occurred in the former sector between 2008 and 2010.




| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Higher education | 1165 | 1181 | 1283 | 1425 | 1432 |
| Public sector | 565 | 588 | 657 | 692 | 684 |
| Business enterprises | 4513 | 5102 | 4847 | 4854 | 5047 |

FIGURE 16. R&D expenditure

(Source: research.fi=>Statistics Finland: S & T and information society)

As it is evident in the chart, business enterprises accounted for most of the R&D expenditure over the period (roughly 70%), followed by higher education sector (around 20%) and public sector (approximately 10%). In general, the total R&D expenditure increased considerably from EUR 6243 million in 2007 to EUR 7164 million in 2011, thanks to the steady growth in R&D expenditure in all the three sectors.

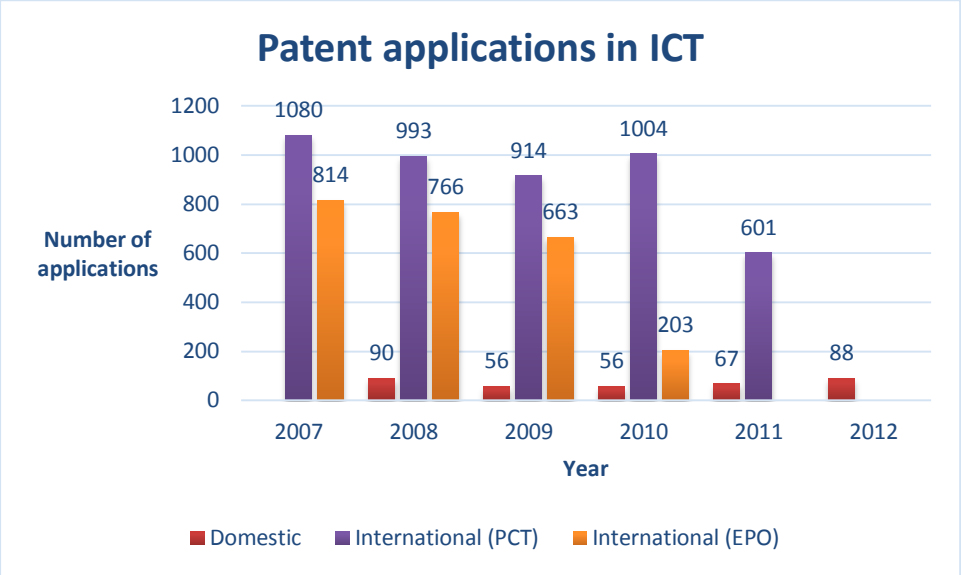



FIGURE 17. Number of patent applications in ICT

Source: Statistics Finland (domestic) and OECD (international)

The bar chart illustrates that there was an overall declining trend in ICT related patent applications both at domestic as well as international level. At domestic level, the number of patent applications went down from 90 in 2008 to 56 in 2010. Since then, it bounced back and reached almost the 2008 level by 2012. On the other hand, patent applications at the international level dwindled over time. Patent applications to PCT and EPO shrank at a similar rate between 2007 and 2009. The former declined in number from 1080 to 914, while the latter fell from 814 to 663. However, in 2010, while the number of applications to EPO slumped to just over 2000, the one to PCT rather soared to over 1000, before plummeting to just over 600 in the following year.

### 5.1.4 Ownership attractiveness

Many ICT firms, particularly the start-ups, require huge funding, which is usually done by the venture capitalists or public development agencies. ICT clusters, making handsome returns, also draw a great deal of foreign direct investments.

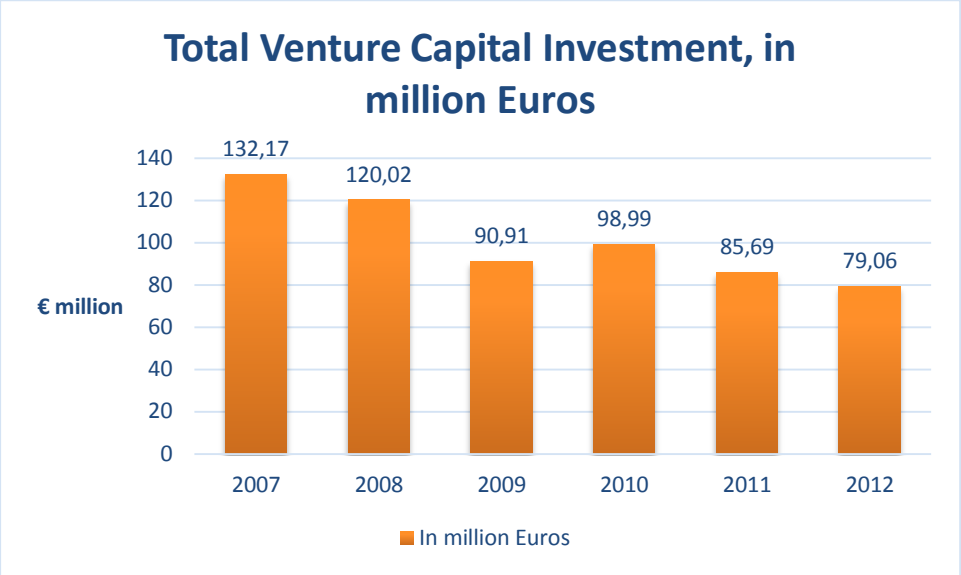



FIGURE 18. Total venture capital investment

(Source: European commission => EVCA Europe and Country year book 2013)

The column chart presents the total venture capital investment in Finland. As it is evident, the total amount of venture capital investment dropped significantly from € 132,17 million (accounting for 0,073% by GDP) in 2007 to as low as € 79,06 million (comprising 0,041% by GDP) in 2012.

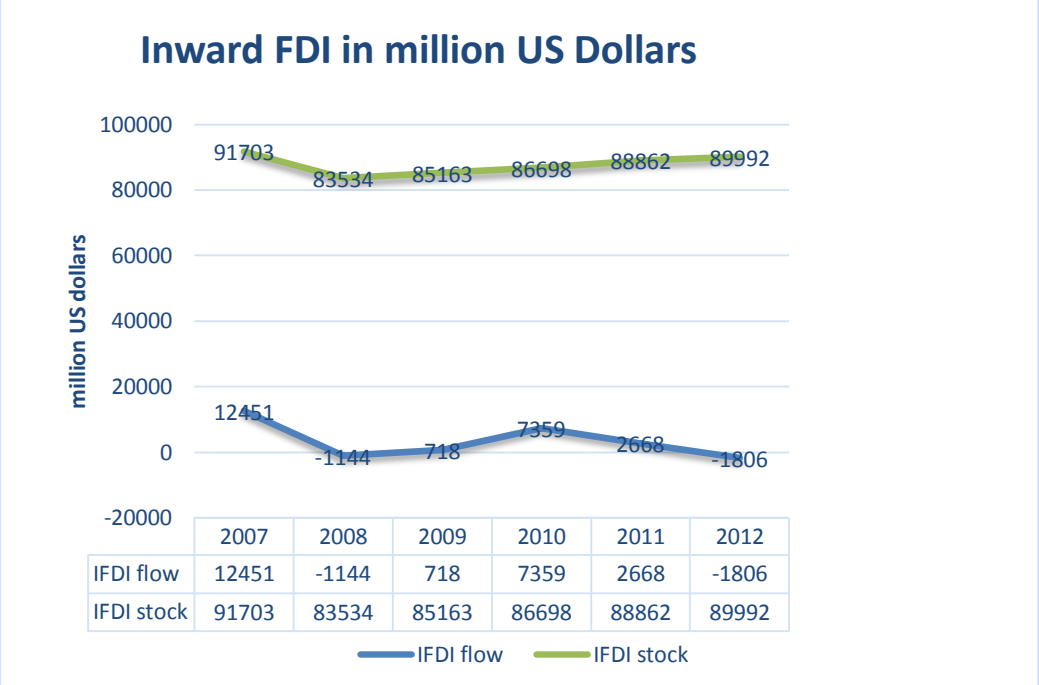



FIGURE 19. Inward Foreign direct investment in million US dollars at current prices and exchange rates

