Lappeenranta
University of Technology

Reijo Lilius

# THE FINNISH IT INDUSTRIES IN TRANSITION

## Defining and Measuring the Finnish Software Product and IT Services Industries by Applying Theoretical Frameworks

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## Abstract

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The starting point of this study is that the prevailing way to consider the Finnish IT industries and industry information often results in a limited and even skewed picture of the sector. The purpose of the study is to contribute and increase knowledge and understanding of the status, structure and evolution of the Finnish IT industries as well as the Finnish IT vendor field and competition. The focus is on software product and IT services industries which form a crucial part of all ICT industries. This study examines the Finnish IT sector from production (supply) as well as market (demand) perspective. The study is based on empirical information from multiple sources.

Three research questions were formulated for the study. The first concerns the status of the Finnish IT industries considered by applying theoretical frameworks. The second research question targets at the basis for the future evolution of the Finnish IT industries and, finally, the third at the ability of the available definitions and indicators to describe the Finnish IT industries and IT markets.

Major structural changes like technological changes and related innovations, globalization and new business models are drivers of the evolution of the IT industries. The findings of this study emphasize the significant role of IT services in the Finnish IT sector and in connection to that the ability to combine IT service skills, competences and practices with high level software skills also in the future. According to the study the Finnish IT enterprises and their customers have become increasingly dependent on global ecosystems and platforms, applications and IT services provided by global vendors. As a result, more IT decisions are made outside Finland. In addition, IT companies are facing new competition from other than IT industries bringing into market new substitutes. To respond to the new competition, IT firms seek growth by expanding beyond their traditional markets..

The changing global division of labor accentuates the need for accurate information of the IT sector but, at the same time, also makes it increasingly challenging to acquire the information needed. One of the main contributions of this study is to provide frameworks

for describing the Finnish IT sector and its evolution. These frameworks help combine empirical information from various sources and make it easier to concretize the structures, volumes, relationships and interaction of both, the production and market side of the Finnish IT industry. Some frameworks provide tools to analyze the vendor field, competition and the basis for the future evolution of the IT industries.

The observations of the study support the argument that static industry definitions and related classifications do not serve the information needs in dynamic industries, such as the IT industries. One of the main messages of this study is to emphasize the importance of understanding the definitions and starting points of different information sources. Simultaneously, in the structure and evolution of Finnish IT industries the number of employees has become a more valid and reliable measure than the revenue based indicators.

Keywords: IT industries, Software product, IT services, Frameworks, Ecosystem of Finnish IT industries, IT enterprise space

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Almost forty years of work experience in different positions in the IT sector, in public as well as private, in Finnish and global organizations, has given me the opportunity to follow closely the Finnish IT industries through many profound changes to the present new challenges. All this raised a desire to consider the transition of the Finnish IT industries also in a scientific context. Several persons have made this effort possible.

Firstly, I would like to express my gratitude to my supervisor, Professor Tuomo Kässi from Lappeenranta University of Technology. He had a key role in inspiring the commencement of this project and has offered his time and insight throughout the course of the study.

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Kerava, October 2012

Reijo Lilius

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# PART I: INTRODUCTION

# 1 Introduction

## *1.1 Background of the Study*

During the last two decades the growth of the Finnish economy has been very dependent on information and communication industries (ICT industries). They had a key role in the country's economic recovery after the recessions of the early 1990s and 2000s. In this development, Nokia was in an exceptionally central position (e.g. Häikiö, 2002; Koski, Rouvinen and Ylä-Anttila, 2002; Hyytinen, Rouvinen and Ylä-Anttila, 2006).

Today the traditional ICT industries seem largely to be in transformation from high growth to "business as usual" industries. The growth rate of the Finnish ICT industries started to slow down already before the global financial crisis in 2008 and the following recession. Thereafter the downturn has raised questions and contradictory views of the role and ability of ICT industries to serve as a major source for growth in the Finnish economy.

Simultaneously, the ICT in Finland as well as globally is facing remarkable structural changes. For the Finnish national economy this development is becoming a challenge since, at the same time, major, traditionally strong manufacturing industries are under the same global pressure and have not been able to grow at the same pace as in past decades.

Nevertheless, several government bodies and various businesses expect that the ICT industries and innovations based on applying information technology will remain among of the main sources and drivers for future growth in Finland and have important positive effects on the national economy and employment (Hernesniemi, ed., 2010; Eloranta et al., 2010). These expectations have also important financial implications: to retain and improve the competitiveness of the Finnish ICT industries the public sector offers significant funding as well for basic research on the ICT area as enhancement of innovations and concrete development projects and programs of ICT companies (e.g. funding of Tekes, TIVIT[1]).

In recent years, greater expectations have been directed towards services as a key driver in the economy. Etla (The Research Institute of the Finnish Economy) has estimated that already up to 70 percent of the Finnish workforce is employed by services (Statistics Finland). In the traditional IT industries (part of ICT industries) services have played a strong role in Finland since the 1960s. Production of services using information technology as an enabler is expected to grow rapidly (e.g. Hernesniemi, ed., 2010; Eloranta et al., 2010).

[1] Tieto- ja viestintäteollisuuden tutkimus TIVIT Oy

In the 2000s, also production of software products became an area with high expectations while production of ICT hardware (equipment) has since the 1990s gradually migrated to lower cost countries. The same evolution is to be seen also in the structure of the so called Nokia cluster (e.g. Rouvinen, 2009; Pajarinen et al., 2010).

Main drivers of the evolution of the ICT industries are various structural changes, such as technological changes and related innovations, globalization and deregulation. For instance, major technology waves (mainframes, mini computers, PCs and Internet) have reshaped the structure of ICT industries in many ways during the last 50 years (e.g. Malerba et al., 1999; C. M. Christensen, 1997; G. A. Moore, 2000; Moschella, 2003). At the same time, when companies attempt to utilize various structural changes, also new business models and related innovations have become important drivers of industry evolution. Additionally, changes in customer needs and behavior have significantly affected the evolution of single ICT firms and entire industries (Hamel and Prahalad, 1994; Sako, 2005; Jacobides and Winter, 2005; Jacobides, 2009).

One important development has been internationalization of customers and vendors. It has fueled changes in global division of labor, resulting in radical changes concerning the location of production of ICT products and services as well as locations where they are utilized. Consequences of this development can be seen as an increasing unbundling of processes or even separate tasks and further as a scattering of traditional clusters (Baldwin, 2006; Jacobides et al., 2006; Ylä-Anttila, 2008; Pajarinen et al., 2010). So far there is, however, rather limited empirical research available of the impacts and importance of this evolution.

Since the ICT has been recognized a major source of economic and social change efforts have been made to improve official statistics of the field. Also ICT related research has increased in several areas like new information technologies, consumption, investment, innovative efforts and human resources (OECD, 2007, 2009, 2010; Statistics Finland, 2008). However, there are still major problems and obstacles in forming a comprehensive and reliable picture of the Finnish ICT industries and their structures.

A serious, both scientific and practical, problem is that the prevailing research methods, confusions in terms and definitions, sometimes also data credibility issues, often result in a rather limited and even skewed picture of the status and evolution of the Finnish ICT industries. It is difficult to get to consistent answers or estimates even on basic matters like the contents and size of the Finnish ICT sector. At the same time the need of research based on consistent and well defined terms and definitions is emphasized by continuous changes reshaping both single companies and entire industries.

The issues described above form the main starting point of this study. Various users of industry information need a more coherent and accurate picture and understanding of the Finnish IT industries than presently available from public data sources.

ICT companies provide products and services based on use of information and communication technologies. The companies producing or providing computers and

related hardware (equipment), software products and IT services form the traditional IT industry. The IT industry consists of separate industries or sub-industries. This study focuses on industries and companies producing or providing software products or IT services in Finland as well as on markets and customers of these companies. Software products and IT services represent about 70 percent of the IT spending in Finland (Market-Visio, 2010). In this study the notion of IT sector is used to consider both the supply and market sides of IT products and services.

This study does not include production or market of communication equipment and communication services (e.g. Nokia, telecom operators etc.) or the production and markets of computer hardware. In addition, the production of embedded systems is mainly outside the scope of this study. The companies providing embedded systems are only included to the extent that they also produce software products and IT services defined in the study. However, a good share of firms outside the scope of the study (e.g. Nokia) is considered in the study as important customers of software and services firms.

This study considers, utilizes and assesses traditional industry theories, theories and literature of innovations and other major structural changes and of expansion beyond traditional offerings and customer segments. These have been discussed in parts II and III and summarized in Chapter 4.

## *1.2 Research Problem*

Building a comprehensive and accurate picture and understanding of the status and evolution of the Finnish IT industries is complicated. Main reasons to this are continuous changes influencing single enterprises and entire industries as well as confusions in definitions and terms of IT industries.

The main purpose of this study is to contribute and increase the knowledge and understanding of the Finnish IT industries as well as of the Finnish IT vendor field and competition. At the same time the purpose is to provide and contribute new information and theory. The following general research questions define the research problem of this study:

- What is the Finnish IT industry and how is it formed?
- How does the existing information support and help to understand the Finnish IT industries?

More specific research questions will be formulated later in Chapter 5.3.

Providing answers to the research questions requires identifying and analyzing major drivers, factors and dynamics affecting the current status and evolution of the Finnish IT industries and markets. These will also make it possible to assess the basis for future evolution of the Finnish IT industries. Simultaneously the study will examine the usefulness of the available definitions and indicators used to describe the Finnish IT

industries and IT markets as well as their evolution. On the basis of this analysis it is possible to discuss the possibilities to improve the accuracy of the definitions and measurement of the Finnish IT industries.

These issues often become concrete in everyday discussion and decision making. Presently the following types of information needs are not easy to meet:

- What is the size of the Finnish IT industry or IT market?
- What is the share of domestic production of the Finnish IT spending and market?
- What is the role of imports of the Finnish software purchases (or spending)?
- What is the role of foreign IT firms in the Finnish IT market?
- How many persons are employed in the production of software products or IT services in Finland?
- What is the impact of globalization on the Finnish IT sector?

One of the major starting points of this study is to argue that the current way to consider industries and the industry information available often results in a rather limited and even skewed picture of the status and evolution of the Finnish IT industries.

The roots of the definitions of many industries are several decades old which weakens the validity and reliability of industry indicators and measurement (Baldwin, 2006). A fair share of current definitions, indicators and ways to collect information used in public statistics are based on more static circumstances than is the case today (Jacobides and Winter, 2005; J. F. Christensen, 2008). Technological evolution and other structural changes have widened the gap between the picture received from official industry data and the reality (cf. Hamunen, 2008).

Needs to receive relevant information and have definitions which react more rapidly to changes in industries have not been realized only in the ICT industries (cf. Jacobides and Winter, 2005). During the last few years these issues have become also more important topics in public debate related to software product and IT services industries.

IT industry information produced by statistical authorities typically focuses on the production (supply) side of the industry. Market research firms consider the market and user (demand) point of view. Both directions often provide only a one-sided picture of the status and evolution of an industry. Another challenge is a trend that a growing share of IT products and services are produced or provided by other than the IT industries.

In addition to an overall picture of the Finnish IT industry and its structure it is important to identify and understand major differences between software product and IT services industries. Apart from their role in the domestic market, they are also increasingly important exporters (Rönkkö et al., 2010, Tilastokeskus, 2010). In public debate the Finnish software industry is often emphasized as one of main drivers in the economy. However, the definition and content of the software industry often remain unclear and the border between software products and IT services requires more accurate definition. Software product and IT industries can differ significantly when considering business

models, employment, required skills and knowledge or investments required. Differences may also rise from varying customer bases. All these facts and developments justify a closer consideration and analysis of both the software product and IT services industries.

## *1.3 Key Concepts Used in the Study*

The following section discusses briefly key concepts used in this study.

### 1.3.1 IT Industries

ICT firms produce or provide products or services based on information or communication technology. The products may be equipment (hardware) or software products. This study concentrates on firms and groups of firms (firm populations) that produce software products or IT services targeted to user customers. As a result of this limitation, the production of communication equipment and communication services or production of computer equipment are not included in this study.

IT industries are defined and examined by several organizations and directions, including statistical authorities, OECD, market research firms and different schools of economists. In literature the term industry is typically used to describe a group of firms producing certain types of products or services (Bain, 1968; Porter, 1980, 1985; Utterback and Suarez, 1993; McGahan, 2004). In practice there is however, no solid, undisputed and widely accepted definition for ICT industry or IT industry (cf. Hamel and Prahalad, 1994; McGahan, 2004; J. F. Christensen et al., 2006). Some economists and other scholars do not see any reason for defining of industries. The definition of industry may, however, alternate according to needs and requirements at hand.

Nevertheless in this study the notion of industry is chosen to be necessary tool in examining and analyzing different firm populations. In this study the term IT industry is used of groups or populations of firms which produce or provide IT products or services. These firms are called IT companies (firms, enterprises). IT industry consists of separate industries or sub-industries that can be defined from different starting points or needs.

Further, IT sector is a wider concept, constituting of both IT firms (producing sector) and their customers (utilizing sector or market) using products or services of IT firms.

To distinguish the different roles of firms, the customers are divided into two main groups. The first group, IT users, consists of firms using IT products or services to develop, run or manage their own operations and functions. The second group, IT appliers, includes customers who utilize products and services of IT firms in their own products or services sold to their own clients.

Drawing of the borderline between IT firms and the two groups of customers has become increasingly difficult during the last few years. A single firm may belong to all these

groups. The need to understand the whole industry emphasizes the importance of understanding the differences and characteristics of separate firms and groups of firms as well as the necessity of solid definitions.

These needs can be recognized also in literature and public debate where IT industry, ICT sector or other related terms may be used without any definition or indication of sources or origins of information used. This imprecision often leads to confusions and misunderstandings. For instance, the industry information based on the production (supply) side and market information based on the market (demand) side is often used synonymously.

In examining industries and their evolution it is important to realize how dynamic or static or how structured or unstructured they are. IT industries (ICT industries) are often used as examples of dynamic or unstructured industries (e.g. Hamel and Prahalad, 1994; Jacobides and Winter, 2005). During the history of 50 years of the utilization of information technology the definitions of IT industries have transformed continuously, and the same development is expected to continue. The expanding utilization of information technology changes also IT industries and IT market. New industries emerge, old ones diminish or even die resulting in an ongoing disintegration and converging of industries (e.g. Hamel and Prahalad, 1994; J. F. Christensen et al., 2006; Jacobides et al., 2006). In addition to major structural or other changes even one single actor may reshape entire industries (C. C. Christensen, 1997; G. A. Moore, 2000; Hamel, 2000; Kim and Mauborgne, 2005; Jacobides, 2009).

Understanding the status of IT industries as well as their evolution a comprehensive view of drivers and influences behind the change is required. This makes it important to have solid but flexible definitions for examining, measuring and analyzing industries or other groups of firms.

### 1.3.2 Software Product and IT Services Industries

In this study the Finnish IT sector is examined from the point of view software product and IT services industries. Due to differences in terms and concepts defining software product and IT services industries there are also different opinions and estimates of the sizes and structures of the Finnish software and IT services industries. This makes it imperative to consider and present more accurate definitions of the related concepts and terms in this study. The basic assumption is that there are significant differences between software product and IT services businesses, as well as between software product and IT services industries. As a result, software product and IT services industries are considered as separate industries.

In this study the term **IT services industry** is used of firm population providing IT services, whereas the term **software product industry** comprises firms that provide software products. Both industries contain sub-industries and a single firm can provide both software and services. This issue is discussed later in the study.

The software product and IT services industries comprise about 70 percent of all IT purchases (including hardware but excluding telecommunications) of end user customers in Finland (IDC, 2010; Market-Visio, 2010). The share of IT services is about a half of the total and yet, until quite recently, the software products have attracted more attention in public debate and academic research and also public funding.

Services are often seen as a part or an extension of software product businesses (Nukari and Forssell, 1999; Ali-Yrkkö and Martikainen, 2008; Rönkkö et al., 2009, 2010). A good share of IT services, however, is totally independent of the Finnish software product business. In addition, software product and IT services industries follow distinct business logics (Hoch et al., 2000; Cusumano, 2004). The role of services is expected to continue to grow because of transition to replace products with services in the IT market.

In general, there are high expectations targeted at different service industries as future drivers of the Finnish economy (e.g. Hernesniemi, ed., 2010). In the 2000s the growing interest in services has resulted in increased research activities and development of new theory both internationally and in Finland (e.g. Grönroos, 2000, 2009; Vargo and Lusch, 2004).

A central purpose of this study is to help getting more precise and comprehensive picture and estimates of sizes, structures and evolution of the Finnish software and IT services industries, as well as their mutual relationships. The considerations and analysis are based on information and indicators provided by multiple information sources.

### 1.3.3 Customers and Market

Customers of IT firms have traditionally been seen to consist of IT departments of different organizations, organizations using IT to develop, run and manage their operations or consumers. In the 2000s IT is increasingly being applied in different products or services, resulting in growing role of new and often different types of clients and in IT firms expanding their business beyond traditional market segments.

Simultaneously, borderlines between IT vendors and their customers have become increasingly blurred. Strengthening relationships and dependences between IT firms and their clients have changed traditional vendor-customer relationships (cf. Prahalad and Ramaswamy, 2004, Vargo and Lusch, 2004).

These developments have an impact on the evolution and dynamics single IT firms and entire industries. For example, Nokia is both a major ICT vendor and an important customer of several IT firms in Finland and abroad, and has accelerated and reshaped both the IT services market and industry.

In this study the clients are classified into three main categories that form the market of the IT firms:

1) Customers which utilize IT products or services or IT knowledge for developing, running or managing of their own operations and functions (users of information technology)
2) Customers which include information technology and IT knowledge in developing and producing their own products or services sold to their own customers (appliers of information technology)
3) Other IT companies

IT users are the traditional and largest customer base of IT companies. Appliers typically represent customers and industries that often are called IT enablers and IT based or IT enabling industries. IT companies (IT vendors) are increasingly subcontracting software related or other IT services from other IT firms. As a result, other IT firms may be considered as the third main customer segment. A growing share of subcontracted services is produced outside Finland, especially in lower cost countries.

In the study the role and significance of the customer segments are considered and analyzed especially from the IT services point of view.

### 1.3.4 IT Vendors and Competitive Field

IT vendors (IT companies) form a heterogeneous population. They meet competition from various directions.

In addition to the technological changes globalization and changing borderlines of industries affect remarkably the structure and evolution of the vendor and competitive fields of IT industries. Furthermore, expanding customer bases as well as changing roles and relationships of IT firms and their customers reshape the competitive positions.

Globalization has resulted in major transformations and reshaped the competition and division of labor both in local and global IT markets (Jacobides and Winter, 2005; Jacobides et al., 2006). The value chains of software and IT services firms have been broken into pieces when processes and even single tasks have transferred to different countries (Baldwin, 2006; Jacobides et al., 2006; Ylä-Anttila, 2008; Pajarinen et al., 2010). Traditional firms meet in their home market an increasing amount of new competitors from lower cost countries.

Enterprises producing SW products or IT services can be classified into two main categories. The first and largest category consists of traditional IT firms that belong to the ‘official’ IT industries as presented by the Statistics Finland (industry codes 62-63, TOL 2008). The second group of companies, in turn, provides IT products or services but belong to other IT industries, for instance business services or manufacturing industries.

SW products and IT services or their different substitutes are produced outside traditional IT industries, forcing IT firms to meet also totally new types of competitors. Some of them do not provide traditional IT products or services at all. Correspondingly, several IT firms have expanded their businesses beyond their traditional product and services offerings or customer segments (Jacobides, 2009; Market-Visio, 2009).

These developments of the IT vendor field and competition are often kept like given in public debate. There is, however, a rather limited amount of information of the vendor and competitive field based on research.

## 1.4 Structure of the Study

This study is organized as presented in the table below (Table 1). After the introduction (Part I) the theoretical part (Part II) consists of Chapters 2–5. Chapter 2 discusses industry definitions, major drivers of industry evolution and theories of industry evolution, Chapter 3 theories from the perspective of software product and IT services industries. Chapter 4 summarizes the theoretical part and discusses the basis for setting and specifying the objectives and research questions of the study defined in the final Chapter 5 of the theoretical part.

Part III of the study consists of Chapters 6 and 7. Chapter 6 describes the methodology, data gathering and information sources of the study. In Chapter 7 a bridge between theoretical and empirical parts is provided by presenting a framework for describing and analyzing the Finnish IT industries and the vendor field.

The empirical part (Part IV) of the study consists of Chapters 8–10. Chapter eight examines major factors influencing the Finnish software product and IT services industries and related market. The ninth chapter focuses on total volumes and structure of the Finnish IT sector and the tenth chapter examines the structure of the vendor field.

Part V analyzes and discusses major observations presented in Chapter 11 in relation to the research questions and finally, Chapters 12.1-12.3 answer the three research questions and discuss the contributions, credibility and limitations of the study. Part VI, Chapter 13 summarizes the main conclusions.

**Table 1. The structure of the study**

| Input (objectives) | Number and name of chapter | Output |
|---|---|---|
| | PART I: INTRODUCTION | Background<br>Research problem |
| Main purpose of the study: to increase understanding of Finnish IT industries | 1 Introduction | Background of the study and general research questions |
| | PART II: THEORETICAL PART | |
| Theories related to industry definitions and evolution, especially from perspective of IT industries | 2 Evolution of industries<br>3 Theoretical perspective of IT industries<br>4 Intermediate summary and conclusions | Industry theories are discussed.<br>Discussion and summary of the contribution of theories as basis for specifying objectives and research questions of the study. |
| | 5 Objectives of the study and research questions | Objectives of the study<br>Three research questions |
| | PART III: METHODOLOGY AND DATA | |
| Hermeneutic, action analytical Empirical case study | 6 Methodology and data gathering | Description of approaches and information sources of the study<br>Credibility |
| Dynamic nature of IT industries, variety of definitions and terms require wider perspective for examining and analyzing Finnish IT industries and vendor field. | 7 Framework for analyzing Finnish IT industries | The frameworks form bridges between theoretical and empirical parts of the study. |
| | PART IV: EMPIRICAL PART | |
| Empirical analysis based on data collected from external information sources. | 8 Major changes affecting status and structure of Finnish IT sector | Answers to the research questions concerning the status of the Finnish IT industries (RQ1), the basis for future evolution of the Finnish IT industries (RQ2) and the existing information (RQ3). |
| | 9 Total volumes and structure of Finnish IT sector | |
| | 10 Structure of Finnish IT vendor field | |
| | PART V: ANALYSIS AND DISCUSSION | |
| Results of empirical part. Findings and observations | 11 Observations of status and evolution of Finnish IT industries | Presentation and discussion on major observations of the study |
| | 12 Conclusions | Conclusions<br>Contributions of the dissertation<br>Credibility of the study<br>Limitations of the study and topics for further research |
| | PART VI: SUMMARY | |
| | 13 Summary | |

# PART II: THEORETICAL DISCUSSION

# 2 Evolution of Industries

To understand the evolution and structures of the Finnish IT industries this main chapter discusses at first industry definitions and structural and other major changes and factors driving the industry evolution. Secondly, various theories related to industry evolution are considered.

## *2.1* Industry Definitions

This chapter examines and discusses different industry definitions as well as their starting points and applicability to dynamic industries.

### 2.1.1 Concept of Industry

At national economy level and in business enterprises there is a need for various data concerning different groups of firms or firm populations, often called industries. The information is expected to be accurate and readily available.

The term industry is not, however, universally applied. Different scholars and various organizations like statistical authorities and market research companies have their own industry definitions. All authors do not see any reason to use the term industry at all.

In studies and business as well as in public discussion the term ”industry” is often considered as given, based e.g. on technology or industrial classification schemes used by statistical offices (Jacobides and Winter, 2005; Sako, 2005). This may, however, be misleading, since industry boundaries are not necessarily static and given.

Schumpeter (1942) called new industries “new economic spaces”. According to him dynamic competition of firms attempt to create new rules for the game and also to create new economic spaces that are ever-changing. New technologies, for example, gradually change borders between industries.

Lovio (1993) also emphasizes the ever-changing nature of industries and has presented a flexible approach to analyze the evolution and structure of firm communities in new industries. He considers industries as industrial spaces which are occupied by changing firm communities comprising different types of firms and firm types. Industries are not actors themselves but spaces where firms and other related organizations act.

In literature several other terms are used instead of the concept of industry, often as synonyms or interchangeably with industry. Population ecologists typically use the terms population or organizational population (e.g. Carroll and Hannan, 1995; Aldrich and Ruef, 2006), whereas some scholars use the notion segment (Jacobides, 2005) or sector

(Kroeger et al., 2008). Hannan and Freeman (1977) define a population of organizations as "all the organizations within a particular boundary that have a common form".

In this research industry definitions and related issues are considered mainly from of the perspectives of production and use of IT products and services. The aim is to understand how different definitions and related theories may be applied in analyzing the IT industries and their evolution.

### 2.1.2 Defining Industry Boundaries

The definition of an industry varies according to the user's needs and requirements and the nature of the industry or the operating environment of companies. These factors determine how fixed the borders of an industry must or can be and what kinds of firms will be included. Also the phase of the industry evolution may impact possible ways to define and delimit the industry. (Fransman, 2002; Sako, 2008).

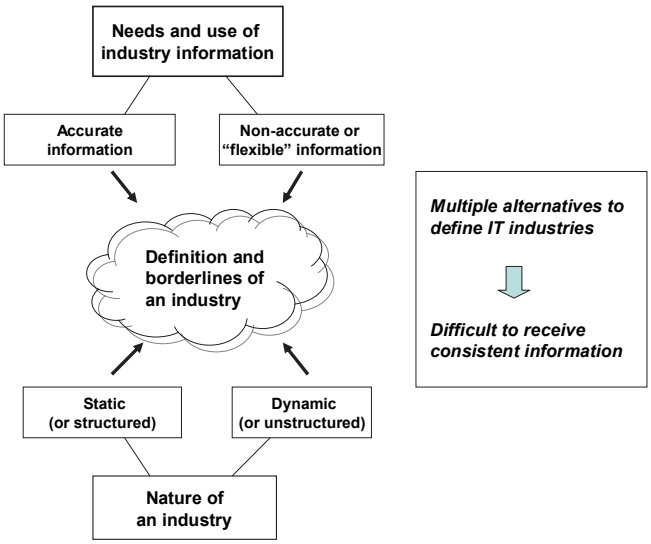
Industries are often divided by their nature to static or dynamic ones (Jacobides and Winter, 2005). Major discontinuities, such as globalization, technology changes and convergence reshape the competitive landscape and environment of industries and companies as well as industry boundaries and product definitions (Prahalad and Ramasvwamy, 2004, Jacobides et al., 2006). These developments are challenging both for industry definitions and industry evolution theories. Hamel and Prahalad (1994) use the terms structured and unstructured industries. They argue that some industries are more "structured" than others, characterized e.g. by more stable industry boundaries, more predictable technology change and more precisely measurable customer needs. Today, however, almost all industries are affected by unpredictable, often continuous changes making industries more unstable and defining the industry boundaries more difficult (Hamel and Prahalad, 1994, Fransman, 2002; McGahan, 2004).

According to Hamel and Prahalad (1994) almost all emerging industries are unstructured. IT industries typically are included in dynamic industries. They use the term digital industries that consist of various IT or IT enabled industries.

One of the most critical questions in defining industries is how narrow or broad (or flexible) an industry definition should be. Examples of both ends are to be found in literature. Since the appropriate definition can also depend on the nature of the industry, both too narrow or too broad (flexible) definitions may result in misleading information and decisions. (See Figure 1).

From company perspective, narrow and rigid industry definitions may result in difficulty to identify direct or indirect competition. For instance, in narrowly defined industries detection of new competition may be unnoticed if it comes from other industries. (Hamel and Prahalad, 1994; Prahalad and Ramaswamy, 2004). This development can be seen also in the IT industries. Several theories and literature emphasize the need for broad or more flexible definitions to get a dynamic view of industries with blurring and changing boundaries (Lovio, 1993; Hamel and Prahalad, 1994; Jacobides and Winter, 2005).

Conventionally, industries are seen as groups of firms producing certain products or services (Bain, 1968; Porter, 1980, 1985; Utterback and Suarez, 1993; McGahan, 2004). Jacobides and Winter (2005) propose different view that differs from dominant literature by defining industries as groupings of firms that satisfy a certain type of customer need despite of the ”official” industries they belong to.




Source: Based on different theories and literature (Lovio, 1993; Hamel and Prahalad, 2004; McGahan, 2004; Jacobides and Winter, 2005)

**Figure 1. Perspectives in defining IT industries, needs and nature of an industry**

This view forms the ground of several conventional definitions of industries, also of IT industries. This kind of definition would include also different substitutes of the traditional IT products and emphasizes the need to be able to identify totally new types of competitors that may come from other industries. When customer needs can be filled with several different technologies or services, it becomes difficult to base analysis of industry evolution on established industry classifications.

This thinking supports the arguments of researchers of services who argue that the clients do not purchase products or services but benefits which are provided by products and services (Grönroos, 2009; Vargo and Lusch, 2004).

Some scholars argue that the definition of an industry may change during its life cycle and tie definitions with the phase of an industry evolution (e.g. Munir and Phillips, 2002; Weaver, 2007; J .F. Christensen, 2008).

### 2.1.3 Outlook to Narrow Industry Definitions

There is a wide range of scholars who favor for narrow industry definitions that are connected to products or services and typically emphasize the production side of the market. In addition, they often represent rather static view of industry evolution. Industrial economists (e.g., Bain, 1968; Porter, 1980, 1985; Utterback and Suarez, 1993; McGahan, 2004) and researchers of life cycles (Gort and Klepper 1982, Utterback and Suarez 1993, Klepper 1996) have strongly contributed this literature (Fransman, 2002).

The industrial economists typically consider an "industry" as a group of firms that produce products and services that are close substitutes and who supply a common group of buyers (e.g., Porter, 1980, 1985; Utterback and Suarez, 1993)[2]. Industrial economics have gained a strong position in several uses. Their definitions have formed a basis for many areas of management research and literature, as well as for classification schemes used by government statistical agencies in collecting industry data (including IT industry data in Finland). (Munir and Phillips, 2002; Weaver, 2007). McGahan (2004) emphasizes also other characteristics, such as common buyers, common suppliers, common intent and common technical platforms in defining industry borders.

In addition to industrial economists, also the literature of industry life cycles prefers rather narrow definitions of industries. This approach essentially equates industries with products (Gort and Klepper 1982, Utterback and Suarez 1993, Klepper 1996) and often analyzes rather the evolution and life cycles of certain products or product groups than life evolution of entire industries (Fransman, 2002).

Also industrial economists see defining industry boundaries as a challenge (e.g. Porter, 1985; McGahan, 2004). McGahan emphasizes that industries may be defined narrowly or broadly depending on needs or purposes. He mentions anti-trust regulation and strategy work as examples of needs requiring strict definitions of industry borders (see also, Sako, 2005; Fransman, 2002).

Some authors (e.g. Hamel and Prahalad, 1994; Hamel, 2000; Kim and Mauborgne, 2005) warn about too narrow and static definitions of industries and competitive fields. Sometimes new competition can enter from "the bush", from totally different type of industry.

Theories supporting the views of narrowly defined industries are often based on a more static view of industries with fixed boundaries. These views are also the most common target of the critics: Narrow definitions and classifications react slowly to changes in products and competition. Defining the borders of substitutes is difficult. Critics are also concerned about other application areas based on use of static and fixed views, including production of public statistics (Baldwin, 2006) and the strategy work of firms (Hamel and

[2] Conventional definition of an industry by Porter: "An industry (whether product or service) [as] a group of competitors producing products or services that compete directly with each other." Porter: (1990, s. 33).

Prahalad, 1994). A significant problem or even risk is the decision making based on information that may describe the real world the poorly (Munir and Phillips, 2002). These issues are recognized also in information concerning the IT industries.

Some scholars argue that the industry definitions of industrial economist can be applied only in phases of evolution when the industry has stabilized (Munir and Phillips, 2002; J. F. Christensen et al., 2006). J. F. Christensen (2008) has studied the evolution and convergences of ICT intensive industries. He uses the term industry only to reflect the well-established industry. In other phases of evolution the groups of companies are defined and called niches or sectors.

Several market research and consulting companies have developed their own industry definitions and classifications. To some extent also their views represent a rather static view because of the need to ensure some level of continuity and ability to produce time series and compatible data e.g. for market shares. These companies, however, also have to be ready to react and adjust very rapidly to changes and developments in both, the production and user sectors. This is especially the case with IT market research companies who produce market forecasts. To get more up-to-date information public organizations have increasingly utilized ICT market information produced by commercial research organizations.

### 2.1.4 Outlook to Broader Industry Definitions

More dynamic views of industries have gained popularity during the last few years. There is a wide and heterogeneous range of literature in favor of broader or more flexible industry definitions based on dynamic, evolutionary and cyclical views of economic competition. This literature does not find industry boundaries static and given (Lovio, 1993; Hamel and Prahalad, 1994; Jacobides and Winter, 2005; Sako, 2008). The roots of many of these schools are in the Schumpeterian (1942) thinking (see e.g. Weaver, 2007).

This literature consists of heterogeneous group of researchers who consider industries from different aspects, including technology and innovation (C. M. Christensen, 1997), impacts of globalization on industries (Jacobides and Winter, 2005; Jacobides et al., 2006; Baldwin, 2006), influence and opportunities of individual firms (e.g. RBV school) and roles of the customers (e.g. Jacobides and Winter, 2005). As mentioned earlier, industry definitions of some authors depend on the phase of evolution (Munir and Phillips, 2002; J. F. Christensen et al., 2006; Weaver, 2007). In some phases it is possible to define industries rather narrowly whereas in other phases broader definitions are required.

**Resource-Based View**

Industrial economists conventionally focus mainly on exogenous factors when defining industries and considering their evolution. Opposite to this market-based view the resource-based view (RBV) emphasizes endogenous factors. From the industry definition point of view this approach provides strong arguments against fixed and static industry

definitions and boundaries. Hamel (2000) has contributed the visibility of the ideas based on the resource-based view in management literature.

The resource-based view emphasizes the uniqueness of each firm, based on a collection of unique resources and capabilities that enable a firm to develop its performance and design its own internal structure and organizational boundaries. Even a single firm may be capable to affect the structure of entire industries. (Barney 1986, 1989; Conner, 1991; Santos and Eisenhardt, 2005). Barney and Hesterly (1996) argue that discovering assets and skills that are unique to a firm and cannot be imitated enables a firm to protect its organization with knowledge barriers. According to Richardson (1972) the resource-based view also emphasizes an industry as a set of activities which are bound by a dense network of cooperation and affiliation.

Different and often continuous and unexpected changes make it difficult to set any fixed and static boundaries for industries, resulting in requirements for broader or more flexible industry definitions.

There are numerous examples of decisions or other activities of individual firm which have resulted in major changes of industry borders and industry structures (e.g. the case of IBM PC; Baldwin and Clark, 2000; Moore, 1996).

During last few years, focusing on own skills and capabilities has become an increasingly important differentiator in IT industries both in local and global competition. In several IT industries the products and services are quite similar, often also standardized, making it difficult to differ from competitors. During the last few years the debate around ecosystems has emphasized the importance of high-level IT skills. In many IT industries the entry barriers are low. These developments emphasize the importance of management skills.

**Industry Architecture**

Industry architecture is a concept that gives a fairly new approach to defining and analyzing of industries and their evolution. Jacobides et al. (2006) argue that the industry architecture offers a broader field of vision beyond the conventional idea of an "industry".

According to them the industry architecture consists of rules and roles that govern the ways of the participants to do business in an industry or sector, including the ways in which money is made (business models). Roles and rules are not static but change substantially over time. The industry architecture approach considers both production and customer needs.

When the roles and rules change the whole industry will change (Jacobides et al., 2006; Jacobides, 2009). As a result, industries are very dynamic, and it is impossible to define fixed industry boundaries. Industries (even broader sectors) change, integrate, disintegrate, re-integrate, converge and diverge. This brings both challenges and opportunities to enterprises. (Jacobides and Winter, 2005; Jacobides et al., 2006).

Opposite to the conventional definitions Jacobides and Winter (2005) have given a broad definition for industry. The define industries as groupings of firms that satisfy a particular (type of) customer need. This approach differs significantly from existing industry classifications. Jacobides and Winter (2005) argue that the industry architecture approach provides a broader view of "industries" or "organizational populations" than most research traditions thus far.

Industry architecture concept includes the entire structure of the supporting value chain, and the full range of institutions involved, directing attention to the developing patterns in which labor is divided between different types of industry participants and the associated set of "rules and roles" that emerge (Jacobides et al., 2006). Jacobides and Winter (2005) argue that by taking a sector as given does not pay attention to the dynamics shaping the division of labor or to the socially embedded and institutionally ratified rules. They also argue that expanding of the use of the term value chain (Porter, 1985) would enable a better examination and analysis of the totalities covering the whole value chain and related participants (e.g. in issues related to division of labor). In their view the value chain covers activities within a firm and all other activities across firm borders required to produce final products and services.

The concept of industry architecture was presented in the mid 2000s and requires more empirical analysis (Jacobides and Tae, 2009).

## *2.2* Major Drivers of Industry Evolution

Industry boundaries and industry structures and the competition are continuously reshaped by integrating, disintegrating and converging resulting from different changes (e.g. Hamel and Prahalad, 1994; Jacobides and Winter, 2005; Sako, 2005). Structural changes, such as technological changes, globalization and deregulation are major drivers of these changes. Firms attempt to take advantages of these changes by developing their business models (e.g. Casadesus-Masanell and Ricart, 2010). As a result, changes in business models have become increasingly important drivers of industry evolution, especially in ICT-related industries.

New technology and innovations have traditionally been considered major drivers of change and transition in industries (e.g. Schumpeter, 1942; C. M. Christensen, 1997). Emerging of business models have often been connected to new technologies (G. A. Moore, 2000) when firms attempt to adapt or seek for competitive advantages. In the 2000s globalization has become a major driver of change in several industries (Jacobides and Winter, 2005; Baldwin, 2006). Simultaneously, the relationships between vendors and their customers have become increasingly important (Prahalad and Ramaswamy, 2004; Vargo and Lusch, 2004).

In this chapter we discuss these major drivers of change from IT industries point of view. The aim is to focus on issues that are especially relevant from the Finnish IT industries point of view.

### 2.2.1 Technological Changes and Innovations

**Major IT Industry Waves**

Since their early days in the 1950s the IT industries have been very dependent on technological innovations. Some of the innovations have been radical and have generated major technological waves, IT industry waves, which have profoundly changed and reshaped a wide range of IT industries (hardware, software, services and communication industries). All major waves have substantially enlarged both the producing and using sides of the IT sector, generated a large number of new firms and increased the number of IT users and customers.

A quite common way to divide the technology waves is based on "computing" approach: mainframe wave (1950-), mini computer wave (1970-), personal computer wave (1980-), Internet and e-business wave (1990-) and mobile communications wave (2000-). Several scholars have examined similar kinds of wave categories (e.g. Malerba et al., 1999; Bresnahan and Greenstein, 1999). David Moschella (2003) divides the IT industry expansion into stages: systems centric (proprietary systems), PC-centric (de facto HW and SW standards), network-centric (de jure Internet standards) and customer-centric (information, content and transaction standard) stage. According to Moschella in every decade the IT industry's center of gravity tends to shift with profound implications for new and existing IT industry participants. In particular the rise of the Internet in the 1990s and the adoption of e-business and e-commerce have drastically changed the way companies do the business. (Osterwalder 2004; Tapscott et al., 2006).

Each new wave has developed a number of new industries and changed and reshaped the existing ones. A part of new industries have remained short-lived; so far none of the new waves has totally ousted the previous ones. The effects of previous waves of computing are still very much with us. (Moschella, 2003). Numerous smaller technological innovation and changes have had more restricted impact on the evolution of IT industries.

A remarkable consequence of all major waves is the growth of the number of IT users. Compared to early days of mainframes with few customers in large organizations, the use of IT has now expanded to all types of organizations and citizens around the world.

Despite of the essential role of technology as the generator of IT industry waves, the role of technology may sometimes be over-emphasized. Most new products and many new sub-industries are dependent of technology (e.g. hard disks and related industry). However, the impacts of technology have often been powered or changed by process or service innovations, business decisions or business model innovations making it possible for the firm to do something totally differently as competitors. (See e.g. Hamel and Prahalad, 1994; C. M. Christensen, 1997; Hax and Wilde II, 2001; Gawer and Cusumano, 2002; Jacobides, 2008; Jacobides and Tae, 2009; Hamel, 2010).

The evolution of IT industries is characterized, however, also by coincidences changing single firms as well as whole industries (e.g. Grove, 1996). The history of personal

computing alone includes many of them. For instance, the emergence and growth of personal computer wave can be seen to be a result of a business decision rather than a consequence of microprocessor technology. The technology was necessary to the change but the decision to open the IBM PC for external hardware and software firms ensured the fast emergence and expansion of the PC industry and several other new IT industries. Nobody can give a certain answer how the industry had developed in more proprietary environments.

The Internet has radically changed the IT industries as well as the behavior and processes of companies and the daily life of consumers. In the beginning the internet was expected to generate totally new industries, "new economy", and destroy many old ones (cf. Tapscott and Williams, 2006).

Some of these expectations have realized, but many of the new functions, products or services have integrated or converged with existing ones expanding their offerings and reshaping industry boundaries (e.g. J. F. Christensen et al., 2006). Totally new industries are fewer than expected late 1990s.

The IT industry waves have gradually led to a world where the information technology can be considered a commodity (Carr, 2008). The trend to migrate from products to services (including cloud services) can be seen as a step to this direction. This time boundaries between IT producers and firms enabling information technology are being blurred and reshaped.

As a conclusion, it can be said that each new wave has changed the boundaries of IT industries and has made it increasingly difficult to lean on traditional industry definitions and classifications.

**Outlook to Innovations as Drivers of Industry Change**

In the literature there are numerous definitions of innovations. Many emphasize change (Drucker, 1985; C. M. Christensen, 1997; Tidd et al., 2001, 2002) and novelty (Tidd et al., 2001, 2002, Rogers, 2003, Frank, 2009).

Tidd et al., (2001, 2002) mention steam power and ICT technology as examples of radical and far-reaching innovations which have changed the entire society. Frank (2009) proposed that all kinds of new ideas should be considered as innovations.

McGahan (2004) considers innovations from a company point of view and refers to any investment made by a company that has a deferred payoff. An innovation can benefit a firm by improving its possibilities to survive and by improving its profitability.

In several industries, e.g. in IT industries, competing against time has become increasingly important. It is not enough to introduce a new product but to introduce it before competitors (Stalk and Hout, 1990, Tidd et. al, 2001, 2002). Success often requires process innovations.

Process, service and business model innovations have gotten more attention in recent years, when the rise of IT service industries has become a major driver in economy. These innovations are expected to become increasingly important mechanisms in the competition and drivers of changes especially in the software and IT services industries. Earlier technology innovations have had the central role in considerations of IT industry innovations.

Tidd et al. (2001, 2002) discuss the terms 'product' and 'process' innovation. Product innovation traditionally refers to change in the products or services of an organization. Process innovation refers to change in the way the products or services are created and delivered. The dividing line between these two types of innovations is often somewhat blurred. As an example the researchers asked, if a new holiday package is a product or process change. A service often represents a case where a product and process merge (Tidd et al., 2001, 2002). This applies also to many IT innovations.

Due to the rise of the Internet the scope for service innovations has grown enormously disrupting radically services of any information-related business. Evans and Wurster (2000) argue that division of services into two different groups, "high reach" and "high richness" services, is not valid anymore. Internet has made it possibility to offer both richness and reach at the same time and also create totally new markets. For example, cloud computing can provide access to services or capacities which earlier were too expensive for many firms.

By impacts and nature, innovations are typically divided into two categories. Widely known dichotomies are: incremental and radical (e.g., Abernathy, 1978; Freeman 1994), sustaining and disruptive (e.g., Christensen, 1997; Bower and Christensen, 1995) or continuous and discontinuous innovations (e.g., Tushman and Anderson, 1986). Despite the different names these categories are as close synonyms (Frank, 2009).

An innovation may generate new industries, reshape and change boundaries and structures of the existing ones or even destruct some industries. Innovations often also change competitive positions of single firms, competitive fields or entire ecosystems. Radical (or disruptive or discontinuous) innovations have played an especially strong role in the evolution and major turns of IT industries. Many fast changes in several IT industries have been fueled by both technological and process innovations. However, it is important to notice that an innovation is no guarantee of change. Abernathy and Clark (1985) argue that although technological innovation imposes change, the change need not be disruptive for a company (Peltoniemi, 2009).

In addition to single "traditional" industry innovations may reshape entire IT industries, making it increasingly difficult to apply existing industry classifications.

**Sources of Innovation**

Criticism towards the "not invented here" attitude (e.g. Tidd et al., 2001, 2002) and utilization of innovations made outside own firm or outside own industry have gained

attention (Hax and Wilde II, 2001; Gawer and Cusumano, 2002, 2008; Chesbrough, 2003; Jacobides and Tae, 2009). The concern is not directed to utilizing different open innovations alone (Chesbrough, 2003) but more extensively to utilizing innovations made elsewhere (Hax and Wilde II, 2001; Gawer and Cusumano, 2002; Jacobides, 2008; Jacobides and Tae, 2009; Hamel, 2010). Several authors argue that technology destabilizing an industry often comes from outside that industry. IT industries have been a major object of studies considering innovations coming from outside own firm.

Utilizing of innovations from outside the firm has increased the role of ecosystems. A number of authors (Hax and Wilde II, 2001; Gawer and Cusumano, 2002, 2008; Jacobides, 2008) emphasize the close relationships between ecosystems and innovation.

Gawer and Cusumano (2002, 2008) present a model of innovation based on their research on platform leadership. The platform leader and the companies supplying complementary products and services may form together an "ecosystem" of innovation and increase greatly the value of the innovation as more users adopt the platform and its complements. Gawer and Cusumano (2002) emphasize the difference between a product and industry platform. A product is largely proprietary and controlled by one company, an industry platform is no longer in full control of the originator, even though it may contain certain proprietary elements. To be useful the platform needs complementary innovations.

Jacobides (2008, 2009) argues that becoming a bottleneck in an industry is more important than own innovations or build an ecosystem, not develop a technology. He argues that the firms that succeed are not those that develop and conceive of the new ideas, technologies, or products. Instead, the successful firms are the ones which implement successful ecosystems, architectures of co-dependent firms around them, emphasizing the importance of architectural advantage and bottlenecks. Jacobides urges firms wanting to be successful to look outside their own boundaries and see how they can tap into energy of other firms to build success. A bottleneck around a key innovation or a new feature may result in a very strong position in the market, making it possible to form an ecosystem that consists of wide range of other vendors who act as complementors. Jacobides argues that an innovation is not about the creative genius of a solitary inventor. Instead, question is about new ways of orchestrating and managing the benefits we can create. And that will transcend the boundaries of traditional sectors.

Hax and Wilde II (2001) have presented the so called Delta model with a strategic triangle for defining and evaluating firm's strategic position. The basis of innovations varies by different positions of the model. The lock-in position is similar to the concept of bottleneck where the company can benefit innovations of all complementors in its industry (e.g. Hax and Wilde II, 2001). In practice, the firms in the lock-in position are the keystone enterprises (Iansiti and Levien, 2004) of ecosystems. Microsoft and Intel are prominent examples of firms in lock-in positions. Both have also large ecosystems.

Jacobides (2008, 2009) recommends innovators to think harder about how they can capture more of the value they create. Put simply: how to capture more revenues from the whole value chain by capitalizing better the existing supplier networks and mass market manufacturing capacity outside own form.

Recently, several authors (e.g. Jacobides, 2009; Hamel, 2010) have argued that Apple´s success during last few years is based on fast reacting and building and utilizing own ecosystem, not so much on developing own technology.

In addition to redefining firm or industry boundaries new product or business innovations may also result in new firms or industries that are difficult to classify into any existing industries. E.g. many firms based on innovations around the Internet are seen as IT firms although only a small share of their revenues come directly from IT products or services. Some of them may belong to several industries, e.g. Google. In addition, new innovations may lead to new businesses, expansion to new industries and then difficulty in defining the main industry of an enterprise. The combinations of different industries may also change quite often. Nokia is an example of a firm belonging to several industries.

In IT industries a phenomenon called exaptation (Dew et. al, 2008) can be met. In this case an innovation is applied for a totally different purpose than assumed at first.