(Source: UNCTAD stat)

According to the line graph, the amount of inward foreign direct investment (IFDI) stock in Finland fell markedly from US 91,7 billion dollars in 2007 to US 83,5 billion dollars in 2008, but climbed steadily since then to almost US 90 billion dollars by 2012, whereas the inward foreign direct investment flows fluctuated throughout the period. There was a significant inflow of roughly US 12,5 billion dollars in 2007, but the next year saw a negative flow. The flow kept growing till 2010, marking another considerable flow of US 7,4 billion dollars. After that, the IFDI flow dipped and eventually turned negative by 2012.

### 5.1.5 Environmental attractiveness

ICT plays a vital role in solving environmental problems and doing greener business. However, the ICT cluster itself also causes environmental impact and ecological damages. On the whole, Finland, along with its ICT cluster, has done pretty well in environmental aspects.

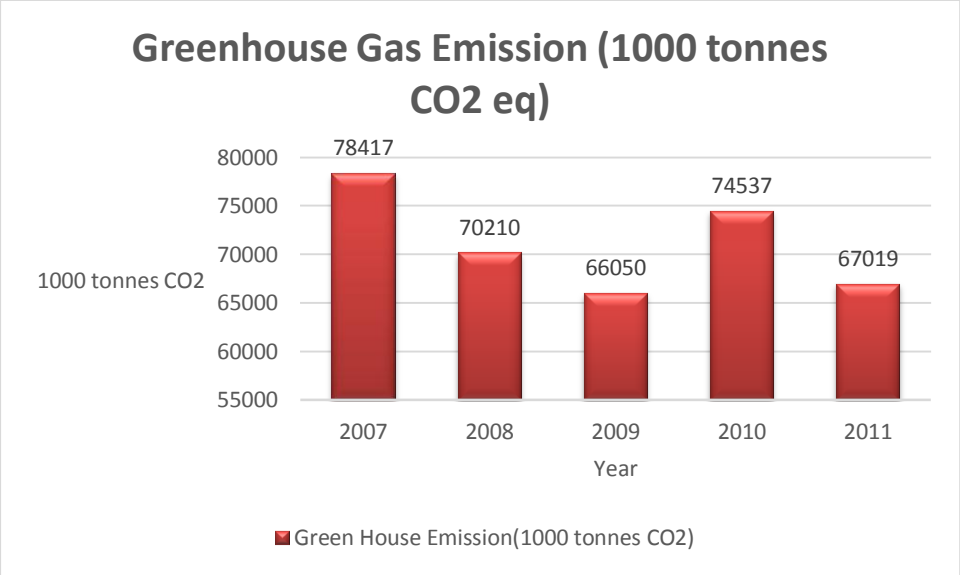



FIGURE 20. Greenhouse gas emissions in 1000 tonnes CO2

(Source: OECD stat)

The greenhouse gas emission in Finland, in general, stood at just under 78,5 million tonnes of $CO_2$ equivalent in 2007. However, the emission was reduced to just over 66

million tonnes over the next two years. In 2010, again there was a substantial increase (over 8 million tonnes) in the greenhouse gas emission, which was then curbed almost to the 2009 level in 2011.

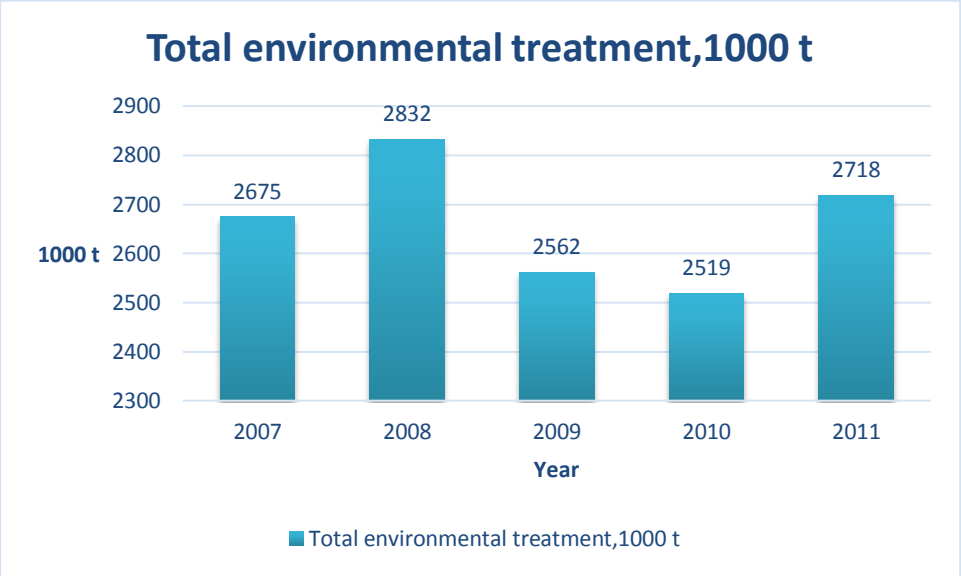



FIGURE 21. Total environmental treatment in 1000 t

(Source: OECD stat)

Total environmental treatment in Finland fluctuated between 2007 and 2011. It rose from around 2,6 million t in 2007 to over 2,8 million t in 2008, but dropped to just over 2,5 million t in 2010. However, in 2011 the total environmental treatment again grew to over 2,7 million t.

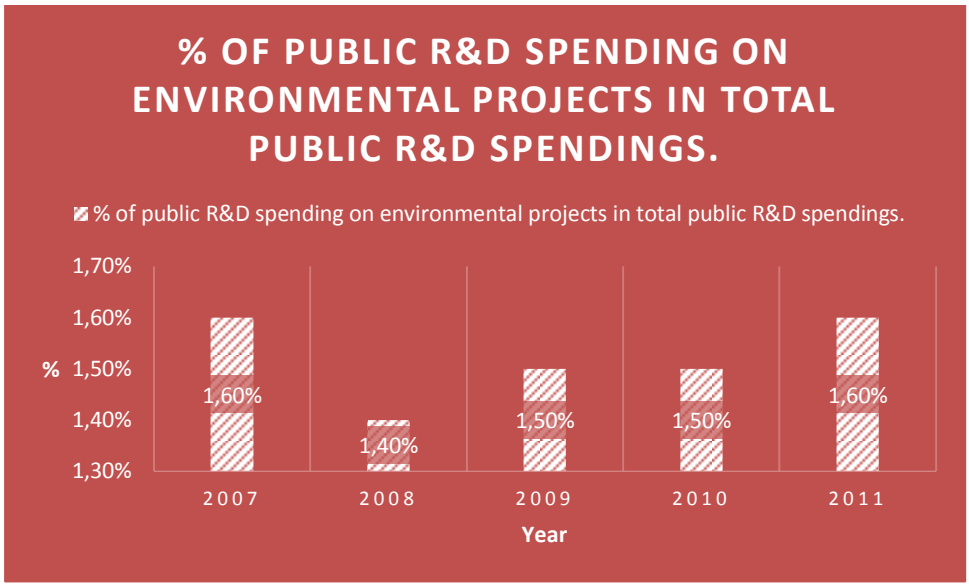



FIGURE 22. Proportion of public R&D spending on environmental projects in total public R&D spending

(Source: OECD stat)

Public R&D spending on environmental projects was 1,6% of the total public R&D spending. The proportion fell to 1,4% in 2008, but bounced back soon to keep increasing to the 2007 level by 2011.

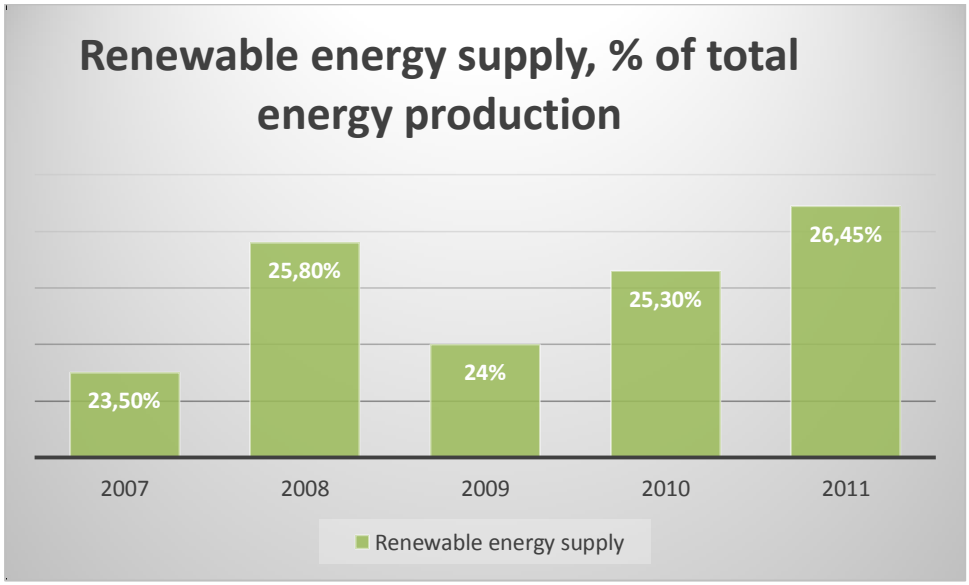



FIGURE 23. Proportion of renewable energy in total energy production

(Source: OECD stat)

Renewable energy accounted for 23,5% of the total energy production in 2007. The share jumped to 25,8% in 2008, but dipped to 24% in 2009. Since then, the proportion climbed gradually to 26,45% in 2011.

### 5.1.6 Cluster attractiveness

The cluster attractiveness indicates the attractiveness of a region from a structural point of view. Cluster agglomeration – including size and specialization, completeness, value creation and internationalization are good indicators of this attractiveness.

TABLE 3. Agglomeration of the cluster(s)

(Source: Cluster observatory)

| Year | IT-Size | Telecom-Size | IT-Specialization | Telecom-Specialization |
|---|---|---|---|---|
| 2007 | 2,1 | 2,78 | 2,07 | 2,74 |
| 2008 | 1,8 | 2,54 | 2,03 | 2,87 |
| 2009 | 1,74 | 2,45 | 2,01 | 2,83 |
| 2010 | 1,78 | 2,15 | 2,08 | 2,51 |
| 2011 | 1,76 | 2,14 | 2,06 | 2,52 |

Overall, it can be observed from the table that the size and the specialization of both IT and the telecom clusters were rather significant, on a declining trend, though. Clearly, the agglomeration of the telecom cluster appeared to be greater than that of the IT cluster.

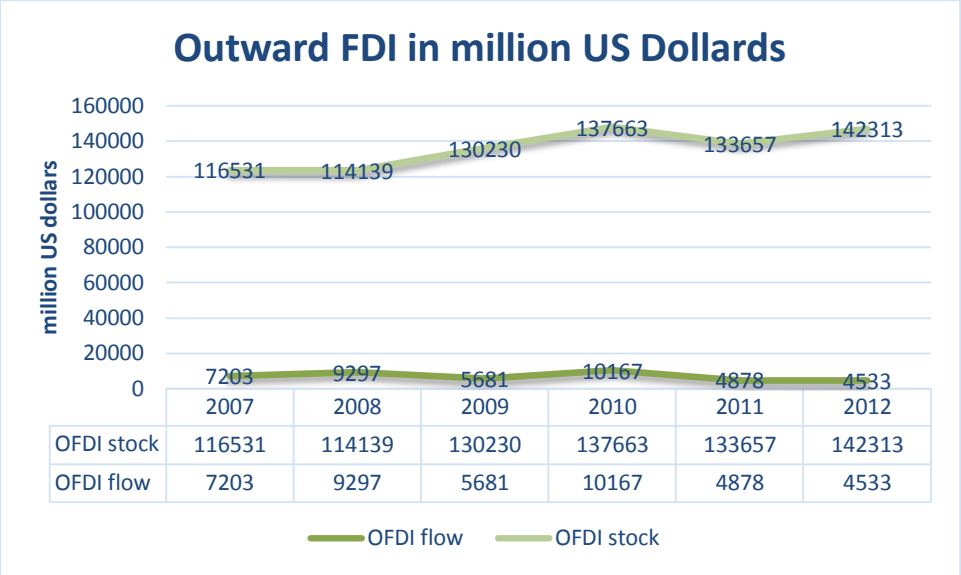



FIGURE 24. Outward Foreign direct investment in million US dollars at current prices and exchange rates

(Source: UNCTAD stat)

According to the line graph, Finland's outward foreign direct investment (OFDI) stock stood at more than US 116,5 billion dollars in 2007, and the figure grew considerably to US 142,3 billion dollars in 2012. On the other hand, the amount of OFDI flows fluctuated between US 4,5 billion dollars and US 10,16 billion dollars over the period. Noticeably, in 2011 and 2012, the flow figures were among the lowest within the time-frame.