**More Theoretical Aspects**

IT-industries and IT firms have gained a lot of attention in the literature discussing technology innovations (C. M. Christensen, 1997; Chesbrough, 2003). The studies are mainly focused on tangible products and hardware technologies; only a few concern software products or services. Several technology innovations, however, have direct or indirect impacts on software products and IT services industries.

Industry life-cycle theories have a strong position in the research of industry dynamics. These theories emphasize different roles and natures of innovations in different phases of the life cycle. Radical innovations, (typically) technology innovations, introduce new products. Incremental innovations take place when products are standardized. According to the theory, the shift from radical to incremental innovation marks the maturity and adopting of process innovations. (Abernathy, 1978; Peltoniemi, 2009).

Abernathy and Clark (1985) present a framework called transilience map for analyzing relationships among product innovation, competition and evolution of industries. They classify innovations along two dimensions, depending on their impact on existing technological competence and existing markets/customers. Transilience map presents four kinds of innovation: revolutionary, regular, niche creation and architectural innovation. A new technology can “preserve” or “destroy” existing links with customers and “preserve” or “destroy” existing technological capabilities and competences. Some innovations disrupt, destroy or make obsolete established competence, whereas others may refine and improve. This also means that some innovations can create new industries while some others reformat old ones. (Abernathy and Clark, 1985; Peltoniemi, 2009; Cusumano et al., 2008; Coccia; 2006).

The work of Abernathy and Clark is utilized in several other frameworks considering industry discontinuities. Among them are those of Anderson and Tushman (1990), C. M. Christensen (1992) and (Cusumano et al., 2006). Anderson and Tushman´s (1990)

framework focuses on existing technological competence. They propose that a discontinuity can be "competence-destroying" if it destroys or renders obsolete existing technological capabilities or "competence-enhancing" if it preserves existing technological capabilities. (Anderson and Tushman, 1990; Cusumano et al., 2006). Christensen´s (1992) framework focuses on existing market or customers. He proposes that discontinuous technologies often create new markets that are out of the radar of incumbents and their customers. Therefore a discontinuity "destroys" or renders little value and the links with existing customers (Cusumano et al., 2006). On the other hand, slow adoption of new technologies or related businesses can help incumbents to reach the lead and advantage of newcomers (cf. Adner and Zemsky, 2005).

The transilience map is based on analysis of product innovations. Cusumano et al. (2006) argues that the map does not provide useful framework for understanding the impact of discontinuities on services. He proposes an addition of a third, independent dimension to the transilience map for describing the impacts of new technologies on the need for backward integration with the previous technology. A new technology can destroy linkages with the installed base of the existing technology, resulting in little need for backward integration. It also may "preserve" those linkages, resulting in high need for backward integration. These issues can be met when developing and implementing complicated IT applications which require services covering both new and existing applications. (Cusumano et al., 2006).

Each kind of innovation presented in the transilience map also has competitive impacts requiring different organizational and managerial skills. The significance of innovation for competition depends on its capacity to influence the existing resources, skills and knowledge of a firm (Coccia, 2006).

Even an advanced new technology or advanced features in a new product or service do not necessarily bring fundamental competitive advantage. Also in IT industries there are numerous examples where the best technology or best products have not succeeded in the market. Sometimes success is based on coincidence, more often on material resources, human skills, relationships and relevant knowledge of the firm. In building success the question is often about the firm's own role and own activity (Hamel and Prahalad, 1994).

### 2.2.2 Globalization and Industry Evolution

**Drivers of globalization**

Globalization is one of major factors generating discontinuities in the competitive landscape and blurring industry boundaries and reshaping industry structures (Prahalad and Ramasvwamy, 2004; Jacobides et al., 2006; Sako, 2006).

In formal and informal debate globalization is often seen only as offshoring meaning transfer of businesses and jobs to lower-cost countries, especially to Asia. The term near-shoring is often used of similar operations in the context lower-cost European countries (Sako, 2006).

Gupta et al. (2008, p. 5) presents a wider definition: "Globalization refers to growing economic interdependence among countries as reflected in increasing cross-border flows of three types of entities: goods and services, capital and know-how. The term globalization can relate to any of several levels of aggregation, the entire world, a specific country, a specific industry, a specific company, or even a specific line of business or functional activity within the company."

Globalization has become one of the major drivers of IT industry evolution. It affects directly businesses of IT vendors and their clients, as well as their mutual relationships. Recently the effects have been seen especially in IT services and software industries. The production of IT hardware moved already earlier to lower-cost countries. From the perspective of the Finnish IT industry it is important to identify businesses that can be transferred and the impacts of that on the structure of the Finnish IT industries, including competition and the vendor field. A major challenge is to identify the value chains and places where the value is added (e.g. Jacobides and Kudina, 2009, Pajarinen et al., 2010).

Lovio (2009) classifies the most important drivers of globalization to technological, political (e.g. deregulation) and economical factors. Technological factors (especially ICT technology) have made it possible to decentralize production and work (labor) geographically (Lovio, 2009; Grossmann and Rossi-Hansberg, 2008). In international trade exchanging bits in different forms has become a major driver of globalization and offshoring (Grossmann and Rossi-Hansberg, 2008). Gupta et al. (2008) have emphasized knowledge related drivers of globalization.

For a single firm establishing operations in emerging countries can provide means to improve effectiveness and performance and cut costs. E.g., to cut the cots of service production the IT services vendors increasingly use capacities in lower-cost countries, extending their value chains and value networks behind traditional firm and country borders (Hoch, et al., 2000).

The fast growing emerging economies have also become attractive and potential new markets (Lovio, 2009; Gupta, 2008; Yip, 1992). By establishing operations in lower-cost countries firms are better able to respond to price and other requirements of customers and competitors (Gupta, 2008; Yip, 1992).

**Impacts on Structures of Industries**

Globalization and the growing role of offshoring change and reshape both evolution and structures of several industries. The impacts are seen in the evolution of employment and competition. The power and impacts of globalization vary by industries, by firms and by regions (Lovio, 2009).

However, the researchers are not unanimous of the importance and impacts of globalization and offshoring. Some economists take the impacts of globalization rather as business as usual belonging to the normal evolution of the international economy (e.g. Mankiw, 2004). One group of economists, in turn, sees in the current globalization and

off-shoring features that differ substantially from earlier developments. They argue that the globalization has moved to a phase that can be characterized as a radical change (Baldwin, 2006; Blinder, 2006; Grossmann and Rossi-Hansberg, 2008).

Baldwin (2006) has proposed a term "second unbundling" to describe the major change. According to this new paradigm internationalization and specialization between countries and regions are expanding the competition from industry or firm levels to functions or even tasks, extending the impacts also to individuals. The firms split their production and value chains to increasingly small, also geographically diverged parts and the value is added in many locations. (Baldwin, 2006). Grossmann and Rossi-Hansberg (2008) have presented the term "task trade" for this new type of international division of labor.

Baldwin (2006) describes this development as a transition from "the old paradigm of globalization" to "the new paradigm of globalization". Blinder (2006) sees globalization as the third industrial revolution and a significant threat to services jobs in the Western world; the rich countries are likely to have some major readjustments to make.

Products and services are traditionally characterized as tradable and non-tradable. While services earlier were seen mostly as non-tradable they have become increasingly tradable due to the growing utilization of information technology (Blinder, 2006). As a result, the globalization and the new paradigm have profoundly changed the production processes as well as purchasing of several services. This has increased the potential for off-shoring of several kinds of services, including IT services. For IT firms this provides growing shares of entire value chains across borders (c.f. Jacobides and Kudina, 2009).

This development has made the national clusters obsolete. For instance, the Finnish ICT sector has already partly disintegrated due to geographical shattering of the value chain. This can be seen also in the shrinking size of the Nokia driven cluster. (Ylä-Anttila, 2008; Pajarinen et al., 2010). So far, there is not enough information or academic research to verify if the other parts of the cluster, such as software production, have been able to compensate the losses in mechanical production (e.g. Ylä-Anttila, 2008).

There is a wide range of literature concerning the global disintegration or fragmentation of production processes (e.g. Campa and Goldberg, 1997; Hummels, Rapoport and Yi, 1998, Yeats, 2001; Hummels, Ishii and Yi, 2001; Egger and Falkinger, 2003; Hanson et al., 2001, 2005).

There is also to be seen quite a rapid change in attitudes towards globalization and offshoring in Finland. Until 2006 several major IT services firms did not see offshoring a significant trend from their point of view. In early 2000s Lilius and Vuorinen (2001) interviewed CIOs of large Finnish international and global enterprises and found the users more positive to offshoring of IT projects or processes than many major vendors.

Lovio (2009) has considered globalization applying the product life-cycle theory developed by Vernon (1966). According to this theory the direction of foreign trade of a product may change radically when an innovation becomes a mature product. Vernon´s

model suggests that a country which developed and exported the product may become a country importing that product. Mature product requires no more special expertise and, simultaneously, the price competition increases. Lovio argues that the globalization seems to fasten the actualization of the theory.

The traditional theory of trade assumes that technology is country-specific and the operations transferred abroad will use local technology (Baldwin, 2006). According to Grossman and Rossi-Hansberg paradigm (2008) the domestic and higher technology will, however, be combined with the lower-priced workforce abroad. This paradigm seems to be realized in IT industries and often seen also as a natural evolution. IT services firms have transferred their methodologies and knowledge not only to their own subsidiaries but also to their subcontractors or other partners in lower-cost countries. Consequently the differences between knowledge and performance have diminished while the differences in the costs of work have remained. Transferring of knowledge has also been seen as one of the drivers of globalization (Gupta et al., 2008). Transferring technology and operations has also been found as a disadvantage for higher-cost countries. Some economists warn of consequences (e.g. Samuelson, 2004).

A major factor fueling off-shoring in some industries, including the IT industries, is the standardization of products and services. Standardization and integration of IT infrastructures and applications may remove or lower the barrier to split processes and tasks also geographically, making it easier to transfer and utilize knowledge between countries. For example, expertise related to many leading international software products, such as SAP applications, is often universal. Simultaneously, there are high numbers of well-educated IT professionals in many lower-cost countries, e.g. in India. Therefore also the competition of services requiring high level of knowledge is increasing.

Globalization increases the importance and power of multinational firms in the world economy (Kroeger et al., 2008; Lovio, 2009). This is also seen in the consolidation of the IT industries. Globalization and producing of services in lower-cost countries have strengthened the market positions of large global software products and IT services vendors.

Migration from products to services is reshaping the mechanism to produce and deliver IT services. For example, the large global data services centers established for cloud services have also increased concentration. (e.g. Carr; 2008, 2010). This development favors economies of scale and strengthens the roles and competitive positions of large services vendors. The location of new global data centers are chosen by different rules than location of more traditional services. Factors like power supply and security are often more important than production costs (c.f. Carr, 2008, 2010). As a result many new global data centers are located in higher-cost countries.

Lovio (2009) argues that concentration of core functions increases transferability of jobs. A survey based on interviews of CFOs of major Finnish firms (Lilius and Sipola, 2006) indicated that the outsourcing of support functions, such as finance and personnel administrative functions, is often preceded by streamlining in-house and sometimes also

establishing an internal shared services center. After these actions it is easier to outsource functions, in some cases also to lower-cost countries.

Jacobides and Kudina (2009) have studied empirically why some industries seem far more amenable to globalization than others, and why some firms fail to 'export' the competitive advantage. They argue that the "fit" between industry architectures (i.e. the similarity between the value chains in home and host countries) and the institutional modularity (i.e. the separation between the stages in a value chain in a segment where firms are active) are two key success factors in international expansion.

**Impacts on Employment**

Much of the recent debate about offshoring concerns the relocation of white collar jobs. Many tasks requiring reasonably high levels of skills formerly remained in the advanced economies. Today many of these tasks are performed offshore. (Grossmann and Rossi-Hansberg, 2008).

During the last few years, several scholars have studied the impacts of offshoring on employment in higher-cost countries. They have tried to find out what kinds of jobs meet the new type of competition and are forced to be transferred to lower cost countries. These studies cover jobs both of manufacturing and business services functions, many are based on official statistics. (Amiti and Wei, 2005; Michel and Rycx, 2009).

Generally, the impacts on employment in higher-cost countries have been reported sparsely and the information is inconsistent. Some scholars have found significant differences between industries. Some authors do not find outsourcing to lower-cost countries an important phenomenon (e.g. Amiti and Wei, 2005), some argue that in IT industries the impacts directs mainly to lower-paid employers (e.g. Mann, 2005). Until recently, several scholars argued that globalization threatens mostly only the lower-skill or routine jobs, whereas the higher-skill jobs are in better safe. Ylä-Anttila (2008) has speculated transferring of jobs with lower levels of salaries. According to Ylä-Anttila (2008) low value added production as well as jobs requiring less education seem to disappear rapidly from Finland to lower-cost countries. He does not see the development only negative from the perspective of the Finnish economy if the better paid and higher value added jobs are can remain in Finland.

Literature and analysis available are mainly based on research conducted before the year 2005. This may result in rather optimistic evaluations concerning e.g. the impacts of off-shoring on services and employment in higher-cost countries.

Krugman (1996) has emphasized that the transferability of services is the key, not the level of education. Among scientists this view is supported also by Blinder (2006) as well as by Grossmann and Rossi-Hansberg (2008).

Instead of classifying jobs by skills required Blinder (2006) looks at types of services. He classifies the service jobs into personal and impersonal services and argues that compared

to personal services the impersonal services which have more in common with manufactured goods are easier to outsource even to another country. However, with the improvement in the use of information technology, more and more personal services will become impersonal and need not be delivered face to face. Changing trade patterns will keep most personal service jobs at home while many jobs producing goods and impersonal services migrate to lower-cost countries (Blinder, 2006).

Baldwin (2006) argues that unbundling, brought by globalization does not divide the labor market on the basis of knowledge (skills) level. Therefore, the significance of the level of education will decrease as a factor keeping jobs in higher-cost countries. From the IT industries point of view the arguments presented by Baldwin are very interesting. According to Baldwin this development could affect also the basic assumptions of information society policies, as well the national education policies emphasizing high level of IT knowledge as well as in Finland and other EU member states.

Grossmann and Rossi-Hansberg (2006) also argue that trading of a particular task is a variable, not a constant. Tasks which seem safe from foreign competition today may not be so tomorrow. They also argue that the tradability of a task might bear no relation to the amount of skill it requires. This makes it difficult to identify the threats of globalization and seek protection of them. Grossmann and Rossi-Hansberg (2008), however, emphasize that certain groups of tasks are required to be performed in close proximity. They call these tasks complementarities (e.g. nurse and surgeon).

There is a strong consensus among authors that services requiring face to face interaction between vendor and customer are difficult to offshore (Blinder, 2006; Van Welsum and Reif, 2005).

The Finnish debate reflects uncertainty of the impacts of globalization and offshoring. So far, there is no profound understanding or academic research of the impacts of offshoring on the structure of Finnish production and labor market. On the basis of separate cases and experiences from the ICT cluster some conclusions have been presented.

Several economists (e.g., Ylä-Anttila, 2008) emphasize the importance of strengthening research activities of the impacts of globalization and offshoring. There is a need to understand which of functions and jobs of the manufacturing industries as well as the information intensive service industries would be moving abroad. On the basis of current knowledge the services firms offshore more jobs demanding high education than the manufacturing companies.

### 2.2.3 Business Models and Industry Evolution

Business models have become the third major driver of change especially in ICT related industries, including software product and IT service industries, when firms attempt to take advantages of the structural changes (e.g. Casadesus-Masanell and Ricart, 2010). The changes in business models often have a close relationship to radical (disruptive)

technological innovations and other changes which create discontinuities in industries. Business model innovations may capitalize these discontinuities.

There is still a lively debate of the definition and role of a business model, as well as the differences between strategy and business model (e.g. Casadesus-Masanell and Ricart, 2010). Numerous of definitions have been presented in the last few years (Amit and Zott; 2001; Afuah and Tucci, 2003; Bouwman and Van Ham, 2004; Hedman and Kalling, 2003; Lambert, 2007; Miller and Lessard, 2000, Osterwalder, 2004; Timmers, 1998; Weil and Vitale, 2001).

Casadesus-Masanell and Ricart (2010) define business model as the "logic of the firm" referring to the way the firm operates and creates value for its stakeholders. Also several other definitions emphasize that the business model defines how a firm earns money (Malone et al., 2006; Osterwalder, 2004; Jacobides and Kudina, 2009). In other words, a business model describes what and to whom a firm offers and how this is accomplished. Business model includes pricing mechanisms, customer relationships, partnering and revenue sharing (Osterwalder, 2004).

Jacobides et al. (2006) have presented a concept called "industry architecture" consisting of the roles played by companies in a sector and the rules that govern them (Chapter 2.1.4). These roles and rules define the business models of the companies, i.e. the ways in which money is made. By this definition a business model expresses also for instance division of labor, outsourcing, partnering, globalization, value creation in the network. (Jacobides, 2009).

In the literature, there are also several business model frameworks (Lambert, 2007, Malone et al., 2006; Osterwalder et al., 2002, 2004, Bouwman et. al, 2005; Chesbrough and Rosenbloom, 2002).

Osterwalder (2004) argues that the rich variety of business models is closely related to the adoption of ICT in business, fueled by globalization and increasing complexity of business environment shaped by ICT. The use of the term business model has increased since the appearance of the Internet and the "new economy" (Hamel, 2000; Tapscott et al., 2000). Malone et al. (2006) argue that the most academic research on business models is related to e-business, an important enabler to new business ways (e.g., Timmers, 1998; Tapscott et al., 2000, Weill and Vitale, 2001; Rappa, 2003; Osterwalder, 2004).

Despite the age of the term business model is less than twenty years, the changes in business models have had a central role in the evolution of IT industries since the 1960s. The origins of the notion of business model go to the writings of Peter Drucker (Casadesus-Masanell and Ricart, 2010). Every new technology wave brought about new kinds of business models (e.g. Cambell-Kelly, 2003).

In the middle of the hottest wave of "new economy" debate Hamel (2000) argued that new business models are more than disruptive technologies, they are completely new business concepts that open up entirely new possibilities (see also Johnson, 2010).

Cusumano (2004) has analyzed business models of the software industry. He divides firms into three categories: product, service and hybrid companies on the basis of their business model. These categories differ according to the share of revenues received from sales of the company's own software products.

Chesbrough and Rosenbloom (2002) emphasize the connections a business model provides between technical potential and the realization of economic value. They have explored the role of business model in capturing value from early stage technologies in selected spin-off companies in Xerox Parc, technology companies of Xerox Corporation. They argue that a successful business model creates a heuristic logic which connects technical potential with the realization of economic value. The spin-offs that became successful evaluated the technical potential through evolving business models, whereas Xerox evaluated the technical potential of these spin-offs through its existing business model. As the result, Xerox was not able to benefit of the innovations. (Chesbrough and Rosenbloom, 2002).

**Business model innovations**

In several industries, including the IT industries the firms must continuously be prepared for different changes in business environment (Osterwalder, 2004). In addition to structural changes, also changes like new customer needs or legal decree may require also new business models (Osterwalder, 2004). These do not necessarily destroy the old ones, but often slowly weaken their relevance (Hamel, 2000). The changes often provide an opportunity for firms to differentiate, even to create new disruptive business models. Hamel (2000) emphasizes that competition takes place not only between products or companies but also between business models. He uses the term business concept innovation of new ways to differentiate the existing business concepts. (Hamel, 2000). This term business concept innovation can be considered synonymous to business model innovation typically meaning radical or disruptive change of a firm's business model.

Business model innovations may result in profound changes by blurring industry boundaries and changing the competitive composition. Numerous examples of impacts of disruptive changes in business models have been witnessed in the IT industries since the 1960s. The success of many IT firms is based on disruptive business model innovations.

As discussed earlier, business model innovation may enable a firm to achieve a dominant role in the market, such as a bottleneck position (Jacobides, 2008) or lock-in position (Hax and Wilde II, 2001). Jacobides (2009) and Jacobides and Tae (2009) argue that the firms succeeding in this are not those which develop and conceive the new ideas, technologies, or products. They are rather those which implement successful ecosystems, architectures of co-dependent firms around them. Jacobides also prefers managing the value chain over owning it.

Recently technology is used in many business models rather as an enabler, not the core of the product or service (e.g. Amazon, eBay). Some firms have combined product and business model innovation (e.g. Apple). (Jacobides, 2009; Lindgardt et al, 2009).

Business model innovations are not required only in cases of radical changes. For example, in the commodity type of market with slow growth rates a business model innovation may be a major differentiator between competitors. (Johnson, 2010). Growing commoditization of several IT products and services and the rather slow growth in many market segments have increased the importance of new business models.

**Impacts on industry evolution**

Both sustained and radical/disruptive changes of business models may have remarkable impacts on both separate enterprises as well as entire IT industries. Unfortunately, the impacts of changes of business models are difficult to predict (e.g. Moschella, 2003).

The major technology waves and numerous innovations have had a remarkable impact on the evolution of IT industries. Each technology wave has generated new business models that have shaped the evolution of both the IT industries and their customer industries. The implications of business models are often crucial in the success of technology innovations (e.g. Malerba et al., 2001; Moschella, 2003). New business models may strengthen or change the impact the new technologies have on the evolution of industries and competition. There are examples of cases when a better or even the best technology has not been able to compete with a technology that has had a good business model.

Even one firm can reshape the evolution and structures of entire industries with the help of a new business model. A classical example is IBM PC with a business model that radically changed structures of IT industries and competition. Foreseeing these impacts was impossible. (C. M. Christensen, 1997, 2003; Moschella, 2003).

IBM's change of business model has played a central role also in transformation of IT industries from vertical to horizontal integration (Grove, 1996). This transformation also resulted in numerous new industries and new business models in companies in different layers of the new industries (cf. Grove, 1996; Carliss Y. Balwin et. al, 2009). These developments also reveal how rapidly old structures can change. In the early 1980s the old large vertical computer companies were strong, growing and vital. By the end of the decade, many of these companies were in the midst of layoffs and restructuring. (Carliss Y. Balwin et. al, 2009).

Innovations often come from new competitors, many of them outside the company's own industry. An increasingly important driver to change business models is the need to meet this new competition. (C. M. Christensen, 1997, 2003). From the IT industry point of view among the most important outcomes of new business models are new services, global production and division of labor, as well as the changes in collaboration with clients and partners.

Suhonen (2002) has studied the evolution of the Internet service provider industry in Finland. She found that the business model related innovation played a bigger role than expected.

## *2.3* Theories of Industry Evolution

This chapter discusses the theories and models examining industry evolution. The consideration emphasizes views important in analyzing and understanding the Finnish IT industries.

### 2.3.1 Established Industry Life Cycle Theories

The industry life cycle model (Abernathy, 1975; Abernathy and Utterback, 1978) has become one of the most popular and widely accepted theories in studying industry evolution and dynamics. It also has a strong position in management literature (e.g. G. A. Moore, 1991, 1999) considering transitions in the business environment and competition. The basic premises of life cycle models are often taken for granted as a conventional wisdom (e.g. McGahan, 2004).

Despite its popularity the theory is not universally applicable (Nelson and Winter, 2002; McGahan, 2004; Cusumano et al., 2006; J. F. Christensen, 2008). The industry life cycle model emerged from the product-life cycle literature of the 1970s and enhanced during the 1980s by studies grounded in technology management (e.g. Foster, 1986; McGahan and Argyres, 2004).

The industry life cycle hypothesis was originally presented by Abernathy (1975, see also Abernathy and Utterback, 1978). It is based on exploring the history of the American automobile industry. Since, several closely related variations of the lifecycle model have been developed to address the development and transition of products, market and industry. Several models are quite similar but the number of stages and names of each may differ (Baum and McGahan, 2004).

In considering life cycle literature, Nelson and Winter (2002) have found that the level of analysis is sometimes unclear and fuzzy. They suppose that because of the evolution history of the theory the analysis may shift among an industry life cycle, a product life cycle or a technological life cycle.

Some authors have modified or expanded the “established” industry life cycle model to describe better larger number of industries. McGahan (2004) argues that the theory is only partly relevant. She does not see the life cycle to be applicable in industries undergoing architectural transformation. Cusumano et al. (2006) have proposed a life cycle model that covers services better. J. F. Christensen (2008) has proposed yet another model called “complementary convergence cycle model” which provides an alternative to established industry life cycle models and to the industry evolution paths presented by McGahan.

In addition to life cycle related literature deviating views of industry evolution are discussed. One of them, based on industry architecture framework, was recently proposed by Jacobides et al. (2006).

Among the major issues analyzed in many industry life cycle studies are stages of the cycle, emergence of dominant design, role of innovation and technology changes in different stages of the life cycle, complementarity and impacts on incumbent enterprises. All of these are interesting when considering the evolution and dynamics of IT industries.

**Stages of Industry Life Cycle**

Industry life cycle research often considers the historical evolution of industries by looking at the co-evolution of technology and industry structure (Nelson and Winter, 2002). The basic assumption is that an industry lifecycle has four stages: fragmentation, shake-out, maturity and decline (Abernathy and Utterback, 1978). Each stage is associated with different basis of competition at the firm level (Cusumano et. al, 2006).

Fragmentation is the first stage and the beginning of a new industry. Companies develop their business by experimenting different paths and approaches to understand and meet customer needs (Utterback, 1994; Nelson and Winter, 2002; Ayres et al., 2003, McGahan, 2004). There is often uncertainty about the new technology and therefore experimental product innovation (Utterback, 1994; Nelson and Winter, 2002; J. F. Christensen, 2008).

New innovators and firms enter the industry offering variety of products. A part of companies fail and exit the market. (Nelson and Winter, 2002; McGahan, 2004; J. F. Christensen et al., 2006).

Gradually the products based on new technology begin to attract attention and get foothold in the market. Also the competitors see business opportunities in the emerging industry. With time a “dominant design” emerges and companies adopting it achieve competitive advantage whereas among the others the failure rate increases, resulting in a shakeout in the industry. Industry volumes increase rapidly when more companies adopt the dominant design. (Nelson and Winter, 2002; Ayres et al., 2003; McGahan, 2004). The concept of shakeout can be defined as a period in an industry life cycle when the number of firms exiting the industry exceeds the number of firms entering the industry (Horvath et al., 2001, Suhonen, 2002).

At the maturity stage the demand in the market starts to decline, the growth slows down, competition increases. Companies have to lower their costs and seek new business opportunities, for instance, by expanding abroad. The maturity of an industry also leads to concentration and a more stable industry structure. (McGahan, 2004; Baum and McGahan, 2004).

Finally the industry moves to the stage of decline: the volumes drop and the number of firms in the industry diminishes. Often a relatively small number of large firms is left to dominate the industry (Nelson and Winter, 2002). The competition will further intensify, and the remaining firms have to strengthen their efforts to improve profitability. (Nelson and Winter, 2002, McGahan, 2004; Baum and McGahan, 2004). Some may develop new products or services which can create new industries (Francis & Desai, 2005).

The industry life-cycle theory emphasizes the roles of different types of innovations in industry evolution. The major argument is the alternation between radical and incremental innovations. According to the theory, the shift from radical to incremental innovation indicates the maturity of an industry. Abernathy (1978) argues that radical innovations introduce new products, incremental innovations are applied after a dominant design has emerged. Some authors do not support the view of alternation of innovations (e.g. McGahan, 2004).

Nelson and Winter (2002) emphasize that the variety of evolutionary process tends to be at its maximum in the early stages of an industry evolution, before the emergence of a dominant design. In a mature industry there may not be much variety to work with.

In the life cycle literature, expanding abroad is mainly seen to belong to maturity and decline stages. Today, however, in several industries including the IT industries, an increasing number of companies start to expand abroad before the maturity stage.

Industry life-cycle studies typically consider changes in industry volumes over time by using distinct models. The quantitative data has a major role (McGahan et al., 2004). Some scientists feel it as a challenge that the core theory underlying the model is not yet fully articulated (McGahan et al., 2004). Also, using information based on industry classifications of statistical offices may result in inaccuracies because of blurred industry boundaries.

The life cycle theory emphasizes the concentration of industries in the decline phase. Especially industries where the economy of scale is critical usually consolidate (see e.g. Kroeger et al., 2008, J. F. Christensen, 2008).

**Examples of IT industry related literature**

In the literature concerning industry life cycles there are numerous lists of studies of different industries, in some cases also evaluations of the extent to which these models seem to fit (Mowery and Nelson, 1999; Nelson and Winter, 2002; Moilanen, 2009; Peltoniemi, 2009). Major part of the studies have focused on traditional manufacturing industries, whereas the evolution and dynamics of services (non-manufacturing) industries have not been intensively studied (Suhonen, 2002; Cusumano et al., 2006; J. F. Christensen et al., 2008; Peltoniemi, 2009).

Peltoniemi (2009) emphasizes the lack of research on industries where the value is created in offices by highly educated people. These industries include both software and IT services industries but research on their dynamics is limited (Cusumano et al., 2006; Peltoniemi, 2009).

This means that many assumptions, conclusions and generalizations of industry evolution also base on studies concerning product manufacturing industries. Use of their results may be misleading in other industries, e.g. in services industries. Recently some scientists have questioned the universally used generalizations of industry evolution based on life cycle model (Nelson and Winter, 2002; McGahan, 2004; J. F. Christensen, 2008).

Literature concerning the evolution of software or IT services industries include studies of strictly defined industries, such as facsimile transmission services (Baum et al., 1995), Internet services provider industry (Suhonen, 2002), encryption software (Giarratana 2004), mobile payment services (Dahlberg et al., 2008), game industry (Peltoniemi, 2009), systemic industries (König and Stephan, 2007). The industry life cycle research does not include traditional IT service industries or "mainstream" application software product industries. In general, it is difficult to get reliable industry data from public sources which may restrict research activities in certain industries.

Major topics in the life cycle studies include analyzing the evolution and dynamics of different stages and their major phases like shakeout periods, emergence of dominant design, exits and entries.

The studies of the beginning and duration of the shakeout phase result in high variety between industries. Klepper and Graddy (1990) and Klepper and Miller (1995) report that in many industries it takes twenty to thirty years from the first entry to the beginning of a shakeout. Furthermore, the shakeout periods last about ten years. (Suhonen, 2002). Day et al. (2003) argue that in the "new economy" the shakeout will come much faster. Suhonen (2002) has studied the shakeout mechanisms in the Internet service provider industry. She argues that this industry is one with early shakeouts. It took only 5-6 years from the starting of a mass-market to a shakeout.

Peltoniemi (2009) has studied life-cycle phases and events of the games industry both in the hardware and software sectors. She argues that the dynamics of the game industry differ from the propositions of the industry life-cycle theory in two respects, innovative activity and level of concentration of the industry. Innovative activity of the game industry has not leveled off in either hardware or software sectors. Peltoniemi explained this by the constant need for novelty and the fact that the production of original ideas has a key role in game development firms. The concentration trend has not caught game development which is explained by a smaller pressure for economies of scale. This in turn is explained by fear of bankruptcy and managerial problems if the firm would grow considerably. (Peltoniemi, 2009).

Peltoniemi (2009) has studied the shakeout in the games industry that emerged in the early 1970s. Despite the time span of over three decades phenomena described in the industry life-cycle literature did not appear.

The manufacturing industries typically have rather fixed boundaries and rather homogenous products whereas many other industries are more dynamic and evolve with less fixed boundaries than generally acknowledged in industry life cycle analyses. For example, many software and IT services industries are characterized by blurring industry boundaries and often also by rapidly changing product and service offerings. (Hamel and Prahalad, 1994; Cusumano et al., 2007; J. F. Christensen, 2008). These differences may also affect emerging of dominant design and shakeout. In all, the dynamic nature of industries may make it difficult to apply the industry life cycle model in studying industry evolution.

Despite the limited number of academic studies of software and IT industries the terms and basic ideas of the industry life cycle theory are widely used by management in IT firms, as well as in management literature (e.g. G. A. Moore).

**Dominant Design in IT industries**

Life cycle theories suggest that a dominant design typically emerges after fragmentation phase and leads to shakeout. In some industries, though, it is not possible to identify any dominant design (Porter, 1983; Klepper, 1997; Dahlberg et al., 2008) whereas in some industries multiple dominant designs may emerge (de Vries et al., 2009).

The term dominant design was firstly presented by Abernathy (1975) and by Abernathy and Utterback (1978). They defined it as a single architecture that establishes dominance in a product category. For them it marks the transition from made-to-order production to standardized mass-manufacturing. (de Vries et al., 2009). A similar definition is used e.g. by Anderson and Tushman (1990). Instead of dominant design some authors use the term dominant model as a synonym (e.g. McGahan, 2004).

Certain limitations in applying the dominant design theory have been presented in literature. Some authors limit the theory to industries with homogeneous markets (Teece, 1986; Nelson, 1995; Windrum and Birchenhall, 1998), others to industries operating in mass markets (Teece, 1986; Windrum and Birchenhall, 1998).

From the market point of view there are major differences between different kinds of software and IT service industries. Both of these industries include sub-industries that operate in heterogeneous market, consisting e.g. of customers having different needs or locating in different countries. So far, only a small part of IT services industries have mass market customers whereas several software industries are focused on mass market. Software product industries typically are R&D intensive, whereas in many IT services industries the role of R&D is rather low.

Dominant design is not always easy to identify. There is no widely accepted definition. The definition may base, for example, on the share of the dominant products or service in product categories using the technology (e.g. Anderson and Tushman, 1990; de Vries et al., 2009). Globalizing of industries presents further challenges to defining dominant design. For instance, different designs may be dominant in different parts of the world. (de Vries et al., 2009).

Some authors use the term standard as a synonym to dominant design (e.g. Shapiro and Varian, 1999a, Shapiro and Varian, 1999b), others find the terms fundamentally different (e.g. Gallagher, 2007). Gallagher (2007) argues that dominant design can only be recognized post hoc, standards can be identified before dominance is achieved. In ICT industries, especially in communication industries, there are different technology and country specific or international standards set by authorities or industry organizations. Standards are often expected to be used repeatedly or continuously (de Vries et al., 2209). In this study dominant design and standards are seen as two separate concepts.

In IT industries the term ‘de facto standard’ is widely used. It is often a synonym to dominant design because it can be identified only afterwards when certain product or service has already achieved a dominant position.

It is difficult to foresee an alternative becoming a dominant design. However, there are examples of situations where the best technology or the best solution has not become a dominant design (C. M. Christensen, 1997; McGahan, 2004, deVries et al., 2009). There are also examples showing that replacing a dominant design can be very difficult, often because of high investments needed. Moilanen (2009) mentions track width of railways as an example of dominant design difficult to replace.

Dahlberg et al. (2008) developed a theoretical framework to describe factors having influence on the emergence of dominant designs in complex information and communication technology enabled service markets. Their study of the Finnish mobile payment service market showed that a dominant design had not emerged for that market. De Vries et al. (2009) have studied the flash memory card industry. They did not discover any emergence of dominant design. Instead, multiple competing designs coexisted in the market.

The emergence of the dominant design (Teece, 1986; Murmann and Frenken, 2006) may change the competition in the industry in many ways. Typically it also changes the structure of the industry and leads to concentration of firms in the industry. This development will be strengthened if the dominant design enables economies of scale.

In some cases the dominant design may be based on or may lead to a strong market power of one company in the industry (e.g. Intel or Microsoft). A dominant company may also be able to build a network of companies which base their businesses on its technology or products. This network of companies together forms an ecosystem. As a result the dominant company may achieve a bottleneck (e.g. Jacobides, 2009) or a lock-in position (Hax and Wilde II, 2001) and in that situation one of few companies can manage and control the evolution of the industry and utilize innovations developed in the network of firms. According to the life cycle theory, once a dominant design emerges innovative activity is directed to improving processes by with the dominant design is delivered rather than to exploring alternatives.

### 2.3.2 Industry Trajectories and Industry Life Cycles

Despite the wide acceptance of the industry life cycle model also notable critical views are presented by leading scientists who research industry evolution. Among them is Anita McGahan (2000, 2004). On the basis of her empirical research she has pointed out several reasons why she does not see the established life cycle model as applicable for strategic analysis in all industries.

McGahan (2004) has analyzed industry evolution by considering how different changes (which she calls threats) affect industry evolution. She considers the industry evolution

from an enterprise point of view. Her main aim is to provide a profound understanding and tools for firms to recognize and utilize better the opportunities of industry evolution. McGahan emphasizes the need to identify own industry, as well as strict definition of industry borders. For instance, she considers live-auction and on-line auction industries as different industries. The former is a traditional or established industry, the latter an emerging industry. McGahan argues that both follow their own trajectories of change.

McGahan (2004) has empirically studied how changes (threats) impact on evolution of different industries. The starting point is to consider how changes affect assets and activities of industries. Changes, such as new technology, globalization, changes of buyer tastes, can threaten in multiple ways the core assets and core activities of an industry. According to these impacts McGahan proposes four different trajectories of change: progressive, creative, intermediating and radical changes. When the changes affect core activities, the industry is undergoing a "architectural transformation" (radical or intermediating changes). If the changes affect core assets the industry is undergoing a "foundational transformation" (progressive or creative changes).

McGahan (2000, 2004) points out several reasons why she does not see the established life cycle modes applicable in all industries. She makes difference between established and emerging industries and emphasized problems in defining industry boundaries. For example, depending on which products are counted as parts of the industry and which as substitutes, the results and conclusions of the industry evolution can be different.

In emerging industries changes are almost always foundational (progressive or creative) and architectural (radical and intermediating) in established industries, respectively. McGahan (2004) argues that the (traditional) industry life cycle model and its phases can be applied only in cases of foundational transformation of an industry. Instead, if the industry is undergoing an architectural transformation the evolution follows different phases: emergence, convergence, co-existence and dominance. A new technology gradually gains ground and gradually replaces the old one.

### 2.3.3 Expanding Lice Cycle with Services

Major part of the industry life-cycle literature has focused on traditional product manufacturing industries. The evolution and dynamics of services industries, however, have not been intensively studied (e.g. Suhonen, 2002; Cusumano et. al, 2006; Peltoniemi, 2009).

Cusumano et al. (2006) have considered services as a part of the business of product industries applying the lenses of industry lifecycle (Abernathy and Utterback, 1978). They analyzed the role of services and shifts in the basis of competition in different stages of industry evolution. Even if independent services industries have been left outside, some results and arguments are applicable for them too. One of the major arguments is that services are a way to expand the life cycle of certain product companies. Therefore, the analysis is well suited also for IT industries, especially for software and other product companies.

One of the central propositions of Cusumano et al. (2006) is that the importance of services varies in the stages of industry lifecycle, being largest in the mature stage. In the early phase of industry evolution, unstable product offerings and customer preferences often create complexity for the provision of services, ranging from product customization to technical advice and support (Cusumano et al., 2007). This often requires also a high level of integration with the customer (Mills, 1986, Skaggs and Huffman, 2003).

Cusumano et al. (2006) considered several drivers and factors which increase the role and value of services in maturing industries. These drivers include moving to relatively standard services, complementarities between products and services (Teece, 1986) and installed base of products. The cumulative installed base of products provides a growing potential for services. Firms are able to compensate declining product revenues (Utterback, 1994) with increasing service revenues. In some cases, the service revenues may even increase the total revenues despite the declining product demand and prices (Potts, 1988; Cusumano, 2004).

This kind of development has been seen also in IT industries when a product firm has been able to increase sales of services (e.g. IBM). As a result some product firms have gradually become service companies. Today, an increasing share of revenues of several traditional Finnish manufacturing companies (e.g. Kone, Wärtsilä) is derived of services (cf. Penttinen, 2007).

Firms are therefore naturally inclined to explore service opportunities as sources of revenue and profits as the industry matures (Oliva and Kallenberg, 2003, Davies, 2004; Wise and Baumgartner, 1999).

Industry life cycle theory argues that a discontinuous technological change may interrupt the mature phase (Andersen and Tushman, 1990; C. M. Christensen, 1992) and restart the industry life cycle (Andersen and Tushman, 1990). Cusumano et al. (2006) emphasize the installed base of products based on previous technology as an important source for growth of services after a discontinuity. The business potential depends on the level of integration required between the existing and new technology.

The existing theory does not cover this types of considerations related to services. The activities are synergistic in the sense that one benefits from the other. According to Cusumano et al. (2006) the synergies tend to run from products to services so far as the service activity tends to follow the installed base of products: the larger the installed base, the larger the potential service activity. In a variety of industries, the additional sale of a product often generates service opportunities in the form of warranty agreements, maintenance, training, implementation and after-sale technical support.

### 2.3.4 Industry Convergence

Industries change continuously by integrating, disintegrating, re-integrating, converging and diverging (Hamel and Prahalad, 1994; Jacobides and Winter, 2005; Jacobides et al., 2006; Sako, 2007).

From the perspective of this study, J. F. Christensen (2008) offers a useful taxonomy and framework which recognize the blurring boundaries of industries. He proposes the "complementary convergence cycle" (CCC) framework as an alternative or supplement to both the product life cycle model and the model of substitution-oriented convergence proposed by McGahan. Christensen argues that complementary industry convergence phenomenon is seen especially in ICT-intensive sectors that co-evolve with new enabling technologies. Typically emerging industries (niches) will converge with existing ones.

### 2.3.5 Role of Complementarity

By definition two activities are complementary when an increase in one raises the marginal return of the other (Milgrom and Roberts, 1990, Brandenburger and Nalebuff, 1996).

Complementarity is a very relevant factor in shaping IT industries. The evolution of IT hardware, software and services industries are often firmly interconnected. For instance, technology innovations in hardware industry often affect the evolution and dynamics of both software and services industries. Accordingly, new industries may emerge and existing ones often have to change their structures.

The growing importance of various platforms (Gawer and Cusumano, 2002; Gawer, 2010) and business ecosystems (Iansiti and Levien) have contributed also research activities related to complementary products and services (e.g. Gawer and Henderson, 2007; Parker and Alstyne, 2008).

All major waves of information technology, as well as several smaller technological changes have given birth especially to numerous new IT product industries since the 1960s. For example, both the emergences of PC technology and the Internet have resulted in several new software and IT services industries or their sub-industries (see e.g. Grove, 1996; C. M. Christensen, 1997; Moschella, 2003).

Complementarity has several implications on different levels in industry evolution and may be seen as a driver in creating new industries and reshaping industry structures.

The changing relationships between products and services can be considered as an actual example of the importance of complementarity on industry structure. Products and services are often complementary activities (e.g. Teece, 1986; Cusumano, 2004; Cusumano et al., 2006) and Cusumano et al. emphasize the increasing importance of complementarities between products and services in industry evolution. In a maturing industry the share of service businesses increases of the total business of a firm. (Cusumano, 2004). This trend can be seen also in several other industries, including (traditional) manufacturing industries (e.g. Penttinen, 2007).

Internet services provider industry is a representative example of the importance of complementarity. It would not exist without the emergence of the TCP/IP technology, and its adjacent innovations, such as web browser or html-language (Suhonen, 2002).

Peltoniemi (2009) has considered complementarity in the evolution of the game hardware and software sectors. She classified these sectors into cultural industries that are often facing complementary issues. For example, music or film recordings typically require the purchase of complementary equipment (Peltoniemi, 2009). This also means that the needs for complementarity may come from outside the traditional IT industries.

Since the mid 2000s complementarity has become one of the most important drivers to expand businesses in the mobile phone industry. The technological evolution has made it possible to expand the use of mobile phones to continuously increasing uses and applications. The strong trend is to increase the share of different services (music, navigation etc.) of the total revenues of mobile phone manufacturers. Simultaneously, the aim is to sell more phones with services. Product companies attempt increasingly to become service companies (e.g. Apple iTunes, Nokia OVI etc.). Simultaneously, it has become increasingly difficult to define the industries and industry boundaries of companies like Nokia and Apple. This development represents the recent trend and direction of several ICT and other industries to expand businesses from products to services, often also beyond current industries.

Despite the importance of the complementarity only a limited number of studies related to the role of complementarity of products or services in the life-cycle dynamics are available (e.g. Klepper, 1997; Suhonen, 2002; Peltoniemi, 2009).

## *2.4* Platforms and Ecosystems

Platforms play a particularly critical role in technology intensive industries, such as enterprise software, electronic commerce or mobile communications (Cusumano and Gawer, 2002; Evans et al., 2006; Gawer and Henderson, 2007, Gawer, 2009, 2010). Cusumano and Gawer as well as Eisenmann (2008) have listed various successful platforms and their providers, such as Cisco, Intel, Wal-Mart, Visa and Microsoft. Platforms have become one of the major drivers also in the IT industries. This development has been fueled also by growing role of ecosystems.

In product strategy literature platforms are considered as foundation for new products (Wheelwright and Clark, 1992; McGrath, 2001). McGrath (2001, p. 53) defines a product platform as “a collection of the common element, especially the underlying technology, implemented across a range of products.”

In recent years industry platforms have got an important role as drivers of evolution in various industries and become also crucial objects of research. Gawer (2010) has presented a topology of platforms. It comprises three main types of platforms: internal, supply-chain and industry platforms, and, as a fourth, multisided markets or platforms (Gawer 2010). The topology also demonstrates a transition from internal platforms to supply chain platforms and further to industry platforms using IBM as an example. Gawer defines industry platforms as “building blocks” that can be products, technologies, or services. Platforms are foundations on which companies can develop complementary

products, technologies, or services (Gawer, 2009, 2010). Many high-tech products and services are increasingly provided by complex networks of firms.

Another direction to analyze industry evolution is to consider the economy as ecosystems based on ideas from biological ecosystems (Rotschild, 1990; J. F. Moore, 1996; Iansiti and Levien, 2004). According to Rotschild firms can be compared with biological organisms and industries with species. Among the first ones Lovio (1993) used the same idea in studying the evolution of the Finnish electronics industries.

Both directions lead to similar considerations of company networks. As a result, the network of firms around industry platforms is also called business ecosystem (cf. Moore, 1996; Iansiti and Levien, 2004; Gawer, 2009, 2010). Originally, J. F. Moore (1993, HBR, 1996) defined business ecosystem as a concept for strategic planning. Later it has become a popular framework for examining of structures and evolution of IT industries.

J. F. Moore (1993) defines the business ecosystem as "an organization group crossing many industries working cooperatively and competitively in production, customer service and innovation". Moore has suggested for giving up the notion of industry due to definition issues resulted from the fast technological changes. Peltoniemi and Vuori (2004) argue that Moore´s business ecosystem is closer to concepts of cluster and value network. They have examined several types of ecosystems and their origins.

Basole and Rouse (2008) define an ecosystem to consist of interdependent firms that form a symbiotic relationship in order to create and deliver products and services. Iansiti and Richards (2005) have examined an IT ecosystem that refers to the network of organizations that drives the creation and delivery of information technology products and services. They have applied the ecosystem thinking as a frame for considering IT industry in examining the health of IT ecosystem.

In emerging technology industries the increasing complexity of product and service development as well as the increasing vertical and horizontal disintegration of markets result in various inter-firm relations and firm networks (e.g. Iansiti and Levien, 2004). Since the 1990s various supply chains have transformed into value networks. At the same time, value networks (Christensen and Rosenbloom, 1995) have increasingly moved towards business ecosystems (Iansiti and Levien, 2004). Value networks are largely based on cooperation whereas in ecosystems the firms may both compete and cooperate (J. F. Moore 1993, Iansiti and Levien, 2004; Peltoniemi 2005).

Platforms may have a fundamental effect on transformation of industries (cf. Evans et al., 2006, Gawer, 2009). According to Gawer (2009) "technological platforms, embedded within industrial ecosystems, have redesigned industrial landscapes as well as the balance of power between firms, fostered innovation, and raised new questions on competition, innovation, and organization." Also Schilling and Phelps (2007) suggest that inter-firm relations and the resulting ecosystem significantly influence innovation. Dyer and Singh (1998) emphasize providing and enabling an access to resources, knowledge, and information for competitive advantages. Platforms have become a core feature of many

emerging business models (Basole, 2009, Jacobides, 2009), and are particularly important in the IT industries impacting the competitive dynamics as well as industry innovation. Simultaneously, a distributed industry structure may shift the focus of competition increasingly to assets that are outside the direct ownership and control of the company (Iansiti and Levien, 2004).

Business ecosystems consist of networks of companies with different roles. The companies that own the technology platforms and drive the related industry-wide innovation are called platform leaders by Gawer and Cusumano (2002) whereas Iansiti and Levin (2004) use the term a keystone. The members of the ecosystem, in turn, may be platform complementors developing complementary technologies, products, or services (Gawer, 2010). According to Chesbrough and Appleyard (2007) the firms have different roles. They may collaborate and coordinate activities to create and deliver products and services that complement, enable, and drive the platform. Often firms utilize platforms in their own products that they provide to their own customers. Members of business ecosystems may both collaborate and cooperate (Iansiti and Levien, 2004).Some considerations of ecosystems may also include the customers using products or services produced in these ecosystems.