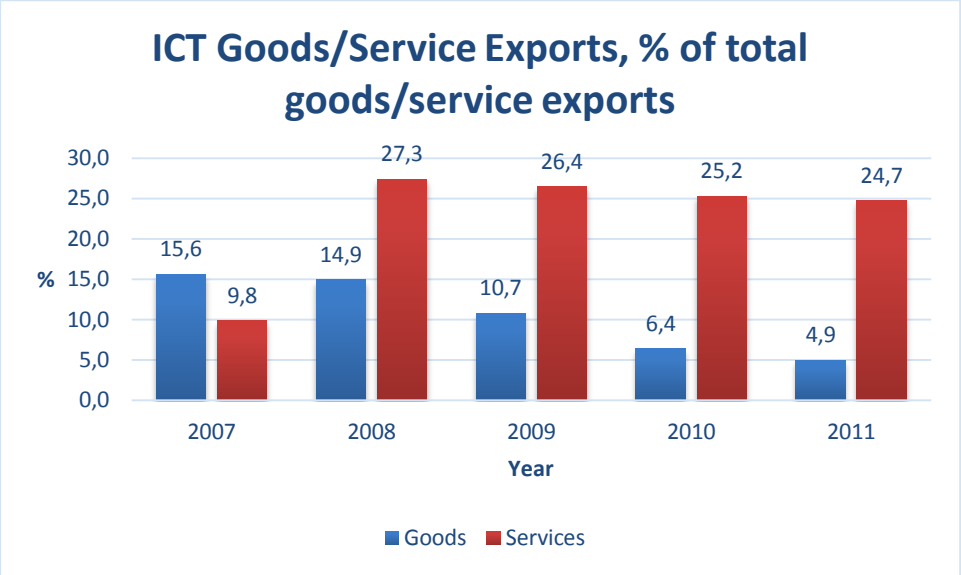



FIGURE 25. ICT goods/service exports as a percentage of total goods/service exports (Source: World Bank data)

The share of ICT goods exports comprised 15,6% of the total goods exports by Finland in 2007. It declined marginally to almost 15% in 2008, but more significantly in the following years. By 2011, the share of the ICT goods had plunged to under 5%. At the other end of the scale, the proportion of ICT services stood at under10% of the total service exports by Finland. The share soared to more than 27% in 2008, but declined marginally since then. In 2011, the ICT service exports accounted for under a quarter of Finland's total service exports.

### 5.1.7 Knowledge dynamics

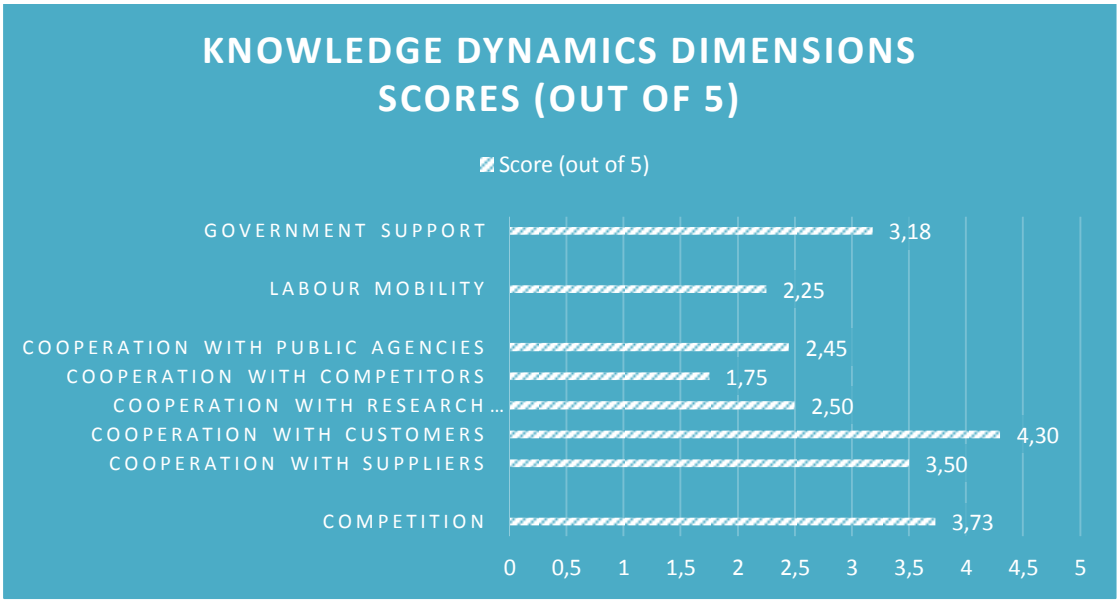



FIGURE 26. Level of cooperation, collaboration and labor mobility across the cluster (Source: authors' own study)

This chart provides a brief overview of the results of the telephone interviews conducted by the authors. The average score of the level of competition across the cluster firms turned out to be 3,73 (out of 5), which typically refers to quite high level of competition. However, as regards collaboration, the firms tend to participate much more with their customers (4,3) and suppliers (3,5) than the research institutes (2,5) and public agencies (2,45). The level of cooperation of the firms appeared extremely low with their competitors. The firms, on average, found the support from the government at a moderate level. Labour mobility, on the other hand, turned out to be relatively low, scoring only 2,25 at the 5-point scale.

## 5.2 Nokia's decline and cluster competitiveness

The interview results have broadly been placed into four distinct categories. The first category deals with the current level of competitiveness of the Finnish ICT cluster – its strengths and challenges. The next category encompasses issues as to how the cluster has been affected with Nokia's descent. The third category involves responses within the cluster to tackle the changing situation, and the final category includes anticipations about the future development.

### 5.2.1 Current competitiveness level of the Finnish ICT cluster

The general responses of the participants about the current level of competitiveness of the Finnish ICT cluster were mostly positive. They acknowledged the cluster as a significant one for the Finnish economy. The respondents identified a number of strong points. Firstly, the Finnish ICT cluster is a big area with many segments. SH exclaimed, '' in Finland, you still have those software companies!'' Increasing focus has been put on segments that have potential to grow. PN clarified that ''…we put power to the industrial services and …(thinking).. and so…(breathing)..network will be very strong, because the number of knowledge will grow, and you need more and more networks!''

These notions are reinforced by the outlook of The ICT 2015 Group that comments that the firms inside the cluster, in this shifting context, are benefitting from diving in narrower domains, namely constructing digital infrastructure, creating specialized applications and services. NSN, in particular, is making greater strides with its 4G network technologies. Software and digital applications are also significantly contributing to the industrial growth. (The ICT 2015 Group 2013, 11-12).

Another area of strength is human capital – knowledge, competence and experience. In SH's words, for example,

> *Definitely knowledge, let's say that knowledge may come from that way that.. let's see if.. let's compare to all the ex-Nokia people,,, there is people who has been doing also another thing than software coding or that basic software stuff, they have market people, how to establish global sales network. So, definitely that kind of competence, knowledge.*

On the other hand, key challenges include, for instance, the transition period – how to cope with the changing situation. There is a psychological impact as well. PN describes – ''It's part of people used to work in big companies…. It was like a state worker! Now it is not anymore…'' Another significant problem is lack of customers. It appeared that ICT cluster is competitive to do things, but lack sufficient customers. SH explained-

> *let's say they can offer to Samsung that ''Hei! We will be able to do everything to you, we have a hardware team, we have laboratories, we have a software team ta ta ta'', but, I don´t know how they are going, but my feeling is that they do not have those kinds of customers.*

Moreover, there is not only intense competition from the developing countries with comparable knowledge base and low-cost production/service facilities, but also from new technologies and innovations that are continuously coming into existence and may come from anywhere. Financial situation is another key challenge. SH explained,

> *Also I guess that the financial level is this that the company do not invest anymore so much in development work. If they have systems and ERPs and whatever they need to deliver, they can use the old one; they are not developing so much.*

A recent publication by the Ministry of Employment and the Economy, to some extent, verifies the data. According to the paper, in recent times, Finland has been ranked very high on a number of competitiveness rankings, such as the ones conducted by the World Economic Forum and the Institute of Management Development among others. Finland's main strengths appeared to be its quality of education, innovation systems and efficient labour markets. The key challenge, however, is to translate this competitiveness into economic growth. A few stumbling blocks identified were high taxes, inflexible labour markets, small domestic market and low levels of local competition. (Känkänen, Lindroos & Myllylä 2013, 32-33)

The following table prepared by the European Cluster Observatory also provides some evidence of the current competitiveness of the Finnish ICT cluster.