Gawer (2010) argues that positions of industrial leadership are often contested and lost when industry platforms emerge. She emphasizes the importance of innovation on complementary products and services as creator of value for the platform and its users via direct and indirect network effects, resulting also to a cumulative advantage for existing platforms. This development has been seen, for instance, in the ecosystem that Microsoft has built around the Windows OS platform, or in the Apple´s ecosystem around its mobile platform. Both have resulted in continuous reinforcing cycle. A growing number of applications generates more customers and draw more developers, and again, attracts more customers (cf. Basole, 2009; Gawer, 2010).[3]

Strong industry platform and ecosystem may help an IT firm to get a dominant position in its industry. Achieving of "lock-in" position (cf. Hax and Wilde II, 2001), or becoming "a bottleneck" (e.g. Jacobides, 2009) can make it possible for firms to dominate and control the evolution of their industries. Platform providers can hold dominant positions in their industries, but they also face the challenge of managing the evolution of the platform (Cusumano and Gawer, 2002). Ballon (2009a, 2009b) has examined different patterns of control and gatekeeper roles of platforms in the mobile communication industry. According to him, the platform owners may control over assets and over the customer relationship.

Business ecosystems provide a framework for considering structures and relationships of firm populations also in the global context. Major business ecosystems have expanded to

[3] Basole (2009) has examined the structure of competing platform ecosystems in the mobile industries in years 2006-2008. He identified the mobile device platform market to face similar the issues the desktop computing industry experienced in the 1980´s when the choice was between Microsoft Windows and IBM´s OS2.

global networks of IT firms, covering also vendors in lower-cost countries. In addition, adopting the idea of ecosystems may also replace the cluster-based structures both in national and global considerations.

So far the focus in research of platforms and ecosystem has been on products. There is, however, a growing interest in research concerning service platforms (Gawer, 2010).

# 3 Theoretical Perspective of IT Industries

This chapter discusses issues that characterize IT industries. The aim is to find tools and views to get a more accurate picture of the structure and dynamics of the IT industries. In addition, key issues in getting accurate information of IT industries will be discussed. This analysis focuses on IT services and software products industries that cover only part of industries included in the ICT cluster considerations but have an important role both directly and indirectly on the evolution of ICT industries in Finland.

## *3.1* Definition of IT Industries

Like many other industries also the IT Industries are often taken for given. In addition, the concepts IT industry and IT market are often mixed in public discussion. In this study IT industries are groups of firms producing products or services based on use of IT and related knowledge. Defining IT industry borders are, however, found difficult (Hamel and Prahalad, 1994; Mowery and Nelson, 1999; Fransman, 2002).

Firms producing software products or IT services operate in a very dynamic environment. It is affected by continuous and often rapid changes, such as radical (disruptive) changes (C. M. Christensen, 1997), impacting also on customer needs and globalization (Jacobides and Winter, 2005). As a result, the landscape and competitive environment of firms involved are continuously changing and industries get re-defined by integrating, disintegrating, re-integrating, converging and diverging (see, e.g. Hamel and Prahalad, 1994; Prahalad and Ramaswamy, 2004; Jacobides and Winter, 2005). The situation is the same in Finland; defining IT industries and their boundaries is challenging.

The customer base of IT firms has expanded rapidly during the last twenty years and the expansion continues. At the same time, there has been a remarkable growth in the share of other than traditional user customers and a change as remarkable in customer needs and requirements and relationships and roles between IT firms and their customers. The needs of customers can be satisfied with traditional and alternative IT products and services but often the customer can also choose from a wide range of substitutes for IT products and services, often based on new business models.

Various kind of information is needed of IT industries and their evolution. A major challenge is how to get timely and reliable information (Fransman, 2002).

Another major challenge in defining IT industries is the drawing of industry boundaries, i.e. which firms must be included and which left out. Drawing industry boundaries is especially challenging in dynamic industries like the IT industries (Hamel and Prahalad, 1994). The issue is even more complicated when the industry must be defined from the user point of view (Jacobides and Winter, 2005).

IT industries are often defined around a certain product or technology. The key question is, how narrowly – or how broadly and flexibly – the borders should be set. The dynamics

of most IT industries makes it challenging to define them narrowly. In addition, several firms can be classified to belong into more than one industry.

Examples of large IT companies demonstrate the problems in defining. IBM, for instance, provides multiple types of IT products and services which serve a wide range of distinct customer segments. The revenue ratios between different products and services may change quite rapidly. Traditionally IBM has been classified into computer industry. Earlier, the company derived a major part of its revenues from computers and other hardware products. In the 1990s and early 2000s the company has gone through an outstanding transformation (2002) and today more than half of IBM's revenues come from services (IBM Annual Report, 2009). Since the 1950s IBM has also been one of the major producers of software products globally (Campbell-Kelly, 2003; Cusumano, 2004).

In Finland, Nokia is another representative example of a company having activities in several industries, also outside the traditional ICT industries. As a result, it is also difficult to define one single industry for Nokia.

The IT industry information collected by statistical offices and market research firms is based on classifications of categories or subcategories representing different levels of aggregation. Classifications and categories are defined according to needs of information users, or often, according to the knowledge of the level on which the information is possible to get. Depending on the needs and views of information users the IT industry may be divided into a few main industries or into numerous separate industries and categories. Some authors (e.g. Hamel and Prahalad, 1994) emphasize the importance of being able to apply flexible industry definitions.

The heterogeneity of IT products and services typically increases at the higher levels of aggregation, whereas at the lower levels of aggregation it is possible to ensure a better homogeneity. From the point of view of many uses, the higher levels of aggregation often provide information of IT industries and their structures that is too inaccurate. (e.g. Malerba et al., 1999, 2001; J. F. Christensen, 2008).

When considering all ICT industries at the highest level of aggregation they consist of IT industries and communications industries. The highest level of aggregation of IT industries, in turn, consists of firms producing IT hardware, software products and IT services. The IT hardware industry, often called computer industry, includes production of all computer categories (despite of their size class or technology like mainframes, PCs etc.) as well as all peripherals (such as printers, storage units etc.). Depending on the information needs all these categories or often also their subcategories may be considered as separate industries.

Fransman (2002) has noticed it difficult to define the boundaries of "telecoms industry", which in turn will determine the limits to analysis of any industry or, more concretely, what needs to be included, what can legitimately be left out. Some authors argue that it is difficult to draw industry borders between software and IT services (e.g. Mowery and Nelson, 1999). In this study we argue that it is possible to define boundaries between

software products and IT services and therefore it is also possible to define software product industry and IT services industry.

Until recently a popular way to consider the size and structure of ICT industries at national level has been to apply the concept of ICT cluster (cf. Porter, 1990). These considerations, however, remain at a very high level of aggregation leading to issues of heterogeneity of products and services. Today, the concept of business ecosystem has replaced the cluster in many considerations.

Official statistics and several other examinations may define the terms software product and IT services rather inaccurately. Software product and IT services industries are often considered as one industry or partly overlapping industries. This makes it difficult to get a clear picture of the size, structure or market these industries. One of the starting points of this study is to assume that incomplete information may result in misleading conclusions and decisions. Understanding the differences between software product and IT services industries requires defining of both products and services at the general level as well as defining software products and IT services.

## *3.2* Defining Products and Services

A wide range of literature proposes different answers to the question how do services differ from products. Definitions vary according to different views of angles and needs.

Economists traditionally divide all economic activity into two main industry categories, goods-producing industries and service industries. Goods-producing industries, such as manufacturing and construction, create tangible objects, manufactured goods. Service industries, in turn, produce everything else that is not tangible (e.g. banking, communications, professional services, computer software development and government services). The classifications of the public statistics are based on the same thinking.

This approach is recently criticized e.g. by some scholars studying services (Vargo and Lusch, 2004; Grönroos, 2009). They argue that it results in information emphasizing the production of tangible goods and underestimating the significance of services, and may mislead decision makers (Grönroos, 2009).

Some authors describe the differences between goods and services by listing characteristics or non-characteristics of services and products (Zeithaml et al., 1985; Axelsson and Wynstra, 2002; Normann, 1991). There are a number of characteristics applied in literature to differentiate products and services, including locations of production and customers, standardization of output (Mills, 1986), ability to stockpile and location of consumption, possibility to transfer ownership (Hill, 1977; Gummesson, 2004) and ability to utilize the service when it is produced (Grönroos, 2009).

The assumption of the production of services close to customer has lost ground in IT services because of offshoring (c.f. Sako, 2005). Services have commonly been

characterized by non-standardized output (Mills, 1986). Today, also this view is being criticized (e.g. Penttinen, 2007). During the last few years there has been an increasing tendency to standardize and "productize" services or single processes of services to improve effectiveness and performance of the production of services. This development applies also to several IT services, for instance, help desk services. The literature (Heskett, 1986; Organ and Grower, 1987) emphasizes that services differ from manufactured goods in the respect that they cannot be stockpiled and are generally consumed at the point of production.

Globalization of services, resulting in offshoring of service processes to low-cost economies, is a still growing tendency (Sako, 2006; Jacobides and Kudina, 2009). As a result, services are increasingly produced elsewhere than they are consumed. This development is fueled by fast developing communication networks and capabilities. Stockpiling of services, however, is still not possible.

Transferring of ownership is often mentioned as a differentiator between products and services. Several authors (e.g. Hill, 1977; Gummesson, 2004) emphasize the impossibility of transferring of the ownership of service. When purchasing a software licence the right of possession will not be transferred.

Services are often related to physical products. For example, in IT services like hardware maintenance or software implementation and integration the service processes are often tied to some physical product. Lovelock and Wright (1999) define services as acts or performances that one party offers to another. The performance (the service process), instead, is intangible and does not normally affect ownership of any of the factors of production (Lovelock and Wright, 1999; Penttinen, 2007). Penttinen argues that in cases when a service process may be tied to a product, the performance is essentially intangible and does not normally result in ownership of any of the factors of production.

There are, however, cases when an output of a service will indisputably become owned by the customer. In some cases the service will result in a type of end product, such as a customized application. The customized application typically will be owned by the customer after the service process. Producing this type of application is based on individual requirements and close participation (co-creation) of the customer. This is often the case also in many other IT services. Grönroos (2009) emphasizes that the service comes into existence during the service process.

An important characteristic for several services, including IT services, is the ability to utilize a service when it is produced. Examples of these kinds of services include different services based on the use of computer capacity. Another factor making difference between product and service is the role of the customer. Several authors emphasize the direct contact and active participation of the customer in the delivery of a service (Mills, 1986, Prahalad and Ramaswamy, 2004; Vargo and Lusch, 2004; Penttinen, 2007; Grönroos, 2009). The customer has a key role in generating the value from the service. The value arises partly in the interaction between the customer and the vendor. (Prahalad and Ramaswamy, 2004; Grönroos, 2009).

As seen, the validity of many of the characteristics described above is under pressure due to changes in the business environment. As a result, differentiating of products and services is increasingly difficult if it is based on these kinds of characteristics.

A group of authors sees it difficult to draw a strict line between products and services and consider products and services as a continuum (Rathmell, 1966; Chase and Aquilano, 1977: Axelsson and Wynstra, 2002). In one end there are pure products, in the other pure services. This basic classification has been often questioned due to the "goods-like" nature of many services, such as health care, and the "service-like" functions performed within non-service organizations (Stanback, 1979).

The thinking based on continuum, however, may help to analyze businesses or offerings of companies. Cusumano (2004) uses the continuum in considering business models. He divides software businesses into three categories, such as software, hybrid and services businesses. All represent different business models. Oliva and Kallenberg (2003) have applied the idea of continuum in analyzing the movements from goods to services.

From the IT services point of view an interesting and relevant approach is formed by authors who consider services as a way to receive technical and human capacity or competencies (Gadrey 2000; Vargo and Lusch, 2004). Technical and human capacity is owned or controlled by the supplier. The use of IT services is typically based on needs of customers to utilize external suppliers to receive human competencies or technical capacities to help develop or run processes and businesses. (Penttinen, 2007).

Software product is not a physical product. However, in this study software products are considered as goods. One of the basic arguments is the business dynamics of software products. In addition, software products clearly fill several characteristics defined to goods, including locations of production and customers, standardization of output, ability to stockpile as well as location where production is consumed.

**Services related literature**

Lately an increasing amount of effort has been put to examine impacts and roles of services at different levels from national economies to individual companies.

Part of the literature is focusing on the transition from products to services and the management of this transition. The emerging post-industrial stage and the shift from manufacturing to services have been documented by scholars and economists since the early 1970s (Cusumano et al., 2006). Oliva and Kallenberg (2003) have studied the transformation from products to services. In Finland, Penttinen (2007) has studied the transition from products to services in manufacturing companies. Cusumano et al. (2006) have studied the role of services in extending the life cycle and in ensuring the growth of product companies, including software companies. In his book the former CEO of IBM, Lou Gerstner (2002), has analyzed IBM's transformation from a product company to an IT services company from the management point of view. Major market research firms have tracked and measured the same transition in the IT market during the last twenty,

thirty years. According to their reports services have steadily increased their share of the total spending on IT, representing a good half in 2008 (IDC, 2010; Market-Visio, 2009).

An important factor separating products and services is the role of the customer. Several authors emphasize the direct contact and active participation of the customer in delivering services (Mills, 1986, Prahalad and Ramaswamy, 2004; Penttinen, 2007 Grönroos, 2009). There is also a group of authors who underline service-dominant approaches in their analysis of industry evolution (Oliva and Kallenberg, 2003; Vargo and Lusch, 2004; Edvardsson et al., 2006; Grönroos, 2009). The customer is in a key role in generating value from a service. The value arises partly in the interaction between the customer and the vendor. (Prahalad and Ramaswamy, 2004, Grönroos, 2009).

**Offerings**

In addition to defining a product and a service as such, more emphasis is being put on services as part of an offering. From the customer point of view a delivery is often an offering consisting of products and (customer-specific) services. This is how customers typically see the purchase of IT systems. For instance, the implementation of an enterprise application system usually includes, besides the software product, also customization and integration services from an external service provider. From the customer's point of view the offering is often more relevant than single products or services.

Grönroos (2009) argues that the customers do not buy services or products but benefits they can afford. For him a service means supporting the functions and processes of a customer. Grönroos emphasizes the adoption of service logic because the customers look for and buy comprehensive service offerings consisting of products, services, information and attention received by the customer. These offerings are seen as services by customers and the value is generated by the service they experience. (Grönroos, 2009).

Some IT services are based on providing human competencies, others on providing technological capacity. Capacity services may often be an offering including both the vendor's own competencies and software or hardware products purchased from other companies. Another example of a comprehensive (overall) offering, often enabled by information technology, are the business process outsourcing (BPO) services, when the vendor takes care of the customer's whole business process.

In the course of a purchasing decision it may be difficult for a customer to make a difference between products and services. A market study (Market-Visio, 2005) indicated that this was the case in selecting an information system. In several cases, the primary decision was to select the services provider, not the software product included in the offering. In practice, the customers preferred the competence they needed to ensure a successful implementation.

Oliva and Kallenberg (2003) have utilized the idea of the continuum to describe the extent to which an offering includes products and services, as well as to analyze the

movements from goods to services. They argue that the relative importance of services is growing in the manufacturing (product) companies. As a result, tangible goods are increasingly considered as "add-ons". This is a significant change from earlier times when services were seen as "add-ons". (Oliva and Kallenberg, 2003; Penttinen, 2007). The same development is seen also in the IT industries. Price erosion and declining value of hardware sales have made it necessary for many vendors to harvest more revenues from the former add-on services. However, Grönroos (2009) and Eloranta et al. (2010) emphasize that the physical product still remains the core of the offering of the manufacturing firms and the service respectively in services firms.

Penttinen (2007) uses the term completeness of an offering to describe the extent of services in an offering. This is consistent with ideas presented by Anderson (2002).

In this study, the continuum may describe offerings or businesses that include different combinations of software products and IT services, whereas a single software product or a service will not be considered as a continuum. For instance, market research firms typically make a distinct difference between software products and IT services. A product is "a hundred percent a product" and "a service hundred percent a service". This way of thinking excludes any compromises. This requires a clear definition of both, a software product and an IT service.

A significant conclusion based on several studies is the increasing amount of services in various offerings. This can also be seen in the IT market (e.g. Rönkkö et al., 2009, 2010).

## *3.3* Software Product and IT Services Business Dynamics

The previous chapter discussed the definitions of products and services from the view of software products and IT services. This chapter analyzes the different business dynamics shaping the structures and developments of these two industries. The analysis provides another view to understand why it is justifiable to consider software product and IT services industries as separate industries.

There is a long tradition in software and IT industries of producing both software and services in the same company (Campbell-Kelly, 2003; Cusumano, 2004). Cusumano (2004) emphasizes the role of business models and proposes that a company must adopt one of three basic business models: a product company is at one end of the strategic spectrum, at the other end a services company, in the middle a hybrid solutions company.

Managing a software and services business simultaneously can be a big challenge. There are examples of major failures of software or IT services firms because the management has not realized the differences between product and service businesses (Gerstner, 2002; Campbell-Kelly, 2003). There are a number of similarities, such as low barriers to entry and often also a high pace of technological change and innovation. Despite the similarities, the business models of the two industries are often radically different. Major differences include the role of increasing returns, the importance of utilization rates, the

roles of economies of scale and economies of scope and the differences in cost structures. (Hoch, et al., 2000; Cusumano, 2004). There are also major differences between different software firms, as well as between different types of IT services firms.

The starting point in considering the dynamics of software product businesses is to realize the differences between two software product groups (segments). One part of software products, e.g. enterprise (corporate) solutions require customization, whereas the other, especially mass-market (packaged) software, is ready to implement as such (Hoch et al., 2000; Campbell-Kelly, 2003; Cusumano, 2004). Another major difference is the sales volumes. Mass-market products may sell high volumes of copies, whereas sales in some other software categories remain on much lower levels. (Hoch et al., 2000)

From the customer point of view the delivery of an enterprise solution is an offering. Implementing customized software always includes services, provided by either the software vendor or external service companies. The services may cover more than a half of the total cost of the implementation. (Hoch et al., 2000, Cusumano, 2004).

**The law of increasing returns and network effect**

Brian Arthur (1996) has described the ”law of increasing returns” ruling and shaping large parts of the software product industries. According to the law a product that gains market share tends to proceed even further and sell even more copies (or shipments), while one that falls behind tends to fall even further behind. This development is fueled by several reasons, such as growing user (installed) base, trend to standardization and avoiding of compatibility issues. (Hoch et al., 2000; Cusumano, 2004).

A network effect (also called network externalities) can be seen as a remarkable driver in realizing the law of increasing returns. According to the network effect the value of a product increases when the number of users increases (e.g. Shapiro and Varian, 1998). This has been seen in the evolution of several software products, recently especially in the growth of social media as well as in the expectations related to cloud computing. In traditional IT services the role of net effect often remains rather low.

The players compete of the leading position in the new product segment, trying to “set an industry standard” and achieve a dominant design type of position. To be able to benefit the law of increasing returns G. A. Moore (2000) emphasizes the importance of speed in reaching a substantial market share. The success of a product is not necessarily based on technological or other superiority (Liebowitz and Margolis, 1999).

The law of increasing returns results quickly in high market concentration, leaving few winners and many losers (Hoch et al., 2000). Software products often follow the life cycle model when a new product field is created. The aim to become quickly a market leader often results in early shakeouts when the winners of the race secure their position among multiple players at the early stage. (Hoch et al., 2000). There are, however, numerous cases when a company or a product (e.g. Visicalc, Lotus 1-2-3, WordPerfect) has become a market leader in a short time but has also lost its place quickly (Campbell-

Kelly, 2003 Hoch et al., 2000; Cusumano, 2004). Today, fast changes in market leaderships are seen e.g. in social media software. Microsoft and SAP are examples of major vendors having been able to benefit the law of increasing returns and keep their leading positions for a rather long period of time.

Software vendors can be very dependent on the success of a single product. There are examples of software firms having been forced to discontinue their business or exit because of losing their foothold in the market.

In some cases the only way to stay in business is to migrate to services business. Developing a new generation of software or a new category of software products usually requires significant investments and time and still there is no guarantee of winning back the former position or be profitable. There are a number of former market leaders who have not succeeded to make a comeback.

The law of increasing returns is not valid in IT services. In IT services industries the evolution of single services and the evolution of the industry are more consistent. In addition, existing competences and capacities may often be easier and more flexible to transfer or utilize in other services.

**Cost structures**

The cost structure and cost management requirements differ greatly in software and IT services industries. In the enterprise solution and mass-market software businesses the cost structures are characterized by high up-front fixed costs and low variable and marginal costs. The production costs are low, often close to the material costs, and remain quite the same despite the sales volume (Hoch et al., 2000, Campbell-Kelly, 2003; Cusumano, 2004). Revenues start to accumalate only after the first copy is sold, investment and other cost gather long before that. Due to the high up-front fixed costs a high number of copies must be sold, which often means also early export activities. In the recent years, reducing personnel costs by transferring software development to lower-cost countries has become a growing trend (e.g. Sako, 2005, 2006; Jacobides and Kudina, 2009).

In IT services the revenues typically accumulate during the whole service process (Hoch et al., 2000). However, services based on human competencies (professional services) and technological capacities are different. Services based on technological capacity require investments in infrastructure, including equipment and often external software. In professional services industries personnel costs are the biggest expenditure and investments in production environment are low. Therefore the variable costs remain rather constant and the fixed costs are lower than those in the software industries. This reduces the pressure to gain sales volume or market share. As a result, the law of increasing returns has a smaller role in IT services than in software product industries. Because of low starting costs entering the market is easier for new professional services companies than for firms providing technical capacity based services. This is also seen in different levels of fragmentation in these segments.

While software product companies must emphasize their market shares the IT service firms, in turn, must concentrate on utilization rates. They are the critical success measures for both professional service firms and for providers of technological capacity (Hoch et al., 2000; Cusumano, 2004).

The study conducted by McKinsey (1996) emphasizes that in professional services the question is of selling time of people who are expensive and repeatedly working in different projects. However, even if the expertise cumulates it is difficult to gain remarkable differences in expenses in same kinds of projects. To lower the production costs the IT services vendors are increasingly using resources and capacities in lower-cost countries. This, in turn, has extended the value chains and value networks arcoss traditional firm and country borders.

The law of increasing returns has no significant role in the IT services industries. Instead, the economies of scale, often also the economies of scope may strengthen the positions of IT services vendors. Large customers often favor vendors with economies of scale, which, in turn, increases concentration. The IT services industries are often both fragmented and concentrated. In several countries, few large vendors control a high share of the market. (Kroeger et al., 2008). Simultaneously there are often a high number of small services vendors, mainly professional services firms. Another difference to the software product industries is the role of economies of scope. In the IT services industries large vendors often provide a wide range of services (and sometimes also products) to serve customers preferring extensive service offerings. The aim of the vendor is to cover the whole life cycle of the IT environment of the customer and ensure long and close customer relationships. (See e.g. Grönroos 2009). Hoch et al. (2000) emphasize the importance of trust because a project is sold before anything is delivered. Professional services firms may also share implementation risks. In software product industries the delivery of the products is often based on the use of partners or other distribution channels. As a result, the software producers and their customers often do not reach the same level of intimacy in their customer relations as do many IT services vendors.

## *3.4* Defining Software Product and IT Services Industries

### 3.4.1 Evolution of Definitions

Some authors argue that it is difficult to draw industry borders between software products and IT services (e.g. Mowery and Nelson, 1999). In this study it is suggested that defining boundaries between software products and IT services is possible and therefore it is also possible to define software product industry and IT services industry.

Until the late 1960s the term computer services and software industry was commonly used to describe the sector of computer industry that supplied intangibles, to distinguish it from the rest of the industry that supplied tangible products, such as computers, mass storage devices, peripherals, telecommunications equipment and other hardware (Hoch et al., 2000; Campbell-Kelly, 2003). According to Campbell-Kelly (2003) the computer

services and software industry constituted four main sectors: programming services, processing services, facilities management and teleprocessing services. All these services are the basis for the majority of the current IT services. The roots of the software product industries are in programming services.

Despite various changes the mutual dependence and relationships of software production and IT services have remained strong during the over 50 years of IT industries. This has also resulted in some difficulties to define the software and IT services industries.

In the literature the term software industry is often used as a general term to describe all production of software, including customized software and software products. This view has roots in the 1950s and 1960s when software was produced mainly as customized service by professional or programming services firms. For example, Campbell-Kelly (2003) classifies the software industry into three main categories: software contracting, corporate software products and mass-market software products. Hoch et al. (2000) use quite similar division in three industry segments: professional services segment, enterprise solution segment and mass software product segment.

In several Finnish studies and examinations similar definitions have been applied. However, the main focus has been on software products (Kontio, ed., 2008), Rönkkö et al., 2008, 2009).

Differences, inaccuracies or even some confusion characterize both literature and public discussion concerning the concepts and definitions of software and IT services industries. Terms such as software sector or software business often include both software products and to a varying extent also services (Steinmueller, 1995; Mowery (ed.), 1996; Mowery and Nelson, 1999; Hoch et al., 2000; Campbell-Kelly, 2003; Cusumano, 2004; Ali-Yrkkö and Martikainen, 2008; Kontio, (ed.) 2008). Terms used may also include information processing services, software production or consulting services. For instance, in the US, software used to be classified as a "business service" (Steinmueller, 1995).

Market research firms, in turn, often draw a strict line between software products and customized software that is classified to belong to IT services industry. Market research companies emphasize the perspective of markets and IT firms in their analysis.

Several changes, such as major technology waves have shaped the software product and IT services industries and their structures both directly and indirectly. Especially software product industries have been very dependent on technological changes, experiencing also disruptive changes (C. M. Christensen, 1997).

For instance, the emergence of the PC industry led to several new software industries and forced some existing ones to transform or even withdraw. In the IT services industries, instead, the impacts have mostly been different, often more indirect. IT services firms have often been able to adopt new requirements of customers and remain in business or even expand by combining their existing skills and expertise with the new ones required by new technologies.

In spite of the entrance of numerous new software and services firms since the 1970s, some services companies from the 1950s and 1960s are a vital part of the software and services industries also today.

### 3.4.2 Definition of Software Products

Software is one of the main drivers and enablers of the economy today. Its role is growing and it ranges from enabling daily operations and activities of organizations and consumers to controlling numerous infrastructures from telecom networks to nuclear power plants (Hoch et al., 2000; Cusumano, 2004). In a nutshell, software is "nothing but pure knowledge in codified form" (Romer, 1997; Hoch et al., 2000). So, even if a software product has characteristics typical to products is not a physical product.

From the business point of view producing and selling software products and IT services have different business dynamics and business models than the ones identified in product and services companies (cf. Hoch et al., 2000; Cusumano, 2004).

In literature the terms software product and software package are often used as synonyms. Some authors like Campbell-Kelly (2003) emphasize the distinction between these notions. In this study software products are defined as software artifacts (single or suite) that are produced for multiple customers and may require a varying amount of customization. The terms software product and software package are used here as synonyms.

The prices of software products traditionally consist of license payments and maintenance fees. The increasing sales of software as a service have changed the pricing mechanisms. In the study the software product revenues include the income received from the use of the software, not the incomes derived of production of the services. In this study customized software, which is unique and produced on the basis of individual needs of customers, is – according to the former definition – included in IT services.

An increasing share of software products in the Finnish market are produced by international software companies and imported to Finland. The Finnish statistics of software production, however, cover only the domestic production.

### 3.4.3 Classification of Software Products

Classifications of software products may be based on different perspectives and needs.

Figure 2 shows a widely applied categorization of software products (e.g. several market research frms). Software categories at high level of aggregation are typically rather static whereas individual software products are often impacted by different changes and dynamics. As a result the several sub-industries of the software product industry can be considered dynamic. In many cases the life cycles of single software products remain very short. There may be significant differences in life cycles between different software categories.

At the highest level of aggregation software products can be divided into two main parts, the conventional user software and embedded software. In some considerations also game software is seen as a separate category, but often included into the conventional software category (see Peltoniemi, 2009). A part of embedded software is produced as a service. Embedded software is often divided and considered by industry segments (e.g. Rönkkö et al., 2010). Another widely used practice is to divide software products by user groups, e.g. into enterprise software products and mass market software products (includes often also consumers software) that have several differences concerning their nature and business dynamics, including service requirements (Hoch et al., 2000; Campbell-Kelly, 2003).

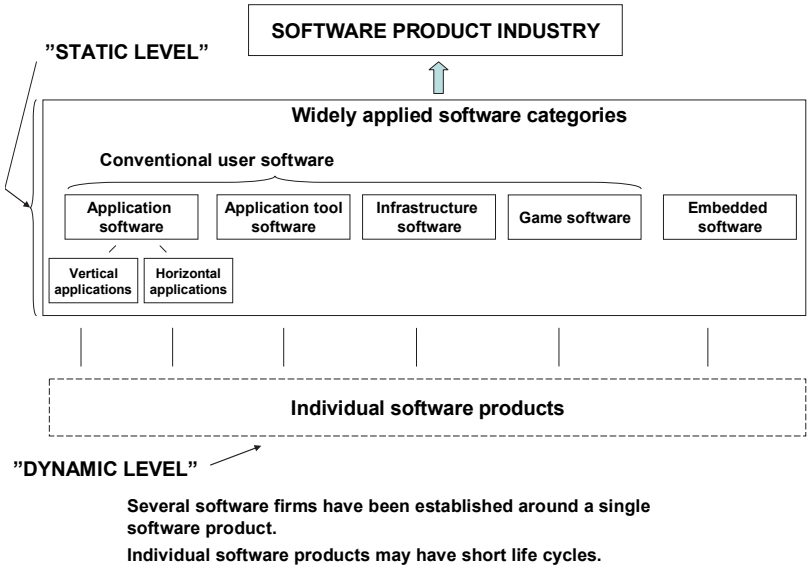



**Figure 2. Major categories and main levels of aggregation of software products**

Software products can also be classified by technology. The validity of these classifications is decreasing because of the cross-use of same software on platforms varying from large computers to mobile devices. In addition, the increasing use of open systems is making it less important to emphasize the technology.

A widely used practice is to divide software products by function (e.g. market research firms). At the highest level of aggregation the conventional software products consist of three main categories: infrastructure software, software tools and application software. All these main categories are often divided into subcategories or segments and end up, for instance, around a single task at the lowest level of aggregation.

The function of infrastructure software is to manage, integrate and ensure the reliability and security of the information technology infrastructures, varying from IT and

communication hardware to applications and networks. These kinds of software products may also be used in industrial automation environments, controlling plants and industrial processes. The tools software helps in developing and maintaining different software and systems. This category includes e.g. programming languages and tools and data base software. The main role of application software is to help the users to develop, perform and manage their specific business or other functions and tasks.

Both infrastructure and tool software are normally targeted to be applicable in all industries. Application software products, instead, can be classified from different perspectives. They are typically divided into industry-specific (vertical applications) and cross-industry applications (horizontal applications).

Market research firms (e.g. IDC, Gartner) typically apply main categories quite similar to the ones presented above. In addition, they have developed own detailed classifications (subcategories) and taxonomies based on the use or application areas, using them as frames for industry and market considerations. The classifications and categories are much more detailed than those used by the statistical authorities.

### 3.4.4 Defining Software Product Industry

In this study, the software industry is defined to include the supply (production and imports) of software products. Therefore all firms producing or providing software products in Finland are included in the software industry despite their other businesses or the "official" industry they belong to or the share of the software revenues out of their total revenues or value added. This definition reflects the real world and thereby will lead to realistic volumes of the Finnish software product industry.

The challenge is that, so far, the available information does not support this definition. As mentioned before, for instance imported software is not systematically included in the official statistics. In this study, software imports are included in the market and spending considerations utilizing public information from other sources than the industry statistics.

Depending on the needs and perspectives at hand the software industry can be considered at several levels of aggregation, varying from total software industry level to different levels of aggregation, e.g. selected categories or their sub-categories and related sub-industries. At the highest level of aggregation the focus of interest may be, for instance, the entire application software industry. Narrowly defined, the software industry may consist of production of software used to run or maintain a certain function, process or task. The official statistics do not provide this level of industry or market information, which usually is presented by market research firms.

It is, however, impossible to define any stable structure for the whole software industry. As discussed earlier, the software categories and related industries at the highest level of aggregation have remained rather stable for years. Instead, many sub-categories and especially the categories and product segments at the lowest levels of aggregation are in continuous move, driven by technological, often rapid changes blurring the industry and

sub-industry boundaries. Certain software products or even whole product classes (e.g. infrastructure software) may sometimes be very dependent on technological changes which can also affect software industry structures by creating new industries or niches or by leading to convergence or substitution (J. F. Christensen, 2008).

This study examines the Finnish software industry at the highest level of aggregation. As the result the main focus is put on the total volumes of the industry.

### 3.4.5 Defining IT Services

There are various studies of the Finnish IT sector or ICT cluster emphasizing software production whereas the role of services has remained much smaller. Often IT services are only looked at from the software production and sales point of view (e.g. Ali-Yrkkö and Martikainen, 2008; Rönkkö et al., 2009, 2010). Therefore the division between production and supply of software products and IT services often remains obscure or fuzzy (e.g. Hernesniemi, ed., 2010).

In some cases services are seen rather as an add-on or by-product type of business, not as a major IT industry in Finland (Ali-Yrkkö and Martikainen, 2008). However, services are an increasingly important business also to the software product firms (Rönkkö et al., 2010). Among the main reasons to underestimate IT services are the lack of information and issues related to definitions. The vital question is, can the prevailing way to consider IT services lead to a skewed picture of the Finnish software product and IT services industries, their employment, profitability, productivity or even the growth potential of the Finnish IT industries or the national economy.

Defining service as a way to receive technical and human capacity or competencies (Gadrey, 2000; Vargo and Lusch, 2004) is very valid from the IT services point of view. The use of IT services is typically based on a need to utilize external suppliers to receive human competencies or technological capacities to develop or operate processes and businesses. According to the market research and consulting company Gartner “IT services refer to the application of business and technical expertise to enable organizations in the creation, management, optimization of or access to information and business processes” (Gartner, 2004).

The main reason to buy IT services is to utilize the human competences or technological capacities of the services provider. For instance, purchasing consulting services is a way to get competent advice for IT related decision making without recruiting own special expertise. Buying computer capacity or other data center services, in turn, usually are a way to avoid or reduce investments in own computer capacity. IT services typically are universal and are possible to use in all kinds of organizations.

Along the thinking referred above IT services are defined in this study as acts and performances providing to customers human competencies or technological capacities owned and controlled by external service vendor.

On the basis of this definition the IT services include two different groups: services based on human competences (professional services) and services based on the use of technological capacity (e.g. computing services). Some of the services, especially those based on selling of technological capacity may also be offerings, i.e. a combination of products and services. Offerings can also include products or services acquired from third party vendors.

In this study, a continuum may describe offerings or businesses including different combinations of software products and IT services, whereas single software product or a service will not be considered as a continuum (cf. Oliva and Kallenberg; 2003; Cusumano, 2004). For example, market research firms typically make a clear difference between software products and IT services. A product is "hundred percent a product" and "a service hundred percent a service". This way of thinking excludes any compromises. This requires a clear definition of both, a software product and an IT service.

### 3.4.6 Classification of IT Services

IT services may be classified from the point of view of production, markets or customer demand. Like software products, also IT services are often defined at different levels of aggregation. At the highest level of aggregation the IT services industries may be divided into traditional IT services and IT-based or IT-enabled services.

As discussed earlier, different industries are increasingly applying information technology in their products and services. IT services can be provided to both user and applier customers.

Applying information technology in products often requires developing embedded software and other related services (e.g. programming, maintenance and IT infrastructure services) which often are based on similar skills and resources as the ones used in traditional IT services increasing the importance of applier customers. These applier services have been considered as a part of the IT services industry in this study.

IT services included in IT-based services as well as the applier services provide a route for IT services vendors to expand beyond their traditional markets and customer bases.

At the lower levels of aggregation the services are usually divided into various subcategories or segments, varying by needs and perspectives. Also subcategories may be broken down to different levels.

The basic needs to purchase IT services have remained very stable since 1960s. The segmentation of IT services is built to describe these durable customer needs. On the basis of customer needs the traditional IT services can be classified into six groups. The first service category comprises services helping the customer to utilize IT and find the appropriate IT systems and services. The next group of services helps the customer to develop, build and implement IT systems. Thirdly an IT service deal with operating a

customer's IT system and fourthly make sure, that the IT systems the customer needs are readily available and the customer can use them. The fifth service category includes processing or other IT services using the vendor's technical infrastructure and capacity. The final type of IT service is operating the IT parts of the customer's business process.

Table 2 provides a more detailed picture of the contents of traditional IT services.

**Table 2. Basic customer needs for IT services**

| **Response to customer needs (long-lasting basic needs of customers)** | **Examples of service segments or categories (may be considered as industries or sub-industries)** | **Comments** |
|---|---|---|
| To help customer in decisions related to utilizing IT and finding and selecting appropriate solutions and services | Business consulting<br>IT consulting | Division between business and IT consulting increasingly unclear |
| To develop, build and implement IT systems for customers, including integration with existing or other systems | Developing customized applications<br>System integration services<br>Programming services<br>Developing embedded software or solutions<br>R&D services<br>Testing services | Based on human competences<br>Services for both user and applier customers<br>Includes development of embedded systems |
| To help or take care of operation and management of IT systems of customers | Infrastructure management<br>Appplication maintenance<br>Application management | Technical infrastructure owned by customer or vendor<br>Application owned by customer |
| To ensure that customers are able to use their IT systems and that systems are applicable and available | Hardware support<br>Maintenance services<br>Software support services<br>IT training | |
| To produce for customers processing or other IT services based on use of technical infrastructure and capacity of the vendor | Operation services<br>Hosting services<br>Security services<br>Utility services<br>SaaS services<br>Other cloud computing services | Based on use of vendor´s technical infrastructure and software<br>Includes only IT services parts of cloud computing services<br>Infrastructure services for 'free' services (e.g. Google) |
| To take care of IT parts of (business) processes of customers | Process outsourcing<br>Business process outsourcing (BPO) | E.g. payroll services<br>May include other than IT processes |

Source: Based on several classifications developed and applied by IT firms and market research firms (e.g. Gartner, IDC)

The classification is quite similar to the one applied by leading market research firms. The categories differ significantly from the official classifications used in the official statistics in Finland. The IT services industry information received from the official statistics (TOL 2008) includes some separate services categories. However, the largest IT

category (code 6201, computer programming activities) includes both production of software products and software related services.

Market research firms apply several different perspectives or dimensions to segment and classify IT services. A widely used practice is to consider the types of skills that are employed to produce the service. Another way to look at the services market is to examine how the services are delivered to or contracted by the customers. The former is common in both, services delivering human competencies and technological capacity. The latter is often applied in service projects or in continuous service contracts. Services are normally contracted on project basis (discrete services) or on a long-time contract for ongoing management of infrastructure, application (e.g. outsourcing contracts). All these segmentations can be further broken down into different sub-categories.

Even if the needs for these IT services have remained stable despite technological and other changes in the customers' business environment, the tools, service processes, business models and offerings have been developed continuously. At the same time the customer base for IT services has expanded.

Some IT service categories include services based on human competences, such as consulting, system development and integration services, whereas other services are based on providing both competences and technological capacities and form offerings. IT service categories increasingly include services produced globally or subcontracted from other service firms (e.g. Sako, 2005, 2006; Jacobides and Kudina, 2009).

### 3.4.7 Defining IT Services Industry

In this study, the IT services industry is defined to include the production and providing of IT services based on use of human competence or technological capacity. All firms producing these kinds of services belong to the IT services industries despite their other businesses or the industry they 'officially' belong to or the share of the IT services revenues of their total revenues or value added. This definition reflects the real world and thereby will lead to realistic volumes of the Finnish IT services industry.

Similar to software industries the IT services industry can also be defined and considered from different perspectives and needs at several levels of aggregation. It is, however, impossible to define any stable structure of IT services industries.

At the highest level of aggregation the industries often are referring to service categories based on long-lasting basic needs of customers as presented in the previous chapter. In this study, these needs form 'mother services' which can be considered as the 'mother industries' of IT services (cf. J. F. Christensen, 2008). Presently this level of industry or market information is mainly presented by market research firms. The whole industry and mother industries grow and change according to evolution and changes at different sub-industry levels. The definitions at the level of mother industries have remained rather stable for years. Instead, some sub-categories at the lowest level of aggregation are facing continuous changes, driven by technological changes.

These developments are seen as blurring and unstable industry boundaries at the lower levels of aggregation. These changes can also result in new sub-industries (niches, emerging industries) as well as continuous disintegrating and converging. Several new services have emerged along with new technologies and converged later with the existing industries. Some have become parts of the existing mother services, some have had to exit the market. This was seen clearly, for instance after the Internet and "new economy" waves (J. F. Christensen, 2008).

Some new Internet-based or enabled services have, however, challenged the definition of IT services and industry borders (e.g. Google, social media). Many new firms are not IT services firms by the conventional definition but may still be serious competitors for traditional IT services firms. In addition, these firms often enter the market outside IT industries (e.g. Carr, 2008).

Technological and other disruptive changes cannot be looked at similarly at mother industry and sub-industry levels. Despite the disruptive technology, IT service sub-industries like consulting services or system design services industries will remain. Depending on the nature of the future changes, for instance the level of demand for those services may change or a new technology may force services vendors to learn new skills.

In this study the IT-based or IT-enabled services have been defined as services which are based on some business-specific or functional expertise provided for customers.

Examples of IT-based services are different business process outsourcing (BPO) services, banking services or telecom services provided by telecom operators. Developing and running these kinds of services may utilize different traditional IT services, such as IT consulting, systems design and integration, application maintenance or (computer) operating services purchased from external service providers.

This study focuses on traditional IT services. Only the traditional IT services parts provided by external vendors have been included in the volumes of the IT services industry.

This study examines the Finnish IT services industry at the highest level of aggregation. As a result the main focus is put on the total volumes of the industry.

# 4 Intermediate Summary and Conclusions

The theory part of this study discusses studies, theories and viewpoints concerning the definition and evolution of industries, emphasizing perspectives of IT industries. Different schools and scholars examine industries as populations of firms that are selected or defined on the basis of various starting points and needs (see e.g. McGahan, 2004). This results in heterogeneous ways to see and define industries. A part of literature emphasizes rather strict and static definitions of industries (e.g. industrial economists, definitions and categories of statistical authorities). Some others, in turn, favor for more flexible definitions (e.g. Schumpeter, 1942; Lovio, 1993; Hamel and Prahalad, 1994, Jacobides and Winter, 2005) and examine changes of firms or firm populations and related influences. A group of scholars finds the concept industry less relevant (e.g. Penrose, 1959; Hamel and Prahalad, 1994; Jacobides and Winter, 2005; Jacobides et al., 2006). According to some views no specific IT industry does exist (e.g. Hamel and Prahalad, 1994; Jacobides and Winter, 2005; Rusko, 2005).

As the result there is no commonly acknowledged definition for the IT industry. In literature, statistics and public debate different populations of firms that product or provide IT products or services are called IT industries. Definitions may vary according to needs and angles at hand. In this study the concept of industry is an important tool for describing and understanding the production and supply side of the Finnish IT sector.

From the perspective of this study the concept enterprise space applying the idea of the economic space (Schumpeter, 1942) and industrial space (Lovio, 1993), provides a central framework for defining and examining industries. The firm population consisting of all IT enterprises producing or providing IT products or services in Finland can be considered to form an enterprise space or IT enterprise space. This space in turn builds up different kinds of firm populations that can be defined from different viewpoints. These populations can be called industries or sub-industries.

The literature considering ecosystems (e.g. Rotschild, 1990; J. F. Moore, 1996; Iansiti and Levien, 2004) provides the idea and basis for more extensive framework for examining the whole IT sector and its dynamics. The IT enterprise space and their customers (market) form the main elements of the ecosystem of Finnish IT industries.

Existing theories and literature do not provide unambiguous basis or frameworks to answer questions what is the Finnish IT industry and how it is formed. However, they significantly contribute to increasing understanding of the Finnish IT industries. The literature discussed in the theoretical part of the study can be classified into groups according to what kinds of changes and evolution they consider:

- literature on innovations
- literature related to major structural changes
- literature of issues related to expanding beyond traditional customer segments
- traditional industry theories, such as industry life cycle theories

Theories and literature on technological or other innovations emphasize disruptive innovations and changes which can have unexpected impacts on industries and markets (e.g. C. C. Christensen, 1997; Hamel, 2000; Tidd et al., 2001, 2002; Chesbrough, 2003; Jacobides, 2009). They may result in emergence of new types of products, services or new companies leading to new kind of competition and changes in market positions of established companies. Disruptive innovations may create new industries, reshape existing industry borders or sometimes cause changes in other industries than expected (C. C. Christensen, 1997). In addition to technological innovations business model innovations have become increasingly important drivers of IT industry evolution as well as topics of academic research and business management literature in the 2000s (Hamel, 2000; Amit and Zott, 2001; Chesbrough, 2003; Osterwalder, 2004; Kim and Mauborgne; 2005; Jacobides et al., 2006, Jacobides, 2009).

However, the character of the most technological changes and advances in industries is sustaining resulting in improvements to existing products (C. M. Christensen, 1997; Christensen and Raynor, 2003; Christensen, et al. 2004; McGahan, 2004). Therefore industries characterized by sustained innovations are often considered static. In addition, incumbent firms often master sustaining innovations which may increase the static impression of whole industries (C. M. Christensen; 1997; Christensen, et al. 2004). From the perspective of this study also these industries may be dynamic which can be seen as changing company structures inside industries whereas industry borders change slowly (cf. C. M. Christensen, 1997; Christensen and Raynor, 2003). For instance, low barriers to enter a market may result in continuous stream of new entries.

Industry theories that study the evolution of industries, such as industry life cycle models (Abernathy, 1975; Abernathy and Utterback, 1978), typically focus on strictly defined and rather static product industries. The literature supports the argument that in dynamic industries, including several IT industries, adapting of these traditional theories of industry evolution can be less relevant. In IT industries these models have been utilized in researching quite strictly defined industries and sub-sectors or separate software products (e.g. Suhonen, 2002; Peltoniemi, 2009).

Major structural changes, such as globalization and related division of labor or changes of customer behavior have gained growing interest in literature in the 2000s (see e.g. Jacobides and Winter, 2005; Sako, 2005, 2006; Baldwin, 2006; Jacobides et al., 2006; J.F. Christensen, 2008). These changes profoundly affect IT and several other industries but are not based on single and specific technological or other innovation like disruptive innovations described above. Major structural changes do not necessarily create new industries or change existing industry borders. Instead, they can significantly reshape business practices and vendor structures in entire industries as well as division of labor and value networks From the perspective of a company the question often is about reacting and adjusting to these changes (Jacobides et al., 2006; Baldwin, 2006).

Wide number of literature discusses themes related to expanding beyond traditional customer base and searching for new business opportunities. In these cases existing technologies and expertise are often utilized to serve new markets and clients. Literature

provides studies of various kinds of developments and changes, including converge of IT and business services (Sako, 2006), outsourcing and offshoring (Sako, 2005; Jacobides et al., 2006), migration from IT products to services (Cusumano, 2004; Gerstner, 2004; Cusumano et al., 2006), production of embedded systems (cf. Nikulainen et al., 2011), migration from products to services in manufacturing industries (Oliva and Kallenberg, 2003; Penttinen, 2007; Kowalkowski, 2008) and growing role of various platforms (Gawer and Cusumano, 2002; Gawer, 2009, 2010) and business ecosystems (Iansiti and Levien, 2004). These changes and developments are often characterized by transition, blurring or overlapping of industry borders and also by more collaboration of firms and converging of offerings. At the same time new competitors come also from non-IT industries. Several studies referred above emphasize the role of information technology as an enabler in various industries. Expanding the customer base of IT firms beyond traditional user customers increases the importance of applier customers.

The two by two matrix (Figure 3) summarizes and demonstrates influences of different changes discussed above. The vertical axis describes the nature of a change and the horizontal axis the impacts of changes on borders of industries or other firm populations.

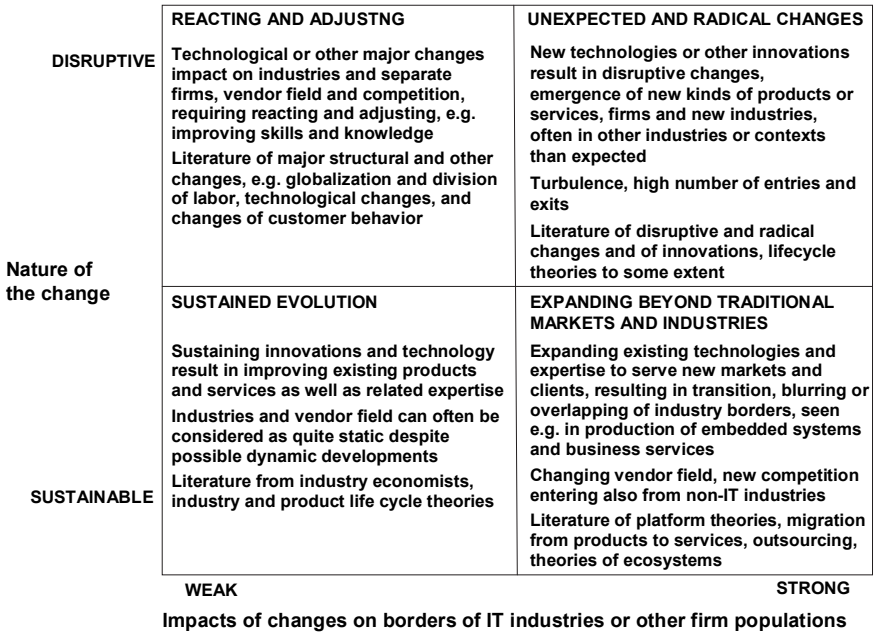



**Figure 3. Impacts of different changes on industries**

The matrix concretizes the variety of dynamics. It positions unexpected disruptive innovations, structural or other major changes requiring IT companies to react and adjust changing condition, sustaining evolution as well as changes related to expanding beyond traditional customer base. Thus the matrix also helps to perceive issues which make it

difficult to describe and understand IT industries. In addition, it points out the importance to identify and know the vendor field and its structure. In different parts of the matrix it is possible to identify different types of vendors and competition.

In addition to the literature discussed above there is wide range of literature that considers how to be prepared and adjust to various changes and emphasizes various capabilities and abilities, such as education, knowledge and expertise as well as quality (e.g. Barney 1986, 1989; Conner, 1991; Hamel, 2000; Santos and Eisenhardt, 2005).

Lack of coherent theory results in variety of definitions and inconsistencies of IT industry information. This also supports the assumption that the existing data describes incompletely the reality and makes it difficult to perceive and understand what the Finnish IT industry is and how it is formed. Despite dynamics of IT industries the existing official industry data is largely based rather static definitions. Therefore, it is possible to suppose that the discussion above support the starting points and assumptions presented in the introduction of the study. On the basis of the theoretical discussion it is also justifiable to argue that understanding the Finnish IT industries requires accurately defined and specified concepts and terms, definitions, frameworks and also new information and to some extent new theory.

Literature discussing industry spaces and ecosystems helps in perceiving the total picture of the Finnish IT industries and provides the basis for frameworks of this study. Building the picture of the Finnish IT industries, however, must be based on 'bottom up' approach by proceeding towards broader picture and conclusions by using and combining various data gathered from various information sources.

The framework of Anderson and Tushman (1990) that is based on the work of Abernathy and Clark (1985) provides an important tool for analyzing industry discontinuities and the Finnish IT enterprise space. Their framework focuses on existing technological competence. A discontinuity can be "competence-destroying" if it destroys or renders obsolete existing technological capabilities or "competence-enhancing" if it preserves existing technological capabilities (Chapter 2.2.1).

Together with related debate (e.g. C. M. Christensen, 1992 and 1997; Adner and Zemsky, 2005; Cusumano et al., 2006; J. F. Christensen, 2008) this perspective provides an important theoretical basis for considering the structure and evolution of the Finnish IT enterprise field and the roles of incumbents and newcomers in the Finnish IT industries.

Several researchers point out differences between software products and IT services, for instance, from perspectives of production and business logics (e.g. Hoch et al., 2000; Cusumano, 2004). These views together with the growing role of business ecosystems and various platforms support the examination of IT services and software products and related industries separately.

# 5 Objectives of the Study and Research Questions

## *5.1 Objectives of the Study*

Various IT enterprises, public authorities and other organizations engaged in developing and improving the conditions of the Finnish IT sector require information providing a comprehensive and accurate picture and an understanding of the Finnish IT industries.

There are, however, varying opinions, views and angles as well as conflicting information concerning the field. For instance, it is difficult to have a consistent view of their size and structure. Another issue is to mix up the production and market views.

As discussed earlier, existing theories or literature provide neither an unambiguous basis nor universal or exact frameworks or tools to define, describe and understand the Finnish IT industries. None of the theories does as such help to get answers to general research questions of this dissertation presented in the introduction (Chapter 1.2). Some existing theories, however, can be applied to frameworks of this study (e.g. theories of industry space and ecosystems).

Answering these general research questions like what is the Finnish IT industry, how it is formed or how well the existing information helps to understand the Finnish IT industry, requires both new information and new theory as well as specifying and reformulating the existing theories, definitions, concepts and terms. They help to sort and interpret complicated issues and phenomena related to the IT sector as a whole and to the separate IT industries. They also make it easier to identify the ability of the existing information to describe the prevailing conditions in the industry.

The main purpose of this study is to contribute and increase the knowledge and understanding of the Finnish IT industries as well as of the Finnish IT vendor field and competition. As the result, the study contains two main objectives.

- Objectives related to the understanding what is the Finnish IT industry and how it is formed: Achieving this objective requires a comprehensive picture of the status of the Finnish IT industries and a profound understanding of the field. These also provide a sound starting point for assessing and discussing also the basis for the future evolution of Finnish IT industries.
- Objectives related to definitions and measurement of the Finnish IT industries: Assessing the existing information, definitions and indicators helps to see how well they describe the Finnish IT industries which in turn provide a basis for identifying needs to improve the definitions and measurement of the field.

Defining and specifying terms, concepts and definitions forms a system of IT industry related concepts. These, together with constructing frameworks and combining information from various sources are crucial in providing new information and new theory concerning Finnish IT industries. They also form the scientific contribution of this study.

The core outcome of the study is resulting clearer understanding of the Finnish IT industries than possible on the basis of existing information.

Understanding the Finnish IT industries requires also defining, describing and explaining the types of firms, firm populations of these industries and the competitive field. For this study IT industry was defined (Chapter 1.3.1) as a population of firms producing or providing IT products or IT services in Finland. The term is used as a top level term and contains various populations of IT firms that are formed and defined from various perspectives and needs.

The main focus of this study is on firms that produce or provide software products or IT services (cf. Hoch et al., 2000; Campbell-Kelly, 2003; Cusumano, 2004). Software product and IT services industries will be examined separately. They can contain several types of industries or sub-industries.

Due to this focus of the study the term IT industry may also refer only to enterprises that produce or provide software products or IT services. Since this study examines also the demand side of software products and IT services, the term IT sector is used to cover both production and demand (market) sides.

## *5.2 Research Gap*

The starting point of the study are practical observations of significant fluctuations in IT industry information depending on the theories and frameworks used in data collection and presentation. Also the perspective of the analysis or changes in relations and conditions of IT industries and other firm populations reflect in the figures describing the structure and volumes of the Finnish IT industries.

It is assumed in the study that there is a gap between existing public information and the reality of the Finnish IT industries. One of the main purposes of this study is to shrink this gap which has not been systematically examined before.

As discussed earlier the dynamic nature of the IT industries results in continuous changes of industry borders and IT vendor populations. The traditional industry theories like life cycle theories alone can only partially describe and explain these developments. This study contributes to the discussion based on theories which are related to and reflect different changes influencing the IT industries (see Chapter 4).

This study assesses the ability of various theories and chosen frameworks to describe IT industries in a relevant and realistic manner. The study also attempts to concretize the usability of various theories and related frameworks in analyzing the Finnish IT industries in order to improve the understanding of the status of the sector and the base of its future evolution.

## 5.3 Research Questions

The main purpose of this study is to contribute and increase the knowledge and understanding of the Finnish IT industries as well as of the Finnish IT vendor field and competition. At the same time the purpose is to provide new information and theory.

In order to answer the general research questions presented in the introduction (Chapter 1.2) and fulfill the objectives discussed in the previous chapters (5.1 and 5.2) three research questions and their sub-questions have been formulated and addressed for this study.

The first research question is formulated as follows:

**The first research question:** ***What is the status of the Finnish IT industries studied by applying theoretical frameworks to assess and describe their size and structure?***

To understand the Finnish IT industries it is necessary to know how they have been formed which in turn requires a detailed and concrete picture of their present status[4].

The following sub-questions specify the first research question:

a. Which frameworks and theories help provide a realistic and relevant picture of the Finnish IT industries?
b. How does globalization influence the Finnish IT industries?
c. What are the influences of changing customer needs and requirements on the Finnish IT industries?
d. What are the drivers of change inside the software product and IT services industries?

There are a wide number of theories behind the official information describing volumes and structure of the Finnish IT industries. The statistical authorities apply theories related for instance to national accounts, industrial clusters, consumption, investments and foreign trade.

The present information of volumes and structure of the Finnish IT industries based on these theories, however, has limitations. From the perspective of this study the view is too restricted and static. For a thorough understanding and description of the Finnish IT industries a more extensive approach is needed. This approach includes a wider use of information and theory related to the entire IT sector[5] and special dynamics of IT industries. These include information and theories dealing with major structural and other changes, such as technological innovations, globalization, new business models and changes in needs and behavior of customers (e.g. C. M. Christensen, 1997; Hamel, 2000; Prahalad and Ramaswamy, 2004; Jacobides and Winter, 2005; Jacobides et al., 2006).

[4] Status describes "state or condition with respect to circumstances" (Webster). It provides a wider perspective than that based only on size and structure of industries.
[5] In this study the notion IT sector covers both production and market sides.

The first research question is approached by examining, describing and analyzing the status of the Finnish IT industries in 2008. On some parts it has been possible to extend the analysis even to more recent years. The study concentrates on two areas of the IT sector, software product and IT services industries, and their related markets. Answering to this research question requires also profound analysis on the vendor field and competition. Indicators utilized consider the IT software products and IT services from both production and market sides**.**

The second research question is related to understanding the status and influence of structural and other changes on the Finnish IT industries. The second research question is formulated as follows:

**The second research question:** ***What is the basis for the future evolution of Finnish IT industries?***

Major structural changes have raised concerns about the future development of the Finnish IT industries. Often these developments are seen only as threats whereas the possibilities brought by change have gained less attention. Since 2011, several forecasts and expectations about the future evolution of the Finnish IT industries have been in the centre of public debate[6].

The second research question is specified by the following sub-questions:

a. What are the determinants of the evolution of Finnish IT industries?
b. How do international competition, international technological platforms and business ecosystems influence the evolution of the Finnish IT industries?
c. How are the Finnish IT industries able to create value and gain competitive edge in the international competition?

Answering the second research question requires identification of issues important both to the Finnish IT sector and the whole economy. Major factors and drivers which are expected to shape the Finnish software products and IT services industries during the coming years will be assessed and discussed. The study attempts to provide new information and perspectives for further discussion and research. The purpose is not, however, to provide exact guidelines, propositions or forecasts for the evolution of the Finnish IT industries.

As discussed earlier, public studies and considerations concerning the Finnish IT industries are mainly based on data and information or their derivates provided by three main sources: statistical authorities, various research organizations (e.g. Etla, OECD) and, for some parts, market research companies.

[6] See e.g. debate related to impacts of the new strategy of Nokia announced early 2011.

The third research question is formulated as follows:

**The third research question:** ***How well does the existing information describe the Finnish IT industries?***

Several authors have criticized the usability of parts of public information because of its static nature (e.g. Jacobides and Winter, 2005; Baldwin, 2006; Weaver, 2007). Practical experience supports the view that due to incomplete and conflicting information the statistics or public studies often do not correspond to the real situation.

One of the main starting points of the study is the assumption that there is a gap between existing public information and the reality of the Finnish IT industries. One of the main purposes of this study is to provide new information and theory to shrink this gap which has not been examined systematically before. A clear picture of the status and evolution of the Finnish IT industries and precise terms and definitions of the field make it possible to assess the usability and accuracy of the available information, definitions and indicators describing the Finnish IT industries.

By analyzing various information gaps the study also attempts to identify information inaccuracies caused by structural and other chances affecting the IT industries. Several changes have been pointed out in the theory part of the study. For instance, due to globalization the labor, expertise of engineers and other IT experts increasingly cross both industry and geographical borders making it more challenging to produce accurate information of IT industries at a country level.

The third research question is approached by analyzing and assessing the ability of the existing definitions and indicators to describe and explain IT industries and their market, status and dynamics. The purpose is to identify key issues and weaknesses in defining and measuring IT industries and, on the basis of the findings, to propose views or guidelines for improving definitions and measurement of IT industries as well as to provide ideas how to be able to describe better these industries. This study does not, however, provide unambiguous or general model or framework to answer how industries should be described.

The answers to the three research questions are presented in Chapter 12.

# PART III: METHODOLOGY

# 6 Methodology and Data Gathering

This part describes the methodology, information and data sources and discusses the scope and limitations of the study.

## *6.1 Methodology and Research Design*

This chapter starts discussing the methodology and research design of the study. This is followed by examining issues related to quality and credibility of qualitative research and by considering procedure which can increase the credibility.

### 6.1.1 Research Design

The overall research design of the study (see Table 3 below) applies the layers presented in the research onion of Saunders et al. (2003).

**Table 3. Overall research design of the study**

| Layer | Approaches | Comments |
|---|---|---|
| Research philosophy | Hermeneutic approach, qualitative research approach | Hermeneutics represents interpretivistic philosophy. |
| Research approaches | Action analytical, inductive | Study also utilizes features of induction |
| Research method | Case study | Embedded case studies |
| Data collection methods and analysis | Data is based on various sources, interviews used in supporting role<br>Defining and specifying terms, notions and classifications<br>Empirical analysis | Primary and secondary data (cf. Saunders et al., 2009), part of data modified for this study |
| Time horizons | Cross sectional, partly longitudinal | Main focus on year 2008<br>Some data from 2009-2011 |
| Evaluation of the quality and credibility | Evaluation criteria<br>Credibility and validity strategies, tactics and procedures | |

Source: applied Saunders et al. (2003), Sassenburg (2005), modified to this study

**Research philosophy**

The main purpose of this study is to contribute and increase the knowledge and understanding of the Finnish IT industries as well as of the Finnish IT vendor field and competition. The study primarily applies the hermeneutic theory of interpretation which attempts to understand phenomena using descriptive, explanatory and exploratory approaches (Olkkonen, 1994). As the result, the research questions will be answered

according to the hermeneutic analysis which represents qualitative research. In this study this means the understanding of the Finnish IT sector through theoretical and empirical examination (cf. Niiniluoto, 1983; Olkkonen, 1994).

**Research approach**

Applying the hermeneutic theory of interpretation the study mainly follows the principles of action analytical approach. Understanding, explaining and interpreting phenomena are characteristics of the action analytical research (Olkkonen, 1994).

The study is empirical and attempts to examine and analyze Finnish IT industries also from new angles. For instance, there is only limited research that combines the perspectives of both supply and demand of IT products and services. Also the study attempts to produce new information and new theory of the Finnish IT industries on the basis of existing empirical facts and frameworks formed in the study.

This study also utilizes features of induction[7] (cf. Olkkonen, 1994; Saunders et. al., 2003). Saunders et al. (2003) propose that inductive reasoning applies to situations where specific observations or measurements are made towards developing broader conclusions, generalizations and theories. Remenyi et al. (2000), in turn, suggest that inductive reasoning is applicable to business and management studies where established and accepted theories are unlikely available. This is largely the case in this study that attempts to build the picture of the Finnish IT industries by using data from various sources and applying views and ideas received from different theories and literature.

This study also attempts to identify issues and problems related to measurement of the IT sector as well as to make suggestions for improving this measurement. Because the nature of the suggestions is not normative, the approach of the research can not be considered constructive (cf. Kasanen et al., 1991).

**Research method**

One of the major decisions in defining the research design is the choice of appropriate research method for collecting data. In this study, the case study method was selected. This method is widely used in qualitative research. However, standard definitions for case studies do not exist. Eisenhardt (1989 p. 534) defines a case study as "a research strategy which focuses on understanding the dynamics present within single settings". Yin (1994, p. 13) defines a case study as an empirical enquiry that "investigates a contemporary phenomenon within its real life context, when the boundaries between phenomenon and context are not clearly evident". According to Lukka and Kasanen (1993) the case study research is especially well suited when the purpose of the research is a deep understanding of the nature, relevance and function of few cases.

[7] Opposite to inductive reasoning is deductive reasoning, which starts from generalizations, and then proceeds toward the specifics of how to prove or implement the generalizations (Saunders et al., 2003).

Among reasons to apply the case study Benbasat et al. (1987) propose that the researcher can answer the questions which lead to an understanding of the nature and complexity of the processes considered. Yin (1994) classifies case studies into three categories; descriptive, explanatory and exploratory research. To increase understanding of the Finnish IT industries this study applies especially the descriptive approach, to some extent also explanatory and exploratory approaches.

On the basis of various definitions, Benbasat et al. (1987, p. 370) summarize that a case study contains following characteristics which can also be identified in the setting of this study:

- case study examines a phenomenon in its natural setting
- multiple methods of data collection are employed and information is gathered from one or a few entities (people, groups or organizations)
- the boundaries of the phenomenon are not clearly evident at the outset of the research
- no experimental control or manipulation is used

Case studies may involve either single or multiple cases and numerous levels of analysis (Eisenhardt, 1989; Yin, 1994). Yin prefers multiple cases when the purpose of the research is to describe phenomena, develop and test theories. Moreover, case studies can employ an embedded design, that is, multiple levels of analysis in a single study (Yin, 1994). For instance, Pettigrew (1985) has conducted two levels of analysis, industry and firm, in his study concerning competitiveness and strategic changes of major U.K. corporations. Suhonen (2002) has studied Internet service provider industry and multiple sub-cases within this industry.

This study uses multiple cases and examines the Finnish IT sector from different levels and perspectives, based on empirical information from various information sources. The embedded case design (cf. Yin, 1994) is applied. To increase understanding of the Finnish IT industries the study mainly focuses on two case industries, IT services and software product industries, which represent 70 percent of the traditional IT market in Finland (Market-Visio, 2009, 2010). In addition, some various sub-cases of these industries or other groups of IT firm populations and to some extent also single IT companies have been examined.

Yin (1994) emphasizes that case studies based on empirical information should attempt to answer the questions ‘how’ and ‘why’. The main starting point of the study expressed in general research questions is to answer the questions, how the Finnish IT industries are formed and how the existing information supports and helps to understand the Finnish IT industries.

**Data collection methods and analysis**

This study utilizes mainly external data which contains both primary and secondary data (cf. Saunders et al., 2009). The data has been collected from multiple sources. This makes

it possible to increase the validity of the research by triangulation (e.g. Denzin, 1978; Yin, 1994; Creswell and Miller, 2000; Tuominen and Sarajärvi, 2002; Johansson, 2003). The information and data sources are described in Chapters 6.3–6.5. Despite being qualitative by basic nature this study also uses quantitative data to support the qualitative analysis and help perceive and understand the Finnish IT industries.

The data collection consists of the following main phases:

1. identifying existing IT industry related information sources
2. collecting relevant and potential information
3. evaluating the usability of the data and its imperfections and overlappings
4. combining data from various information sources
5. constructing for the study separate databases by using external information (e.g. database of the top 100 IT vendors)

Volumes and structures of the Finnish IT sector and its separate industries were estimated and analyzed by using multiple public data sources and theoretical frameworks. The main focus of the empirical analysis is on software product and IT services industries as defined in this study.

The vendor information mainly concentrates on data which helps to describe the size (e.g. turnover, number of employees) and structure of single companies or groups of companies. In addition, data and analysis take into account the perspective of internalization of business operations. The use of vendor level information makes it possible to complement and deepen the analysis of the Finnish IT industries compared to analysis based solely on public statistics or industry studies.

The majority of the terms, notions and classifications applied in this study are familiar from other contexts, for instance, public statistics, industry and market studies. However, several terms and classifications have been defined or specified for this study for presentation and analysis of empirical data. For these purposes and to help operationalize theoretical concepts a number of frameworks as well have been formed for the study. As a result it is possible to validate these concepts and frameworks and provide new or preliminary theory.

The quantitative data based on public sources like official statistics and the database of the top 100 IT vendors collected for this study is illustrated in tables, matrices and graphs to increase understanding of the status, structure and evolution of the Finnish IT industries. The analysis is mainly qualitative.

**Time horizon**

The time horizon of this study is mainly sectional. The study examines and analyzes the status of the Finnish IT industries and the vendor field in 2008. For instance, the database of the top 100 IT vendors describes company performances of that year. Understanding the Finnish IT industries requires also understanding of the evolution and history of IT

sector as well as major IT firms. Therefore also longitudinal research design is applied. Some major developments of the industry or their impacts are tracked and examined at different points of time. Some information is gathered from years 2009-2011.

### 6.1.2 Credibility and Validity

There are various views, opinions, definitions and debate on evaluating the quality of qualitative and case studies. However, there is general consensus of the need to demonstrate that studies are credible (Creswell and Miller, 2000; Eskola and Suoranta, 2000). In addition to evaluation methods and criteria of credibility several authors have proposed strategies, tactics or procedures for establishing or increasing validity (e.g. Klein et al., 1999; Creswell and Miller, 2000).

Applicability of the evaluation methods of quantitative research to qualitative studies, such as reliability and validity, is a highly debated topic (e.g. Lincoln and Cuba, 1985; Yin, 1994; Eskola and Suoranta, 2000; Patton, 2001; Stenbacka 2001; Golafshani, 2003). In qualitative research the concept of reliability has remained obscure and problematic. For validity it is possible to identify a wide range of terms and characteristics, but, inspite of this, the concept has remained complicated (cf. Creswell and Miller, 2000). Opposite to the practice in quantitative research several authors do not consider the concepts reliability and validity separately in qualitative research (see e.g. Creswell and Miller, 2000, Golafshani, 2003).

Some authors define validity as the accuracy of the findings of the research. Creswell and Miller (2000) consider validity as how accurately the account represents participant´s realities of the social phenomena and how credible the account is to them. Eskola and Suoranta (2000) emphasize that in the evaluation of qualitative research the key question is the credibility of the research process, not only the validity or credibility of the measurement or results (e.g. observations and conclusions). As the result, data collection, analysis and description of the research process have important roles in securing and evaluating the quality of qualitative and case studies. Yin (1994) approaches this issue by examining reliability, construct validity, internal validity and external validity. According to him reliability demonstrates that the operations of a study, such as data collection, can be repeated with the same results.

Yin (1994) defines the construct validity as establishing the correct operational measures for the concept studied. Some authors do not see construct validity relevant in qualitative research. In this study, however, the construct validity is seen important in evaluating and also in increasing the credibility of the research.

Increasing construct validity of this study requires specifying of terms and definitions and also profound understanding of existing data. Yin (1994) emphasizes triangulation as an important procedure (tactics) to increase construct validity. According to him findings or conclusions of a case study are likely more convincing or accurate if they are based on several and different information sources. In this study the use of different sources is also

necessary due to lack of consistent and accurate data of the Finnish IT industries. At the same time different methods are used in data collection.

For Yin (1994) the internal validity means that a causal relationship is established, whereby certain conditions are shown to lead to other conditions. On the basis of this definition it is difficult to identify a significant role for internal validity in this study. According to Eskola and Suoranta (2000), the internal validity demonstrate how well the results and findings of a study correspond to the reality or the views and definitions of participants. Thus, the internal validity describes the harmony of theoretical and conceptual definitions (cf. Eskola and Suoranta, 2000). This view of the internal validity is important from the perspective of this study where the credibility depends on how well the results are able to describe the Finnish IT industries.

Tactics to achieve internal validity may be difficult to identify. Yin (1994) supposes that internal validity can be increased by using clear logic in the data analysis. In this study, this emphasizes the relevance of definitions (link to construct validity) and ability of the researcher to interpret and analyze data from various sources. In this study, the researcher has been able to use his longstanding experience and knowledge in identifying appropriate data and sources, whereas he has had no possibility to influence on the content of the original external data.

**Generalizability and transferability**

Several authors emphasize generalizability of research results of an account as a major criterion in evaluating the credibility of a qualitative research. There are, however, different opinions of the importance generalizability in case of results of qualitative research (e.g. Maxwell, 1992; Guba and Lincoln, 1996; Eskola and Suoranta, 2000; Saunders et al, 2007). Some authors emphasize that the purpose of qualitative research is not to form generalizations similar to quantitative research (e.g. Eskola and Suoranta, 2000).

In addition, the terminology concerning generalizability is not standardized. In qualitative research, some authors substitute the term generalizability with the term transferability (e.g. Guba and Lincoln, 1996). In this study these terms are used as synonyms.

Despite different views and opinions, generalizability is examined and defined from various perspectives in literature. One way to consider this issue is to evaluate whether the findings are generalizable to similar or also to different environments. Saunders et al. (2007, p. 598) define generalizability as “the extent to which the findings of a study are applicable to other settings”.

Some authors, in turn, define external validity as generalization of the study findings to a wider context beyond the research environment (Yin, 1994, Remenyi et al., 2000). According to Yin (1994) case studies rely on analytical generalization, in which a particular set of results are generalized to some broader theory, contrary to statistical generalization to the population

Lincoln and Guba (1996) argue that in qualitative research the transferability of results from one context to another depends on similarities of the environment studied and the environment that may apply the results. They also propose that the evaluation of the transferability requires thick description.

The extent of the generalizability of findings depends also on the design of the research. For instance, if the aim is only to describe or explain present situation in a particular research setting it is unreasonable to expect a theory generalizable to wider populations (cf. Saunders et al., 2009). This applies largely to this study. On the other hand it is possible that even if the study focuses on selected IT industries within the Finnish IT sector (IT services and software industry), due to similarities in the problems and methods in defining industries, some of the findings are generalizable to other IT industries or, even more widely, to other industries as well. Some authors (cf. Eskola and Suoranta, 2000) argue that the evaluation and conclusions of the generalizability of a study belong to both the researcher and the users of the research.

### 6.1.3 Procedures for Establishing Credibility

An important question is how the research quality can be increased. Several authors have suggested different strategies, tactics and procedures which may increase the quality of qualitative research (e.g. Yin, 1994; Klein et al, 1999; Creswell and Miller, 2000, Creswell, 2007). Several validity strategies or tactics consist of similar procedures, such as triangulation, thick description or external audits.

Creswell and Miller (2000) suggest a two-dimensional framework to help researchers to identify appropriate validity procedures for their studies. They suggest the governing of validity procedures by two perspectives. They propose the choice of validity procedures based on two perspectives that consist of the lens researchers choose to validate their studies and paradigm assumptions of researchers. Table 4 demonstrates both perspectives and procedures proposed. Creswell and Miller (2000) propose researchers to engage in one or more of these procedures.

**Table 4. Validity procedures within qualitative lens and paradigm assumptions**

| Paradigm assumptions/Lens | Postpositivist or Systematic Paradigm | Constructivist Paradigm | Critical Paradigm |
|---|---|---|---|
| Lens of Researcher | Triangulation | Disconfirming evidence | Researcher reflexivity |
| Lens of Study Participants | Member checking | Prolonged engagement in the field | Collaboration |
| Lens of People External to Study (Reviewers, Readers) | Audit trail | Thick, rich description | Peer debriefing |

Source: Creswell and Miller, 2000

Fairly similar procedures have been presented by several other authors (e.g. Yin, 1994; Klein et al., 1999). Klein et al. (1999) have proposed a set of principles to conduct and evaluate interpretive case research, based on the perspective of hermeneutic philosophy. In addition to the fundamental principle of hermeneutic circle, the principles include conceptualization, interaction between researchers and subjects, abstraction and generalization, dialogical reasoning, multiple interpretations and suspicion.

In this study triangulation and thick, rich description have been used in attempting to establish the credibility of this study.

Applying the lens of the researcher favors the use of triangulation (see table above). In addition, also the lens of people external to the study must be taken into account. They have to understand the process and be able to evaluate the results. This favors the adoption of thick rich description. Due to the data collection method there are no proper participants or informants in this study. Some ideas (e.g. frameworks) and major findings and conclusions have been tested in interviews of executives of large IT companies.

**Triangulation**

The existing information of the Finnish IT industries comes from several sources and is heterogeneous, based on various starting points, needs and definitions by information users and providers. On the other hand, both qualitative and quantitative information are needed for this study, and therefore also different data collecting methods are required. Therefore the method of triangulation is favored since it is assumed to improve the quality and coverage of the data.

Several authors find triangulation as the core of case study methodology (e.g. Denzin, 1978; Tuominen and Sarajärvi, 2002; Johansson, 2003). The concept means using different views and combining different approaches, methodologies or multiple data sources. Denzin (1978) has identified four types of triangulation:

- triangulation of sources of evidence (using multiple sources of evidence)
- analyst triangulation (using multiple analysts to review findings)
- theory/perspective triangulation (using multiple theories to interpret data)
- methods triangulation (using multiple data gathering methods, such as observations, interviews, and documents)

Triangulation related to sources of evidence (information sources) as well as methods triangulations have been applied in this study. Triangulation is widely applied as a validity procedure. By employing the researcher's lens it provides researchers an opportunity to evaluate and sort multiple and differing data sources and helps to search for convergence, form themes or categories as well as eliminate overlapping areas in a study (Creswell and Miller, 2000).

In this study, triangulation increases the validity in multiple ways (see e.g. construct validity, Chapter 6.1.2). Using different methodologies and data sources also helps to

perceive and collect dispersed information and identify inconsistencies between different information and sources which otherwise might be difficult to detect (cf. Tuominen and Sarajärvi, 2002). Triangulation also gives an opportunity to concretize and construct different frameworks by utilizing and combining data from various information sources as well as to examine the Finnish IT sector from different angles.

**Thick, rich description**

Another procedure to improve credibility applied in this study is thick rich description which describes the setting, participants and themes of a qualitative study by providing as much details as possible (Denzin, 1989; Creswell and Miller, 2000). In this study, the thick, rich description procedure is also applied in defining the terms and concepts related to IT sector as well as in constructing the frameworks used in the analysis.

According to Creswell and Miller (2000, pp. 128-129) the purpose of rich description procedure is to "produce for the readers the feeling that they have experienced, or could experience, the events being described in a study". Thus, the credibility is established through the lens of readers, helping them to understand that the account is credible and also enabling them to make conclusions about the applicability of the findings to other settings or similar contexts (Creswell and Miller, 2000).

Major share of information utilized in this study is based on public sources, including data published by Statistics Finland, other public statistics or public research reports, as well as wide base of company information. Major part of this data is available for all reviewers and readers.

A part of the information used in the analysis is based on public sources and has been modified for this study as will be described later. The interviews of executives of major IT firms and user organizations used in this study may include confidential information. However, the major messages of these interviews have been conveyed to the study by the researcher and much of the data is available also in public sources if the reader is able to recognize it.

Cuba and Lincoln (1996) propose that the credibility of a study requires data collection during a long period of time as well as sending of results to informants. In this study, the results have not been sent outside the project because of the data collection method. Instead, during the research process major observations, findings and views have been discussed with executives of major IT firms and other organizations interviewed for the study (cf. reflection, Patton, 1990).

## *6.2 Scope and Limitations*

This study focuses on companies which produce or provide software products or IT services in Finland. They form the software product and IT services industries considered in this study. The companies have to fill two characteristics. Firstly, they have to get

revenue from software products and/or IT services and, secondly, all of them provide software products or IT services to external user customers, some also for applier customers. Due to the focus of the study internal IT production and related employment of the IT organizations or internal (captive) IT firms as well as internal transactions concerning IT products or services are outside the scope.

The companies producing or providing products or services based on use of information technology can be divided into two main categories: The first category consists of enterprises which produce or provide software products or IT services to their customers. For them information technology (IT) is the business. These firms are mainly traditional IT companies (software companies, IT services vendors) which help their customers to develop and run their businesses. The second category contains firms that utilize information technology in their products or services that are sold to their customers. For them the information technology is in the role of enabler. These companies come from various industries, e.g. from manufacturing industries.

The borderline between these categories is blurring and the businesses of several enterprises are increasingly overlapping (see Figure 4). As defined above the study focuses only on the enterprises that provide software products or IT services for end user customers. This study has not defined, however, any level or share for revenue that must be derived from these customers. As the result, this study can cover also other than traditional IT companies.

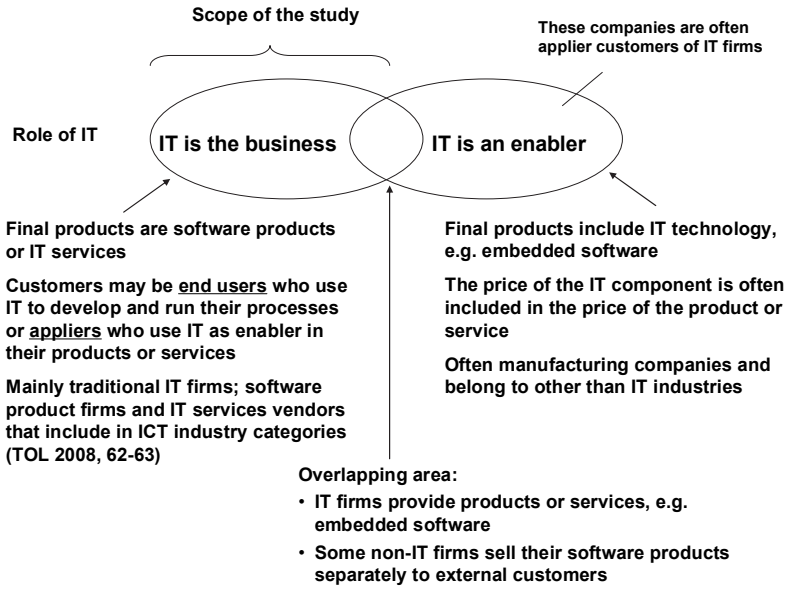



**Figure 4. The scope of the study according to the role of the company**

In practice, companies and industries enabling IT in their products or services are mainly outside the scope. The study does not include production or markets of communication equipment and telecommunication services or the production and markets of computer hardware. Further, the production of embedded systems is mainly outside the scope of this study. The companies that provide embedded systems are only included to the extent that they also produce software products and IT services defined in the study.

Open software is not analyzed separately. Open software and related services provided for external customers belong to IT industries considered in this study.

Nokia and NSN (Nokia Siemens Networks) are not included as providers of software products or IT services in the study. This decision has been made due to absence of relevant performance data as needed for this study. Instead, several telecom operators provide traditional IT services as defined in this study and are included[8].

Production of computers and other IT hardware has very insignificant role in Finland justifying to focus only on software products and IT services. In addition, a growing part of the revenues of traditional hardware manufacturers is received of services (e.g. IBM and HP). A further limitation is that this study focuses on industry and partly market levels but not on separate products or technologies.

A significant share of the production of embedded software is outside the scope of this study. This is because embedded software is largely produced by internal organizations of major manufacturing companies (Nikulainen et al., 2011). However, these companies like others may be included in the study if they create revenue from sales of software products or IT services to external customers as defined above. At the same time several traditional IT services companies are important producers and subcontractors of embedded software and related services.

It is important to emphasize, however, that companies remained outside the scope can be important customers of software and services firms examined in this study and therefore are, in this role, part of the study. The total volumes of the study may include also sales to consumers. The consumer market, however, is not considered separately.

One of the main starting points of the study is the argument that the prevailing definitions and related information of industries do not serve the examination or analysis software product and IT services industries. Therefore this study can not be considered as a traditional industry research (e.g. Abernathy and Utterback, 1978; Gort and Klepper 1982; Anderson and Tushman, 1990; Utterback and Suarez 1993; Klepper 1996; Suhonen, 2002). To get a better understanding of the Finnish software product and IT services industries some definitions have been specified and various frameworks have been constructed and validated for this study.

[8] For instance, Elisa, Teliasonera and some other telecom operators have daughter companies or other business units that produce IT services, often IT infrastructure related service. This study covers only revenues received from their own software products and IT services.

Some discussions and references concerning the evolution of the Finnish IT industries or separate firms are made but despite them this study does not attempt to describe or explain the complete history of the Finnish IT sector. Neither does the study provide a profound analysis of the Finnish IT market or company level considerations.

The study assesses the basis for future evolution but does not attempt to forecast or anticipate the evolution of the Finnish industries. This study does not examine the impacts of IT technologies or industries on productivity of organizations or on the whole economy.

In describing and measuring IT industries this study focuses on total volumes like revenues, employment and IT spending. Indicators describing profitability, research and development activities or innovativeness are outside the scope of this research.

Foreign-owned IT companies are called also foreign IT firms in this study.

## *6.3 Data Gathering and Information Sources*

The objective of this chapter is to demonstrate the data and information sources used in the study. Despite the basic nature of qualitative research the study also uses quantitative data to support the qualitative analysis and help to understand the Finnish IT industries. Multiple sources and data collection methods enable the use of triangulation.

The quality and credibility of qualitative research depend on the credibility of data and information sources used. The following description of the information sources applies thick, rich description. The sources are largely open for everybody. The observations conducted in this study are based on the information of these sources.

### 6.3.1 Main Information Categories

In this study, the data contains four main information categories which may include various data sources:

- theory and literature
- external empirical data, based on primary and secondary sources
- empirical data modified for this study
- experience and knowledge of the researcher to find and interpret various data and information sources

These categories, their roles and contributions to the study are described below (see also table 5).

**Table 5. Information categories, their roles and contribution**

| Information category | Data sources, roles and methods | Contribution to the study |
|---|---|---|
| Theory and literature<br><br>*(Qualitative data)* | Industry research, literature and journals dealing with industry definitions, industry evolution and major structural and other changes impacting on IT industries | Basis for specified definitions, terms and concepts for the study<br>Forming of overall frameworks at the highest level of aggregation, such as "ecosystem of Finnish IT industries" and "IT enterprise space"<br>Basis for understanding industries |
| External primary and secondary sources<br><br>*(Mainly quantitative, partly qualitative data)* | Public statistics (Statistics Finland, OECD)<br>Public research reports<br>Market studies/data<br>Company reports and information<br>Press articles | Contributing for definitions, terms and concepts and frameworks of the study<br>Basis for examining size and structure of Finnish IT industries and for description and analysis of key case populations<br>- IT service industry<br>- Software industry<br>- Vendor field<br>Basis for evaluation the usability of public IT industry information |
| Modified information<br><br>*(Quantitative data)* | Constructed to specify and deepen existing information by using external sources and expertise of the researcher<br>Modified information of total volumes (e.g. revenues, employees) and their distribution by type of production, location and firm categories<br>Specified groups of vendors | More accurate descriptions and analysis of key case populations<br>Specified vendor information; vendor field and competition demonstrated by<br>- database of top 100 IT vendors<br>- selected groups of top 10 vendors<br>Basis for evaluation the usability of public IT industry information<br>Focus on software product and IT services industries |
| Experience and knowledge of researcher<br><br>(*Qualitative data)* | Tools and methods used in market analysis and strategy consultancy (tacit knowledge) | Contributions to specification of definitions, terms and concepts as well as to constructing frameworks by applying tools and methods learnt in research and analyst firms<br>Knowledge to understand and interpret vendor field and competition |

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**Theory and literature,** consisting of industry research, industry related literature and journals provide many-sided viewpoints of defining industries and theories related to industry evolution. The literature helps to identify specific issues for the case studies and to create a better understanding of the nature, complexity and structure of IT industries

which are reshaped by various structural and other changes, such as changing behavior of customer and globalization. These sources also build an essential basis for specified definitions, terms and concepts used in this study. For instance, they provide the theoretical base for forming the overall frameworks that describe and concretize the highest level of aggregation in this study, such as "ecosystem of Finnish IT industries" and "the IT enterprise space". The data is mostly qualitative.

**External empirical data** is based on primary and secondary sources (cf. Saunders et al., 2009) collected from various sources. Analyzing, comparing and combining empirical data based on different needs and definitions contribute to the specifying of definitions, terms, concepts and operational frameworks used in this study.

The data is mainly quantitative and builds the basis for examining, analyzing and describing size and structures of Finnish IT industries. The mainly quantitative data is also the basis for perceiving empirically the key case populations, such as IT service industry, software product industry and vendor field. With the exception of some market research information all this data has been gathered from public sources. The external data sources and their inputs to the study are presented in more detail in Table 6.

**Empirical data modified for this study** attempts to form a more coherent view and basis for understanding the Finnish IT industries.

Due to different needs and definitions existing empirical data is often incoherent and inaccurate for description and analysis of the key case populations and for objectives of this study. Therefore existing data has been modified and new information has been constructed by using various external sources (e.g. public registers, company reports) as well as expertise of tools and methods used in research and analyst firms.

As the result more accurate information has been received of total volumes of the Finnish IT sector and IT industries (e.g. revenues, number of employees) and their distribution into types of production, location and firm categories. Modified data focuses on firms providing software products or IT services. The data is mostly quantitative.

The major outcome of the modifying work is the database of top 100 vendors. The database consists of companies providing software products or IT services. The building and principles of the database as well as a more detailed description of enterprises included are presented in Chapter 6.5. In addition, some other groups of IT firms, such as the top 10 vendors, have been constructed on the basis of external empirical information.

The modified data also contributes to concretizing the usability of public IT industry information. A part of the company level information of the database of the top 100 IT vendors has been received in confidential discussions and interviews making it possible to publish data only at aggregate level.

Experience and knowledge of the researcher have been utilized in this study in identifying information sources, defining firm populations as well as in evaluating and

interpreting various data by applying tools and methods used by market analysts and strategy consultants.

### 6.3.2 External Empirical Information

This study uses empirical information from several external data sources like official and other public statistics, public research reports, academic studies, market studies and reports, company information and press articles. Interviews and discussions with IT industry executives have given insight into the industry structure and evolution. In the following the major data sources and their inputs for the study are presented (Table 6).

**Table 6. External data and inputs for the study**

| Major Data sources | Major content | Inputs for the study |
|---|---|---|
| Public statistics | Statistics Finland (publications and data bases), especially<br>- enterprise statistics<br>- foreign trade statistics,<br>- national accounts | Data from the production (supply) side of IT sector<br>Data for examining size and structure of Finnish IT industries<br>Basis for evaluation the usability of public IT industry information |
| Public research reports | Software industry surveys<br>Reports from research organizations, e.g. Etla<br>Statistics and reports from technology industries<br>Yearbooks of VTT<br>Technology and industry reports from Tekes<br>OECD reports | Data for examining size and structure of Finnish IT industries<br>Data for description and analysis of key case populations and specified groups of vendors, e.g. analysis of incumbents<br>Information of major structural changes and developments, e.g. globalization<br>Input for evaluating the usability of public IT industry information |
| Company reports and information | Annual and other financial reports<br>Data from the official trade register | Data for specified analysis of size and structure of Finnish IT industries<br>Data for description and analysis of key case populations and developments, e.g. top 10 vendors |
| Market studies/data | Information published by market research companies | Supporting data for definitions, terms, concepts and frameworks<br>Data of market, vendors and competition<br>Support for understanding major changes<br>Input for evaluating usability of public IT industry information |
| Press articles | IT industry news<br>Company news<br>Tietoviikko magazine´s Tivi 250 surveys | Information for examining size and structure of Finnish IT industries and describing and analyzing vendor field<br>Data for top 100 IT vendors database |
| Interviews | Interviews of IT industry executives (informal interviews) | Company level information on business volumes (e.g. informal data concerning businesses and revenues)<br>Comments of findings of the study |

**Public statistics** used in this study are produced by Statistics Finland and published as reports or in statistical databases. From the perspective of this study, the most important statistical information is received from enterprise statistics, foreign trade statistics (e.g. volumes of exports and imports of software products and IT services) and statistics of national accounts.

The data from these statistics, based on official industry definitions and categories, mainly describes only the volumes of the production (supply) side of the IT sector, whereas examining the demand and market requires other sources. However, public statistics have a key role in describing and analyzing the size and structure of Finnish IT industries as well as in evaluating the usability of the existing IT industry information.

**IT sector related studies and reports** form a versatile information source consisting of wide range of public research and other reports produced by research organizations (e.g. Etla), public organizations (e.g. ministries, Tekes) and industry federations (e.g. Technology Industries). In addition, separate studies and reports have been produced by research programs or projects (e.g. software industry surveys) and international organizations (e.g. EU and OECD).

These sources are used to examine and analyze the size and structure of IT industries or the impacts of major structural changes on them. Yearbooks of the Finnish IT market, produced by VTT (Technical Research Center of Finland), have been used to examine IT enterprises of 1980s and 1990s, for instance in analyzing incumbent companies. All these sources offer also input for evaluation of usability of the public IT industry information.

**Company reports and information** (firm specific, company level information) consist of annual and other financial reports of companies. In some cases, data collected from official registers (National Board of Patents and Registration) is used to complement the company information. Company level information is important for analyzing the structure of the vendor field and separate vendor populations. For instance, understanding the role of globalization on Finnish IT industries requires firm level consideration. Company information concretizes or confirms the picture which is given by the statistical sources.

**Market studies and market data** consist of information published by market research companies (e.g. IDC, Gartner, Market-Visio). This information mainly covers the market (demand) side of the IT sector and focuses strongly on IT spending providing essential data for constructing frameworks.

**Press articles** used in this study include IT industry and IT company news and background articles. These give support for assessing size and structure of Finnish IT industries and for describing and analyzing the vendor field and competition. One single source has a prominent role. The list of the 250 largest ICT companies in Finland, published by Tietoviikko magazine, is used as the main basis for building the database of the top 100 vendors in 2008.

**Interviews of IT industry executives** are utilized in evaluating and commenting some major observations and findings of the study. The nature of interviews of executives was informal. Discussions were also partly confidential, for instance, when dealing the distribution of revenues and other volumes within the companies. This information was used in constructing the data base of top 100 vendors.

### 6.3.3 Information Sources and Their Use

Figure 5 below summarizes the information categories, main data sources and their roles and contributions to the outputs and results of the study as presented in tables above.

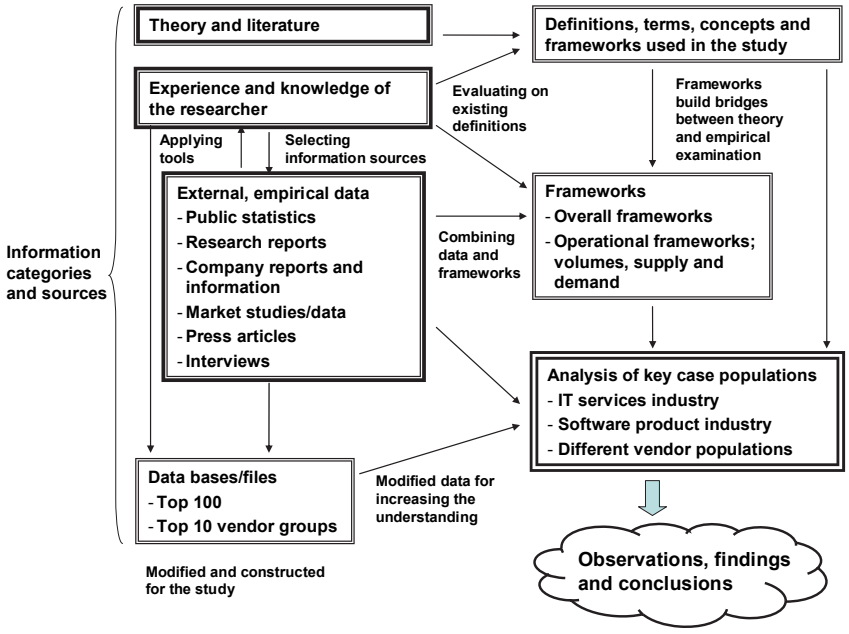


**Figure 5. Information categories, sources and their use**

The definitions, terms, concepts and frameworks used in this study are presented in Chapters 2–3 and in Chapter 7.

## *6.4 Main Sources of IT Industry Information*

### 6.4.1 Official Statistics

The most commonly used industry information is based on definitions and classifications of statistical authorities. This information is used in decision making both in the public

and private sector, as well as in research and strategy work. Statistical authorities have developed a globally harmonized entity (system) of industrial classification schemes to promote the development of national statistical systems, as well as to improve the international comparability of economic and other data.[9]

The information of the statistical offices has a strong scientific background that is based on various theories and research. In the national statistics industrial classification schemes are used as basic frames and tools for collecting and producing industry information, covering production, employment, gross domestic product and other statistical areas. Industries are typically defined from the production point of view which emphasizes information related to the producing sector. The emphasis on production side and the homogeneity of industries can partly be seen due to the history of industry classification schemes. These schemes have a close relationship to industrial economics or industrial organization tradition (Munir and Phillips, 2002; Weaver, 2007). Collecting information of the user side is not as systematic.