TABLE 4. ICT Cluster Competitiveness Ranking by The Cluster Observatory

(Source: Protsiv & Sölvell 2013, 28)

| Cluster | Largest city in region | BSR CC Rank | Europe CC Rank | Transatl. CC Rank |
|---|---|---|---|---|
| Oslo og Akershus, Norway | Oslo | 1 | 1 | 6 |
| Stockholm, Sweden | Stockholm | 2 | 2 | 11 |
| Hovedstaden, Denmark | Copenhagen | 3 | 6 | 23 |
| Etelä-Suomi/Åland, Finland | Helsinki | 4 | 7 | 25 |
| Pohjois-Suomi, Finland | Oulu | 5 | 8 | 26 |
| Västsverige, Sweden | Göteborg | 6 | 16 | 46 |
| Trøndelag, Norway | Trondheim | 7 | 17 | 47 |
| Länsi-Suomi, Finland | Turku | 8 | 18 | 49 |
| Sydsverige, Sweden | Malmö | 9 | 20 | 57 |
| Mellersta Norrland, Sweden | Sundsvall | 10 | 22 | 60 |
| Östra Mellansverige, Sweden | Uppsala | 11 | 25 | 70 |
| Agder og Rogaland, Norway | Kristiansand | 12 | 28 | 74 |

As it can be seen from the table, three Finnish regions, namely Etelä-Suomi/Åland, Pohjois-Suomi and Länsi-Suomi, have been listed in the top 10 regional clusters in Baltic Sea Region. The first two of the regions have even held their position in the top 10 list in Europe. Etelä-Suomi, having Helsinki as the largest city, employed nearly 46,500 people and found itself in top-10 rankings in manufacturing, software and telecommunications sub-clusters across Baltic Sea Regions. In manufacturing sub-cluster, particularly, the first three positions went to these Finnish regions. Overall, it can be said that Finland is still very competitive in the ICT sector, even though the employment in the sector is on the decline throughout the country. (Op. cit. p. 27-31)

### 5.2.2 Nokia's downfall and impacts on the ICT cluster

According to the interviewees, Nokia's descent has significantly affected the ICT cluster. One important issue was Nokia's failure with its Symbian operating system (OS). Symbian, being the biggest operating system for smart phones, lost its global

market share drastically. PN attributed this failure to its complexity in design and not being an update technology – ''Symbian was start of going down (smiling) down, because it was too hard to program and handle it…… It was planned for traditional mobile phones, not for smart phones... and they were delay in this new, new telephone.''

Jorma Ollila, Nokia's former CEO (1992-2006) as well as Chairman of the board (1999-2012), also pointed at Nokia's chronic incompetence in software know-how as one of the main reasons for Nokia's downfall. He mentioned that the slump was mainly initiated by Apple (with its iPhone in 2007) that, as opposed to Nokia, developed software first and phones later. Nokia, already in 2007, recognized that its predominant operating system, Symbian, was getting outdated, but was assured by the responsible departments within the organization about making necessary improvements, but only in fallacy, and eventually ended up lagging far behind in the competition. Other reasons for the failure, Ollila revealed, included telecom operators pressure to produce inexpensive models, shuddered trust base across the organization originated from the failure in making Symbian competitive and regular delay in bringing the new productions into the pipeline, organizational changes and erroneous business strategies, e.g. partnership with Microsoft. (Sajari 2013, 1-2).

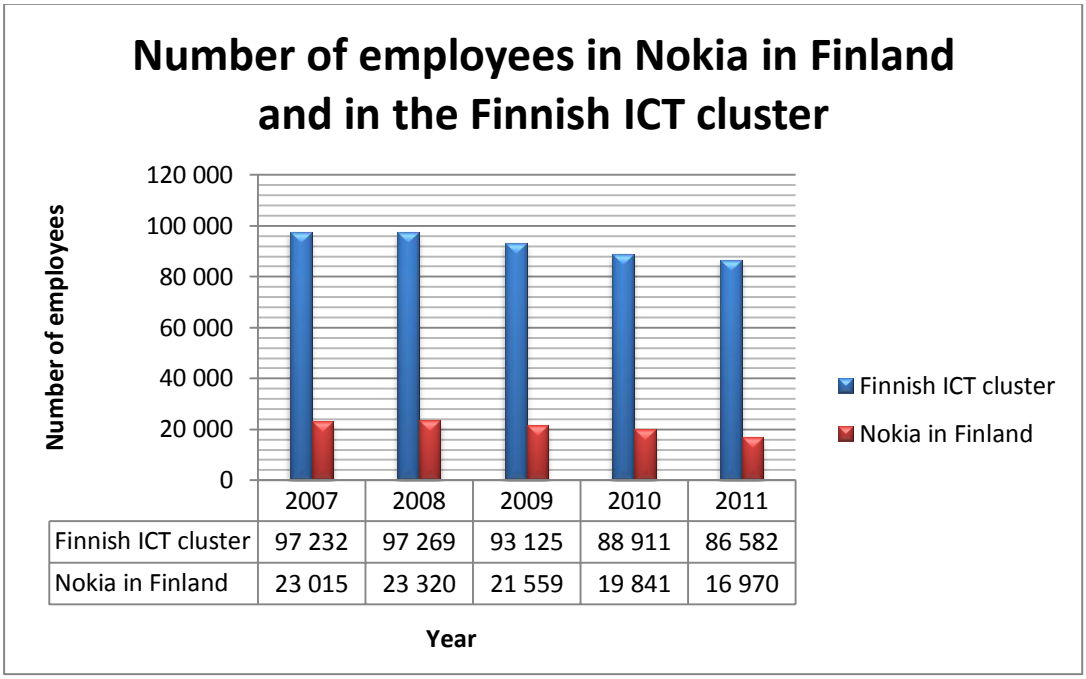
Nokia's partnership with Microsoft was also extremely controversial. There have been many opinions, but the overall impression of the interviewees regarding the partnership as well as its outcome appeared to be negative. PN was very straightforward in making his remark – ''Maybe 50% told that it was ok, and 50% told that it was a failure. And who told that it was not good they are right. Also especially the leadership of the president (Stephen Elop) of the work it was, he is not good leader!'' ES put it more diplomatically – ''It's a big question also for me really (laughs), so… but in anyway it has been bigger changes after that when they started to use Windows**.''**

Overall, Nokia's failure with the operating systems significantly affected the whole ICT cluster in Finland. A large number of people, including software programmers as

well as hardware designers lost their jobs. ES described – ''it has affected a lot, of course directly to Nokia but also those companies who are work for Nokia. That has been great impact to whole ICT''.