Both in domestic (e.g., Paija, 2000; Steinbock, 2004; Hernesniemi ed., 2010) and international (e.g. OECD, EU) research and considerations the information concerning the Finnish IT sector is usually based on industry data collected and presented by Statistics Finland.

Statistical units, enterprises and local kind of activity units (establishments[10]) are most commonly classified according to their main activity or output (products or services) or value added generated.[11] According to this approach, statistical units of IT industries are IT firms or their establishments that produce IT products or services. Their clients and markets consist of companies, other organizations or households buying and utilizing IT products and services. The using/utilizing sector has been considered and defined e.g. by OECD, (2007, 2009, 2010) which has an active role in developing the industry classification schemes for IT industries. The IT market related information, however, is mainly produced by commercial research companies.

Combining industry information results in entities and concepts like ICT cluster or ICT sector that describe the Finnish IT production and its structure at a high level of

[9] The United Nations Statistics Division (UNSD) has defined the International Standard Industrial Classification (ISIC) of all economic activities. NAICS (North American Industry Classification System) is developed and used by the North American countries. The European Union has the corresponding classification is NACE. All EU member states are obligated to use the national application of NACE classification in their statistical activities. In Finland the current industry classification, implemented in 2009, is called TOL 2008.

[10] Local kind of activity unit (establishment) is a production unit that is owned by one enterprise, located on one site and operates within one industry and produces goods and services of mainly one particular type. Sources: EU regulations concerning statistical units (EEC 696/93) and Business Registers (EC 177/2008), Concepts and definitions, Statistics Finland

[11] According to Statistics Finland the main industry of an enterprise is the industry generating the highest added value.

aggregation. This information is often applied in economic planning at a national level. Among "pure" ICT companies these clusters or sectors often include other companies classified as enablers of information technology. On the other hand, some industries which have ICT offerings or produce substitutes that compete directly with IT software products or IT services are not included in the ICT cluster or sector.

The critics concerning the industry information provided by the statistical authorities emphasize the static (long-lasting) nature of definitions and classifications as well as homogeneity or heterogeneity of firms included in industry categories. The definitions and classifications do not take into account well enough industries that continuously face changes and transitions (Jacobides and Winter, 2005; Sako, 2005; Baldwin, 2006; Rouvinen, 2009). Grönroos (2009) has presented another critical comment, arguing that the public statistics emphasize manufacturing industries whereas the services industries have too small a role.

Two further issues decrease the usefulness of the official industry information. Firstly, IT products and services are increasingly produced outside the 'official' IT industries (e.g. Jacobides and Winter, 2005; Ali-Yrkkö, 2008). Secondly, the industry classification scheme and existing information may be presented at a higher level of aggregation than required by many uses (see e.g. McGahan, 2004; J. F. Christensen, 2008, Rönkko et al., 2009, 2010). The question often is of the balance between homogeneity and heterogeneity of firms belonging to an industry. Using local kind of activity units as statistical units may help in some cases. On the other hand, too narrow definitions may make it difficult to react to technological or other changes, new players or new products and services that reshape industry structure and borders.

In dynamic industries the public authorities meet great challenge in keeping up and measuring the industry developments. Technology and other changes may lead to a widening gap between industry indicators and the real world. This issue is recognized in statistical offices (cf. Hamunen, 2008). The static nature of definitions and classifications may weaken the reliability of industry indicators (cf. Baldwin, 2006). As a result important decisions can be based on inaccurate, even misleading information. Jacobides and Winter (2005) emphasize continuous transitions of industries and suggest considering of a new empirism, which defines industries in a more dynamic way. According to them, reconsideration of the boundaries of existing industries might transcend the traditional SIC definitions, focusing on the comparative analysis of value chains instead of traditional industries.

### 6.4.2 Market Research Firms

Market research companies have a long history in defining IT industries and in collecting related information (e.g. Chesbrough, 2003; Campbell-Kelly, 2003) and can therefore be regarded as pioneers in defining and producing information of IT industries. The shortages of the information provided by official statistical authorities and its inability to respond the challenges of ongoing changes build a strong basis for demand of commercial research and consulting services (cf. J. F. Christensen, 2008).

Market research companies provide information of utilization of information technology by analyzing the size and the structure of the IT market, as well as making estimates and views of market potential. The IT market is typically considered through the end user spending or IT consumption by IT product and services categories in different user segments. In addition, the market research companies analyze vendor community and its performance and revenue structure.

Many of the first definitions of IT industries were very much based on definitions set by the major IT firms such as IBM. These definitions often described and reflected organizations and business structures of the companies and market information was required to fit into these structures. Market research companies were expected to offer indicators for measuring company performance and competitiveness in the marketplace (Kaitila, 2005; Chesbrough, 2003).

Today, the major market research companies have their own definitions, classifications and data collection methodologies to satisfy the needs of expanding groups of customers. Simultaneously, research companies have become less dependent on single customers and major industry players. They also compete for a role as a forerunner and trendsetter in the IT information expertise. In this competition the definitions and classifications are seen as a competitive edge, immaterial property and business knowledge, and therefore a hindrance to standardization of definitions. As a result, the data provided by separate research companies is not always directly comparable.

Major international market research companies produce IT industry and market information and analysis at country level. Despite of using consistent definitions and classifications worldwide there may be some differences in the reliability of information between countries.

This comes from the fact that the research firms typically focus on large countries and markets while small countries like Finland may remain as "residuals" in their information. For instance, the Finnish IT spending represents less than a half percent of the worldwide IT spending and about 1.5 percent of the total spending of the EU. Consequently even big changes in the Finnish market usually have no relevant impact on figures at European level. The period of Nokia's strong growth so far is the only time when the Finnish IT market has caught wide interest in European or global market research.

Major part of the information and forecasts of the Finnish IT markets is produced outside Finland, often without using any local expertise. Local expertise has increasingly concentrated into a few local market research companies or separate research activities conducted by both public and private organizations.

The market research companies have gained strong foothold in vendor companies, sometimes also in user organizations. Among the major strengths are their knowledge of the vendor community, their active and timely analysis, assessments of technological changes and new business models of IT companies. Their success largely depends on

flexibility to respond to changing customer needs and to ability to attach attention to new phenomena and early signals of change. Some research companies have expanded also into consulting services.

In this study the information concerning IT market and IT spending is largely based on information published by market research companies.

### 6.4.3 Major Indicators

The available indicators measuring the performance and structure of IT industries and IT market mainly concentrate on volume data and provide information of the structure of vendor and user populations. The indicators are based on information collected by statistical authorities and market research firms.

Economic and public finance considerations emphasize quantitative indicators, such as value of production (revenue), employment, foreign trade, value added, productivity, number of enterprises and derivatives of these indicators like revenue per employee. This type of information is mainly based on data received from official statistics. Recently, the employment in IT sector and separate industries has become increasingly important indicator (e.g. Ali-Yrkkö and Martikainen, 2008, Nikulainen et al., 2011). Globalization has increased the weight of information related to foreign trade of IT products and services (Eloranta et al., 2010; Pajarinen et al., 2010; Gozzo, 2010).

In developing and running their businesses IT companies seek for both quantitative and qualitative information and related indicators to better understand and foresee the demand and evolution of their markets, customers and competition. In addition to IT spending and demand, IT firms expect information and separate indicators describing the value of purchases of various products and services, market shares and growth rates as well as forecasts for future evolution. The role of qualitative industry analysis has increased in services offerings of market research and analyst firms in the 2000's.

The information needs of researchers, in turn, may vary from wide economic perspectives to firm level studies and analysis.

To avoid misleading information, the IT industry data and related indicators should be able to describe the real conditions and changes of IT sector as well as possible. The credibility and usefulness of industry information largely depend on definitions and ability to react and take into account changes both in the production and market sides of the sector. However, both software product and IT services industries have experienced it problematic to receive reliable and timely industry information (e.g. Rönkkö et al., 2010).

Globalization and related new division of labor and unbundling of processes and tasks across countries (Sako, 2005; Jacobides et al., 2006; Baldwin, 2006) as well as growing use of subcontracting by Finnish IT firms and their customers both in Finland and abroad have resulted in increasing challenges for public statistics. Information of this evolution is largely based on data from market research firms or on separate research activities.

In this study, the usefulness of IT industry information and related indicators will be discussed. In addition, some views to improve the measurement of IT industries are presented.

## 6.5 Top 100 IT Vendor Database

To create a basis for getting a reliable picture of the Finnish software product and IT services industries and their structure and vendor field, a database of the top 100 IT vendors (IT companies) was constructed for this study. The database was built by collecting, combining and complementing firm level information from different sources. The main aim was to improve the validity and relevance of this information.

The top 100 IT vendor database has a crucial role in understanding and describing the status and structure of the Finnish IT industries. It forms the central empirical information in this study by allowing both complementing and deepening the picture of the status and structures of the Finnish software product and IT services industries and their company structure. The top 100 IT vendors form a sub-population of the IT enterprise space defined in the study.

The database is based on the list of the top 250 ICT firms in 2008. The list is published by Tietoviikko magazine which collects the basic data directly from companies. The companies selected for the database meet the study criteria, that is, they produce software products or IT services to external customers. Some of these companies are coming from non-IT industries.

To improve the validity of the database it has been complemented by a number of firms missing from the top 250 list (e.g. some business consulting and business outsourcing firms as well as the new rivals like Indian IT services vendors). In addition, some vendor level information has been complemented by using several information sources. For instance, this is the case with foreign firms which may have various reporting practices concerning their income in Finland.

The IT companies were ranked and selected according to their combined software product and IT services revenue. As a result, several large and mid-sized ICT firms have fallen outside of the list. Among them are some hardware manufacturers, distribution channel firms, several telecom operators and providers of embedded systems. Nokia and NSN were left outside the database due to difficulties in getting information of their revenue structure as needed in the database. In the study Nokia has a strong role as an applier customer of the top 100 vendors.

The majority of the top 100 firms are traditional software product and IT services firms. In 2008, Tieto Oyj was the largest in Finland by revenue, more than 150 times larger than the smallest ones in the database. The database includes both Finnish and international companies like Accenture, Appelsiini, Basware, Capgemini, Deloitte, Digia, F-Secure, Fujitsu Services, HiQ, IBM, HP, Logica, Microsoft, Nebula, Nixu, Oracle, Reaktor, SAP, Sulake, Tekla, Teliasonera, Tieto, Visma and Wipro.

The basic information (total income and number of employees) is derived mainly from vendor sources and materials[12]. To get separate revenue from IT services, software products and other than traditional IT services the turnover data was distributed ('splitted') at firm level. In addition, the significance of international operations was examined. The revenue and employee distributions are partly collected from public vendor data (e.g. company materials, trade register) and estimated on the basis of various public data like market studies or other research (e.g. Rönkkö et al., 2009, 2010). In some cases tools and methods learnt in market research and analyst firms have been used.

Software revenues include sales of both own software products and software of third parties (e.g. agencies and dealerships). The value of the software products covers the license revenues and maintenance fees as well as of compensations for distribution channels or other partners. Services revenues, in turn, include the revenues of sales based on human competence and technological capacity, including both traditional IT services as well as other services like developing of embedded systems or business outsourcing services that are based on use IT skills or capacity. According to practical experience, even the IT firms themselves often have difficulty in providing these kinds of volume distributions. Despite possible inaccuracies of the revenue or employee splits the database provides a better base for observations and conclusions than plain total figures or other public information so far.

A further advantage of the database of the top 100 IT vendors is that it helps examining and analyzing the Finnish IT industries from different perspectives, including major volumes like revenues and employment, the structure of the vendor field and the distribution of businesses between software products and services. It also allows to assess the level of concentration of the IT industries as well as of the roles of incumbents or foreign IT firms in Finland. Finally, the database is a central data for assessing the future evolution of Finnish IT industries.

[12] Some foreign IT firms report only part of their Finnish revenues in Finland. In the database their revenues are estimated to better describe the real situation using estimates and methodologies applied by market research firms.

# 7 Frameworks for Analyzing Finnish IT Industries

The dynamic nature of IT industries and the static nature of many industry definitions and classifications were discussed in the theoretical part of the study. On the basis of the literature this study argues that the industries can not be taken as given (e.g. Hamel and Prahalad; 1994; Jacobides and Winter, 2005; Jacobides et al., 2006). The basic assumption is that examining the Finnish IT industries and other groups of IT firms requires more flexible ways than those based on traditional industry definitions and classification applied e.g. in the public statistics.

Therefore a comprehensive set of frameworks is formed on the basis of the theories for examining and analyzing the Finnish IT industries. The key aim is to have frameworks which allow examining the structures and volumes of the Finnish IT industries at different levels and from different perspectives, varying from the overall picture ("big picture") of the production and market of the Finnish IT sector to separate industries, groups of specific firms on both the production and market (demand) side. As defined earlier the focus is on software product and IT services industries.

Industry clusters or industry value chains (cf. Porter, 1985) are often applied in analyzing and measuring ICT industries, typically from the perspective of production. Globalization has broken the value chains into pieces geographically making national clusters obsolete (cf. Baldwin, 2006; Jacobides et al., 2006; Ylä-Anttila, 2008; Pajarinen et al., 2010). In addition, IT industries are strongly influenced by changing needs and behavior of customers.

These developments have guided the selecting of the frameworks of this study. The study also discusses and provides information of developments related to value chains and networks by considering e.g. changing industry architectures, business ecosystems and issues of value creation and capture.

The frameworks of this study utilize theories and ideas of ecosystems (e.g. J. F. Moore, 1996; Iansiti and Levien, 2004) and of economic space (Schumpeter, 1942) and industrial space (Lovio, 1993) as well as classifications concerning IT industries and software products (e.g. IDC, 2010).

The overall framework of this study consists of the ecosystem of the Finnish IT industries. It is complemented by operational frameworks constructed for defining, analyzing and measuring the volumes of the Finnish IT sector and separate industries from different angles.

In this study the main segmentation of customers is based on the needs and nature of the use of information technology. At a higher level of aggregation the classifications applied to software products and IT services have proven to be long-lived and constant. They have also proven to be independent of the different types of producers of software products and IT services or their customers. Therefore some of these classifications are suitable to be used in frameworks.

## 7.1 Issues in Measuring IT Industries

Various actors need valid, reliable and relevant information and understanding of IT industries, their evolution and structures as well as of their vendor field, competition and markets. Meeting these information requirements is not easy. Firstly this is because the IT sector is often examined either from the production or demand side giving little information of the other. Secondly, the firm populations analyzed or the indicators applied are rarely defined precisely. And thirdly, various actors may use different definitions in their analysis.

Part of these challenges result from the dynamic nature of IT industries. Globalization and technological and other changes reshape the borderlines of IT industries and single IT firms continuously (Jacobides, 2008). Also products and services of IT firms can change and naturally also information needs. As a result, the static definitions and classifications used in public statistics have received critical commentaries (e.g. Jacobides and Winter 2005; Baldwin, 2006; Weaver, 2007).

In addition to the existing IT products and services, an increasing number of new offerings and substitutes attempt to satisfy the customer needs. Part of the new supply comes from industries which are newcomers in the field and challenge the official industry definitions and classifications based on stable conditions.

A good share of analysis concerning the Finnish IT sector concentrates on the production view (Hernesniemi, 2010; Ali-Yrkkö and Martikainen, 2008; Rönkkö et al., 2009, 2010) and is dependent on information provided by Statistics Finland. Because of this the total supply and the role of foreign-owned IT firms more or less remain outside the scope of the analysis. Market research firms, in turn, examine the IT sector from the market point of view with a strong focus on IT spending and market sizes.

## 7.2 IT Enterprise and Customer Spaces

A significant weakness in the general picture of the Finnish IT industries is that the measurements only include software product and IT services producers belonging to the official software and IT services industry categories (Statistics Finland, TOL 2008, categories 62-63). Since also firms outside these categories do produce software and IT services, the official information provides only a partial picture of the Finnish IT production (cf. Ali-Yrkkö and Martikainen, 2008; Hernesniemi ed., 2010).

A further problem is that the IT industry categories used in official statistics include a number of heterogeneous firms providing also other than software products or IT services. This affects the relevancy of the revenue and employee information (cf. Rönkkö et al., 2010).

Another weakness is the limited availability of information concerning volumes of foreign software and services as well as the structure of the total supply.

A wider perspective is needed in order to get more exact information of the Finnish IT production and other supply (imports). It requires identification and examination of all firms producing and providing software products or IT services in Finland regardless of their official industry classification or the share of IT production in their total revenues or value added. This firm population is dynamic and characterized by continuous changes impacting both the number and structure of the firms. The customers may be users, appliers or other IT vendors.

The concept IT enterprise space (based in ideas of Schumpeter and Lovio) chosen for this study provides a flexible way to consider the Finnish IT industries and differs significantly from more fixed and static industry definitions.

In the following analysis and discussion all firms belonging to the scope of the study are called IT firms and form together an industry space called the IT enterprise space. Accordingly, different IT industries, like software product and IT services industries are sub-populations of the IT enterprise space and can be defined differently depending on the need or perspective at hand. The various sub-populations may also consist of separate or partly overlapping groups of firms. A single firm can belong to one or more industries.

The sub-populations of software product and IT services industries consist of all software products and IT services firms that produce software products or IT services in spite of the industries into which they are officially classified or how big part of their revenues comes from these products or services.

The IT enterprise space also includes all companies providing software products or IT services in Finland regardless the country of production. Of firms providing substitutes the IT enterprise space covers only those offering also software products or IT services. Firms providing exclusively substitutes have been remained outside the IT enterprise but may be direct competitors of IT vendors.

Since the IT enterprise space is more comprehensive than the official software product and IT services industries (e.g. TOL 2008), it provides a basis to form various sub-populations (in this study IT industries and their sub-industries) based on certain of needs, starting points and definitions.

Identically to the IT enterprise space, a concept of IT customer space (or IT market space) is used to describe the demand side, i.e. the population of existing and potential customers using software products or IT services provided. The customer space is more versatile than IT market defined by e.g. market research firms. Separate market and customer segments defined from various perspectives are sub-populations of the space.

Different characteristics of the IT sector have a significant effect on both the IT enterprise and customer space. Borderlines between vendors (IT firms) and customers are increasingly difficult to draw. A growing number of firms from various industries outside the traditional IT sector enables information technology in their products or services or provides IT products or services (e.g. Sako, 2006; Rönkkö et al., 2010). Therefore a firm

can at the same time be an IT vendor and an IT customer (see Prahalad and Ramaswamy, 2004; Vargo and Lusch, 2004). Consequently, a company or a part of it can also belong to both the IT enterprise space and customer space. Thus, from the perspective of a software product or IT services provider the same company can be at the same time a potential customer and a potential competitor.

## 7.3 Ecosystem of Finnish IT Industries

Since traditional considerations of the IT sector mostly base either on the production or market side of IT industries, it is often difficult to perceive the whole environment ("big picture") where the IT vendors and their customers operate. To attack this problem the concept of the ecosystem has been chosen as the overall framework of this study. Similar to biological ecosystems also the ecosystem of the IT industries can be very diverse and dynamic (see Iansiti and Richards, 2005). The ecosystem of the Finnish IT industries covers both the IT enterprise and customer space (Figure 6). Both spaces are independent of official industry definitions and classifications.

Due to globalization IT firms and their customers increasingly participate to various global value and other networks of firms (e.g. Jacobides et al. 2006, Baldwin, 2006). The ecosystem of the Finnish IT industries includes also portions of different international business ecosystems formed around various firms and their technologies or other platforms. In addition, the firms belonging to the ecosystem of the Finnish IT industries may be members (complementors) of several business ecosystems.

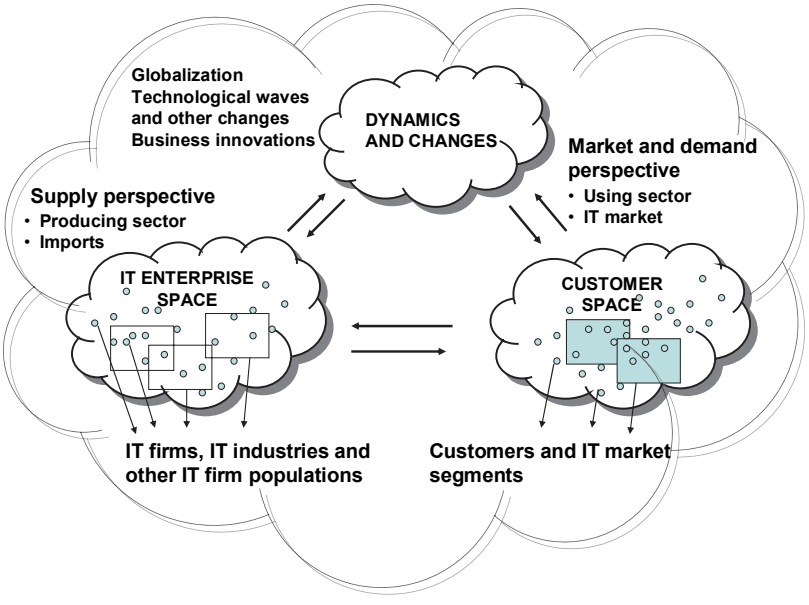


**Figure 6. The ecosystem of the Finnish IT industries**

The ecosystem approach is more extensive than business ecosystems (Moore, 1993, 1996; Iansiti and Levien, 2004). For instance the IT business ecosystem constructed by Iansiti and Richards (2005) focuses on the production side of the IT sector and uses only official industry information. The ecosystem of the Finnish IT industries again is more specific than the concept of ICT sector used by Statistics Finland or the widely used ICT cluster.

Together the concepts of the ecosystem of the Finnish IT industries and the IT enterprise and customer spaces chosen for this study help to describe the Finnish IT industries in a wider yet more specific and versatile manner than in several other commonly used concepts. They make it easier to examine, perceive and understand the structure, sub-populations and groups of firms and total volumes of the Finnish IT sector, make many-sided considerations of both spaces and analyze the effects of the highly dynamic environment on their evolution and relationships. Several changes like globalization, technology waves and other technological changes and business innovations reshape these spaces.

## 7.4 Measuring Finnish IT Industries

One of the basic assumptions of this study is that understanding the Finnish IT sector requires a coherent picture of both supply (production) and demand (market) of software products and IT services. Even an accurate picture of basic elements like the size of the IT sector, the value of the IT production, the IT market or IT spending is difficult to acquire due to incomplete, often conflicting information or inaccurate definitions of key concepts.

To attack these problems an operational framework is presented in Figure 7. It applies the overall framework, the ecosystem of the Finnish IT industries, and demonstrates the central volume indicators of the Finnish IT sector: total supply, Finnish IT demand (market), Finnish IT production, exports and imports. The framework helps to define the main concepts of the Finnish IT industries and understand the structure of the Finnish IT industries and measure its total volumes. It also allows the Finnish IT sector to be examined from both, the perspective of supply and demand. This framework can be considered as a basic operational framework which will be applied and modified in different ways in the following chapters.

The total supply (total volume) of the Finnish IT sector is generated by IT firms forming the IT enterprise space and consists of IT products and services produced in Finland or imported to the country. A part of the Finnish production is used in Finland and the rest is exported. Finnish IT firms also have production facilities abroad, increasingly in lower-cost economies.

Looking at the total supply from the perspective of the customer space (use and market), the distribution of the total supply is different. The Finnish demand for IT consists of products and services produced and used in Finland as well as goods and services

imported to Finland. Since the volume of total supply contains also exports from Finland its volume exceeds the volume of the Finnish IT demand.

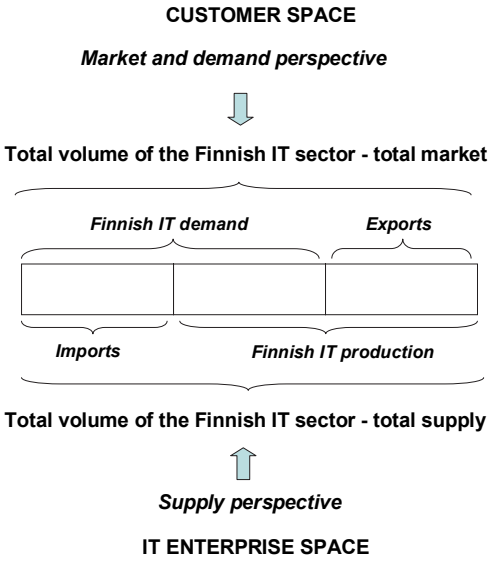


**Figure 7. Operational framework for analyzing volumes of the Finnish IT sector**

In this study the Finnish IT demand is a synonym of the Finnish IT market. On the basis of information technology utilization the Finnish IT market is divided into two main segments, (end) user market and applier market. In addition, IT firms themselves form another market segment (IT vendor market) by purchasing e.g. software tools or subcontracting services from other IT firms for their own use. All these segments can include customers operating outside Finland. The consumer market includes in total volumes but is not considered separately.

In country-level considerations the concepts of IT market and IT spending (end user spending) are often used as synonyms. In this study the two concepts have different contents. The value of the market is higher than that of IT spending, because the Finnish IT spending represents only a part of the Finnish IT market. Applier customers have increasing share of the Finnish IT market.

Market research firms use IT spending to measure the value of external IT purchases of end user customers and frequently also use it as an indicator of the market size. The end users can be seen as the traditional IT customers. The end user spending is often used as an indicator also when comparing the utilization of information technology in different countries (e.g. EU and OECD).

There are a few challenges in the use of the end user spending as an indicator of the market size. As mentioned before, one is the growth of the applier market while it is

increasingly difficult to separate end user and applier purchases. This is concretized in attempts to split revenues of IT services vendors in these to categories. Another measurement problem is the growing share of IT purchases made in Finland but used abroad by foreign subsidiaries. And vice versa, also IT products and services purchased abroad are used in Finland. When describing the IT sector, also the value of IT production and IT market are often taken as synonyms (cf. Rönkkö et al., 2009, 2010). However, their contents differ significantly. These issues are discussed in Chapter 9).

## 7.5 Intermediate Summary

The ecosystem of the Finnish IT industries forms the overall framework of this study. The main elements of this ecosystem are the IT enterprise space and the customer space providing the basis for analyzing the structure and changes of the Finnish IT sector. Structural and others changes such as and technology waves and other technological changes reshape both of these spaces. The figure 8 demonstrates the major connections of the overall framework to operational framework constructed for defining main concepts, for analyzing the structures and for measuring the volumes of the Finnish IT industries required in answering to the research questions.

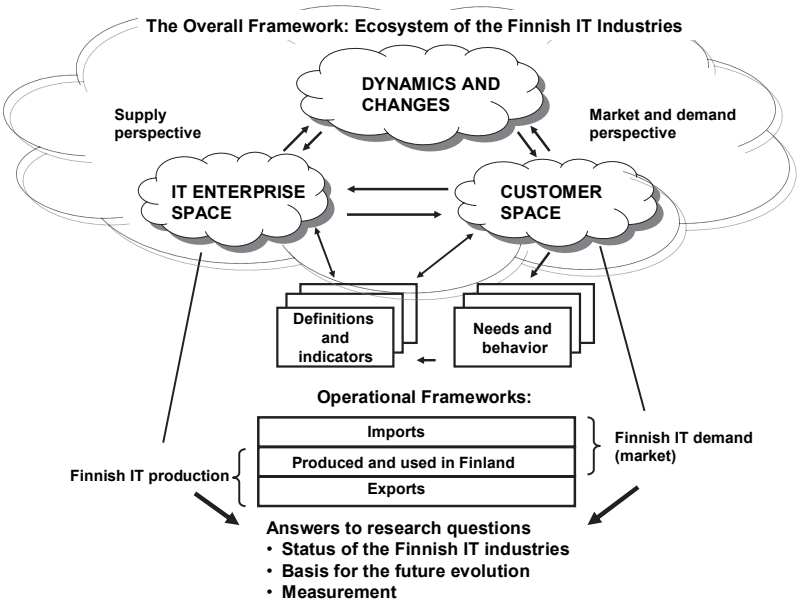


**Figure 8. The overall and operational frameworks of the study**

In the following chapters the variations of the operational framework will be utilized for analyzing the Finnish IT industries from different perspectives.

# PART IV: EMPIRICAL PART

The empirical part of the study (Chapters 8-10) focuses on examining and analyzing the status and structure of the Finnish IT sector in 2008 and its evolution until the early 2010s. The main perspectives of the examination are the supply and use of software products and IT services.

The first chapter of the empirical part (Chapter 8) analyzes major structural, market and other changes affecting the Finnish IT industries and reflecting also in the measuring of the IT industries. Next (Chapter 9) the total volumes of the Finnish IT sector and finally (Chapter 10) the structure of the Finnish IT vendor field and competition are discussed. These analyses deepen the understanding of the Finnish IT sector and allow evaluation and comparison of different definitions and indicators based on different viewpoints and used by different organizations.

# 8 Major Changes Affecting Status and Structure of Finnish IT Sector

A number of changes in customer behavior, markets and business structures affect and reshape both the production and market sides of the Finnish IT industries. The next discussion concentrates on changes affecting the structure and measuring of the Finnish IT sector. Two important types of changes are examined: changes in needs and purchasing patterns of the customers of IT firms (Chapter 8.1.) and changes in supply and business environment of the IT sector (Chapter 8.2.).

## *8.1 Changes in Customer Needs and Purchasing Patterns*

In the 2000s several global structural, economical, technological and business changes have reshaped industries all over the world and forced also Finnish IT firms to react in many ways. A growing number of researchers have emphasized the importance of the changing customer needs and behavior for the evolution of industries (e.g. Jacobides and Winter, 2005, Grönroos, 2009). Moschella (2003) has introduced a concept of customer-driven value chain and argues that the progress of the IT industry will be driven not by suppliers of technology but by customers using technologies.

Three types of customer-related changes can be identified to have an essential effect on the Finnish IT sector. New customer needs and purchasing patterns change and blur the borders of traditional market segments and make IT firms to expand their customer base. Also the rapidly changing structure and business practices of large customers of Finnish IT firms affect the IT industry. And thirdly, the same changes that have a strong impact on the behavior of the large IT customers have also important implications on the potential of IT demand in Finland and therefore on the future prospects of the IT sector.

### 8.1.1 Expanding Customer Base

In this study, the market of IT firms is divided into segments by the nature of the use of information technology: user market, applier market and vendor market. The segments are described in table 7 on the next page.

The user market segment makes up the bulk of the IT market, consisting of customers purchasing software and IT services to develop and run their own businesses and other operations. At the moment user market is the only or the largest market for most IT firms. Consequently, it is in this study referred to as the traditional IT market. Also consumers belong to this market.

Companies enabling IT and related knowledge in their products or services form the second market segment, the applier market. The appliers, e.g. technology companies or business process (BPO) service providers need a wide range of software and services for their own products, services or their development and infrastructure. [13]

The third segment, the IT vendor market, consists of other IT firms buying services (subcontracting) or products for their own offering.

All these segments are sub-populations of the customer space in the Finnish ecosystem of IT industries. A customer may be a firm or other organization or their separate function or operation.

In the 2000s the growth of the traditional user market has slowed down (e.g. Market-Visio, 2010; Andersen, 2010) while the applier market has grown. Both non-ICT industries and ICT product industries have increasingly used information technology and related knowledge in their products or services (Pajarinen et al., 2010; Eloranta et al., 2010). As a result, the importance of embedded systems and related services has increased. Also internal organizations of manufacturing companies produce a significant share of embedded systems (Nikulainen et al., 2011). The embedded systems and related services have provided strong growth opportunities for several IT services companies like Tieto, Digia and Ixonos in 2000s (Market-Visio, 2006, company reports). The traditional IT market in turn has become mature in the Nordic countries (Andersen, 2010). As a result the IT market growth approximates the GDP growth.

Like the IT enterprise space also the customer space and separate market segments are continuously impacted by changes reshaping their structures and redrawing their borders. One example of these changes is the growing number of customers outside Finland. This, in turn, emphasizes the importance of dividing the IT market into domestic and international markets.

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[13] In this study development of banking services are included in user services whereas development of communication networks infrastructure and related maintenance are considered embedded services and belong to services provided for applier market.

**Table 7. Major customer segments of the Finnish IT market**

| Customer/ market segment | What is purchased? | Comments |
|---|---|---|
| User market | Products and services used to develop or operate the customers business and other operations<br>IT used to improve internal productivity and customer services<br>BPO services including IT offerings | Typical buyers IT departments and other organizations responsible for IT systems<br>Purchases largely funded by IT budgets<br>Purchases describe the user spending<br>Internal IT expenditures not included in IT market figures<br>Maturing market (e.g. Andersen, 2010) |
| Applier market | IT is an enabler<br>Products, services and related knowledge used in the customer's products or services offered to the customer's own customers (e.g., embedded software, software components, R&D, maintenance and outsourcing services) | Customers from various manufacturing industries and telecommunication services<br>Funded mainly from other than IT budgets (e.g. R&D and production functions)<br>Cost of IT in the price of end product or service<br>Strong growth in the 2000s<br>Strong internal activities (e.g. Nikulainen et al., 2011) |
| Vendor market (IT firms) | IT products and services purchases for own IT offerings (software components, subcontracting of IT services etc.) | Both domestic and global purchases, e.g. services from low-cost economies<br>Typically reported as external purchases in financial reports of IT firms<br>Intermediate outputs in the statistics of national accounts |

A notable phenomenon affecting customer behavior is that a firm may at the same time be a user and an applier customer. Some customers may even belong to both the IT enterprise and the customer space reflecting the increasing complexity of relationships between IT vendors and their customers.

### 8.1.2 Changing Needs and Requirements of Large Customers

From the early days of IT the Finnish IT the sector has been characterized by a strong role of few large customers in the market and hence a strong dependence of the IT firms on few large customers both at industry and single firm level. This leads to the fact that many IT firms have been and still are vulnerable to change caused by a single large customer. Earlier examples of this vulnerability are from the finance sector, recently changes in Nokia have had a significant effect on the evolution of the whole Finnish IT sector.

Especially in the 2000s the changing needs, new business models and buying behavior of the leading, internationalized (transnational) customer enterprises have largely driven the

evolution of the whole Finnish IT sector. Therefore consequences of major trends like globalization, internationalization, concentration and efforts to increase productivity are here discussed from the perspective of large IT customers. The trends mentioned above have separately and jointly strongly impacted and changed the business environment of the large Finnish IT customers, they have also had a strong impact the demand and growth of the Finnish IT sector in the 2000s.

The efforts of large IT customers to respond to the manifold changes in their business environment have led to many notable new developments. One manifestation of the changes in customer behavior in the globalizing market is outsourcing operation and management of various IT functions and infrastructures. To the Finnish software products and IT services providers outsourcing has meant that a growing share of services needed by their large customers is produced outside Finland (Market-Visio, 2007, 2008b). This, in turn, has created a new market challenge to the Finnish IT firms (e.g. Lilius and Vuorinen, 2003; Market-Visio, 2007, 2008b).

The global harmonization, standardization and improvement of both business processes and IT environments like software applications and IT infrastructures have resulted in major efforts to develop large IT systems (e.g. global ERP systems of several large manufacturing companies) requiring various IT services. From the IT firms' point of view also this has meant new competition when the number of software products used has declined and new, often lower-cost competitor have been able to enter the market.

Also the purchasing patterns of large customers have changed; centralized purchasing of IT products and services has become common (e.g. Lilius and Vuorinen, 2003). During the last few years also public sector customers have more and more adopted the centralized model in organizing both their IT functions and IT purchases.

At the same time, however, IT firms as well as their customers have moved to unbundle their functions and processes or even single tasks between different locations and countries (Sako, 2005, 2008; Baldwin, 2006). Baldwin (2006) describes this evolution as the second unbundling.

Many of these trends, strengthened by increasing tradability (Grossmann and Rossi-Hansberg, 2006) of services, have both speeded up and forced the efforts of also the Finnish IT firms to become more international in order to serve their customers. To secure their future a growing number of IT firms have also expanded beyond their traditional market.

Especially the applier market has offered new possibilities in the 2000s as a result of Nokia's activity on the embedded software and research and development services. At the same time, however, new competition has emerged: the traditional user market attracts increasingly also other than traditional IT firms.

Finally, while extensive global IT projects (e.g. ERP applications) and large outsourcing contracts have become common, also the evolution of the Finnish IT vendor field has felt

new pressures in the 2000s[14]. Among enterprises having signed large global outsourcing contracts with global IT services vendors are e.g. Nokia, Kone and Wärtsilä.

The interviews of business executives of major Finnish IT companies and other large organizations conducted by Market-Visio in 2005-2008, strongly support the assumption that the trends changing the behavior of large IT customers discussed above apply also to the Finnish IT sector. In addition, the executives emphasize that a better identification of current and future needs, expectations and customer behavior is one of their central business challenges. Figure 9 has been constructed on the basis of these interviews to summarize the major trends and changes in business needs and their impacts on the IT sector.

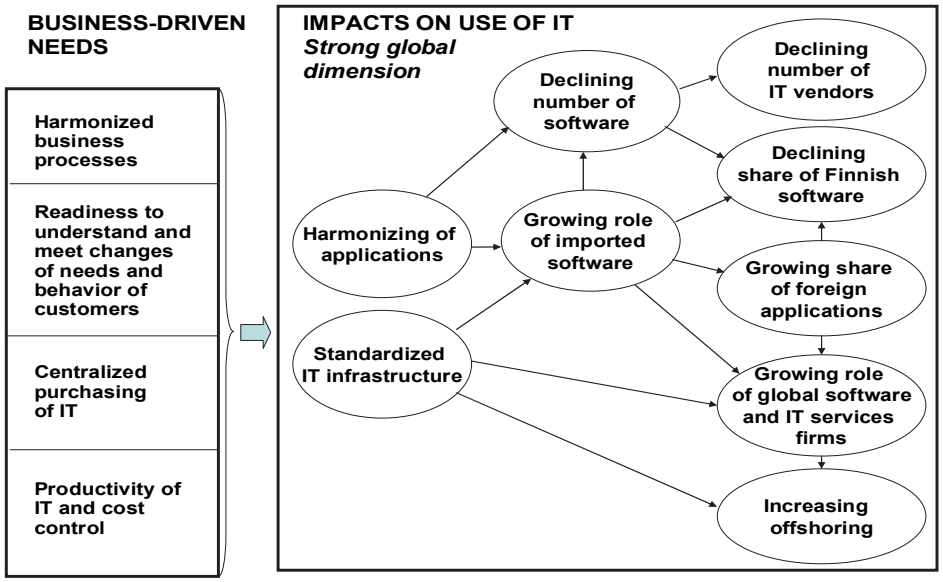



Figure is based on interviews of business executives of 25 major Finnish (customer) enterprises and large organizations in 2005-2008, Market-Visio, 2008

**Figure 9. Business-driven needs and impacts on use of IT**

Table 8 on the next page, based on interviews, reinforces these trends and changes considering also impacts on IT purchasing and vendor selections. Many of these developments started to strengthen since the year 2005.

Sako (2005) has analyzed the causes and consequences of different types of outsourcing for corporate restructuring. She argues that the rise of the shareholder value in corporate

[14] In this study, moving activities to another company is outsourcing. Offshoring, in turn, means moving activities abroad either to the company's own foreign subsidiary or another company (see. e.g. Sako, 2008).

governance has had a strong role in promoting corporate restructuring which in turn has resulted also to the growth of outsourcing since the late 1990s. She emphasizes ICT's role as the enabler of real economies of scale in services. Large outsourcing deals on the other hand make it possible for global companies seeking cost reductions and improvement in return on investment to reduce head count and at the same time shift their own cost centers to other companies to be managed as profit centers. According to Sako this development has been seen mainly in the Anglo-American world.

**Table 8. Changes in customers' business environment and their impacts**

| Changes of customers' business environment and needs | Impacts on use of IT | Impacts on purchasing and vendor selections |
|---|---|---|
| Internationalization of businesses (globalization, cf. e.g. Baldwin, 2006) | Growing part of IT purchases outside Finland | Strengthening role of international/global IT vendors<br>Growth of offshore services<br>Growing role of vendors from lower-cost countries |
| Changing nature of customer needs and behavior, decreasing importance of technology (cf. Jacobides and Winter, 2005) | Availability of different alternatives to fill customer needs (substitutes)<br>Other than IT products or IT services | Growing role of other than IT firms in competition<br>Increasing competition from other than IT industries |
| Improving and rationalization of operations and functions<br>Cost savings | Standardization and harmonization of systems and infrastructure<br>Decreasing of number of software<br>Growing potential for outsourcing | Strengthening role of large IT fims<br>Growth of offshore services<br>Growing role of vendors from lower-cost countries |
| Finnish firms acquired by foreign companies (both IT firms and customers) | Transferring of decision making and IT purchases outside Finland<br>Challenges of daughter company economy | Weakening position of Finnish vendors<br>Strengthening role of international/global IT vendors |
| From products to services, growing share of spending on services | Less own investment<br>From fixed to variable costs; Increase in outsourcing<br>Growing potential for cloud computing services<br>Growing demand for business process services | Expanding vendor field<br>Emergence of new competitors<br>Growth of global service offerings<br>Purchases increasingly outside IT function |

Source: Constructed on basis of interviews of executives, Lilius and Vuorinen, 2003; Lilius and Sipola, 2006

Sako considers mainly outsourcing of business services, but the same reasons are to be seen also in IT outsourcing. Finland has been in the front line among European countries in adopting outsourcing as a means to increase IT effectiveness and cut its costs (e.g. Market-Visio, 2007, 2008b).

### 8.1.3 Changes Affecting IT Demand in Finland

As discussed above the growth of IT spending has slowed down close to the growth of GDP in Finland during the 2000s (Market-Visio, 2010; Andersen, 2010). Globalization of

Finnish companies is one of the main reasons behind the slowing growth and its effects to the Finnish IT demand come from several directions. Globalization increases production and employment abroad which tends to increase software and services purchases outside Finland by both user and applier customers. Part of software products and services are exported from Finland, but a growing proportion of e.g. IT services are produced abroad, increasingly in lower-cost economies (e.g. Market-Visio, 2007, 2008b; Rikama, 2007).

Foreign companies have an important role in the Finnish economy. In several industries they are significant employers and tax payers. Major acquisitions of Finnish companies by foreign enterprises are the other side of globalization, having an impact also on the Finnish IT demand.

In the 2000s several large Finnish companies with a significant role in the Finnish IT market have moved to foreign ownership. The most prominent examples are from the banking and telecom industries (Nordea, Sampo Pankki, Sonera). Ownership change has led to moving many IT related decisions and a significant share of IT purchases and development, maintenance and managing of IT systems from Finland to other countries. All these changes have transferred also part of the former IT spending out of Finland.

Banking and telecom sectors have been major drivers of the Finnish IT market and early adopters and innovators in the Finnish IT sector. Now, due to major acquisitions by foreign companies, their significance has decreased. This can be seen when considering the outsourcing contracts which these firms have signed after acquisitions. However, exact information of the impact of these acquisitions is not available.

Similar influences of major structural changes can be seen in many other industries in Finland. The size and importance of the Nokia cluster have diminished considerably through Nokia's and other companies' decisions to transfer production from Finland. Same type of development applies also to the forest industry.

The IT expenditures (end user spending) of internationalized Finnish enterprises have increased faster abroad than in Finland in the 2000s (Market-Visio, 2008a). In 2008, about 80 percent of all IT costs was decided in Finland but a half was used outside Finland. These developments were seen in also in a globalization survey conducted by Lilius and Vuorinen (2003).

Manufacturing companies account of the majority of the IT spending outside Finland. In the last few years, however, also the internationalization of other industries has increased IT spending outside Finland (Market-Visio, 2007). The same trend is to be seen also in the applier market. Significant share of embedded software is developed outside Finland (Nikulainen et al., 2011).

Technology industries form the largest manufacturing industry sector in Finland. In 2009, a good half of their employees (about 280 000 persons) worked outside Finland (Federation of Finnish Technology Industries, 2010). At the same time, the manufacturing industries accounted for one fifth of the Finnish IT market (Market-Visio,

2010). On the basis of these figures it can be estimated that foreign subsidiaries and offices of Finnish firms spent on external IT expenditures about half a billion euro in 2008. It is roughly one tenth of the value of the Finnish IT market.

In the private sector, the opening international markets and later globalization brought pressures already in the 1990s and 2000s. Now the same pressures are expected to impact also on IT spending in the public sector and lead to concentration of IT activities as well as reductions in the number of both applications and IT vendors.

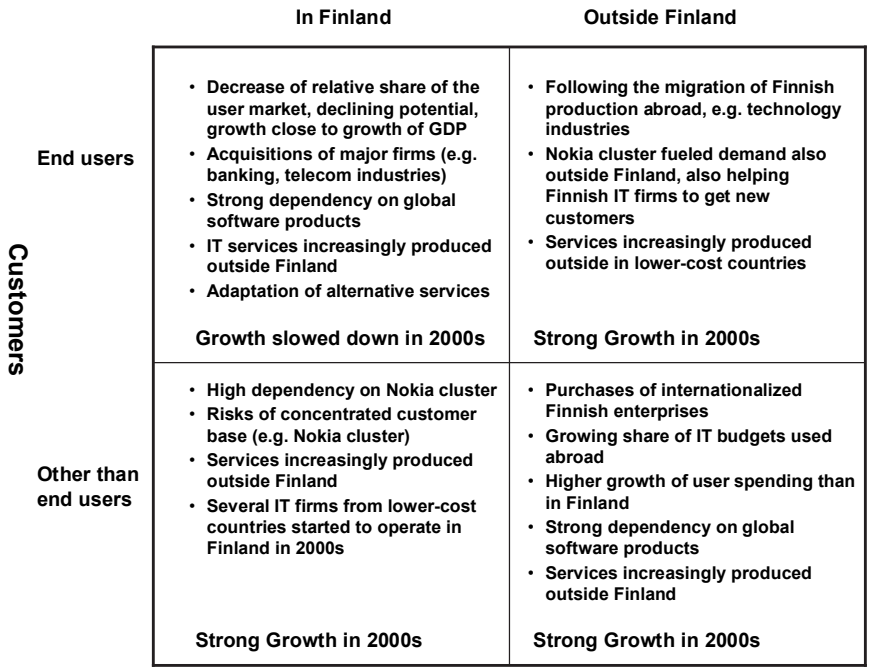
This trend is to be seen both at state and local government levels (e.g. Kieku project of State Treasure, investments to ERP applications in large cities). Recently also the public sector has increased purchases of IT services from lower-cost countries (Market-Visio, 2007, 2008b). This evolution has a great significance to the Finnish IT sector, since the combined IT spending of manufacturing industries and the public sector comprise about 40 percent of the Finnish IT market (Market-Visio, 2006b).

Another factor affecting the growth of the Finnish IT demand is the diminishing role of technology in purchasing software products or IT services. More and more customers look for options answering to their needs instead of buying a particular technology or IT solution (cf. Moschella, 2003; Jacobides and Winter, 2005; Carr, 2008, 2010). This creates opportunities for alternatives and substitutes and new players from the outside of the traditional IT vendor field (cf. Sako, 2006). For instance, several BPO services providers offer substitutes for horizontal application software products (e.g. finance and accounting, human resources software).

All these developments have influence on the growth potential of the Finnish IT user market and on the evolution of the IT vendor field and competition. Foreign-owned software and IT services firms have strengthened their foothold in the Finnish market in the 2000s (cf. Market-Visio, 2007). At the same time, more Finnish subsidiaries of foreign IT firms have become sales offices and their decision making has moved outside Finland. This change can also be seen in their reporting practices about their Finnish operations. In addition, a growing share of services is produced in global production and development centers outside Finland. Few foreign IT firms have significant own research and development activities in Finland any more.[15]

Figure 10 on the next page summarizes developments affecting the IT demand of end user and other customers in Finland and outside Finland.

[15] This can be seen in examining of the major firms included in the top 100 vendor database and company information.




Sources: Combined from different sources: Lilius and Vuorinen, 2003; Interviews of executives 2005-2008; Market-Visio, 2007; Andersen, 2010

**Figure 10. Effects of market developments on IT demand in Finland and abroad**

In the last couple of years some global IT firms (e.g. Capgemini, Google, HP) have established or extended their data center activities in Finland. However, accurate information of the sales or other volumes of data centers is difficult to get, because the owners and customers of the centers are mainly outside Finland.

## *8.2 Changes Influencing IT Supply and Businesses Environment*

This chapter takes a closer look at changes in the offerings (supply) and businesses in the IT vendor side of the IT sector.

Traditionally firms seek growth by targeting new markets and customers or by expanding or changing their offerings. During the 2000s three important trends have influenced the evolution of the Finnish IT industries: the transition from products to services, expanding services beyond traditional market segments and the growing role of substitutes. These trends have been fueled by global developments. Sometimes change has been a condition to survive in the industry.

Especially the large vendors have felt the pressure to adjust to the lower-cost competition by developing their own global and offshore strategies. Smaller vendors, in turn, often attempt to rely on specialization and utilization of vendor networks or ecosystems. Many vendors have sought for international presence via exports or by establishing themselves abroad following their old clients or seeking new customers.

### 8.2.1 Migration from Products to Services

The trend to migrate from products to services has been very strong among major IT hardware companies during the last ten, fifteen years. The transition reflects the renewed strategies of IT firms driven by vertical disintegration at firm and industry levels (e.g. Grove, 1996) and the growth of outsourcing since the late 1990s. Since the early 2000s the Internet has continued to boost the use of services (e.g. Carr, 2008, 2010).

In the early 1990s IBM decided to transform and become a service company (Gerstner, 2002). In 2008 more than half of its revenue came from services (IBM Annual Report, 2009). During the last few years several major IT hardware manufacturers have followed the suite and increased their foothold in IT services by large acquisitions (HP acquired EDS, Dell acquired Perot Systems, Xerox the BPO services firm Affiliated Computer Services). Fujitsu Services, one of the leading IT services vendors in Finland, has a strong background as a hardware manufacturer[16].

Seeking growth from services has become increasingly important also in the strategies of major product companies in various Finnish manufacturing industries (Penttinen, 2007). This transition is in large extent enabled by ICT, providing business opportunities also for IT vendors. Kowalkowski (2008) has studied the services of Swedish manufacturing industries focusing on managing service offerings and the role of information technology as enabler in new offerings.

Rönkkö et al. (2010) argue that the Finnish software firms have moved slightly towards services during last couple of years. When looking at the development in longer term, e.g. during last ten years the migration trend proves to be rather strong. For instance, several large and mid-size vendors have migrated totally services (e.g. Affecto) or have increased the share of services (e.g. Tieto, Dovre or former Proha) in the 2000s.

For IT vendors the migration from products to services can be seen as a natural means to expand or even survive in the strong new competition. Sometimes the existing installed base of software products may be a good basis for transition to services, based on backwards integration (Cusumano et al., 2006). Sometimes investment in new products may be too high or risky (see Hoch et al., 2000).

[16] ICL Data (today Fujitsu) decided to invest in Patja outsourcing model in Finland in 1997. At the same time SAP started to expand in Finland and gradually resulted in a strong network of IT firms providing professional and outsourcing services.

One of the major factors which has reshaped the Finnish software and IT services industries during the last ten years is the rapidly expanding adaptation of international application software products, such as SAP and Microsoft (e.g. Market-Visio, 2006c; Uljas). Their increasing use in both private and public sectors have weakened the competitive position of numerous Finnish software products and vendors and forced many firms to partly or entirely change into service providers. Some have become hybrid firms (Cusumano, 2004) which produce both software products and services.

The migration from products to services has brought about another change in the business environment of Finnish IT firms. Numerous IT services firms get a major part of their revenue from services provided for international software products. At the same time this development has strengthened the position of global IT services vendors in the Finnish market. Universal knowledge related to these products also enables the utilization of international expertise centers and networks of experts and drive increasing the use of offshore services in lower cost countries (e.g. Market-Visio, 2007, 2008b).

Several market research companies (e.g. Gartner, IDC) expect that an increasing share of software license and hardware purchases will be replaced by services. This evolution will be fueled by cloud computing services (e.g. Software as a service, SaaS and storage or server capacity as a service) based on using the Internet and capacity and services provided from centers located around the world[17]. This evolution will influence the offerings and often also business models of both software product and IT services firms. At the same time, a growing number of new services will be launched and new vendors from other than IT industries are expected to enter the Finnish market.

For software firms the migration to services may base on different business strategies and approaches, including changes in distribution of their own products (e.g. SaaS, Software as a service), changes in the role and revenue shares of own products and services and an attempt to obtain a larger share of the value chain of the customers. Migrating to business process services, e.g. business process outsourcing (BPO) services often requires an expansion beyond the company's traditional marketplace. BPO services are discussed in more detail in Chapter 8.2.2.

In the public debate and among some scholars cloud computing and especially the SaaS services are seen as a remarkable opportunity for Finnish software product firms to expand their customer base and markets also globally (e.g. Rönkkö et al., 2009; 2010).

[17] According to IDC the global value of different cloud computing sales will reach a good 40 billion dollars in 2012.

Table 9 summarizes different alternatives and routes to migrate from software products to services.

**Table 9. Different routes to migrate from software products to services**

| Direction to change or expansion | New offerings | Impacts on IT firms or IT industries |
|---|---|---|
| Software as a service, cloud computing services | Delivering own software over the Internet<br>New distribution channel for several software product firms<br>New distribution model may be related to new business models | More cost effective way to reach new clients<br>No necessary (growth) impacts on total revenues or market values<br>Business opportunities also for IT services firms (e.g. service infrastructure, integration services)<br>New types of competitors, also from other than IT industries<br>Increasing global competition<br>Declining value of license sales<br>Possible decrease in sales of other services<br>Entry of new ecosystems |
| Migrating partly from own products to services for other vendors | Expanding service offerings related to own products<br>Providing services for third-party software products | Increasing share of total revenues derived of services<br>Transition to a hybrid company (c.f. Cusumano, 2004) |
| Transformation into pure service vendor | Services for software products of other vendors<br>Infrastructure services | No own software products<br>May result in dependency on software product firms |
| Covering larger share of customer's value chains | Managing customer's business processes<br>Business process outsourcing services to cover various functions | Expansion beyond software product business<br>Competition with IT services vendors and non-IT BPO services vendors<br>Customers often non-IT organizations |

The PC wave brought a major transition from vertical to horizontal integration in the 1980s (e.g. Grove, 1996). Now the growth of cloud computing and BPO services and the service providers' attempt to cover larger shares of the value chains of customers can be seen as indicators of an effort to strengthen a type of vertical integration.

For instance, the acquisition of Sun Microsystems by Oracle represents this trend. Also some acquisitions by IBM and HP have characteristics referring to migration to more vertically integrated businesses. Both have expanded to services and acquired also several software firms producing infrastructure or application tools software. Both are also investing heavily in cloud computing related services (see company reports).

Migrating from products to services is not, however, always easy. Several product firms have experienced the transformation to service company to be much more than straightforward. An example much referred to is IBM (Hoch et al., 2000; Gerstner, 2002; Cusumano, 2004). In 2011 Nokia had to announce to join the same group.

### 8.2.2 Expanding Beyond Traditional IT Market

One way to change is to expand beyond the traditional IT market where an IT company can find new opportunities to utilize its existing skills and strengths. It is also possible to create new markets and change existing industry borders (Hamel, 2000, Kim and Mauborgne, 2005, Jacobides et al., 2006). Expansion beyond traditional IT services has been triggered by several trends.

One of them is the declining demand for traditional IT services as well as changes in competition in the software market. These changes have forced IT firms to seek new sources for growth. Simultaneously, corporate strategies have promoted outsourcing of corporate functions like finance and accounting, human resources, sales and marketing, purchasing and supply as well as research and development (cf. Sako, 2006). Vertical disintegration developments in manufacturing industries, in turn, have rapidly increased the demand for embedded systems produced by external vendors in the 2000s (see e.g. the annual reports of Tieto, Digia and Ixonos).

Depending on the role of IT or the customer, the expansion beyond the traditional IT market can be divided into two main categories. The first consists of services helping to develop, run or manage the customers' business operations and processes and cover a larger part of their value chains compared to the existing products or services of the IT firm. These services include various business services, e.g. business consulting and BPO services (e.g. Sako, 2006). These services already have close relationships with traditional IT services they nevertheless can require wider knowledge of the customer's businesses and functions. The clients are often more or less same as the users (often also buyers) of the traditional IT. Some of the new services may also be substitutes for traditional IT services or products and may compete of the same budgets. Many business consulting or BPO services providers come from outside the traditional IT industries.

The second new category consists of services provided to applier customers who use information technology as a part of their products or services sold to their own customers. Existing IT expertise like programming skills often forms the basis for these services. Major examples of services in this market are planning or developing embedded systems for various industries. The customers of these services use IT as an enabler and represent different business functions as the traditional user customers.

As discussed earlier the BPO services often enable IT services. At the same time they can be competitors for both software product and IT services companies. Applier customers using IT in their products, in turn, are typically only customers not competitors.

In various industries IT has a key role in business development. As a result, it is increasingly difficult to define the borderline between IT consulting and business consulting. Several business consulting firms (e.g. Deloitte, KPMG) have obtained strong positions as vendors of traditional IT services, such as systems integration and outsourcing services. On the other hand, for decades several IT services vendors (e.g. Capgemini) have included business consulting services in their offering and IT vendors

have strengthened their business consulting services by acquisitions (e.g. IBM acquired PWC).

Since the early days of IT industries services for operating business processes, such as payroll, finance and accounting services, as well as printing services have been included in data center services. Today, some of these services are provided also as cloud computing services. Some market research firms (e.g. Gartner) expect high potential for cloud computing in providing business services (BpaaS services) that expands also business process outsourcing (BPO) services offerings for new customer segments.

In the 2000s several IT services firms have expanded further to offering business processes outsourcing (BPO) and captured larger shares of the value chains of these business processes (e.g. Tieto, Logica, Enfo etc.). At the same time, many global players (Accenture, Capgemini, IBM) have increased their efforts to offer BPO services produced in international service centers also to globally operating Finnish enterprises.

Figure 11 describes directions for expansion beyond traditional IT services.

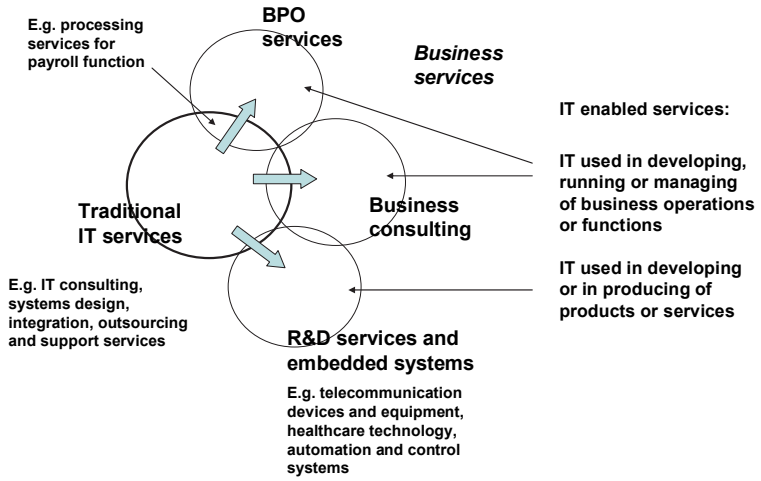



**Figure 11. Expanding beyond traditional IT services, current and potential markets**

During the last few years also some software product firms have expanded to BPO services, typically focusing on services related to their former application areas.[18] However, this expansion often requires expanding also knowledge and skills of the firm

[18] For example, Aditro provides BPO services for HR, payroll and financing and accounting, Visma provides outsourcing services for financial administration and Basware software and services for financial process automation. F-Secure has acquired a firm that produces storage services.

e.g. also by acquisitions. These activities can also be seen as defensive actions against the new competition in BPO services.

A survey of the BPO plans of large Finnish organizations showed, that Finnish companies have proceeded rather slowly in outsourcing their processes abroad (Lilius and Sipola, 2006). According to the survey the firms typically commence by streamlining their processes and then, in some cases, proceed to establishing shared services centers. Streamlined processes and shared services centers, in their part, create a good potential for outsourcing (cf. also Sako, 2006).

Development of embedded systems and industry automation has a long history in Finland. In this field manufacturers or their captive firms (e.g. Metso Automation) have traditionally been active, whereas the role of traditional IT services firms has been rather limited until the 2000s. The fast growth in the production of communication equipment (Nokia cluster), however, resulted in a strong demand for external IT services, such as research and development services, producing embedded software as well as related maintenance and outsourcing services. At the same time telecom operators became important customers for similar types of services. Despite increasing role of external services vendors significant part of embedded software is still produced internally (Nikulainen et al., 2011).

In consequence of these developments the importance of the applier market has increased drastically being vitally important for the growth of several Finnish IT services firms in the 2000s. Also software product companies have benefited from this development but to much less extent than IT services providers. At the same time, Nokia has attracted to Finland international or global IT services companies not otherwise likely to be as interested in the Finnish market. Some of them have entered the Finnish market through acquisitions and mergers (e.g. Wipro, Sasken and Cybercom).

However, in the 2000s the IT services vendors provided embedded systems and research and development services mainly for telecom equipment manufacturers and telecom operators. Even if the role of information technology is critical or at least increasingly important also in products and services of various manufacturing industries, the role of these industries as buyers of embedded software and other IT services has so far been rather limited (Nikulainen et al., 2011).

There is no single reason why the other manufacturing industries do not purchase external IT services in the same extent as telecom equipment manufacturers. Explanations vary from IT vendors' passive marketing to dependence on captive units of manufacturers. One explanation is that the vendors have so far concentrated on grasping the global opportunities opened by the telecom related industries.

A noteworthy result of this change is that 'the Nokia card' helped several Finnish IT services firms to succeed also in becoming service providers to other global manufacturers and telecom services vendors than Nokia. Many new customers are competitors of Nokia.

Converging of IT services and telecom services is often mentioned as a "classic" example of blurring industry boundaries. Several Finnish telecom operators have actively expanded into traditional IT services market and also acquired smaller vendors providing infrastructure services, including cloud computing related services. Sonera was one the main shareholders on Tieto during 1998–2001, but was not able to benefit from this ownership. Instead, the Norwegian operator Telenor has achieved a strong foothold in the Nordic IT services market via its daughter company Evry, the largest IT services company in Norway (see company reports). IT services firms have only limited activities for competing with telecom operators in their conventional markets. Instead, operators create an important customer segment for them.

There is a high number of software product firms specialized in telecommunication technology related software products. So far, however, their role in the applier market has been smaller than that of IT services firms. In expanding beyond their traditional markets the IT services firms have often been more prepared to adapt to new services requirements than software product companies which often need also totally new skills in the transition. This was seen in 2011 when Nokia's new strategy and related lay-offs had only limited immediate impacts on software product firms compared to IT services vendors (Rönkkö et al., 2011).

New services platforms and ecosystems, in turn, form an important route for different and also for small software product firms to expand their new markets and customer base. Often the question is not of expanding beyond their existing industry but of utilizing new platforms provided by other industries.

### 8.2.3 Variety of Substitutes

Because different substitutes have gained more importance in the IT market and brought fundamental changes to the marketplace, their role is considered here separately. By expanding beyond their traditional services and customer segments also IT companies present more alternatives to their customers.

Industrial economists define industry as a group of companies producing products and services which are close substitutes and serve a common group of buyer (e.g. Porter, 1980; Utterback and Suarez, 1993). This concept, based on the production side of industries, direct competition and limited range of products or services, is often applied also in other contexts, e.g. in public statistics and market research.

A more customer oriented, flexible and widely applicable definition considers industries as groupings of firms satisfying a certain type of customer need (Jacobides and Winter, 2005). According to this view all firms fulfilling certain customer needs belong to the same industry despite their official classification.

This view expands the conventional content of substitutes. From the customer point of view substitutes may consist of a substantially wider selection of options and alternatives than conventionally understood. The deciding factor is the substitute's ability to fill the

customer need. This thinking shakes the foundations of the conventional, static definition of an industry and requires more flexible industry definitions.

In considering substitutes in the IT industries the question is often about migration from software products to services. However, also traditional IT services meet increasing competition from other kinds of services. Some new substitutes are based on new business models and earning logics and may come from different industries.

Since the new substitutes of a product or service can come from industries not active in the field before, the strengthening role of substitutes dilutes the importance or usefulness of traditional industry views.

An example related to IT industries illuminated the situation from the IT firm's point of view: A customer is renewing an IT application and related processes presently based on the firm's own software and in-house processes. Now there is a wide range of alternatives which meet the customer's requirements. The offerings vary from fully corresponding software products to different types of services (e.g. traditional data center-based payroll services or outsourcing services, cloud computing services like SaaS or BpaaS). Some are close substitutes (cf. industrial economists), some differ greatly from the existing systems but fill the requirements. The alternatives may also differ by coverage. Some cover the same activities as the old system, others are more extensive. The service provider can be either a software product or IT services firm or come from other industry and be, for instance, a business services firm specializing in business process outsourcing (BPO) services.

In recent years customers have increasingly moved also from separate applications to applications covering wider functions or towards using different services resulting in fewer applications. This has hurt Finnish software firms and favored international applications or use of IT services firms. This trend can be seen in outsourcing contracts which often include a decrease in the number of software products or even in some recent application purchases of the state government and large cities. The public sector has traditionally used numerous separate applications produced also by smaller Finnish software houses (cf. Rönkkö et al., 2010).

A growing number of substitutes to conventional software products and IT services are provided by other than IT companies or other services firms. Companies from different industries provide their customers free services which earlier have required own software or use of external IT or other services. This development, fueled by the Internet, is to be seen e.g. as an increase in many free reservation services. Another example are free payroll services targeted to small enterprises.

In traditional competition, identifying the rivalry is usually not difficult. With the increasing amount of substitutes, also competition becomes more complicated. New rivals are not always easy to identify. They can use entirely new business models or practices which challenge the traditional market players. In addition new substitutes are increasingly based on global offerings.

### 8.2.4 Impacts on IT Market and Spending

Migration from products to services, expansion beyond the traditional IT market and new substitutes have profound impacts on the IT market, IT spending and related indicators.

When the role and competitiveness of IT-enabled services (e.g. SaaS and BPO services) increases in the expense of the traditional IT services and software products, a number of noteworthy changes are to be seen, affecting both the customers and the evolution of the IT market.

One effect is the possible transfer of IT related decision-making away from the IT function and IT costs from IT budgets to other budgets. This changes the roles and decision making in the customer firms. For instance, SaaS or BPO services are often funded from other pockets than the IT budget, which changes the operations of IT departments. A side effect is related to estimating the value of IT spending; it becomes more difficult because an indicator like IT spending describes less accurately the utilization of information technology. Even if the direct IT costs decrease, the total cost of IT may not change at all. (Lilius and Sipola, 2006, Interviews of executives, 2005-2008).

From the vendor point of view an important effect of the ongoing migration to services is the expansion of customer interface. The customers of IT firms no longer are the IT departments alone but come increasingly from different business functions of customer firms. These include functions responsible for business development and operation of business processes, as well as organizations and decision makers representing production or research and development functions (appliers).

This development increases the blurring of industry boundaries and brings new competition to IT firms. The new competitors often are traditional providers of various functional services from other industries than IT. For instance, in the BPO market the new competition comes from other business service industries (e.g. Sako, 2006).

When software products are replaced by services the focus of the customer's decision making shifts. Traditionally purchasing a software license requires significant activity from the buyer in choosing the right alternative from a number of options. Usually the customer also needs software related services and has to take responsibility for running and managing the software if it is not outsourced. When the customer purchases the software as a service (SaaS), the product itself or its brand may get less attention. In the case of a BPO service purchase the importance of the software product used in the service may remain entirely insignificant and invisible for the customer.

The decreasing visibility of software products behind the services, sometimes also of IT services, often also makes it more irrelevant and difficult to know where the services are produced. Instead, important selection criteria are the service's ability to fulfill the customer's needs and the reliability of the service. As a result, the commodity nature of software and services is strengthened (e.g. Carr, 2008, 2010).

Figure 12 shows changing roles of customers and applications in buying software license or different services.

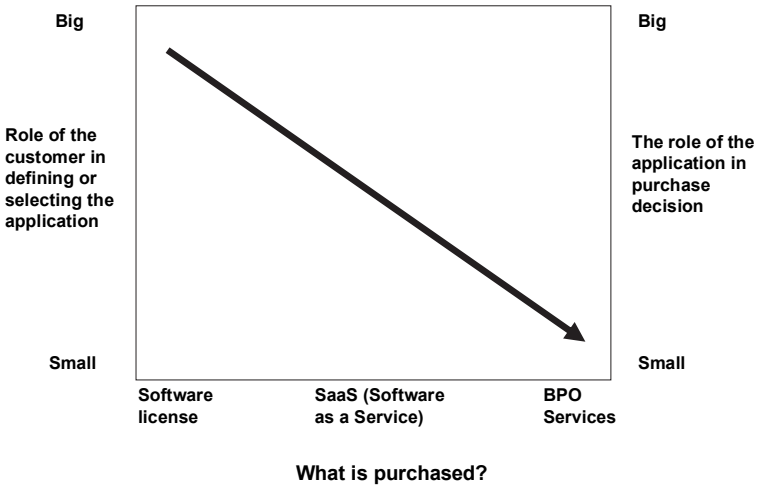



**Figure 12. Changing roles of customers and applications**

Migrating from products to services does not necessarily increase the total volume of the IT market. Instead, it reshapes the industry structure and competitive field. For example, the cloud computing services decrease the share of license sales in the total software purchases (e.g. IDC, 2010). Simultaneously cloud computing and BPO services can also reduce spending on existing external IT services. Also the number of applications used in user organizations may decline.

In all, the migration from software products to services can be seen as a back to basics development. It is good to remember that in the 1960s and 1970s, for instance, a considerable part of payroll, finance and accounting processes was conducted in data centers.

# 9 Total Volumes and Structure of Finnish IT Industries

The empirical part of this study aims at deepening the understanding of the Finnish IT sector and its two major industry categories, software products and IT services. One of the basic assumptions of the study is that to accomplish this it is necessary to examine both the supply and market (use, demand) sides of the sector. Relying solely on the available public information it is, however, impossible to form this type of coherent picture.

Therefore Chapter 9 concretizes and extends "the big picture" of the Finnish IT sector by analyzing the structure and volumes of the sector with the help of the frameworks constructed for this study and by combining and comparing information from different sources. In this way it is possible to illuminate and reduce problems connected to deficiencies in the public information available. As a new source of information a database of the top 100 IT vendors is used.

The analysis moves from the volumes of the IT sector level to a detailed consideration of the focus areas, software product and IT services industries. The analysis is based on definitions discussed earlier in Chapter 3. The operational framework presented in Figure 7 in Chapter 7.4 has been applied. The framework shows the structure and volume concepts of the IT sector and their relationships. Here the framework is extended to encompass also Finnish IT production and IT purchases outside Finland.

However, the study focuses on the Finnish IT supply (imports and production) and demand (use, market). IT purchases by Finnish user and applier firms (user spending and purchases of appliers) abroad as well as IT production of Finnish IT firms outside Finland are considered in context only when they have direct links to the Finnish IT sector.

The framework presented in Figure 13 is an extended view to the total volumes of the Finnish IT industries. It encompasses both the market and supply perspective and includes also Finnish IT production and IT purchases outside Finland into the total supply. These extensions help further demonstrate the problems caused by differences in definitions of same concepts in different contexts.

These considerations are discussed in Chapters 9.1–9.3 using the framework described above to analyze and evaluate the information provided by different sources of the size and structure of the Finnish IT industries and in detail the software products and IT services industries.

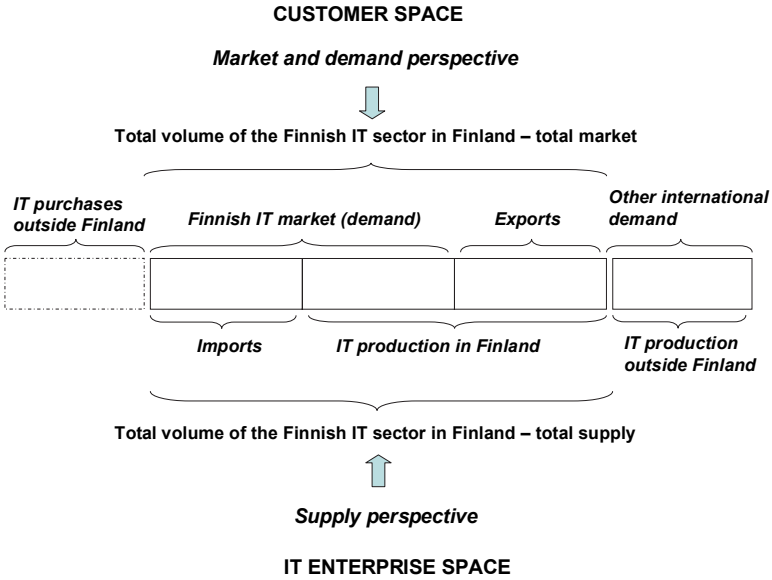



**Figure 13. Total volumes of supply and demand of the Finnish software product and IT services industries, an extended view**

## 9.1 Supply Side of Finnish IT Sector

To put the Finnish software product and IT services industries into a wider perspective the framework presented above and different sources of information are used to analyze the supply side of the whole Finnish ICT sector.

During the past twenty years, concepts like ICT sector and ICT cluster (cf. e.g. Hernesniemi, ed., 2010; Paija, 2000) have been widely used in country-level comparisons. Economists, other researches and international organizations like OECD or the EU usually base their analysis on information produced by Statistics Finland.

Table 10 and figure 14 include the Statistics Finland information of revenues and employment of the Finnish ITC sector from the late 1990s to the year of 2008. The table and figure cover only the total production and separately production of ICT goods and IT services. The production of ICT goods consists mainly of manufacturing of telecommunication equipment (Nokia cluster). Most IT hardware like computers and peripherals used in Finland are imported.

In the following, the IT services category of the ICT sector comprises both software products and IT services based on the TOL 2002 industry classification (category 72)[19].

[19] The data is not consistent with the presently used TOL 2008 classifications.

Since the late 1990s manufacturing of telecommunications equipment has been the core of the Finnish ICT cluster despite the fact that the decline of subcontracting and Nokia's own streamlining have continuously diminished the relative share of the telecommunications industry and the whole ICT goods production, also since 2008 (Statistics Finland; Nikulainen and Rouvinen, 2012). By the size of the ICT cluster Finland has been among the leading ICT countries in Europe in the 2000s (cf. Hernesniemi, ed., 2010).

The number of ICT employees reveals remarkable structural changes in the sector. The compound average growth rate (GAGR) of the number of employees was a good 4 percent from 2000 until 2008 whereas in goods production the growth was negative. Software and services industries have been able to compensate the decrease of production related jobs in the Nokia cluster. One interdependency explains part of the development in employment: the firms representing the goods production are important customers of software and IT services industries in Finland and abroad.

**Table 10. Total volumes of the Finnish ICT sector in 1997, 2000, 2007 and 2008**

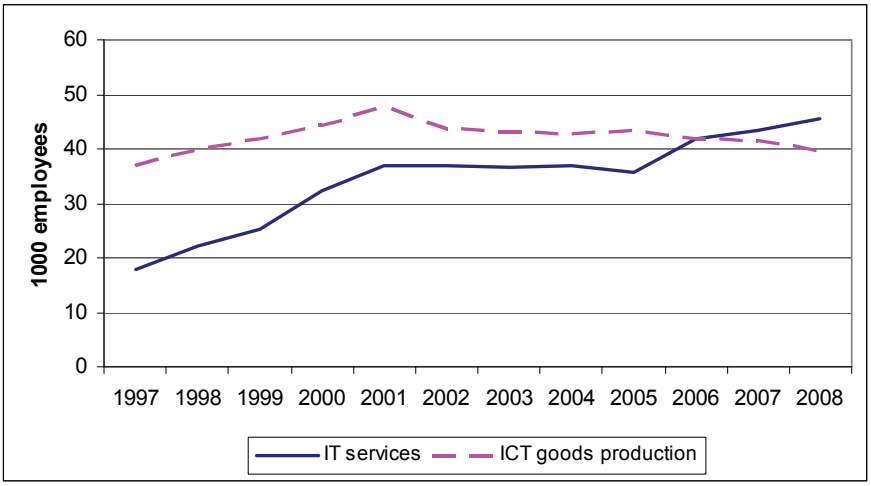
| | 1997 | 2000 | 2007 | 2008 | CAGR 2000-2008, % |
|---|---|---|---|---|---|
| **ICT sector, total *)** | | | | | |
| Number of employees (1000) | .. | 147.2 | 150.7 | 152.0 | 0.4% |
| Revenues, billion euro | .. | 44.4 | 64.1 | 64.4 | 4.8% |
| **ICT Goods production** | | | | | |
| Number of employees (1000) | 36.8 | 44.4 | 41.7 | 39.6 | -1.4% |
| Revenues, billion euro | 8.9 | 24.2 | 40.2 | 39.6 | 6.3% |
| **IT services (TOL 2002) **)** | | | | | |
| Number of employees (1000) | 17.9 | 32.3 | 43.4 | 45.6 | 4.4% |
| Revenues, billion euro | 1.8 | 3.5 | 6.2 | 6.7 | 8.5% |
| % of employees of the sector | .. | 20% | 29% | 30% | |
| % of revenues of the sector | .. | 8% | 10% | 10% | |

*) The ICT sector contains also telecom services, media and content industries not showed in this table
**) Includes both software products and IT services
Source: Statistics Finland (TOL 2002)

Since in the official statistics IT services include both software products and IT services, the total numbers also reveal another important change. They show that the importance of software product and IT services industries as employers has increased clearly in the 2000s. In 2007 the number of employees in these two industries for the first time exceeded the amount of employees in the IT goods production in Finland (see Figure 14).

In 2008, IT services – including software, as mentioned above – comprised 30 percent of all employees of the ICT sector compared to the share of 20 percent in 2000. The Nokia cluster employed major part of the personnel in the ICT goods production. In 2000s a significant number of jobs from Finnish goods production have been transferred to lower-

cost economies. A part of employees has been outsourced to IT services companies (see e.g. annual reports of Accenture and Tieto).




Source: Statistics Finland (TOL 2002)

**Figure 14. Employees in Finnish ICT goods production and IT services**

In interpreting the volume of the Finnish ICT sector on the basis of official statistics, a few comments are in place.

The concepts of ICT sector or ICT cluster are not identical to the concept of IT enterprise space defined in this study. They nonetheless give a rough overall picture of the structure, evolution and importance of the ICT industries in Finland. Therefore these volume figures can be used as a background for examining the main topic of this study, the Finnish software products and IT services industries.

As discussed in Chapters 3 and 8 however, the Finnish ICT sector is characterized by dynamic change and heterogeneity of industries and sub-industries, firms, products and services. Changes like globalization and migration from IT products to IT services weaken the usefulness and relevance of information based on the rather static industry classifications and clusters. For instance, according to the modified definition used by OECD the ICT sector on one hand includes firms which do not produce IT products or IT services and on the other leaves out those which do. For these reasons more dynamic definitions are needed to examine the sector.

An important limitation is that aggregated concepts like ICT cluster or ICT sector examine the field from the production perspective. The market side not included. Neither do these concepts reflect the growing role of substitutes in the ICT sector.

Nokia's role in the Finnish ICT industry deserves special attention. During the last twenty years the company has strongly contributed to the growth of the Finnish ICT sector.

However, from official statistics it is impossible to separate Nokia's share of the total volumes. Etla has provided several analysis of the significance of Nokia for the Finnish ICT industries (e.g. Ali-Yrkkö 2010; Pajarinen et al., 2010). For this study, another public data source provides useful additional information.

Tietoviikko magazine has collected and published a list of the 250 largest ICT firms in Finland annually for several years. Despite some shortages the list complements the information of public statistics and helps to clarify the position and importance of Nokia as the driver of the Finnish ICT sector.

In 2008 the combined revenues of the top 250 ICT firms in Finland were 68 billion euro (Table 11). The number of employees climbed to a good 202 000. Nokia alone accounted for 75 percent of the total revenues and 60 percent of total employment. These shares remained quite similar in 2010 (Tietoviikko, the top 250 ICT companies 2011).

**Table 11. Top 250 ICT firms in Finland, 2003 and 2007-2010**

| | 2003 | 2007 | 2008 | 2009 | 2010 | CAGR 2003-08 | CAGR 2003-10 |
|---|---|---|---|---|---|---|---|
| **All top 250 firms** | | | | | | | |
| Revenues | 42.9 | 67.9 | 68.2 | 57.2 | 58.6 | 9.7% | 4.6% |
| Growth | | | 0% | -7% | 2% | | |
| Employees | 118 163 | 175 000 | 202 533 | 204 725 | 202 603 | 11.4% | 8.0% |
| Growth | | | 16% | 1% | -1% | | |
| **Without Nokia** | | | | | | | |
| Revenues | 13.6 | 16.8 | 17.5 | 16.2 | 16.2 | 5.2% | 2.5% |
| Growth | | | 4% | -16% | 0% | | |
| Employees | 62 552 | 74 500 | 80 810 | 81 554 | 73 248 | 5.2% | 2.3% |
| Growth | | | 8% | 1% | -10% | | |
| **Nokia´s share** | | | | | | | |
| %, of revenues | 47% | 57% | 74% | 72% | 72% | | |
| % of employees | 68% | 75% | 60% | 60% | 64% | | |

Source: Tietoviikko top 250, 2004, 2008-2011. Information is modified.

A few additional notes about the ICT sector volumes and the Tietoviikko Top 250 list are in place. The ICT sector figures provide only a partial picture of the extent of the ongoing migration from products to services discussed in Chapter 8. Due to the definitions, the statistics do not show migration to services inside enterprises (cf. Penttinen, 2007; Pajarinen et al., 2010).

On the basis of recent developments (e.g. the decreasing production of mobile phones in Finland) it is possible to argue that in the ICT manufacturing industries the migration of goods production to lower-cost economies has been faster than in IT services production (see also Pajarinen et al., 2010; Eloranta et al., 2010).

Unlike the Tietoviikko top 250 figures the numbers of ICT sector and IT cluster comprise also media and content industries. In addition, they include only Finnish production.

Tietoviikko on the other hand includes in its total revenues and employee figures also international operations of the firms. The firm population of the top 250 also covers telecom operators, distribution channel firms and some providers of embedded systems. This is important to remember, while the growth of the combined revenues of the top 250 ICT firms is often used to describe the annual growth of Finnish ICT sector. The numbers include overlapping information (e.g. distribution channels, subcontracting) and revenues of foreign production. In some cases also other than ICT revenues may be included in the firms' total revenues.

## 9.2 Finnish IT Market

Due to lack of consistent information it is not possible to consider the ICT market side on the same level as the supply side of the ICT sector in the previous chapter. Therefore this chapter this chapter focuses on the Finnish IT market.

For an overall picture of the the ICT sector from the point of view of markets or users of information technology, market research is a valid source of information. Main part of the market research activity concentrates on the user market, usually divided into three parts: hardware, software and IT services. Sometimes the telecommunications market is separated as the fourth market of the sector.

Market research firms estimated the value of the Finnish IT market (external IT purchases of users) to total around 6 billion euro in 2008, about 70 percent consisting of software products and IT services (Market-Visio, 2009; IDC, 2009). With the telecommunication related IT spending the value of the ICT market climbed to 9–10 billion euro (Market-Visio, 2010).

Market studies bring forth the increasing importance of IT services in the 2000s (Table 12).

**Table 12. Distribution of user market, Finland 1989, 1999 and 2008***

| | 1989 | 1999 | 2008 |
|---|---|---|---|
| IT hardware | 48% | 46% | 30% |
| Software products | 14% | 17% | 20% |
| IT Services | 38% | 37% | 50% |
| Total IT market | 100% | 100% | 100% |

* External expenditures excluding telecom and mobile phone expenses
Sources: 1989 and 1999 figures IDC, 1990 and 2000; 2008 figures Market-Visio, 2009, 2010

In 1999 the IT services comprised a share of 37 percent, in 2008 the share was 50 percent of the total IT spending in Finland representing a revenue of about 3 billion euro (IDC, 2009, MV, 2009). Software product sales, in turn, were 20 percent of the end user purchases in 2008, totaling at about 1.2 billion euro (Market-Visio, 2009). Correspondingly, the share of hardware has decreased.

Thus, the total value of the Finnish software product and IT services market (user spending) totaled a good 4 billion euro in 2008. Major part of this market, 70 percent belonged to IT services.

One market area, however, is not widely covered by the market research either. There is very little systematic research on applier market, e.g. embedded systems.

It is important to take notice that the concepts of IT market and end user spending, commonly used synonymously in many country-level considerations, have become clearly different from this study's perspective. IT market represents the total demand which includes external IT purchases of applier customers whereas end user spending is limited to IT purchases of the user customers.

A database of the top 100 IT firms in Finland was formed for this study to solve or minimize some of the measurement problems connected to the definitions used of ICT sector and ICT cluster considerations, in enterprise statistics and market research. The database comprises vendor-level (firm-level) information on the volumes of the 100 largest IT firms in Finland.

The important advantage of vendor-level information is the better possibility to examine separately the revenues from software products and IT services received in Finland and from abroad. From the perspective of an IT vendor the market value is bigger than end user spending due to sales to the applier market. This emphasizes the need to consider vendor revenues. On the other hand, an analysis based only on vendor revenues may make it challenging to separate end user and applier revenues.

As discussed above market research companies typically examine user market. The following table is based on the information from the top 100 vendor database presenting distributions of both user and total markets (includes appliers).

**Table 13. Distribution of revenues, user and total market, top 100 database, 2008**

| Revenue sources | Distribution of end user market | Distribution of total IT market |
|---|---|---|
| Traditional IT services (user services) | 51% | 46% |
| Other services (embedded software, R&D, BPO) | 0% | 9% |
| Software products | 18% | 16% |
| Hardware and other equipments | 31% | 28% |
| **Total** | **100%** | **100%** |

Source: Top 100 vendor data base, 2009

The information received from the database (Table 13) supports the market research based view of the distribution of the IT market to products and services. The revenues of software products and IT services sold to the Finnish user market totaled at 3.4 billion euro in 2008 representing about 80 percent of the market value presented by market research firms**.** This also tells about the concentration of the Finnish IT market.

In all, the top 100 vendor database can be seen as a means to clarify and confirm the overall market picture. The database gives useful new information by helping to assess the applier market more accurately than from other information sources. One estimate of the size of the applier market can be drawn from database (Table 14). Purchases of applier customers represented 17 percent of all IT services revenues of 3.0 billion euro in 2008. As discussed above, according to the market research firms the user spending of software products and IT services totaled more than 4 billion euro.

Due to the scope of the study the firms in the database must produce software products or IT services for user customers. As the result all companies providing IT services only for the applier market have not been examined.

**Table 14. Revenues from Finnish user and applier markets, top 100 vendors, 2008**

| Market segment | Revenues of IT services | | Revenues of software products | | Total | |
|---|---|---|---|---|---|---|
| | Billion € | Share | Billion € | Share | Billion € | Share |
| User market | 2.5 | 83% | 0.9 | 97% | 3.4 | 87% |
| Applier market *) | 0.5 | 17% | 0.0 | 3% | 0.5 | 13% |
| Total | 3.0 | 100% | 0.9 | 100% | 3.9 | 100% |

*) production of embedded software is included in services
Source: Top 100 vendor data base, 2009

When comparing IT firm level information and user studies it is important to keep in mind, that from the customers' perspective the service costs often are higher than shown in market research figures. For instance, it is common to include hardware and some software costs in outsourcing expenditure because – for the customer – the price of the whole services offering is more important than the cost of separate items included in the contract.[20] As a result, the values of services and products in user studies may differ from the values received from IT firm level information where it can be possible to sort out product and services revenues.

## *9.3 Size of Finnish Software Product and IT Services Industries*

After the Finnish ICT sector the analysis now focuses in detail on the size of the Finnish IT software product and IT services industries. They are examined from supply and market perspectives combining information from different sources. This chapter considers the different volumes of the software product and IT services industries. The employment of these industries will be examined in more detail in Chapter 9.4.

The framework in Figure 15 is presented to concretize the puzzle-type nature of the utilization of different information sources. Three main sources of information will be

[20] This opinion is based on experience of the researcher received in several research and consulting projects concerning IT outsourcing

used. The examination of the supply and production sides of the industries utilizes public official statistics and annual software industry surveys conducted by Rönkkö et al. (2009, 2010). The information related to the demand side of the sector, in turn, is collected and published by market research firms.

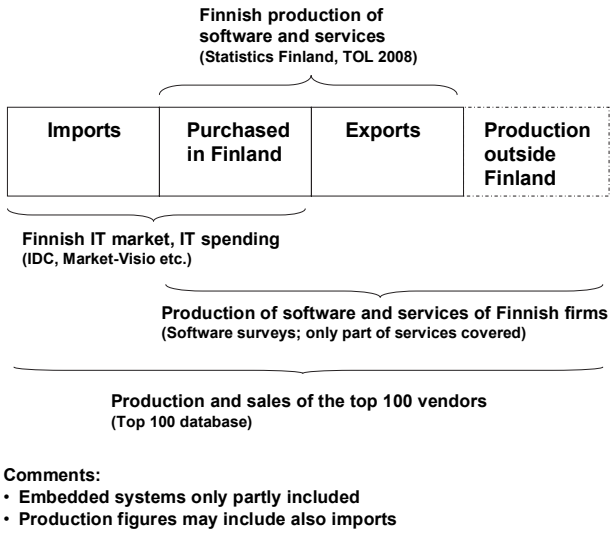



**Figure 15. Coverage of different data sources**

The database of the top 100 vendors constructed for this study is used to clarify, explain and understand the differences between the various information sources.

### 9.3.1 Production of Software Products and IT Services in Finland

The most extensive source of information concerning the production of the Finnish software product and IT services industries are the enterprise statistics and the statistics of national accounts published by Statistics Finland.

According to the enterprise statistics (Statistics Finland, 2009, 2010) about 5 400 firms belonged to the Finnish software product and IT services industries in 2008. Their total revenue was 6.7 billion euro and they employed 44 000 persons in Finland (Table 15).

**Table 15. Production of software products and IT services in Finland in 2008**

| Industry code and sub-category | Enterprises | | Revenues | | Employees | |
|---|---|---|---|---|---|---|
| | Number | Share, % | € Million | Share, % | Number | Share, % |
| 6201 Computer programming activities | 3 008 | 56 | 3 927 | 59 | 27 122 | 61 |
| 6202 Computer consultancy activities | 1 489 | 28 | 875 | 13 | 5614 | 13 |
| 6203 Computer facilities management activities | 229 | 4 | 1 261 | 19 | 7 889 | 18 |
| 6209 Other information technology and computer service activities | 57 | 1 | 30 | 0 | 302 | 1 |
| Total 62 Computer programming, consultancy and related activities | 4 783 | 89 | 6 093 | 92 | 40 927 | 92 |
| Total 63 Information services activities | 594 | 11 | 563 | 8 | 3 343 | 8 |
| TOTAL 62-63 | 5 377 | 100 | 6 656 | 100 | 44 270 | 100 |

Source: Statistics Finland, Enterprise statistics (TOL 2008), Rönkkö et al., 2010

Table 16 below demonstrates the impacts of the financial crisis in 2008 and the following recession on the growth of employment and revenue of the Finnish software product and IT services firms until 2010. Employment figures also reflect migrating of jobs to lower-cost economies.

**Table 16. Production of software products and IT services in Finland in 2007-2010**

| | 2007 | 2 008 | 2 009 | 2010 | CAGR 2007-10 |
|---|---|---|---|---|---|
| Enterprises | 5 065 | 5 377 | 5 435 | 5 582 | |
| Growth | | 6% | 1% | 3% | 3.3% |
| Employees | 42 144 | 44 271 | 43 462 | 43 862 | |
| Growth | | 5% | -2% | 1% | 1.3% |
| Revenues, M € | 6 090 | 6 656 | 6 340 | 6 355 | |
| Growth | | 9% | -5% | 0% | 1.4% |

Source: Statistics Finland, Enterprise statistics database, 2011 (TOL 2008)

The official statistics and its limitations were already partly examined in the analysis concerning the ICT sector (Chapter 9.1). When assessing the different industry volumes the first limitation is the inability to separate from the statistical figures the software products and IT services revenues and employment by company. Secondly, the statistical data includes production of both users and appliers, but it is not possible to sort out their respective shares. This means, for instance, that it is impossible to identify from official statistics the revenue derived from embedded systems. The new industry classification system (TOL 2008) launched in 2009, did not improve the situation remarkably (cf. Rönkkö et al., 2009, 2010). Several problems prevail[21]. Many IT firms provide both software products and IT services, sometimes also hardware, and are classified by the

[21] The differences between the new (TOL 2008) and the previous (TOL 2002) classifications and the related problems are discussed in the software industry surveys, mainly from the perspective of software firms (Rönkkö et al., 2009, 2010).

area generating most revenue. This distorts the overall picture. Firms classified into the industry code 6201 (computer programming activities) provide the main part of the Finnish software production. However, due to definitions, the code also includes a substantial part of the production of IT services. The software surveys (Rönkkö et al., 2009, 2010) demonstrate the heterogeneity of the revenue sources of software companies.

Migration from hardware products to services brings forth new problems. The migration has increased the software and services revenue in the 2000s but probably also moved a number of former hardware firms into software and services categories. Therefore there can be more hidden hardware revenue in the software and service categories of the statistics. A further complication is that a part of software products and IT services are produced and provided by other than traditional IT industries.

Another source of inaccuracy lies in the figures describing the imports and exports of software products and IT services. In principle, the enterprise statistics do not include imports but, because of the definitions and high level of aggregation, some imports can be reported inside the Finnish production. On the other hand exports and other international activities are difficult to get separately. These issues have become more prevalent due to global division of labor and trend to unbundling (cf. Jacobides and Winter, 2005; Sako, 2005; Jacobides et al., 2006; Baldwin, 2006). Issues related to the foreign trade of software products and IT services are discussed in Chapter 9.5.

Statistics of the national accounts (Statistics Finland) provide another information source for the volume and structure of the production of software products and IT services in Finland (see Table 17).

**Table 17. Production of IT services in Finland, 2001, 2005-2010**

| | 2001 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | CAGR 2001-2010 |
|---|---|---|---|---|---|---|---|---|
| Output of the industry M € | 3 849 | 4 990 | 5 664 | 5 915 | 6 503 | 6 241 | 6 432 | 5.9% |
| Intermediate input, M € | 1 573 | 2 170 | 2 680 | 2 557 | 2 953 | 2 951 | 3 055 | 7.7% |
| Value added, M € | 2 276 | 2 820 | 2 984 | 3 358 | 3 550 | 3 290 | 3 377 | 4.5% |
| Value added of output | 59% | 57% | 53% | 57% | 55% | 53% | 53% | |
| Total employment, 1000 persons | 43.7 | 45.4 | 49.1 | 48.2 | 51.9 | 49.8 | 49.8 | 1.5% |

Values at current prices, total employment includes part-time employees
Production of both software products and IT services included (TOL 2008, codes 62-63)
Source: Statistics Finland, The database of the national accounts, 2011

The national accounts include information of central indicators of IT industries, such as industry output (revenue), use of intermediate inputs, value added and employment. Employment figures describe the total employment and include part-time employees. Therefore they provide higher employment numbers than enterprises statistics.

The national accounts demonstrate a significant trend in the 2000s. The output and use of intermediate inputs have increased faster than the value added and employment. The

compound average growth rate (CAGR) of employees has been less than two percent reflecting the growing production outside Finland. Use of intermediate inputs, such as purchases of both domestic and imported products and services, has increased and represented nearly a half of the output of IT industries in 2010. The 2009 and 2010 figures reflect the impacts of the recession after the 2008 financial crisis.

### 9.3.2 Separating Software Product and IT Services Industries

The next chapters aim at deepening and specifying the knowledge and understanding the Finnish software product and IT services industries beyond the information derived solely from the official statistics or current research. For this purpose one of the main starting points of the study has been to make an effort to examine products and services separately having an effect on both the definitions made and the information sources used.

The chosen approach leads to more heterogeneous firm populations but gives in return a possibility to obtain new and more precise picture on the size and structure of the software products and IT services industries in Finland. The approach of the study can also help to point out industry developments with substantial effects on the industry structure, employment and economy which in turn can have impacts on economical and political decision making.

Separate examination of products and services is possible only on the basis of firm level information. Therefore the official statistical information has been complemented with information from other sources like market research and software surveys. To obtain firm level information the database of the top 100 vendors has been a valuable source.