SH provided an interesting insight –

> *It's not so easy to change to some new… new platform, totally new, you have one more people dedicated for that, how to help them change, so maybe it's easier to kick out, maybe new people in….. definitely affect the subcontractor and of course some Nokia HR people also, but they don't need so many Symbian specialist anymore.*




| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Finnish ICT cluster | 97 232 | 97 269 | 93 125 | 88 911 | 86 582 |
| Nokia in Finland | 23 015 | 23 320 | 21 559 | 19 841 | 16 970 |

FIGURE 27. Number of employees in Nokia's Finnish operation and in the Finnish ICT cluster

(Source: Nokia annual reports 2008 - 2012 – Nokia, Statistics Finland – Finnish ICT cluster)

The column chart shows the similar trends in employee reduction in Nokia's Finland operation and the Finnish ICT cluster. The populations of both groups grew slightly in 2008, but shrank considerably in the remaining years. In 2007, Nokia had just over 23,000 employees in Finland, as against roughly 97,230 employed in the Finnish ICT cluster. The figures grew to 23,320 and around 97270 respectively in 2008. Since

then there were sizeable drops in both numbers, and by 2011, the respective populations had dropped to 16,970 and just over 86,580 respectively.

### 5.2.3 Responses from within the cluster

To tackle the impending crisis, the ICT cluster, along with its various constituents, has taken a variety of actions. The policy makers are focusing on other potential segments within the ICT cluster, such as networks, services and programming. PN stressed the fact that ''..we need this mobile communication know-how in Finland. It helps us to grow other sectors…. there are new needs of mobile applications.'' There have been new cooperative recommendations. Government is concentrating its resources to redesign the ICT education, highlighting prospective areas, such as information security, data analysis, gaming and optimization among others.

This has been reflected in The ICT 2015 group's development focus – in-depth data processing expertise, digital services and content, gamification, data security, mobility and big data. Two major moves identified are harmonizing research, application, productisation and commercialisation, and incorporating ICT profoundly with the education policy. (The ICT 2015 Group 2013, 19).

Besides, in Finland, there is a system that if very big changes occur in the economy, government can arrange some special treatment to address those. ES described -

> *..some people will lose their jobs. Some has already, for example, in Oulu, which is very important city for Nokia, and Tampere. And in Finland we have that kind of system that if very big changes will come in the economics, some field, our government can start some special treatment for take care of those people.*

In SH's words,

> *Of course we have that kind of government 'Rakennemuutos' money… Ok …lots of big changes in the big companies that kind of nice word. ''O shit! We have risks to get lots of lots of unemployed people, now we need to put some money there!'' I think that the Protomo (a development community for starting businesses) is one……. In university, they started lots of 10-15*

> *different kind of projects and there was some support money on that government budget*

Nokia also extended its support, for example, with its IDEAS or BRIDGE programme, helping its redundant or affected employees to find a new way and/or become entrepreneurs. SH enlightened -

> *If they are kicking you out, if you have a business idea, you'll just show your business plan, and you'll get…was it like a 4-person team maximum. If the idea is good.. 'Hei! You can maybe live, that sounds good, so 25000 euros per people. So you have 100,000 euro like start-up money.' So I don't know how many that kind of company has been established. It was Nokia BRIDGE money.*

As a consequence, many small companies and startups have been established. Also, there is a need for good programmers and professionals in ICT cluster in Finland. Therefore, many of the employees managed to get new jobs in other companies wanting to exploit their skills and experience. In the eyes of PN,

> *So it was, it was like a second university, Nokia, they educated them, they learnt new skills and they go. Of course some people they don't have their good education. It takes time. They must go back to some university or school and learn new skills, but this is normal.*

A recent paper by ETLA can be used as verification to some of these claims. The paper has concluded that Nokia has contributed significantly to Finnish economic development with its tangible impacts as well as the intangible ones. Nokia taught Finns how to become successful in global business. Ex-Nokia employees by dint of their expertise and experience gained from Nokia have been hired in top-level management and specialist positions in different industries. On a recent note, many of Nokia's employee outflows have ended up in entrepreneurship and public sector jobs. (Pajarinen & Rouvinen 2013, 20).

The evidence how Nokia and the Finnish government tried to address the situation can also be found in a number of articles published on Helsingin Sanomat, a popular daily in Finland.

Stephen Elop, the then Nokia CEO, indicated that Nokia had discussed the outplacement issues of its departing personnel with its partners as well as competitors. The strategic decision to use Microsoft Windows platform for the new mobile phones would result in thousands of workers to be unemployed. Nokia seriously took the aftermath into account and made necessary planning to address the problem. (Helsingin Sanomat 21.02.2011)

On 10.05.2013, a Nokia-Press release announced that its sustainability document of 2012 incorporated issues regarding redundancies and site closures. It further stated that Nokia continued its support for the affected employees through its BRIDGE program, which was designed to help its redundant employees re-employ, re-train, or become entrepreneurs. It claimed that by 2012, it had helped establish 1000 new businesses through the program. (Nokia press release 10.05.2013)

On 11.07.2012, an article was published on Jollatides.com referring to Jolla Mobile's CEO, Jussi Hurmola talking about Nokia BRIDGE Program in an interview on Finnish TV. Jolla Mobile, a startup supported by Nokia Bridge program, was aiming to continue the MeeGo legacy. Hurmola expressed his appreciation and admiration about Nokia and was proud to be a part of it. This provides further evidence of Nokia being a holistic company looking after its employees. (Jollatides 2012.)

On the other hand, a report published in Helsingin Sanomat (English edition) on 15.06.2012 announced that the Finnish government was considering declaring Oulu as an area of sudden structural change. The Salo region already had this status. An area with such a status is entitled to extra employment and business subsidies from the state. Salo had already received EUR 5 million during the spring 2012. Jyri Häkämies, Minister of Economic Affairs, explained, '' It is intended for use in business projects, investments, different types of development measures, and possibly for the training of personnel.'' The report also mentioned that already in spring, government had made a decision on a growth package worth EUR 300 million including tax incentives for R&D activities and corporate capital investments. (Helsingin Sanomat 15.06.2012)

Another article was published in Helsingin Sanomat (English edition) on 16.10.2012 about government subsidy of EUR 13 million for Finnish ICT sector with the aim of boosting employment. Nokia's descent resulted in rising unemployment in ICT industry in Finland. During spring, the Ministry of Employment and Economy created a working group, headed by Pekka Ala-Pietilä, chairman of the board of the state investment company Solidium, with the intention of preparing a strategy to mitigate the impact of the structural change, to stimulate changes in the sector, and to enhance competitiveness. (Helsingin Sanomat 16.10.2012)

Of the proposed funding, EUR 4,1 million would be channeled to the development of digital services and the development of operating environments, for example, to establish development and testing environments of cloud services. In addition, Finnish Funding Agency of Technology and Innovation (TEKES) would be receiving EUR 8 million in order to be ready for any sudden structural change within the ICT cluster. TEKES was supposed to grant EUR 6 million to SMEs for the development of readiness for online sales and marketing. Another EUR 0,5 million was reserved for a network to stimulate R&D activities in the ICT and media sector. (Op. cit.)

Overall, these articles hold evidence that the decline of Nokia did create unemployment problem in the ICT cluster, and Nokia, the Finnish government, along with other cluster constituents, made attempts to address the situation.