In the late 1990s several organizations initiated an annual survey of the Finnish software industry to get more reliable and accurate information of the field. The survey examines the industry largely from the perspectives of software product firms. This is in spite of some recent changes in the focus trying to adjust to the strengthening role of IT services (cf. Rönkkö et al., 2009, 2010, 2011). The changes in the design of the survey once more concretize the challenges in defining software product and IT services industries and their borderlines.

In this study, as defined earlier, the software product and the IT services industries are seen as sub-populations of the IT enterprise space. The software product industries comprise all Finnish or foreign firms producing or providing software products in Finland. The IT services industries, in turn, include companies acting as external service providers offering their customers IT services built on human competence or technological capacity.

To make the separation between software products and IT services the definitions follow closely the ones generally used by market research firms and software product and IT services companies. In their view software product revenue include only license and maintenance fees, nowadays increasingly also revenue from SaaS services. All other

services related to software products are included in IT services (e.g. consulting, development projects, deployment and management services).

According to the chosen software product definition the production of embedded software or systems belongs mainly to the IT services industries. Most embedded software is customized and does not bring license or other IPR related revenue to the producer. It is also often duplicated to a number of devices or platforms produced by the customer and purchasing embedded software is closer to purchasing services than acquiring software products.

As discussed earlier, foreign software products have strengthened their foothold in the Finnish market in 2000s and the share of services related to foreign software has increased. This is consistent with the global trend to concentration of software product firms and increasing role of services (Cusumano, 2004, 2010). Therefore an effort has been also made to separate and analyze the role of foreign software products in the total revenue, a matter which so far has attracted only limited attention in research or analysis.

From the perspective of a software company it might be argued that software related services should be regarded as part of software industry (cf. Rönkkö et al., 2009, 2010). However, software related services are similar to the core activity of IT services companies. Due to the growing role of international software products, software services have been increasingly carried out by external service during the last decade. There are several arguments supporting the choice of definition described in Figure 16.

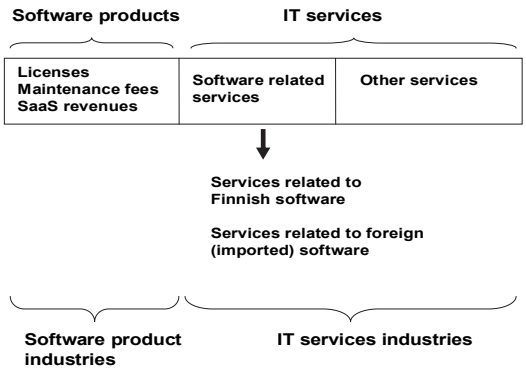



**Figure 16. Definition of software products, IT services and related industries**

Firstly it is justified on the basis of the different business logics of software products and IT services (e.g. Hoch et al., 2000) and their different business models (e.g. Cusumano, 2004). Secondly, software and services companies differ clearly from each other. Development and maintenance of software products are highly dependent on the original producer. IT services companies, for their part, are more independent of the software

used in their services. Furthermore, the entry barrier to software product market is often higher than to the IT services market.

Further, a clear separation of software products and IT services is essential in order to make correct analysis on the role of software products and IT services industries in Finland. For instance, in the public discussion the Finnish software sector is often expected to be one of the fastest growing industries with major direct and indirect impacts on the growth of the Finnish economy (e.g. Kontio, ed., 2008). As the analysis of this study shows, these expectations are based on a remarkably wider definition of software industry than applied here.

This example points out the importance on taking careful notice of the scope of the terms used. The meaning of the terms used to refer to software industry may vary greatly in the literature and in public discussion. Terms such as software sector or software business often include both software products and to varying extent also services (e.g. Hoch et al., 2000; Campbell-Kelly, 2003; Cusumano, 2004; Ali-Yrkkö and Martikainen, 2008; Kontio, 2008; Mowery, D.C. (ed.), 1996; Steinmueller, 1995). Software industry may also comprise both software products and customized software (e.g. Campbell-Kelly, 2003) and also related services (cf. Rönkkö et al., 2010).

The unstable definitions can also be one reason why the importance and impacts of services related to foreign software have remained rather underestimated in several surveys and in public discussion.

In considering volumes of business process outsourcing services this study applies the practice of some market research firms (e.g. Gartner, IDC, Market-Visio) which include the IT operations or other IT tasks related to BPO services in IT services, whereas the tasks concerning the core functions of those processes are excluded.

The following two chapters examine the size of software product and IT services by using different revenue information. The number of employees, one of the main volume indicators of IT industries, is considered separately in Chapter 9.4. Different distributions of revenues provide also a basis for estimating the employment in Finland and abroad.

As defined earlier, in this study the software product and the IT services industries are seen as sub-populations of the IT enterprise space. The approach of this study leads to more heterogeneous firm populations but gives in return a possibility to obtain new and more precise picture on the size and structure of the software products and IT services industries in Finland.

The approach of the study can also help to point out industry developments with substantial effects on the industry structure, employment and economy which in turn can have impacts on economical and political decision making.

### 9.3.3 Size of the Finnish Software Product Industry

Considerations of the size of the Finnish software industry often focus on the Finnish production only. In this study a wider view is taken and the software industry is defined to include also imports of software products.

As discussed earlier the enterprise statistics of Statistics Finland do no allow separate accurately the revenue or employment of the software product and IT services industries. Also figures on the imports of software products are difficult to receive. The statistics, however, include at least some imported software and to some extent also embedded software, but it is not possible to get the information on them separately.

The annual software industry surveys (later: software survey) have increased the understanding of the field by focusing on software production of Finnish firms. Imported software products and foreign software firms are mainly outside the scope of the survey. In spite of this, the software surveys provide a better picture of the size of the Finnish software product industry and its structure than the information contained in official statistics. Lately the surveys have extended their scope towards services.

Nevertheless it is not possible to provide one accurate indicator of the size of the Finnish software product industry relying on the information provided by the official statistics or the software surveys. Analyzing the size of the Finnish software product industry requires additional information.

Here the Finnish software product industry is considered by applying both supply and market perspectives and using both production and market information. Difficulties in getting separate information on software exports from Finland and software production by Finnish companies abroad require analyzing also international activities of Finnish IT companies.

According to the software survey (Rönkkö et al. 2009) the combined revenues of the Finnish software industry totaled at 2.3 billion euro in 2008, one third coming from production outside Finland. Sales of licenses and maintenance fees from Finland or from export customers contributed 40 percent of the total, roughly one billion euro. The remaining 60 percent consists mainly of revenues of different IT services totaling about 1.3 billion euro. The revenues included also some embedded software and related services.

In 2010 the scope of the survey expanded to cover more services. Accordingly, the total value of the software industry as defined in the survey increased to 3 billion euro in 2009 whereas the software products revenue increased to about 1.1 billion euro (Rönkkö et al. 2010).
Different market studies offer a market side comparison to the software survey. As discussed earlier, on the basis of market studies (e.g. IDC, 2010; Market-Visio, 2010) the software purchases of user customers ended up at 1.2 billion euro in Finland in 2008. A good half of the sum was spent on infrastructure and tools software, the rest on

applications software products. Opposite to the software industry survey, in market studies the market value comprises systematically also imported software products.

The database of the top 100 IT vendors enables to examine both revenues received from the Finnish market and from outside Finland. On the basis of the database the total software product revenue and the Finnish market shares of all software product companies have been estimated for this study. On the basis of the database and findings of software survey can be suggest that the companies included in the database generate the major part of international revenues of Finnish software products vendors.

According to the market data, the top 100 vendor database and considerations of company level information it has been estimated in this study that the share of imported software products comprised a good 60 percent of the Finnish user market in 2008. This leads to the estimate that the sales of domestic software products were about 450 million euro in 2008.

The software surveys support these levels of estimates (Rönkkö et al, 2009, 2010)[22]. A part of the Finnish production is conducted by companies in foreign ownership (e.g. Logica, Visma).

Table 18 summarizes the major data and information sources used in evaluating the size of the Finnish software product industry.

**Table 18. Software product industry revenue by different data sources in 2008**

| Indicator and information source | Comments | Revenues, B €, (rounded) |
|---|---|---|
| Computer programming activities, industry code 6201 (Enterprise statistics, TOL, 2008, Statistics Finland) | Production of software products and IT services included in revenue<br>Share of software products not available | (3.9) |
| Finnish software industry (Software industry survey, Rönkkö et al., 2009) | Software product revenue, both domestic and international production | 1.0 |
| Finnish software product market (IDC, 2009, Market-Visio, 2009) | End user spending on software products in Finland | 1.2 |
| Software product revenue of 100 largest IT vendors in 2008 (Database of the top 100 IT vendors) | App. 65% of revenues from the Finnish market, 35% from outside Finland | 1.3 |
| Revenue of imported software products in Finland<br>Combining various sources | End user spending on imported software products, purchases of international SaaS services (only software elements) | 0.8 |

Transferring software between countries makes it difficult to get accurate market values. Some share of software purchased in Finland is exported by customers to their foreign subsidiaries or offices whereas foreign and Finnish firms also import to Finland software purchased abroad.

[22] This is very close to the estimate received in the software survey in 2009 (Systeemityö magazine, 2010)

International software products have significant affects on the evolution of the Finnish software industry and the competition. In the 2000s the international software companies have increased their market shares in Finland fueling the need of the Finnish software product forms to internationalize. In 2008 about a half of their software product revenue was generated from outside of Finland. This supports the argument that the Finnish software product industry is increasingly dependent on exports.

Unlike the Finnish software firms, the foreign software companies largely use external service vendors in integrating and implementing their software, strengthening ecosystems (e.g. Microsoft, SAP) and other networks of companies. This has helped the foreign software products to get a key role in fueling the growth of different project services and application related outsourcing and management services. Foreign software products are expected to increase their dominance but at the same time, the Finnish service providers will be able to work in close cooperation with customers.

The volumes of the Finnish software sector have been estimated on the basis of different information sources presented above and applying the framework presented earlier in Figure 13. The estimates make it possible to consider the software product sector from both the supply and market perspectives.

In this study the Finnish software production is defined to include also imported products. Respectively, the total market volume consists of the Finnish market and exports of software products. This way it is assumed to be able to provide a more comprehensive picture of the volumes of the Finnish software product industry than considering only Finnish production.

The volumes selected to describe the Finnish software product sector from both supply and market perspectives are presented in Table 19. The volumes presented are estimates made for this study by assessing and combining data from different sources. The figures cover all enterprises included in the IT enterprise space defined in this study.

The total volume of the Finnish software sector has been estimated to account for about 1.5 billion euro in 2008. Imports contain a good half of the value reflecting the central role of international software products in Finland. On the basis of market data (Market-Visio, IDC) and company information of major software product vendors this value has been estimated to account for about 1.6 billion euro in 2010.

From the Finnish market perspective the role of imports is even bigger. With a share of nearly two thirds international software products have a strong foothold in the Finnish market whereas the Finnish software products cover only a good third of the market. At the same time exports and other international sales together bring a good half of the revenues of Finnish software product companies.

These figures reflect the importance of international markets for the Finnish software product industry.

**Table 19. Different volumes of the Finnish software industry in 2008, estimates**

| Perspectives and indicators | Revenue, B € (rounded) | Share, % | Comments |
|---|---|---|---|
| A. Imports of software products | < 0.8 | | Software licenses and maintenance fees<br>Part of SaaS revenues (IPR) |
| B. Production in Finland for Finnish market | > 0.4 | | |
| C. Production in Finland for exports | 0.3 | | |
| D. Production outside Finland | 0.3 | | Increasingly difficult to draw borders between traditional exports and other international operations |
| **Total volume of the Finnish software product industry in Finland (A+B+C)** | **1.5** | | Volume can be considered from both supply and market perspectives |
| Total volume reported in Finland (A+B+C+D) | 1.8 | | Includes both reported revenues and estimates |
| Finnish software product market (A+B) | 1.2 | | |
| Domestic production (B+C) | 0.7 | | |
| Production in Finland and abroad (B+C+D) | 1.0 | | |
| **Other indicators:** | | | |
| Share of imports (A) of the Finnish market (A+B) | | < 65 | |
| Share of Finnish software products (B) of the Finnish market (A+B) | | > 35 | |
| Share of total revenue of Finnish firms derived from Finnish market | | < 50 | |
| Share of total revenues of Finnish firms derived from international sales | | > 50 | Exports and other international sales |

When including also production outside Finland the total volume is estimated in this study to rise to 1.8 billion euro in 2008. This is an estimate for all software product revenues reported in Finland.

During the last few years Finnish software product firms have transferred their research and development and some production functions abroad, also to lower-cost countries (e.g. Basware and F-Secure). New types of division of labor and unbundling have increasingly resulted in challenges to identify the production location and measure or evaluate where the value is created. Drawing the borderlines between "traditional" exports and other international activities as well as getting information of volumes and transactions between countries have also become increasingly complicated.

The volumes presented in this chapter include mainly revenues received from user customers. This study assumes that volumes of embedded software products as defined in the study have remained relatively low. As discussed earlier a high share of embedded software production belongs to the IT services industry due to the customized nature of

software. Some producers of embedded software attempt to adopt a more software product type of business model (see e.g. Elektrobit, annual report 2011).

### 9.3.4 Size of Finnish IT Services Industry

In this study, IT services are defined as IT related human competence and technological capacity provided by external service provider. As discussed earlier, the official statistics can give only a general and partly inaccurate picture of the IT services industries. Therefore, for this study also complementary information sources, mainly market research data and the specially compiled top 100 database, have been used.

From the perspective of IT services vendors the IT services industry can be divided into two main parts on the basis of customer needs and the customer's way to utilize IT. The first part consists of IT services targeted to customers who use information technology in developing, operating or managing their functions, operations or businesses. The second part of IT services comprises of applier customers who use information technology (e.g. embedded software) in products or services sold to their own customers.

Table 20 summarized the main sourced used in estimating the size and structure of the Finnish IT services industry.

**Table 20. IT services industry revenue by different data sources in 2008**

| Indicator and information source | Comments | Value/revenue, B €, (rounded) |
|---|---|---|
| Finnish software and IT services production (Enterprise statistics, industry codes 62-63) | Industry codes 6202-6209 and 63; 2.8 B €<br>Part of revenue of 3.9 B € reported in industry code 6201 | .. |
| Finnish software industry (Software industry survey, Rönkkö et al., 2009) | Revenue from services (excl. maintenance fees) a good half of total revenue of 2.3 B € | 1.3 |
| Finnish IT services market (IDC, 2009, Market-Visio, 2009) | End user spending on IT services | 3.0 |
| Total revenue of top 100 IT vendors (Database of the top 100 IT vendors) | Total revenue of IT services<br>- Finland: total revenue 3 B €, 84% derived of end user sales<br>- Outside Finland: 1.3 B €, 82% derived of end user sales | 4.3 |
| Survey of embedded software (Nikulainen et al., 2011) | - External purchases of embedded software globally 1.2 B €, a half of these from Finland | 0.6 |
| Imports of IT services<br>Combining various sources | Estimated by using total revenues and sales to Finnish market<br>Both end user spending and applier purchases<br>Direct purchases of customers<br>Purchasing of external subcontracting services<br>Inaccuracies in estimating internal transactions of services firms | 1.0 |

As mentioned earlier, it is not possible to separate the volume of IT services from the total of 3.9 billion euro reported in enterprise statistics as the total revenue of Finnish software and IT services production.

The market research firms estimated the value of the traditional IT services market (user market) to around 3 billion euro in Finland in 2008, depending on definitions. IDC (2009) has divided this IT services market as follows:

- outsourcing services (45%)
- project services (36%)
- support services (19%)

According to the survey conducted by Nikulainen et al. (2011) the external purchases of embedded software by Finnish customers totaled 1.2 billion euro in 2011**.** A half was purchased in Finland. As discussed earlier a high share of producing embedded software belong to services industry due to customized nature of this software.

The database of the top 100 vendors provides another source to examine and assess the size and structure of the IT services industries. Due to strong concentration of the Finnish IT services market the figures of the database are well in line with the values received of market studies. The database also provides data of the applier market.

IT services for end user customers brought the top 100 IT vendors a revenue of about 2.5 billion euro in the Finnish market in 2008. In addition, the top 100 vendors received about 0.5 billion euro revenues from other services, such as research and development or business process outsourcing (BPO) services. These other services represent more than 15 percent of all service revenues. The sales of other services have largely emerged in 2000s and have increased faster than sales of the traditional IT services. The main drivers of this development have been Nokia and Nokia Siemens Networks (NSN), which have purchased R&D and outsourcing services from several IT services firms (see Nikulainen et al., 2011). This development has been seen clearly in company reports[23], press releases and press articles as well as in market studies (e.g. Market-Visio, 2006, 2007).

Similarly to the volumes of the Finnish software industry also the volumes of the Finnish IT services industry have been estimated on the basis of the different information sources presented in the table above and by applying the framework presented earlier (Figure 13). The estimates concern volumes of the supply as well as the market perspectives.

From the supply perspective the total volume of the Finnish IT services sector in Finland has been defined in this study to consist of revenues of both Finnish production and imports. From the market perspective, in turn, the total volume consists of the Finnish market and of exports.

[23] Examining of the firm population of top 100 vendor database supports the conclusion of the growing role of the applier market. For instance, in 2008 about one third of personnel of Tieto produced services for manufacturers of telecom equipment and devices or for telecom operators.

This consideration is assumed to provide better picture of the size of the Finnish IT services industry than made possible by using the existing data sources.

The central volumes and selected indicators describing the Finnish IT services sector from supply and market perspectives are presented in Table 21. The figures are estimates which cover all enterprises included in the IT enterprise space defined in this study.

The total volume of the Finnish IT services industry has been estimated to account for about 4.5 billion euro in 2008. On the basis of market data (Market-Visio, IDC) and company information of major IT services vendors this value has been estimated to remain below 5 billion euro in 2010. The figures include services provided for both user and applier customers. The revenues from the user customers represented a good 80 percent of the total volume.

Despite the increasing services purchases from lower-cost economies domestic production still represents more than 75 percent of the total volume of the Finnish IT services industry. The IT services vendors operating in Finland are dependent on the Finnish market. This share may, however, include some exports because some customers export services from Finland to their subsidiaries in different countries.

If also the production of IT services outside Finland is taken in the estimate, the total volume is estimated to rise to 5.5 billion euro in 2008. There may be, however, some overlapping between international production and imports due to internal subcontracting of some IT companies.

Globalization and the related trend to unbundle service processes and even single services tasks can clearly be seen in the production of Finnish IT services (cf. Jacobides and Winter, 2005; Jacobides et al., 2006; Baldwin, 2006). Development and services centers locate in various countries around the globe, making it increasingly difficult to divide the values or revenues of services chains at country level. For instance, drawing borderlines between “traditional” exports and other international activities as well as receiving information from different volumes and transactions between countries has become very challenging.

On the basis of different figures presented above this study estimates that the revenues of the IT services for user customers totaled about 4 billion euro in 2008, about 3 billion coming from the Finnish market. The size and the share of the applier market are larger than presented here due to the scope of the study. Several providers of these services do not belong to the IT enterprise space defined in the study. However, the major IT services vendors belonging to the scope of this study produce also a great majority of embedded software.

**Table 21. Different volumes of the Finnish IT service industry in 2008, estimates**

| Perspectives and indicators | Revenues, B € (rounded) | Share, % | Comments |
|---|---|---|---|
| A. Imports of IT services | 1.0 | | Direct purchases of customers<br>Purchasing of external subcontracting services |
| B. IT service production in Finland for Finnish market | 2.7 | | Both user and applier markets |
| C. IT service production in Finland for exports | 0.8 | | |
| D. IT service production by Finnish producers outside Finland | 1.0 | | Increasingly difficult to draw borders between traditional exports and other international operations<br>Some overlapping with imports |
| **Total volume of the Finnish IT services industry in Finland (A+B+C)** | **4.5** | | Figures include revenues from both user and applier customers: users a good 80%, appliers nearly 20% |
| Total volume of IT services production reported in Finland (A+B+C+D) | 5.5 | | Total volume of the Finnish IT services industry in Finland and IT services revenues of Finnish IT firms abroad |
| Finnish IT services market (A+B) | 3.7 | | |
| Domestic production of IT services (B+C) | 3.5 | | Includes exports |
| Production of IT services in Finland and abroad (B+C+D) | 4.5 | | All Finnish production, and production of Finnish IT firms abroad |
| **Other indicators:** | | | |
| Share of IT service Imports (A) of the Finnish market (A+B) | | > 25 | |
| Share of Finnish production (B) of the Finnish market (A+B) | | < 75 | Imports and domestic production used in Finland |

As discussed earlier, IT services purchases from lower-cost countries have increased in the 2000s. Several IT services firms operating in Finland have transferred parts of their production abroad, mainly to lower-cost countries. Despite this development Finnish production of services has so far remained rather strong. Major IT services firms have retained strong positions as providers of both user and applier services in Finland (e.g. Accenture, Capgemini, Digia, Ixonos and Tieto).

## *9.4 Employment in Finnish IT industries*

As discussed earlier, due to various industry changes employment has become an important indicator in describing the size and evolution of IT industries.

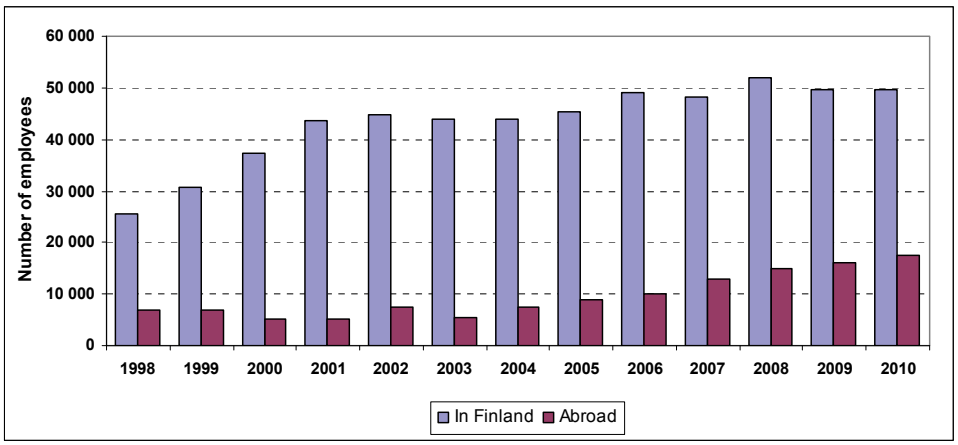
Understanding the structure of the employment of the Finnish IT industries requires examining the numbers and shares of software product and IT services employees and their distribution between Finland and other countries.

### 9.4.1 Total Number and Distribution of IT Personnel

Information of the total number of employees in the software product and IT services industries available is based on the official statistics. In addition, the Finnish IT personnel has been examined from different angles in various studies. Here the top 100 database formed for this study provides valuable additional information and support in analyzing and assessing the structure of the Finnish IT personnel.

The official statistics offer two different employment figures for the Finnish IT industries (industry codes 62-63, TOL 2008). According to the enterprise statistics the software products and IT services industries employed in 2008 somewhat over 44 000 persons in Finland, whereas the national accounts ended up at about 52 000 persons. The latter figure includes also part-time employees leading to a higher number than the enterprise statistics.

The Federation of Finnish Technology Industries (FFTI) publishes figures of the total employments of Finnish IT companies covering also employees abroad. The Finnish part of the data is based on the national accounts, the number of employees outside Finland is collected from several sources. According to FFTI Finnish IT enterprises employed 67 000 persons in 2008. More than a fifth of them were employed by foreign subsidiaries of the Finnish enterprises. Since then, in the years of 2009 and 2010, the share of the personnel working abroad has continued to grow (Figure 17).




Source: Statistics Finland, The Federation of Finnish Technology Industries' labor force survey (26.1.2012)

**Figure 17. Number of employees of IT enterprises in Finland and abroad, 1998-2010**

This data demonstrates that the number of employees has grown only slowly in Finland in the 2000s. At the same time Finnish IT enterprises have increased their personnel abroad.

The compound annual growth rate (GAGR) of the number of employees of IT enterprises demonstrates the following development from 2001 until 2010:

- total number of IT employees 4%
- personnel in Finland 1.5%
- personnel abroad 15%

The growth rate in Finland has remained rather low despite the fact that in the 2000s outsourcing of IT functions has increased the number of employees in IT firms by moving in-house IT jobs to services companies[24]. This reflects another change: during the last few years several Finnish IT companies have outsourced their operations and transferred jobs away from Finland, especially to lower-cost countries.

Thus, also the growth of outsourcing has had an effect on IT employment and can lead to misinterpretation of the employment figures. In the public sector outsourcing is expected to accelerate in the near future affecting thousands of IT professionals.

Another new global trend that may have influence on the country-level employment is the growing role of various globally provided cloud services. They may result in further concentration of IT software and services purchases and decrease the need for local software products and different services.

Due to the rapid changes in the marketplace and the IT firms themselves and the blurring boundaries between industries, the importance of accurate information on the number of IT industry employees and the structure of employment in the field has become even more critical than before. At the moment, however, accurate and consistent information of the number and professional structure of employees in the Finnish IT industries is not available. A demanding task is to obtain personnel data separately of software products and IT services production. Another issue is the share of personnel working with embedded software and systems.

In this study employees of software product industry refer to personnel participating in development, production and maintenance of software products. Employees in IT services industry, for their part, ensure and provide competences and capacities for different IT services.

The employment numbers include some amount of other than IT professionals, such as sales, marketing, administration and management personnel. Their share of the personnel varies by industries and companies. For instance, in international software product companies the share of sales and marketing staff typically is higher than in most IT services companies.

Table 22 summarized the employment figures from different public sources and the top 100 vendor database constructed for this study.

[24] Sometimes large outsourcing contracts may increase the employees of IT industries only temporarily, e.g. outsourcing of Symbian experts from Nokia to Accenture in 2011.

**Table 22. Number of employees of Finnish IT industries by different sources**

| Data and information sources | Number of IT employees | Comments |
|---|---|---|
| Enterprise statistics (Statistics Finland) | 44 300 in total in 2008, about 43 900 in 2010 | TOL 2008, codes 62-63<br>Software products and services personnel not available separately |
| National accounts (Statistics Finland) | 52 600 in total in 2008, about 50 000 in 2010 | TOL 2008, codes 62-63<br>Total employment, includes part-time employees |
| Employment statistics (The Federation of Finnish Technology Industries) | App. 67 000 in 2008, about 52 000 in Finland and 15 000 abroad<br>App. 67 500 in 2010, about 50 000 in Finland and 17 500 abroad | Number of employees in Finland based on national accounts<br>Number of employees working abroad based on different sources |
| Ali-Yrkkö and Martikainen (2008) | 33 000–48 000 in 2004 | Employees in planning and production of software in Finland in 2004 |
| Software industry surveys (Rönkkö et al., 2008, presentation, 2009) | About 14 400 in software products industry in 2007 | Includes also IT services staff and employees outside Finland<br>Focus on Finnish enterprises providing software products |
| Employees producing embedded software (Nikulainen et al., 2011) | In IT firms 6 000-7 000 employees in production of embedded software | Big part of IT firms traditional IT services vendors<br>Substantial share of embedded software produced by internal staff not included in this study |
| Top 100 IT vendor database | 45 600 IT employees in 2008, about 30 500 in Finland in 2008 | More than 15% producing services for applier market |

Ali-Yrkkö and Martikainen (2008) have assessed the state of the software industry in Finland, based on information of Statistics Finland. According to them planning and producing of software employed 33 000–48 000 persons in Finland in 2004. This figure also includes IT professionals from other than the traditional IT industries. According to Tyrväinen et al. (2005) about half of the jobs in software sector situated in other than traditional IT industries.

Finnish software surveys have examined software product companies. The surveys apply a wider definition of software industry than the one used in this study. The last employment data publishes in the software surveys is from the year of 2007. According to the survey the Finnish software industry employed in 2007 about 14 400 persons, including services staff and personnel abroad (Rönkkö et al., 2009, presentation).

Nikulainen et al. (2011) have studied the production of embedded software. They have estimated that a significant share of embedded software is produced in internal units of manufacturing companies. Some of this software is sold to external customers. Their estimate is that external sales of embedded software employ about 6 000-7 000 persons in various companies.

Examining the database of the top 100 IT vendors indicates that these external services are largely provided by major IT firms (such as Accenture, Digia, Ixonos and Tieto). As a result it is possible to propose that a significant share of the production of embedded software is included both in this study and also in the figures presented by Statistics Finland. In addition, in the production of embedded software it is largely question about providing services not software products as defined in this study.

Two thirds, 30 500 persons, out of 45 600 employees of the top 100 IT vendors worked in Finland in 2008. A comparison to the employment figures presented above by the Federation of Finnish Technology Industries reveals that almost all IT employees of Finnish companies working outside Finland were employed by the top 100 IT companies.

The employee structure of the top 100 database shows that foreign firms have a central role as IT employers in Finland. In 2008 nearly half (45%) of the personnel of the top 100 IT firms in Finland worked in foreign-owned companies. Their position is especially strong in IT services, only a small part of foreign IT companies in Finland participates in producing software products in Finland.

According to the database in foreign software product companies the revenue per employee was in 2008 a double compared to Finnish firms whereas between Finnish and foreign IT services companies there was no significant difference. These numbers reflect also differences in numbers of employees.

In this study the number of IT employees in Finland has been estimated by using the results of the software surveys, the top 100 vendor database and from market studies. These sources have provided data of revenues from Finland and abroad, market sizes, average revenue per employee, share of software products revenues as well as shares of personnel working in Finland and abroad. The estimates are based on assumptions that the software product vendors included in the top 100 database represent a share of 65 percent of employees of their industry and IT services vendors 70 percent of their industry respectively. The higher share of the IT services has been defined due to the stronger concentration of the vendor population. A further justification is that the database of top 100 vendors covers 60 percent of employees presented in the national accounts and 70 percent of persons of the enterprise statistics.

On the basis of the collected data and these assumptions this study estimates that about 10 000 employees worked in producing and providing software products in Finland in 2008. The personnel of the IT services in turn climbed to about 35 000 employees. This leads to the total of about 45 000 persons working in Finnish software products and IT services industries belonging to the Finnish IT enterprise space as defined in this study.

Both the study conducted by Nikulainen et al. (2011) and the figures of the top 100 database support the estimate that nearly a fifth of the IT services staff participates in producing embedded software or other services beyond the traditional user services. Most of them worked in the traditional IT services companies.

Due to the scope of this study companies producing software products and IT services only for applier customers (e.g. embedded software) have been left outside this analysis (e.g. Elektrobit, Sasken). As defined earlier, the companies covered here must offer software or services at least to some extent also for end user customers. This study estimates that the companies outside the enterprise space of the study employ a few thousand persons in Finland. Adding them to the employment figure brings the total number of IT employees to about 50 000.

It is important to notice that the employment estimates presented here do not include internal IT employees, i.e. persons working on software product or IT services production not sold to outside customers.

According to the estimates made in this study the number of IT services personnel was about 3.5 times bigger than the number of software product staff in Finland. According to the Statistics Finland the total number of employees has not increased in the software and IT services industries since 2008.

As seen above the growth has been outside Finland. It is justifiable to assume that the trend has been similar both in software products and IT services industries.

As seen earlier (Chapter 9.2), the value of the Finnish IT services market was about 2.5 times bigger than the software product markets. A significant share of software products is imported (e.g. software products from SAP and Microsoft) generating a demand for various IT services professionals in Finland. This further widens the gap between the amount of software product and IT services staff.

A closer look at the different employment estimates reveal several measurement issues related to definitions and base information which weaken the usability of the estimates and complicate the comparison of different figures.

A major problem related to the enterprise statistics is that, due to the underlying definitions, it is impossible to get an accurate distribution of the total employment into software products and IT services personnel. Secondly, the total figure may include also other than IT personnel, but, on the other hand, might not include IT professionals working in other than IT industries. For example, companies producing embedded software often are in other than IT-industries.

Other research challenges include the fact that a part of IT employment is not directly reported in IT industry statistics. One reason to this is the foreign IT professionals (e.g. from India) working in Finland on temporary basis. Part of them work as subcontracts for Finnish IT companies, some have direct contracts with user or applier customers.

Another factor is that both the IT firms and their customers use increasingly services from suppliers providing temporary staffing and project workers for various IT functions. This does not necessarily show in company reports as personnel costs but as purchases of external services.

It is also to note, that even if the number of IT employees in the IT enterprise space of this study and the official statistics are in the same size class, they do not cover exactly the same firm population (Figure 18).

The figures reported in the statistics under the industry codes 62-63 (TOL 2008) do not cover all IT enterprises. The official statistics can also include employees not belonging to the scope of the study. To get a more comprehensive picture of the IT employment the IT enterprise space in this study includes also companies from other industries, such as business services, manufacturing or telecom industries. The top 100 IT vendor database supports this definition: in companies of the top 100 database about a tenth of the employees providing software products or IT services came outside IT industries.

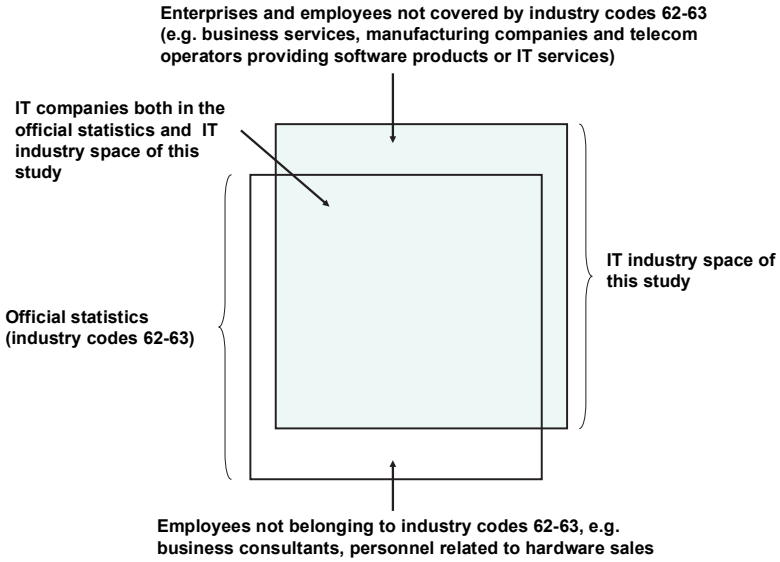



**Figure 18. Overlapping of IT enterprise space and enterprise statistics**

The new global division of labor and cost pressures have already increased IT services purchases by Finnish companies from lower-cost countries. Major software product firms and IT services vendors have during the last few years also increased their own offering from the lower-cost countries and transferred jobs from Finland to these areas. As a result, demand for Finnish employees has decreased. This is to be seen in the statistics: the number of employees has grown slower than the total revenues of IT industries.

### 9.4.2 Migration of Jobs from Finland

In the 2000s globalization has had a significant effect on the employment also in the Finnish industries. Globalization increases the price competition in IT services, changes price expectations and thereby hardens the price pressure also at home (Market-Visio, 2007, 2008b). In search of new markets and as an answer to increasing price pressures

from the lower-cost countries, the companies started at first to transfer production-related jobs to lower-cost countries.

In the second wave also higher-skilled jobs, like IT jobs have been transferred, mainly to Asia but also to the Central and Eastern European countries. Both foreign-owned (e.g. Accenture, Capgemini, HP, IBM, Logica, Oracle) and Finnish software product and IT services firms (e.g. Tieto, Basware, F-Secure) have strengthened their operations in lower-cost locations. IT services vendors have followed their globalizing customers to lower-cost countries in order defend their customer relationship.

In the 2000s an increasing number of Finnish software product firms have also sought new market opportunities abroad by opening sales offices. Several software product firms attempt to reduce their development costs by doing part of the work in lower-cost areas. Some of them have also transferred their service production facilities.

Theses developments confirm the views of the impacts of the global division of labor presented by several researchers (Baldwin, 2006; Jacobides et al., 2006; Sako, 2007). The results can be seen clearly for instance in the employment figures of The Federation of Finnish Technology Industries presented before in figure 17: the growth of the number of employees in Finland has slowed down, but grows abroad.

The trend of unbundling IT production (Baldwin, 2006) is particularly clear in IT services production of global firms. For instance, various processes related to outsourcing services may be more or less unbundled and produced in separate service centers around the globe.

This has been seen in several outsourcing contracts between large Finnish companies with global IT services vendors, such as HP and IBM. It is possible that a customer does not even know the locations of the global production centers, and the work can be transferred from one location to another during the contract period. Accordingly, also research and development functions can be decentralized to different locations. The aim of all these arrangements is to achieve benefits, such as economies of scale or high utilization, like a continuous 24/7 working in the case of research and development.

Examining the migration of jobs to lower-cost economies at firm level provides more accurate understanding of the scope of the phenomenon than statistics at a high level of aggregation. For instance, in 2008 Accenture implemented a good half of the work for its Finnish customers in the company's global network of services centers[25]. In the end of 2010 a share of 37 percent of the personnel of Tieto worked in lower-cost countries (Tieto Oyj, Annual report 2010)

Market-Visio (2008b) has estimated that nearly one fifth of the purchases of traditional IT services are produced in lower-cost economies. A significant change started around the year 2005. In the beginning near-shoring was more common; the services were

[25] Source: Frank Korsström, Accenture press release, 26.9.2008

transferred to Central and Eastern Europe. In the mid 2000s the share of India and some other Asian countries started to grow.

As discussed earlier, during the last few years the internationalization of Finnish IT firms has speeded up. In recent years the number of Finnish software product and IT services employees has increased faster abroad than in Finland. According to company reports, the growth on employment especially in Asia has continued to grow since 2008.

The larger IT firms have relatively more jobs outside Finland than their smaller competitors. In 2008 one third of employees in the Finnish firms belonging to the top 100 IT vendor database worked outside Finland. Among the publicly listed Finnish IT firms the share was even higher. It is also to be noted that foreign employment concentrates to rather small number of firms.

According to the Federation of Finnish Technology Industries 15 000 employees of Finnish IT companies worked abroad in 2008. About 90 percent of them worked in the five largest Finnish IT services firms and in ten largest Finnish software product firms included in the top 100 IT vendor database. Since 2008 the share of the largest ones in foreign employment has still increased.

Table 23 demonstrates the development of employee structures of the above mentioned fifteen firms from the year 2005 to 2010. During this time their combined number of employees has increased a good 30 percent, whereas employment in Finland remained about the same. Because of the rapid change in Tieto, the total amount of employees of the top 5 Finnish-owned IT services firms in lower-cost countries has increased rapidly.

**Table 23. Evolution of the number of personnel, largest Finnish-owned IT firms**

| Employees by countries | 2005 | 2010 | CAGR 2005-2010 |
|---|---|---|---|
| **Top 5 IT services firms** | | | |
| Finland | 50% | 39% | 0% |
| Lower-cost countries | 8% | 34% | 39% |
| Other countries | 42% | 27% | -3% |
| Total | 100% | 100% | 5% |
| **Top 10 software product firms** | | | |
| Finland | 58% | 40% | 1% |
| Lower-cost countries | 9% | 24% | 32% |
| Other countries | 33% | 36% | 10% |
| Total | 100% | 100% | 9% |
| **All 15 firms** | | | |
| Finland | 51% | 39% | 0% |
| Lower-cost countries | 9% | 32% | 39% |
| Other countries | 40% | 29% | -1% |
| Total | 100% | 100 % | 6% |
| (Total number of employees) | (20 700) | (27 300) | |

Source: Figures adjusted and partly estimated on the basis of data from company reports

Even if the figures are partly estimates due to difficulties to get company level information they provide a good understanding of the significance of transferring jobs. The numbers above also indicate that, since the total number of IT employees in the largest companies has remained about the same in Finland between 2005 and 2010, the growth has been a little stronger among the smaller IT firms during this period.

Presently only a rather limited amount of research or other, more profound information is available of the dynamics and impacts of globalization and offshoring. This concerns the globalization of manufacturing companies as well as information intensive service firms (cf. Ylä-Anttila, 2008). For instance, despite the growing role of services produced in lower-cost economies, it is difficult to get reliable estimates of the value of these purchases. This is due to e.g. the varying reporting practices of IT firms as well as their customers**.**

## *9.5 Foreign Trade of Software Products and IT Services*

A full picture of the Finnish IT industries from both supply and market sides requires also information of foreign trade of software products and IT services. Due to the various changes like globalization and new communication technology the importance of foreign trade has increased in both areas of the IT industries in the 2000s.

The main source of foreign trade information is the trade statistics of Statistics Finland. Due to the industry classification applied (TOL 2008, codes 62-63) the imports and exports statistics consider IT services category (computer services) covering both software product and IT services.

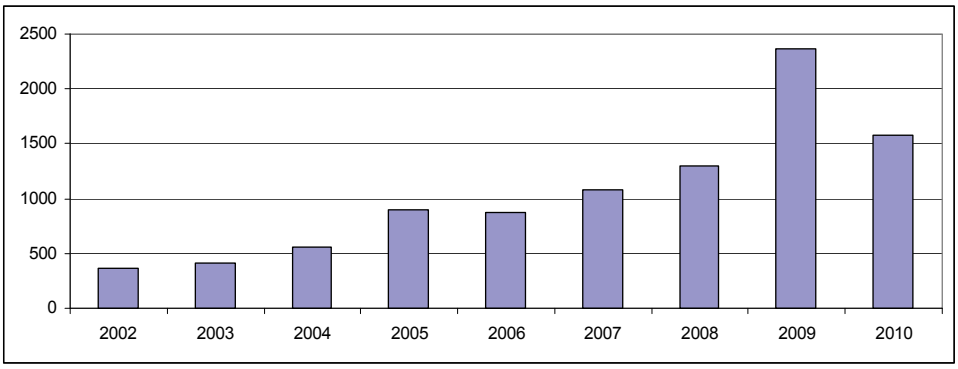
### 9.5.1 Imports of Software Products and IT Services

The foreign trade statistics give only partial and rough information of the imports of software products and IT services. In the statistics a part of the software products imports are included as one, unspecified component in the category of royalties and licenses, making the outcome rather useless for deeper understanding. The value of imports is assumed to include purchases of external services from foreign firms (e.g. subcontracting) as well as internal transactions between headquarters and country offices or direct services purchases of customer firms, for instance infrastructure outsourcing services produced outside Finland. Some imports may include in intermediate outputs in projects or in other services produced in Finland.

Since research does not offer more detailed information, it has to be concluded that the available information can only be taken as directional in describing the evolution and growth rate of imports of software products and IT services.

Figure 19 and Table 24 describe the imports of IT services in the 2000s. According to the trade statistics the value of the IT services imports totaled about 1.3 billion euro in 2008 representing about 40 percent of the value of the traditional IT services market in

Finland. In 2009 the imports climbed up to 2.4 billion whereas in 2010 the figure returned to follow the earlier growth path. It is not possible to find an exact explanation to the leap in imports in 2009 from public information about the IT services market. Instead, it seems reasonable to assume, that the sudden change was connected to internal transactions of both the IT services companies and IT user companies (cf. Pajarinen et al., 2010).




Source: Statistics Finland, International trade in services (15.12.2011), (codes 62-63, TOL 2008)

**Figure 19 Imports of IT services 2002-2010, M €**

As discussed earlier (Chapter 9.3.4) the imports of IT services have been estimated to cover a fifth of the value of the Finnish IT services market. One reason behind the growth of imports is the change in the behavior of the IT service providers; when more IT service production is transferred from Finland to lower-cost locations, also the imports of IT services increase, because a considerable part of the services produced outside Finland are brought back as imports to Finnish customers.

**Table 24. Imports of IT services, royalties and licenses 2002-2010, M €**

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | CAGR 2002-10 |
|---|---|---|---|---|---|---|---|---|---|---|
| IT services | 363 | 407 | 561 | 904 | 879 | 1 077 | 1 293 | 2 366 | 1 576 | |
| Growth | | 12% | 38% | 61% | -3% | 23% | 20% | 83% | -33% | 20% |
| Royalties and licenses | 641 | 545 | 644 | 902 | 1 031 | 1 051 | 1 380 | 912 | 944 | |
| Growth | | -15% | 18% | 40% | 14% | 2% | 31% | -34% | 4% | 5% |

Source: Statistics Finland, International trade in services (15.12.2011), (codes 62-63, TOL 2008)

On the basis of market studies and the top 100 vendor database it is estimated in this study that the value of imported software covered two thirds of the value of the user spending in 2008, representing nearly 800 million euro.

Information from different sources (e.g. market studies, company reports) supports the view of very high growth rates of imports of external services during last years. The

growth is accelerated by the increasing use of off-shoring and will clearly surpass the growth of the traditional IT services market (e.g. Market-Visio, 2007, 2008b).

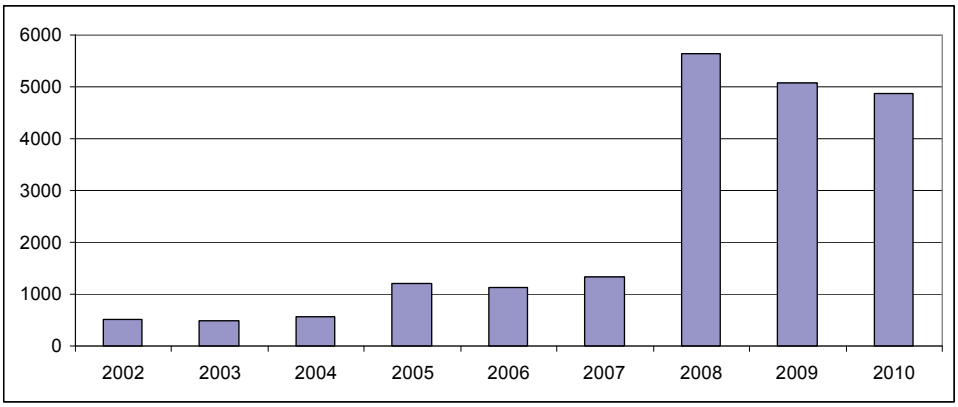
Since research does not offer more detailed information on this matter, either, is has to be concluded that the available information can only be taken as directional in describing the evolution and growth rate of imports of software products and IT services.

### 9.5.2 Exports of Software Products and IT Services

Considering the exports of software products and IT services leads to similar issues discussed ahead concerning imports. The statistics do not provide a sound base for assessing the size or structure of exports.

Like import statistics also statistics of IT services exports include some exports of software products under headings income from royalties and licenses. It is, however, not possible to separate software licenses from the total license exports.

Considering the IT services exports statistics raises also some questions. According to the trade statistics the value of IT services exports has increased even more rapidly than the value of imports. In 2008, the value of IT services exports jumped to 5.6 billion, almost double the value of the Finnish IT services market and four times bigger than in the previous year (Figure 20 and Table 25). In 2009 and 2010 the value declined but altogether stayed on an exceptionally high level.




Source: Statistics Finland, International trade in services (15.12.2011), (codes 62-63, TOL 2008)

**Figure 20. Exports of IT services 2002-2010, M €**

Because of the leap in 2008, the IT services comprised a third of the value of all services exports. The leap in exports can partly be explained by globalization and related increase in IT service transactions between countries.

**Table 25. Exports of IT services, royalties and licenses 2002-2010, M €**

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | CAGR 2002-10 |
|---|---|---|---|---|---|---|---|---|---|---|
| IT Services | 518 | 492 | 576 | 1 194 | 1 136 | 1 335 | 5 650 | 5 067 | 4 873 | |
| Growth | | -5% | 17% | 107% | -5% | 18% | 323% | -10% | -4% | 32% |
| Royalties and licenses | 594 | 443 | 675 | 969 | 850 | 930 | 1 007 | 1 252 | 1 755 | |
| Growth | | -25% | 52% | 44% | -12% | 9% | 8% | 24% | 40% | 15% |
| Exports total | 7 424 | 6 499 | 8 303 | 9 642 | 9 540 | 11 914 | 16 338 | 15 361 | 15 101 | |
| Growth | | -12% | 28% | 16% | -1% | 25% | 37% | -6% | -2% | 9% |
| IT services of all services Exports | 7% | 8% | 7% | 12% | 12% | 11% | 35% | 33% | 32% | |

Source: Statistics Finland, International trade in services (15.12.2011), (codes 62-63, TOL 2008)

The exports contain different types of external and internal transactions. A part of exports naturally consists of IT services sold to customers abroad. However, major part of exports must consist of internal invoices and transactions between headquarters and country offices of customers. Rouvinen[26] has explained the "explosion" of IT services exports and increased volume of internal transactions by transferring the head office of Nokia Siemens Networks to Finland as well as by a change in the practices of the statistical authorities. So far, it is not possible to separate these items from the total numbers.

In addition, it is possible that the exports also contain overlaps with imports when international companies purchase IT services centrally from Finland from different countries and further invoice their subsidiaries abroad.