### 5.2.4 Anticipations about future development

The interviewees, by and large, have been quite optimistic about the future development in the ICT cluster in Finland. ES particularly indicated those small companies -

> *I'm also very hopeful for those small companies that some of them will rise for bigger, and they will give lot of new opportunities. As you know game programming is quite popular in Finland. There are small companies in Jyväskylä and Finland, and some of them make lot of success….. and of course*

> *we need companies who are good in also global market and I hope that in that field they will come, not new Nokia but lot of new companies.*

They also seemed to have good faith in Nokia as well. ES talked nostalgically – ''I have hope that Nokia is good position; they will survive, because it has given lot of to Finland……. Of course Nokia was so big in couple of years ago that it will take time to rise in the same level.''

PN put emphasis on Nokia's telecommunications network business and NSN – ''But Nokia had this communication network business as well. It has all the time positive…… Nokia will be strong in Finland and they will concentrate to telecommunication…….. And they hire new people in Finland!''

The interviewees also expressed optimism about Microsoft and the new deal. ES believed that the big crisis would also mean new possibilities for the new companies – ''It has also chance, because now they have to make some other choices, they have to make new business, they have to cooperation for example with Microsoft, so.. so it can, it also good affects.''

PN regarded Microsoft as a very good company (as far as business is concerned), while SH anticipated that Microsoft – the new Nokia – might bring something really big and innovative as they have resources to exploit.

> *…let's say that in five years, there's more windows applications than iPhone applications. Now they everything is in-house, so it has to be that if the hardware manufacturing guys are saying something, it should be easier to the software guys, ''Hei! Should we change something?'' So that's a good point. From that sense, those Microsoft Nokia phones has to be better in the future.*

The interviewees, however, remained skeptical about the long term commitment of Microsoft to the ICT cluster in Finland. PN sarcastically said ''…they promise (smiling, this is American promise!'', whereas SH stated this straightforwardly -

> *……I am not trusting anything about that. So definitely it's a big company, and if they can learn something about old Finnish guys or Finland based workers, they can suck all the knowledge in some time and they can…….. so I am not so*

*certain of. ''Do we need the most taxes?''….I mean taxes are high. ''So why the hell in Finland? We have the most.. like a global broadcast.'' At least they are maybe squeezing a bit.*

# 6 DISCUSSION

The research project has been carried out with the aim of increasing the understanding about the competitiveness of the ICT cluster in Finland in the context of Nokia's downfall in recent years. The main research question has been ''How has the competitiveness of the ICT cluster in Finland changed in the context of Nokia's descent in recent years?''. In addition, there have been a number of supplementary research questions – regarding the current competitiveness of the ICT cluster, the impact of Nokia's downfall on the cluster, responses from the cluster constituents to address the situation and anticipations about the future development.

In their attempts in seeking for the answers to the questions, the authors used various data collection methods. Emerald model has been used as a theoretical framework to measure the competitiveness of the ICT cluster over a certain time-frame. On the whole, it has been found that the competitiveness of the ICT cluster was certainly eroding. The revenue generated by the cluster fell substantially, so did the number of employees. These reductions in numbers could largely be attributed to Nokia's decline affecting the whole supply chain inside the cluster.

From educational perspective, the situation was rather confusing. At the universities, the number of Master's students studying ICT related subjects dropped markedly, as opposed to a moderate increase in the number of their bachelor counterparts. On the other hand, at the universities of Applied Sciences, the numbers generally declined for both bachelor and Master's degree students. The numbers of licentiate degree students also fell remarkably, while that of the doctorate students rather increased, marginally though. On a positive note, the participation of foreign students was on the rise at both types of institutions. It could be expected that the new education policy with its new focus could increase the attractiveness in the coming years. It is recommended to investigate why Finland, despite having a world

class education system, is lagging behind its American and other European counterparts in attracting the brightest of the students from different parts of the world.

As regards talent attractiveness, the employees with a tertiary degree in Finland accounted for a significant part of the total working population, and the share was increasing. However, in the ICT cluster, the participation of foreigners was remarkably low. It is highly recommended to diversify the workforce ensuring smooth integration of the foreigners. Nevertheless, the increasing economic incentives in almost all types of the employee categories conceivably imply the rising productivity of the employees.

When it comes to research and development, the eroding attractiveness was evident in terms of ICT related patent applications filed both at domestic and international levels. However, increasing amount of funding was allocated in this field – in higher education, public sector and business enterprises. Together with increased number of R&D personnel in higher education and decreasing number in business enterprises, the growing R&D expenditure possibly indicates concerted efforts in searching for innovation and new business opportunities through academic projects. A further explanation could be the rising engagement of ex-business workers (e.g. Nokia's) in research projects in partnership with the universities/universities of applied sciences.

As regards, ownership attractiveness, the value of the venture capital investment in Finland shrank considerably over the years. On the other hand, inward FDI stock decreased significantly in 2008, but rose marginally since then, whereas IFDI flow was in a declining trend. Overall, there were reasons to be concerned. Therefore, the policy makers must take initiatives to make the sector more lucrative to the investors.

Finland has done quite well regarding environmental issues. Its share of renewable energy supply in the total energy production increased, so did the share of public spending on environmental projects. Also, Finland successfully curbed its greenhouse gas emissions. Overall, environmentally this has been a very attractive place.

With regard to cluster attractiveness, the situation turned out to be a little worrying. Finland's share of ICT related exports in total exports shrunk in recent years. The share of ICT services exports fell marginally, but that of ICT goods dropped considerably. However, Finland continued to invest more in foreign countries, but the rate was falling slightly. This can be explained by taking the example of Nokia, which was shifting its production facilities out of Finland.

From the perspective of knowledge dynamics, there were scopes to improve. Labour mobility was not on the higher side; neither were the cooperation between different stakeholders, particularly with competitors, public agencies and research institutes. Collaboration with customers and suppliers turned out to be quite high, though. Competition among the firms also seemed to be relatively high. Nevertheless, for a better and more secured future, stronger performances from the cluster constituents regarding knowledge dynamics are expected.

All in all, the current competitiveness level of the Finnish ICT cluster has appeared to be still on the higher side, but the competitiveness seemed to be fading due to a number of stumbling blocks, namely price competition, small domestic market, relatively low competition at local level and higher tax rate among others. Finnish ICT cluster have traditionally been good at manufacturing and services, compared to software development, but the changing structure of business has been posing a great threat to its existing competitiveness. The firms are, however, responding to the change by focusing more on narrower fields, exploiting its existing sources of competitiveness and specializing in more sophisticated technologies.

The horrendous impact Nokia's downfall has had on the ICT cluster has been attempted to mitigate both by Nokia and the Government with different projects. A great deal of money has been poured in those projects. Entrepreneurship has been highly encouraged, and the results have already been evident in the astounding growth in the number of enterprises, including start-ups. The future of the Finnish ICT cluster is very much dependent on the success of these newly founded companies. One sector with a tremendous growth potential is gaming industry, which has already achieved some success in the global business. Nokia has always changed its business directions, and, despite its current situation, there are many people, who are optimistic about its bouncing back – mainly with its NSN operations. On the other hand, Microsoft in its acquisition of Nokia is expected to produce better results as they are now better resourced. However, their long term commitment towards Finland and the Finnish ICT cluster is not beyond question.

## 6.1 Verification of the study

The research has not been without its limitations. It has been carried out taking account of the time and the resource limitations. The data collected from the secondary sources have not always fitted with the requirements of the theoretical framework. For example, cluster specific data were limited in their availability and appropriateness. However, attempts have been made to make some assumptions and simplifications, and thereby produce optimum results within the limitations. Also, the interview samples were relatively small and predominantly based on Central Finland. These limitations, nevertheless, have largely been overcome by the triangulation of the data.

TABLE 5. The criteria to verification of the study

(Source: Akpinar 2009, 81)

| Criteria | LeCompte and Goetz (1982) | Lincoln and Guba (1985) | Yin (2003); Rowley (2002) | Meaning |
|---|---|---|---|---|
| 1 | Internal validity | Credibility | Internal validity | Sense making of findings |
| 2 | External validity | Transferability | External validity | Ability to generalize |
| 3 | Reliability | Dependability | Reliability | Ability to replicate |
| 4 | Objectivity | Confirmability | Construct validity | Ability to get acceptance |

Internal validity or credibility, which asks for the quality of the study as to whether the findings make sense or answer the research question(s) (Akpinar 2009, 81), has been taken under serious consideration. Having employed case study, as a research method, provided the authors with a rich data set, from which it was really convenient for them to answer all the research questions with necessary details.

External validity or transferability, which seeks for the quality to generalize the findings, has always been a major challenge for case study methods (Op. cit. p. 81). In the study at hand, the case itself was the competitiveness of the Finnish ICT cluster and the context was Nokia's downfall. The main problem is that Nokia has played an incredibly significant role in the Finnish economy as well as in the Finnish ICT cluster. This much of dependence of a country or an industry on a single company is rare. Therefore, it might not be an honest effort to make generalization based on the research findings. Having said so, the theoretical framework used in this study has already been used in a number of studies, and because of its characteristics of using longitudinal statistical data and explicit guidelines, it ensures rather reliable findings that can possibly be used in other clusters in the country or the similar clusters in different countries as well.

Reliability or dependability, which refers to the possibility of the findings to be replicated by other researchers (Op. cit. p. 82), has been a major challenge for this study. In the study at hand, historical data have been retrieved from trustworthy websites, such as Statistics Finland, OECD stat, UNdata, World Bank data and

UNCTAD among others. Interview findings may be vulnerable to subjectivity, but triangulating the data ensures that the results have been verified, and thus more reliable.

Objectivity, which calls for the quality of the study where other researchers would be able to achieve the same result with the same sets of data, is likely to be existent at the study. The first reason is that the authors, being two in number, naturally provide objectivity as they have made constructive criticism of each other's work. Another point is that there is little for the authors to be biased. It has been a project work, the topic was relatively fresh and the point was to make an objective interpretation of the data. The authors have been believed to be taken care of the objectivity.

## 6.2 Implications of the findings

The three major groups that might find this study useful are, of course, policy makers, potential investors, and academics.

The study examines the competitiveness of the ICT cluster in Finland and takes account of six different dimensions of industrial attractiveness, namely educational attractiveness, talent attractiveness, R&D and innovation attractiveness, ownership attractiveness, environmental attractiveness and cluster attractiveness in addition to knowledge dynamics within the cluster. Scrutinizing these dimensions over a longitudinal time-frame has provided the authors with the opportunity to observe the changes or development in the dimensions.

In addition to highlighting the areas of strength, the authors have attempted to pin down the potential drawbacks and the weaker points in the chain. On the other hand, knowing that only statistical data would not provide a complete picture of a particular phenomenon, the authors conducted semi-structured face-to-face interviews with the industry specialists. Thus they got access to further hands-on information by allowing the interviewees to stretch further, while staying on the

track. For verifying the results even further, the authors looked into other recent empirical studies and relevant media coverage. In this process, the findings of the study have become more complete and acceptable. The study at hand, thereby, contributes to the existing literature and knowledge base about the study of cluster and competitiveness, at a general level, and, of the Finnish ICT cluster and Nokia, on a more practical note.

Thus, the policy makers would get a chance to look into a much broader picture, and modify their policy accordingly. Policy makers from abroad can also learn many lessons from this, for example, what kind of risks is involved in relying heavily on one particular firm within a cluster, if not in an economy. They can also learn how Finland is coping with the situation. Potential investors can have a more objective view on the overall scenario, identify areas with growth potentials and make informed decisions with their investment. In addition, the academics may find some issues to become engaged in academic discussion, and identify useful topics from the findings to carry out further research.

## 6.3 Suggestions for future research

The study at hand has used Emerald model to measure the change in the competitiveness of the Finnish ICT cluster in the context of Nokia's downfall. In carrying out the research, the authors have realized that the inclusion of cultural aspect in the theoretical framework would probably make better sense. On that note, there could be a scope for conducting a research as to how to measure the cultural dimension of industrial attractiveness. Another avenue for carrying out further research would be to find out the causal relationship between Nokia's downfall and the competitiveness of the Finnish ICT cluster. It would be really interesting to see how Nokia's downfall, irrespective of global financial crisis, has impacted the competitiveness of the Finnish ICT cluster. Last but not least, one of the findings of the study at hand is the gaming industry with a growth potential. Therefore, the analysis of industrial attractiveness of the gaming industry in Finland would be a relevant research topic to carry out.

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# APPENDIX 1

**The questionnaire used for the interview**

1. How do you see the competitiveness of the Finnish ICT cluster today? What are the key challenges? What are the strengths?

2. How did Nokia's failure in "Symbian OS" smart phones affect the Finnish ICT cluster?

3. How did Nokia's partnership with Microsoft affect the Finnish ICT cluster? What is happening now when Nokia's telecommunication sector is owned by Microsoft?

4. How do you see Microsoft's (in its acquisition of Nokia) commitment / intentions to the ICT cluster in Finland?

5. How did the ICT cluster in Finland respond to Nokia's downfall?

6. What kind of role has the Finnish government played in the ICT cluster in response to Nokia's downfall?

7. Following Nokia's downfall, a large number of people needed to leave Nokia and other companies in the ICT cluster in Finland. What has happened to them?

8. What kind of future developments do you expect for the Finnish ICT cluster?

# APPENDIX 2

**Survey questionnaire used for the telephone interview**

Name of organization: (WRITE IN ADVANCE)

Phone number of organization: (WRITE IN ADVANCE)

Type of Organization: (WRITE IN ADVANCE)

Name of person:

Title of person:

1. How many key competitors do you have in Finland? How tough is competition among you: could you grade from 1 to 5, 1 is not competitive at all, 5 is extremely competitive?

2. How would you grade the strength of your collaboration with suppliers, customers, research institutes, competitors, and governmental organizations from 1 to 5? 1 is no collaboration at all, and 5 is very high level of collaboration.

   Suppliers:
   Customers:
   Research institutes:
   Competitors:
   Governmental organizations:

3. Do you collaborate with companies from other industries? Which industries? How would you grade the strength of your collaboration with them from 1 to 5? 1 is no collaboration at all, and 5 is very high level of collaboration.

   Industry name 1:
   Industry name 2:

4. How often do employees change jobs in your industry? Can you grade from 1 to 5: 1 means very rare and 5 means very often.

5. How do you grade the support of the Finnish government to this industry from 1 to 5? 1 means no support at all, and 5 means very high support.

6. What kind of support do you want from the government?

7. What are current challenges facing your business?

8. How do you see the development of your industry in Finland?