In all, the foreign trade statistics do not describe the real performance of Finnish software product and IT services industries. Getting more precise information on IT imports and exports is gaining importance while internationalization of Finnish firms and the acceleration of internal invoicing and related transactions with that, can make the correct interpretation of the trade statistics impossible and lead to faulty conclusions of the real import/export development.

A corresponding issue has been faced in Sweden where a proposal has been made to improve the related statistics (Gozzo, 2009). In Finland Pajarinen et al. (2010) have suggested improving the foreign trade statistics based on value-added approach.

Statistics Finland provides another view and approach to exports of IT services. According to business services statistics (palvelualojen hyödyketilasto) the value of exports of IT services totaled about 860 million euro in 2009. The statistics include only

[26] Petri Rouvinen, Presentation in launching the study 'Internet in the Finnish economy', 23.3.2012, Ministry of Transport and Communications

companies with a minimum of 20 employees. This level of exports is closer to the view formed on the basis of different other sources applied in this study.

Despite the fuzzy statistics, several market and other studies support the view that exports and other international sales of software products and IT services have grown significantly in the 2000s (e.g. Rönkkö, 2009, 2010, annual reports of major Finnish software and IT services companies). A good share of the growth is related to products or services produced in various networks of firms crossing country borders. In addition, due to the decreasing domestic market many software product firms have been forced to strengthen their efforts to increase exports. The establishment of international computer centers in Finland (e.g. Capgemini, Google) will also increase exports of IT services in the coming years.

Foreign trade of software products and IT services require more attention both at practical and scientific levels. In addition to understanding of structures and dynamics of imports and exports the information available may have influence on decisions made at national and firm levels. Separating the value of internal invoicing would help to avoid or decrease overlaps and double-counting. In all, these issues are also closely connected to value creation of Finnish IT industries and more precise information would help to perceive and understand better the role, structure and also the size of the Finnish production.

# 10 Structure of Finnish IT Vendor Field

The chapter 10 examines and analyzes the evolution and structures of the IT industries from the perspective of IT firms or IT vendors. The basic argument of this discussion is that examining firm level information provides a valuable complement to examination based on official industry classifications and statistics. Likewise, an examination extending over the accustomed industry borders is necessary in forming a deeper understanding of a highly dynamic industry.

The framework of IT enterprise space chosen for this study has been used in order to allow a flexible and dynamic consideration. In order to make company-level considerations, the examination is based on the database of the top 100 vendors constructed for this study. For an even closer look at the firm level an auxiliary database of the top 10 vendors is constructed and used.

A closer look at the firm level helps also concretize the effects of the different changes in the marketplace to the IT industry firms. The major drivers of the industry evolution, such as technology changes and innovations, globalization and business models impact on the whole vendor community, single vendors, as well as their customers.

These drivers as well as changes in customer needs and behavior bring forth new products and services and new substitutes. Sometimes changes force IT firms to expand beyond traditional market and customer bases and meet new competition. On the other hand, there are examples of single firms reshaping its markets and affecting or changing the evolution of an entire industry (Hamel, 2000; Kim and Mauborgne, 2005; Jacobides and Tae, 2009).

This chapter discusses the structure of the Finnish software and IT services industries as well as the roles of different IT firms in the light of the top 100 vendor database constructed on the bases of company information from the year 2008. In addition, major changes and evolution of the vendor field and competition are considered. The terms IT firm and IT vendor are often used as synonyms.

## *10.1 Finnish IT Enterprise Space*

The concept of industry space has been chosen in this study as a framework for discussion, because it allows flexible definitions of industries helping to analyze and understand highly dynamic industries like IT. Accordingly the Finnish IT vendor field includes all firms producing or providing software products or IT services despite their official industry classification or the share of revenues or value added generated from these products or services. The firms can be direct or indirect competitors.

To concretize the types of IT vendor firms belonging to the Finnish IT enterprise space, the population can be divided into two main types according to the role of IT in their businesses.

For the first group of firms “IT is the business”. These firms are mainly traditional IT companies like software companies or IT services vendors providing software products or IT services to their customers who may be users or appliers of the information technology.

The other group consists of firms for which “IT is the enabler”. Also these firms provide software products or IT services or their substitutes competing to satisfy the same customer needs as the traditional IT firms, but their main business is somewhere else. Often also their official industry classification is not one of those defined as actual IT industries.

Some of the firms belonging to the second group operate in the surface of IT and some other industries. Firms in this group can be at the same time customers of IT firms and build their own enterprise spaces.

Figure 21 demonstrates the heterogeneity of customer needs and the IT enterprise space resulting in challenges to define industries.

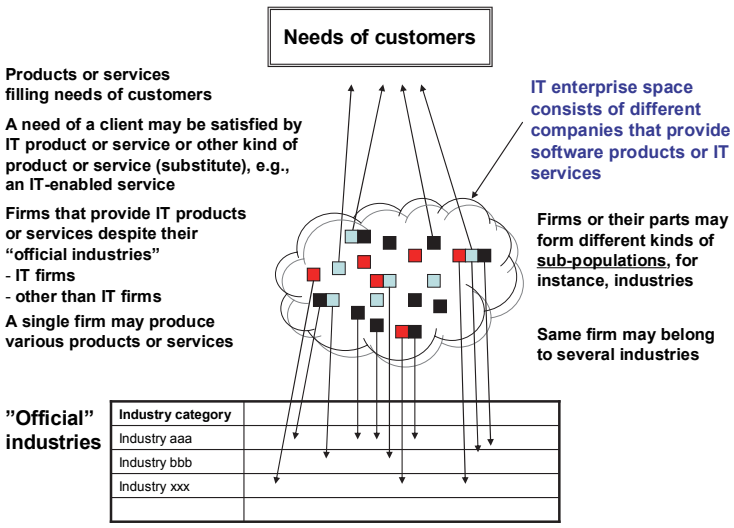



**Figure 21. Heterogeneity of customer needs, IT enterprise space and industries**

It is also possible that a single firm belongs to different enterprise spaces and several official industry categories (e.g. firms like Apple, Google, Itella and Nokia), which also underlines the need for multifaceted examination. For instance, Itella Information is not officially defined as an IT firm but it provides software products and IT services. In addition its main business BPO services competes directly or indirectly with IT firms. According to the scope of this study BPO services are considered only as expansion for software products and IT services companies. Therefore only software product and IT services businesses of companies like Itella have been covered in the study.

## 10.2 Size Structure of Finnish Software and IT Services Enterprises

There is no exact data of the numbers of Finnish software product firms or IT services companies (cf. e.g. Rönkkö et al., 2009, 2010). The enterprise statistics classify 5 400 firms belonging to the software products and IT services industries (TOL 2008; codes 62 and 63). Even if this number does not include IT production or services outside the official IT industry categories the enterprise statistics give a general idea of the size structure of Finnish software products and IT services industries.

It is also to be noted that the two categories included in the IT industries by Statistics Finland also contain firms or functions not examined in this study. The database of top 100 vendors helps to make a deeper analysis of the IT industry structure.

Major part of the Finnish IT industry firms are in the IT services industry. According to the estimate presented by the researchers of the Software survey there were about one thousand firms in 2008 producing own software products in Finland (Rönkkö et al., 2009).

As discussed earlier, according to the Statistics Finland the computer programming activities (industry code 6201) contained about 3 000 companies in 2008. Thus it is possible to assume that a high share of these enterprises is IT services firms as defined in this study.

The characteristic features of the Finnish software products and IT services industries are concentration and polarization or ”boulders, pebbles and sand” as called by Campbell-Kelly (2003). The IT industries consist of a few large firms at the top and a high number of small firms in the other end of the spectrum. The number of medium-size firms in the middle is low.

A few basic figures demonstrate the degree of centralization: In 2008 less than two percent of the 5 400 software product and IT services firms in the enterprise statistics (Statistics Finland) about one hundred firms, reported revenues of 10 million euro or more. This two percent, however brought two thirds of the total revenues of the IT industries and employed, nearly 60 percent of all their employees. According to this statistics there were only 25 enterprises having more than 250 employees in Finland in 2008.

At the same time, as much as 93 percent of IT industry firms reported revenues less than 2 million euro (Table 26). A good half of all software and services firms were very small, having revenues less than 100 000 euro and employing only five percent of all employees in the field. About one thousand firms, a fifth of all firms in these industries, had five or more employees in 2008.

**Table 26. The Finnish software and IT services firms by revenue category, 2008**

| Revenue categories (TOL 2008, industry codes 62-63) | Firms, % of total number | Employees, % of total number | Revenues, % of total |
|---|---|---|---|
| Less than 2 million euro | 93.2 | 23.8 | 15.5 |
| 2-10 million euro | 5.2 | 18.6 | 17.7 |
| More than 10 million euro | 1.6 | 57.6 | 66.8 |
| All firms | 100 | 100 | 100 |
| Less than 100 000 euro | 54 | 5 | 2 |

Source: Statistics Finland, Enterprise statistics database, 2009

To further demonstrate the high degree of concentration of the Finnish IT industries it has been estimated in this study, on the basis of the figures of Statistics Finland, the shares of total revenues and employment of the top 30, 100 and 350 firms in the Finnish software and IT services industries in 2008 (Table 27). These estimates have been used as a comparison in assessing the usability of the top100 firm database when considering the structure and evolution of Finnish software and IT services firms.

**Table 27. Shares of employees and total revenues by size groups, 2008**

| Size group | % of employees | % of revenues |
|---|---|---|
| 30 largest firms | 40 | 50 |
| 100 largest firms | 60 | 67 |
| 350 largest firms | 85 | 75 |

Source: Statistics Finland, 2009 (modified approximate numbers)

The figures above show the strong concentration of the Finnish IT industries and the dependence of the whole industry's evolution on a small number of large vendors. In the following chapters this concentration and its impacts will be analyzed by examining the role of the major vendors.

## *10.3 Categories of Software Product and IT Services Vendors*

In the following the software product and IT services vendors have been classified into four categories by applying the business models presented by Cusumano (2004). These categories help to demonstrate and understand the heterogeneity of the IT vendor field. Cusumano proposes that companies must adopt one of three basic business models: a products company is at one end of the strategic spectrum, a service company at the other, a hybrid solutions company in the middle.

This categorization is applied here to the top 100 IT vendor population because it provides a closer look at the structure and characteristics of the Finnish software products and IT services companies. The hybrid category, however, is defined more broadly due to stronger emphasis on services. In addition, a fourth category "others" has been added to complement three categories above. Compared to the classification of IT firms utilized in

software surveys (Rönkkö et al., 2009, 2010) this categorization represents higher level of aggregation. Table 28 describes the different categories of IT industry firms and gives practical examples of the categorization.

**Table 28. Categories of software and IT services Firms**

| | The focus of the business | Examples of enterprises | Comments |
|---|---|---|---|
| IT services firms | IT services, no own software products | Accenture, Affecto, Capgemini; Fujitsu Services | Category includes also business consulting firms providing IT services, only IT revenues are covered in this study |
| Software product firms | Own software products and related services | Aldata, Basware, F-Secure, Microsoft, Tekla | Only very small share of total revenues may come of selling software of third party |
| Hybrid firms | Wide range of IT services and own software, both have strong role in their strategies | Logica, Tieto, HP, IBM | IT services also for third party software, e.g. SAP, Microsoft. May have also other strong IT businesses, e.g. HP, IBM |
| Others | The main focus is other than IT services or software products | Elisa, TeliaSonera | Only IT revenues are covered in this study |

Source: Categories presented by Cusumano (2004) and are modified for this study

Major part of the Top 100 vendors is traditional IT firms. There are, however, some vendors belonging to other than IT industries. For example, IT services firm category includes management consulting firms that provide IT services as well as some international services vendors which have no subsidiaries or offices in Finland (e.g. some Indian IT companies). The category other, in turn, includes telecom operators and distribution channel enterprises. Several Finnish telecom operators offer also IT services, for instance, capacity based services.

The four categories help to perceive and understand the enterprise structure of the Finnish IT vendor field and also the whole IT enterprise space. Categories also enable to assess the importance and roles of different types of companies in the Finnish IT industries.

Examining of numbers of firms, revenues and employees by vendor categories contributes to the picture of the Finnish IT enterprise space and its structure (Tables 29 and 30)**.** By number of firms the IT services firms form the largest category but not very far ahead of the second largest group, the 'pure' software product firms. On the basis of total revenues and employment, the picture is quite different (Table 29). Despite their rather low number the hybrid firms play very important role in the Finnish IT industry. They generated half of the total revenues (including international operations) of the top 100 firms and also half of their total number of employees (including personnel of Finnish IT firms abroad). In spite of their vast number, pure software product companies generated less than a fifth of both the total revenues and employment of the top 100 vendors. IT services companies employed a third and hybrid firms nearly a half of IT personnel working in Finland.

Nearly a half (software product firms and hybrids) of the top 100 enterprises provides software products produced in Finland or imports their own software. All firms provide some sort of IT services.

**Table 29. Top 100 vendors by categories, total IT revenues and employees, 2008**

| Vendor categories | Number of firms | Total IT revenues | IT revenues from Finland | Total IT personnel*) | IT employees in Finland |
|---|---|---|---|---|---|
| IT services firms | 39% | 22% | 26% | 26% | 32% |
| Software product firms | 35% | 18% | 14% | 15% | 15% |
| Hybrid firms | 12% | 50% | 47% | 54% | 45% |
| Others | 14% | 10% | 13% | 5% | 8% |
| Total | 100% | 100% | 100% | 100% | 100% |
| | N=100 | | | | |
| (Volumes from top 100 database, rounded) | | (7.1 B €) | (5.4 B €) | (45 500) | (30 500) |

*) Total personnel of Finnish IT firms and Finnish employees of foreign IT companies
Source: Top 100 vendor data base. Revenue and employee splits are partly estimated.

Table 30 examines the revenue structures of the top 100 vendors from the perspectives of the Finnish IT market demonstrating also the sizes of software product and different services markets.

The table illustrates the strong role of hybrid firms in the Finnish IT market. Together with software products firms the hybrid firms dominate the software products sales. In the traditional IT services markets the hybrid firms are the biggest player, and dominate the market, at this time, together with the IT services companies. This is the case also in the sales of other services: hybrids and IT services companies take a lion's share of the sales. The dominance in the traditional IT services is explained by the fact that in addition to services related to their own software, similar to IT services firms, hybrid firms provided a wide range of IT services like services for software of other vendors (e.g. SAP, Microsoft) and outsourcing services.

**Table 30. IT services and software revenues by vendor categories in Finland, 2008**

| Vendor category | Number of firms | Software product and IT services revenues | Software product revenues | Traditional IT services revenues | Other services revenues (R&D, BPO etc.) |
|---|---|---|---|---|---|
| IT services firms | 39% | 23% | 2% | 35% | 37% |
| Software product firms | 35% | 14% | 57% | 5% | 5% |
| Hybrid firms | 12% | 60% | 38% | 54% | 50% |
| Others | 14% | 3% | 2% | 6% | 8% |
| Total | 100% | 100% | 100% | 100% | 100% |
| | N=100 | | | | |
| (Revenues, B €, top 100 database, rounded) | | (3.9) | (0.9) | (2.5) | (0.5) |

Source: Top 100 vendor data base. Revenue splits are partly estimated.

The figures reflect clear differences between firm categories. Closer examination at firm level provides more detailed understanding of the reasons and factors forming these differences. Due to concentration a small number of enterprises has strong role in different categories. For instance, Tieto Corporation alone generates significant share of the volumes of the hybrid category.

Table 31 shows the revenue sources of the top 100 IT firms in different categories. The figures help further to specify differences between firm categories providing picture closer to perspectives of different kinds of vendors and their market positions.

**Table 31. Revenue sources of firm categories, Finnish market, 2008**

| Revenue sources | IT services firms | Software product firms | Hybrid firms | Others | All Top 100 vendors |
|---|---|---|---|---|---|
| Traditional IT services | 65% | 17% | 53% | 19% | 46% |
| Other services | 13% | 3% | 10% | 3% | 9% |
| Software products | 1% | 64% | 13% | 6% | 16% |
| Others | 21% | 16% | 24% | 72% | 28% |
| Total | 100% | 100% | 100% | 100% | 100% |
| | n=39 | n=35 | n=12 | n=14 | N=100 |
| Revenues, B € (rounded) | (1.4) | (0.8) | (2.5) | (0.7) | (5.4) |

Source: Top 100 vendor data base. Revenue splits are partly estimated.

IT services companies generated nearly 80 percent of their Finnish revenues of traditional IT and other services, hybrid firms over 60 percent, respectively. Examining the total market sizes of different vendor categories demonstrates the importance of the services sales for hybrids.

The tradition to provide one-stop shopping has been strong among Finnish IT services vendors. This is supposed to explain the strong role of hybrid firms. Inspite of their strong emphasis on services, the major hybrid firms have also retained a strong role as producers of application software products in Finland, e.g. Tieto, Logica and Digia.

Software companies captured two thirds of their revenues of software products and one fifth of service that are mainly related to their own software. Despite high market share of the software products the software revenues of hybrid vendors represent only rather small share (13%) of their total revenues. As seen above in Tables 30 and 31 they are, however, very important players in the software product market.

During the last decade, however, the importance of own application software has decreased in many Finnish software product and hybrid firms. In addition to services related to their own software, they increasingly provide various other services, including services for software of other vendors and different outsourcing services. At the same time several companies have started to expand beyond their traditional markets, for instance to provide BPO or R&D services.

In addition to strong migration to services, there has also been migration to the other direction. The major global players such as IBM and HP have along services developed

strong offerings of systems and tools software strengthening the hybrid nature of their businesses.

Fujitsu, Accenture, Affecto and Capgemini, in turn, are focusing only on services. All of them provide a wide range of software related services. Several software product firms, such as Basware, F-Secure and Dovre (former Proha) have actively expanded to services during last few years. Despite lively debate and promising developments around the game software industry game software firms have no significant role in the of the top 100 vendor database. In 2008 the game software industry employed about 1 000 persons with the turnover of about 100 million euro.

The role of companies classified to the category 'others' has increased during last years. For instance, several telecom operators have expanded their IT services offerings through acquisitions. In addition, several traditional distribution channel firms have increasingly become dependent on IT services revenues.

The strong focus on narrow market segments of major Finnish software product companies and the self-sufficiency of Finnish hybrid firms are proposed to be reasons to lack of significant domestic software business ecosystems in Finland. The software product firms and hybrids often control the entire value chain of their application software products leaving less space for the small software or services firms to become complementors or even grow in certain application areas. Several IT services firms, in turn, are very dependent on ecosystems of major international players, such as SAP and Microsoft.

Software sales of Finnish hybrid firms are very dependent on Finnish customers (including international Finnish firms), who also require software related services. Hybrid firms and other major IT services providers typically concentrate on large customers that often have international operations. Major Finnish software firms, instead, are dependent on international markets (e.g. F-Secure, Basware, Aldata, Tekla, Comptel).

Due to strong concentration of the Finnish IT industries examining the vendor categories of the top 100 IT vendors helps to perceive and understand the structure and basis of the whole Finnish IT enterprise space. The top 100 vendors cover much bigger share of the traditional IT market in Finland than could be expected on the basis of total numbers of IT enterprises. Instead, due to the scope and definitions of the study the top 100 vendors have smaller share of the total Finnish IT production than from the Finnish IT market.

The following chapter widens this picture by considering the role of foreign IT enterprises in the Finnish IT industries.

## *10.4 Role of Foreign-owned IT Firms in Finland*

In the previous chapters growing roles of international software products and IT services companies were discussed. This chapter concretizes the significance of foreign IT companies in Finland.

Several surveys and other research often focus on Finnish production of software and services or only on Finnish companies (e.g. Rönkkö et al., 2009, 2010). The Finnish IT sector and separate IT industries are, however, increasingly dependent on imports of software and services as well as on foreign IT firms operating in Finland. Some of foreign IT firms produce software products locally but imports have gradually replaced big part of the local production.

The foreign-owned IT companies represented 40 percent of the firms included in the top 100 database (Table 32). The majority of them have a long history in the Finnish market. The foreign IT firms generated nearly two thirds of the total IT revenues and employed almost half (46%) of the workforce in the top 100 vendors in Finland in 2008. From combined software product and IT services revenues they accounted for more than half. The total IT revenues include also hardware revenues emphasizing the dominance of foreign companies. Examining company information supports the assumption that the revenue shares of foreign firms have remained same or even increased slightly since 2008.

**Table 32. Shares of Finnish and foreign IT companies, Finnish market, 2008**

| | Number of firms | Total IT revenues | SW product and IT services revenues | IT employees |
|---|---|---|---|---|
| Finnish firms | 60% | 37% | 47% | 54% |
| Foreign-owned firms | 40% | 63% | 53% | 46% |
| Total | N=100 | | | |
| (Volumes from top 100 database, rounded) | | (5.4 B €) | (3.9 B €) | (30 500) |

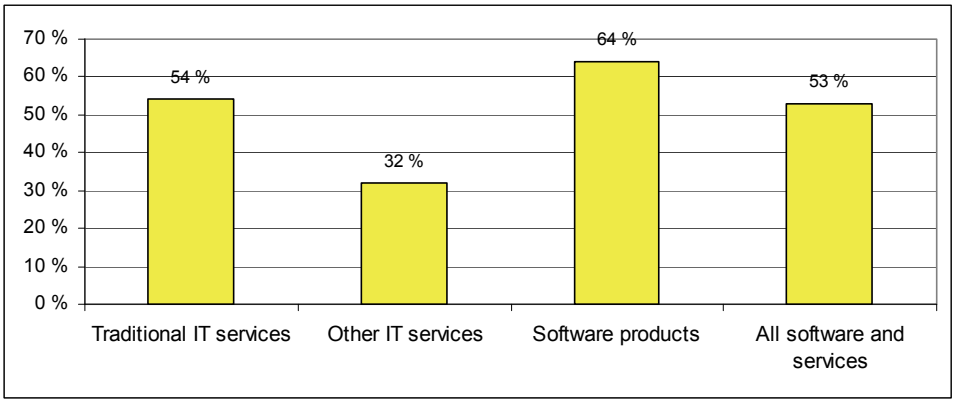
Source: Top 100 vendor data base. Revenue and employee splits are partly estimated.

Comparison of the shares of IT revenues and employment of Finnish and foreign firms is interesting. The foreign firms have a higher share of the total IT and also of the combined software product and IT services markets than that of employees. This demonstrates the important role of imports as well as their dependency on local employees.

Large international IT enterprises have a strong foothold on both the Finnish software products and IT services markets resulting in high market shares for foreign companies (Figure 22). In software products the foreign companies have the strongest position, accounting for more than 60 percent of the total revenues. Also in the traditional IT services market they control more than half of the market whereas in the other services market (e.g. applier market) Finnish vendors are more dominant. Due to the high share of Finnish IT services providers in the applier market Nokia´s activities to decrease services purchases in Finland in 2011 and 2012 have affected more strongly Finnish than foreign IT firms in Finland.

It is to be noted, however, that the share of foreign companies is higher in the top 100 database than in the whole population of IT industries. Nevertheless, because of the high concentration of the market, the role of the foreign IT firms has become very important

for the whole industry and even critical from the perspective of the Finnish IT employment.




Source: Top 100 vendor data base.

**Figure 22. Revenue shares of foreign firms in the Finnish market**

Examining the vendor categories specifies the picture of the role and significance of foreign IT companies in Finland. The table below demonstrates the shares of foreign firms in the top 100 database. Foreign firms account for about one third of the number of firms in all categories expect in other firms category (Table 33).

**Table 33. Distribution of Finnish and foreign firms by vendor categories, 2008**

| | IT services firms | Software product firms | Hybrid firms | Other firms | All top 100 vendors |
|---|---|---|---|---|---|
| Finnish firms | 67% | 63% | 67% | 29% | 60% |
| Foreign firms | 33% | 37% | 33% | 71% | 40% |
| Total | 100% | 100% | 100% | 100% | 100% |
| | n = 39 | n = 35 | n = 12 | n = 14 | N = 100 |

Source: Top 100 vendor data base.

Table 34 considers shares of IT revenues and employees of foreign and Finnish companies by vendor categories. The table explains further the market shares of foreign firms and also their role as IT employers in Finland. Due to strong concentration of IT companies this study proposes that the following information is largely describing the whole Finnish IT enterprise space.

As discussed above, foreign firms including in the database of top 100 vendors control a good half (54%) of the Finnish traditional IT services market. Both foreign pure IT services firms and hybrids have almost equal shares of this marketplace. Especially in hybrid firms the corresponding share of employees is lower indicating higher shares of services produced outside Finland, mainly in lower-cost countries. The IT services vendor category contains some major international players, such as Accenture,

Capgemini and Fujitsu Services which alone employ over 40 percent of the total personnel of the category.

**Table 34. Market shares and IT staff of vendor categories, foreign and Finnish firms**

| Vendor categories by origin | | Traditional IT services | All IT services | Software products | Software products and all IT services | All IT employees |
|---|---|---|---|---|---|---|
| Foreign-owned IT firms | | | | | | |
| | IT services firms | 22% | 23% | 0% | 17% | 20% |
| | Software product firms | 3% | 2% | 40% | 11% | 4% |
| | Hybrid firms *) | 25% | 21% | 22% | 22% | 17% |
| | Others | 4% | 4% | 2% | 3% | 5% |
| | All foreign firms | 54% | 50% | 63% | 53% | 46% |
| Finnish IT firms | | | | | | |
| | IT services firms | 14% | 13% | 2% | 11% | 13% |
| | Software product firms | 2% | 3% | 18% | 6% | 11% |
| | Hybrid firms | 29% | 32% | 16% | 28% | 28% |
| | Others | 1% | 2% | 0% | 2% | 3% |
| | All Finnish firms | 46% | 50% | 36% | 47% | 54% |
| Foreign and Finnish IT firms | | 100% | 100% | 100% | 100% | 100% |
| (Volumes from top 100 database, rounded) | | (2.5) | (3.0) | (0.9) | (3.9) | (30 500) |

*) Number of employees includes also hardware related employees
Top 100 vendor data base. Revenue and employee splits are partly estimated.

Foreign software product companies accounted for 40 percent of the software product revenues. Together with foreign hybrid firms they controlled nearly two thirds of the market. From the table it is to be seen, that in the software products market the number of employees of foreign companies is clearly lower than their share of the software revenues. This indicates that services related to foreign software products are largely provided by local and international IT services firms and hybrid companies. The Finnish software product companies generated about half of the revenues of foreign software firms but employed more people than foreign firms.

The hybrid firms generate the largest software product and IT services revenue shares of both Finnish and foreign companies. From the Finnish companies they are the biggest employers and from the foreign firms the second largest close to IT services firms.

A good half of the IT services revenues of Finnish-owned IT enterprises is generated by hybrid firms, emphasizing the strong role of Tieto. Hybrid firms also employ a half of all employees of Finnish IT firms.

Foreign IT firms have traditionally entered the Finnish market from the U.S. and Europe. Lately globalization has increased the presence of Asian IT services firms. For many of them Nokia has been the most important, in some cases the only reason to be interested in the Finnish market. The Asian firms have entered the Finnish market through different arrangements, including acquisitions (e.g. Indian-based Sasken, Wipro, some Chinese

firms) and outsourcing contracts (e.g. HCL). There are also foreign firms which have entered the Finnish market but have hardly any organization here (e.g. Infosys and TCS).

As discussed earlier, there are also a number of foreign IT professionals from different services firms working in projects in Finland on temporary basis. These employees and their companies are not covered by official statistics. In this study, their number has been estimated and couple of such firms is included in the figures of the top 100. Increasing popularity of transition from products to services, such as capacity and SaaS type of services utilizing cloud computing, may further increase the role of foreign firms having no offices or employees in Finland. The use of these services can be seen in IT spending of firms and consumers.

This study proposes that foreign IT companies have further increased their market shares in Finland since 2008. The developments described above and acquisitions (e.g. Tekla, Whitelake Softaware) have increased market volumes of foreign companies. At the same time Finnish production of software products and IT services have increasingly been transferred to lower-cost countries.

The interest of foreign firms on Finnish IT industries is often seen to have been based on a desire to acquire skills or production capacity in Finland. In most cases in the 2000s, however, this might not be the case. More probably the first reason to come to Finland has been to be close to the Finnish customers. If the number of interesting customers decreases the interest of foreign companies might fade and present a real threat for the future evolution of Finnish IT industries.

Already now there are signs of diminishing interest in the Finnish market from the side of foreign IT companies. In the recent years a growing number of Finnish subsidiaries of foreign companies have been changed to sales offices tightly managed from outside of Finland. Only few have substantial own product development or production functions in Finland anymore (excluding some data centers).

Global IT services firms utilize global strategies, policies as well as service processes built for large customers. This has provided opportunities for different Finnish vendors to serve local and smaller customers.

This study does not attempt to evaluate how unique is the nature of the Finnish IT industries are compared to other countries. Some remarks, however, are possible to address.

Strong role of global IT companies characterize the IT industries in all Nordic countries. Same global software products have strong positions in all four countries. Ireland paints a very different picture. High number of global software product and IT services companies has strong presence and operations in Ireland, largely due to low corporate tax. In the Nordic countries the foreign-owned IT firms mainly serve local customers whereas in Ireland the exports of IT products and services generate a significant share of Irish revenues of foreign-owned IT companies. During last years the importance of

software products and IT services firms has increased. The ICT industry is a significant employer and represented one third of the value of the Irish exports in 2009[27].

## *10.5 Top 10 Vendors*

Kroeger et al. (2008) have analyzed the transition and concentration of industries. On the basis of their empirical study they argue, that every industry will consolidate globally over time and that global consolidation will end up with three or four global consolidators that take 60 to 70 percent of the global market share in each industry sector. Industry sectors will go through their consolidation life cycle in 25 years. Worldwide industrial consolidation threatens all companies which are not among the three global industry leaders, including niche players that comprise 80 percent of all firms. A large majority of them becomes to targets of consolidation. On the basis of the enterprise statistics and the database of top 100 vendors it is possible to suppose that in Finland the share of niches as defined by Kroeger et al. (2008) is even higher.

Signs of this evolution can be seen in the Finnish IT services and software industries when comparing the rankings of the ten largest IT software and services firms in Finland during the past 20 years. Table 35 is organized by total revenue reported in Finland in 2008.[28] Many of the largest firms have grown by being active in acquisitions and mergers.

The top 10 list of Finnish IT industry supports argument of the global consolidation presented by Kroeger et al. (2008). Tieto, the largest IT firm in Finland is followed by large global vendors that have strong positions in the global software and IT services markets. The top ten players in Finland have strong position in the local IT services and software markets. They account for two thirds of the value of the Finnish IT services market and one third of the software market (cf. Market-Visio, 2009, 2010). In 2008 the top ten vendors derived total revenues of 3.3 billion euro in the Finnish market and employed over 17 000 persons in Finland, representing more than half (56%) of the employees of the top 100 IT vendors (source: top 100 IT vendor database).

[27] The Irish ICT industry employed 74 000 people in 2010, 58 500 engaged in ICT services. Employment in foreign owned agency-assisted ICT companies in 2010 was approx 37 000. ICT accounted for €50 billion of Irish exports in 2009. (http://www.ictireland.ie)

[28] The top 10 firms have been selected on the basis of revenues received from the traditional user market. Due this scope e.g. Itella Information is not on the list.

**Table 35. Top 10 IT services and software firms by revenues in 2008, 1998 and 1988**

| Company and ranking in 2008 | Revenues M €, 2008 1) | Employees 2008 2) | Employees in Finland 2008 3) | Ranking in 1998 | Ranking in 1988 |
|---|---|---|---|---|---|
| 1. Tieto | 1 866 | 16 618 | 6 000 | 1. | 4. |
| 2. Hewlett-Packard | 566 | 809 | 800 | 3. | 6. |
| 3. IBM | 480 | 1 480 | 1 500 | 4. | 2. |
| 4. Fujitsu Services | 395 | 2 632 | 2 600 | 2. (ICL Data) | 1. (Nokia Data) |
| 5. Logica | 348 | 2 900 | 2 900 | 5. (Novo Group) (WM-data) | 9. (KT) 10. (PTK) |
| 6. Accenture | 264 | 1 306 | 1000 | 10. | .. |
| 7. Microsoft 4) | 160 | 209 | 200 | Among Top 15 | .. |
| 8. Enfo | 143 | 703 | 500 | Among Top 15 (Tietosavo) | Among top 15 (Tietosavo) |
| 9. Affecto | 132 | 1 136 | 300 | Former Enator (1989) | .. |
| 10. Digia | 123 | 1 314 | 1200 | .. | .. |
| Top 10 vendors | | 29 107 | 17 000 | .. | .. |

1) Ranking according to revenues reported in Finland, may include international revenues and also other than software and services revenues
2) Of foreign companies only the number of employees in Finland
3) Figures are rounded
4) Microsoft revenues are estimated to describe the value of sales in Finland

Source: VTT statistics, 1989; TIVI 250 from 1999, 2009, company reports and estimates

Six out of ten largest IT firms were foreign companies. The only software firm on the top 10 list was Microsoft. The largest Finnish pure software product vendor, F-Secure, ranked eleventh and therefore did not make it to the top 10 list.

In 2000s strategy changes of several major global IT firms have clearly resulted in profound transformations reshaping the vendor field and competition strengthening the positions of large players. For example, both IBM and HP were very dependent on hardware sales in 1990s. In the 2000s both of them have actively moved towards services and also strengthened their software product offerings. Lately outsourcing and the growing use of international software products have further strengthened the position of international vendors.

Several global mergers and acquisitions in the 1990s and 2000s have had a global impact and their effects have been felt also in Finnish market and the Finnish vendor community. Among the most significant ones was the acquisition of the consultancy business of PricewaterhouseCoopers (PwC) by IBM (Gerstner, 2003). Major acquisitions by HP have changed the global market balance on both hardware (Compaq) and services market (EDS). Similarly also acquisitions of Oracle (e.g. Siebel, Sun Microsystems) and Microsoft (e.g. Navision) have increased the concentration of global IT industries.

One more recent development has caused the market shares of many Finnish vendors to decline. Finnish customers who operate internationally or globally often favor global service vendors in order to secure global services. This is not a new trend. In 1998 the top

ten list of IT services vendors included only two Finnish firms, Tieto and Novo Group (IDC, 1999). Acquisitions and expanding beyond traditional IT services have helped Enfo, Affecto and Digia to climb on the top ten list in 2000s.

During the last twenty years Tieto has been the major reorganizer of the vendor field in Finland. In addition to organic growth it has acquired several major Finnish and Nordic firms (e.g. VTKK, Unic and Enator in Sweden). Simultaneously, several Finnish services and software firms have been acquired by foreign firms, including acquisition of Nokia Data by ICL which later was acquired by Fujitsu Services and the acquisition of Novo Group by WM-data, later acquired by Logica which in turn was acquired by Canadian CGI in 2012.

Similar developments apply to other Nordic countries as well. As a result there is no longer any Swedish IT services firm among the top ten Nordic vendors. In addition to global players the list of 2009 still included Tieto, Evry (EDB) from Norway and KMD from Denmark (IDC, 2010). Finnish and Norwegian IT services markets are more concentrated than those in Sweden and in Denmark. Both in Finland and Norway the market leaders are domestic companies, Tieto and Evry.

## *10.6 Age Structure and Incumbents*

The rather stable list of top ten vendors reflects also the strong role of incumbents in the Finnish IT market. Despite major technological changes, many disruptive changes in IT industries and the fast growth of the markets and number of IT firms since the 1960s and 1970s, only very few firms have been able to push to the group of top 10 or even top 100 vendors during the past two decades. The growth rates presented in the industry level may give too dynamic picture of the developments.

The process of creative destruction following major technology waves or disruptive changes in the marketplace or industries (Schumpeter, 1942; Lovio, 1993) has not affected similarly to the major players in the Finnish IT market. On the contrary, several incumbents have been able to keep their market position quite stable despite the disruptions. This is in line with arguments and theories concerning strong role of major incumbents presented by several economists (e.g. Schumpeter, 1942; Chandler, 1990; Tushman and Anderson, 1991; Lovio, 1993).

Often the major players are not first movers in adapting new technologies or other innovations. However, IBM, for instance has been able to redefine the industry and its environment more than once (Chandler, 1990; Gerstner, 2002; Chesbrough, 2003). On the other hand, a high number of new entrepreneurial firms have not been able to hold their leading positions despite the superiority of their products or services (e.g. C. M. Christensen, 1997; G. A. Moore, 2000; Hamel, 2000).

Creative destruction (Schumpeter, 1942) and disruptive changes (C. M. Christensen, 1997) often create new market leaders. In the IT industries many of them have become

market leaders globally. In addition, a number of the new firms entering the market due to major disruptions have come from outside the traditional IT industries (e.g. Google) and are still difficult to be classified into IT industry categories.

In the Finnish software product industry international or global companies have increasingly taken market leader positions. They have expanded and penetrated also to smaller customer organizations whereas in the IT services market the large global players have mainly focused on larger customers.

At the same time some Finnish IT companies have been able to remain market leaders at the lower level of aggregation or at sub-industry levels. Examining the database of top 100 vendors and company information supports these arguments.

During last couple of decades technological waves and related innovations have strengthened market position of international software products transforming also the Finnish software product and IT services industries. These developments have also contributed to the concentration of vendor fields in these industries.

These developments can be seen also among the largest IT services vendors in Finland. Despite several technological waves and other disruptions the incumbents have been able to retain their strong role in the marketplace. Also, in spite of numerous domestic and international acquisitions and other structural changes in the entire vendor field, the list of top 10 IT firms in Finland was quite similar in 2008 as in 1998 (IDC, 1999; Market-Visio, 2009, 2010). The changes were mostly changes in rankings. Mergers and acquisitions have been the major means to strengthen the market position of the major IT services vendors.

The top 100 vendor database and examining of company information also reveal that a good number of the firms have retained their strong position for a long period of time. Major part of the top 100 firms have been around for more than 20 years, many have roots in the 1960s or 1970s, the early years of information technology.

Table 36 below lists some major IT companies by decades when they have been established or entered the Finnish market. These decades can also be linked to major technological waves (cf. e.g. Moschella, 2003). The names the top 10 firms in 2008 have been bolded in the table to help to see the stability of the main players.

Tieto and Logica are examples on the fact, that the long-established incumbents have not remained the same through the decades. They have changed profoundly their strategies and offerings. It is also worth noticing that these two leading services vendors in Finland have been able to keep their positions as major producers of application software products.

Kroeger et al. (2008) argue that 90 percent of the companies existing today will not be around in 25 years. The information available does not make it possible to evaluate the relevance of this argument in Finnish IT industries.

**Table 36. Examples of major IT companies from different decades**

| | Name of the firm | Comments |
|---|---|---|
| In 1960s | **IBM**, 1936<br>**Fujitsu Services** (Nokian laskentakeskus, 1960)<br>**Enfo** (Tietosavo, 1964)<br>Tekla (Teknillinen laskenta, 1966)<br>**Tieto** (Tietotehdas,1968) | Roots in data centers or in processing type of services<br><br>Tekla was acquired by a U.S. company in 2011 |
| In 1970s | **HP**<br>**Logica** (CGI) | Roots of Logica in PTK, Kunnallistieto and WM-data |
| In 1980s | **Accenture**<br>Capgemini<br>Basware (Baltic Accounting System, 1985)<br>Aldata, 1986<br>Comptel, 1986<br>SAS Institute, 1987<br>**Microsoft** (subsidiary 1992)<br>F-Secure (Data Fellows, 1988)<br>**Affecto** (former Enator, in Finland since 1989) | Aldata and Comptel founded as captive IT companies<br>Several major international software product and IT services companies entered Finnish market. The trend continued in 1990s.<br>Main part of Aldata has been sold to an international equity firm in 2011 |
| In 1990s | **Digia** (Sysopen, 1990)<br>Ixonos (Tieto-X, 1994)<br>SAP (entered in 1996, subsidiary from1997) | |
| In 2000s | Reaktor, 2000 (IT services)<br>Mawell, 2001<br>Rovio, 2003 (game software) | Examples of firms with high growth rates |

Source: Company information, VTT yearly reports from 1985-1989

Examining the companies belonging to the database of top 100 IT vendors reveals the difficulty to rise among the largest vendors in the Finnish market. It can be noted that only a handful of firms which have entered the market during the last twenty years have been able to climb to the top 100 list. The examples are clear: It has taken more than fifteen years for e.g. Basware, Digia and F-Secure to achieve revenue of about 100 million euro and about 1 000 employees. To grow to the top group, all three have also needed acquisitions and/or internationalization.

A further proof of the great challenges in being able to grow fast to the top even in a dynamic industry like IT is found by extending the analysis to the group of top 30 IT vendors. In this group there were in 2008 only two companies established during the last ten years[29]. Acquisitions of emerging companies that might be potential competitors or may provide new business opportunities can be supposed to be one reason to prohibit the rise to group of top players. During last years several promising Finnish companies have been acquired by foreign companies.

These findings about the structure and growth history of Finnish software products and IT services firms have important policy implications. In public debate "building a hundred new Vaisalas" is often presented as a goal in keeping the Finnish high-tech industries and national economy on a lasting path to growth.

[29] Sulake Corporation and Plenware that was acquired by Cybercom, a Swedish company in 2009.

# PART V: ANALYSIS AND DISCUSSION

# 11 Observations of Status and Evolution of Finnish IT Industries

Both IT industries and their customers are characterized by continuous change. Therefore several scholars (e.g. Hamel and Prahalad, 1994; Jacobides and Winter, 2005; Jacobides et al., 2006) call for more flexible and dynamic approaches in examining these industries instead of the commonly used older, static industry definitions. The empirical analysis in this study reflects the same thinking.

The empirical part of the study focused on the major changes impacting the Finnish IT industries and moved then to analyze the structure and volumes of the software product and IT services industries, the two increasingly important parts of the Finnish ICT sector. For deeper analysis these two parts of the Finnish IT industries were examined from supply and market (demand) perspective using different public information sources. In addition, a separate top 100 IT vendor database was constructed to analyze the IT vendor field. Special attention has been given to issues related to IT employment and measurement of the IT industries.

Chapter 11 discusses the main observations, findings and future implications of the empirical part of the study. The discussion forms the basis for conclusions presented in Chapter 12.

## *11.1 Frameworks for Analyzing and Describing the Finnish IT Industries*

### 11.1.1 Theories and Frameworks Applied

Answering the research questions requires identification of factors and changes impacting on the structure and evolution of the Finnish IT sector. The focus of the study is on the two main parts of the Finnish IT industries, the software product and IT services industries.

To identify and understand the different changes and their impacts on the IT industries the study has utilized traditional industry theories as well as theories and literature addressing innovations and other major structural changes and expansion by IT firms beyond their traditional markets. Using the theories and theoretical frameworks as guidelines the changes have been classified into four main groups (Chapter 4):

- unexpected and radical changes
- changes requiring reacting and adjusting
- expansion beyond traditional markets and industries
- sustained evolution

The changes have different impacts: some reshape industry borders and vendor field (firm populations), others influence businesses and operations of IT enterprises.

Unexpected and radical changes (e.g. new technologies and technology waves) as well as changes requiring reacting and adjusting (e.g. globalization) can be characterized as exogenous and difficult to influence. Some, like globalization, can be disruptive bringing forth creative destruction (Schumpeter, 1942) both at country and global levels. These changes reshape the competitive environment in a profound way. Many of these changes are like globalization; they can have direct or indirect impacts on a large number of IT companies, also Finnish enterprises and their customers. However, even radical and unexpected changes like major technology changes can also be important enablers of evolution.

During the 2000s major structural changes as well as shifts in customer needs and behavior have significantly shaped the businesses of single IT firms as well as the entire Finnish IT industries. Many software product and IT services firms have expanded beyond their existing customer segments and to new products and services.

This study assumes that as yet the evolution triggered by different, often global and disruptive changes is only in its early phases[30]. Not all changes, however, are disruptive. Changes also open new business opportunities and growth paths for companies.

Especially in the IT services industries a significant part of changes are sustained and incremental in nature. These and partly also changes related to expansion beyond traditional markets leave the IT firms more space and often also time to make their own choices of how to adapt new market situations. In the IT services industries the sustained evolution is seen also as a continuous stream of new entrants providing traditional IT services like IT consulting or programming and systems design services.

In the software product industries, on the contrary, changes are often more disruptive requiring quick reaction. Many Finnish software producers (e.g. Affecto, Basware, F-Secure) have, for instance, decided to expand or migrate from products to services.

In the light of the nature of the changes the Finnish IT industry can be described both dynamic and static. Some disruptive and other major changes have reshaped the borders of IT industries as well as the IT enterprise and customer space. At the same time, because of the strong position of large incumbent firms in the Finnish market, also the Finnish IT vendor field can be characterized as static. The traditional IT services as well have largely remained the same in spite of significant and profound changes in the ways IT services are produced (e.g. transferring production out of Finland) or new technologies applied.

Still another change is to be seen in the Finnish IT industries. As a result of the recent changes discussed above it is increasingly difficult to draw clear borderlines between

[30] A study published by Deloitte in Finland 2011 argues that the globalization is now in its early phases.

industries. Therefore the Finnish IT enterprise space is becoming more heterogeneous than before.

### 11.1.2 Theoretical Frameworks Constructed for the Study

To answer the research questions and analyze and understand the structure of the Finnish IT industries a number of frameworks were constructed for the study (Chapter 7).

The ecosystem (J. F. Moore, 1993, Iansiti and Levien, 2004) of the Finnish IT industries provides "the big picture" of the IT vendor field and IT market as well as changes and dynamics influencing them (Chapter 7.3).

The IT enterprise space, The IT vendor part of the ecosystem has been formed by using the idea of the economic and industrial spaces (cf. Schumpeter, 1942; Lovio, 1993). The IT enterprise space provides the framework for considering the different firms and ever-changing firm populations and industry borders.

Operational frameworks have been used to analyze the structure and volumes of the Finnish IT sector and industries. The aim has been to consider the IT industries from the supply as well as market perspective. The operational frameworks also allow to combine information from different sources and concretize the usefulness of the various data in analyzing and describing the status of the Finnish IT industries. For deeper understanding of the structure and development of the customer space this study divides customers to two main groups: user and applier customers.

An important data source has been the database of the top 100 IT vendors constructed for this study. It contains company level information and has therefore been a valuable tool in analyzing the structure of the Finnish IT industries and assessing the credibility of the statistical and other public industry information.

On the basis of empirical consideration and analysis this study proposes that compared to relying on the existing public information, the frameworks are a useful and more systematic tool to analyze the software product and IT services industries. An essential improvement facilitated by the use of frameworks and multiple data sources is the possibility to regard software product and IT services industries separately and thereby clarify the profound differences between these two parts of the IT industries.

## *11.2 Analysis of Size and Structure of Finnish IT Industries*

A shrinking share of ICT goods production has rapidly increased the relative importance of software products and IT services in the Finnish ICT sector as well as in the Finnish national economy (Statistics Finland; Nikulainen and Rouvinen, 2012).

In this study the Finnish IT industries are considered by focusing on software product and IT services industries. This chapter analyzes and discussed their size and structure as well as developments of the vendor field and competition.

### 11.2.1 Main Size Indicators of Finnish IT Industries

Chapter 9 considered separately the volumes of both software product and IT services industries. The figures presented in the chapter revealed significant differences between data received from different information sources.

Table 37 summarizes the central revenue figures of the Finnish software product and IT services industries based on figures from the enterprise statistics (Statistics Finland), market research firms (IDC and Market-Visio) and estimates produced in this study.

According to the category "Computer and information services" (codes 62-63) of the enterprise statistics the value of the Finnish production accounted to 6.7 billion euro in 2008. The production of software products and IT services is not possible to receive separately as needed in this study.

The market research firms provide the values of both the Finnish software product and IT services markets separately. According to their value of the Finnish software product and IT services markets totaled about 4.2 billion euro in 2008. Their sales represented about 70 percent of the total IT market.

In this study the volumes of the software product and IT services industries have been estimated separately on the basis of multiple information sources by utilizing frameworks constructed for the study. This study estimates the combined volume of these two industries to total 6 billion euro in 2008. The volume of the IT services industry accounted for 4.5 billion euro in Finland compared to 1.5 billion euro of the software product industry.

These volumes represent the revenue of companies belonging to the IT enterprise space as defined in this study and include revenues derived from domestic production and imports. Without exports the volume would describe the total Finnish software product and IT services market because it includes revenues received from both user and applier customers.

The value estimated in the study is close to the one of enterprise statistics, but the figures are not fully comparable because of differences in definitions. Therefore it is not possible to get detailed information of the revenue structures of the single enterprises in the enterprise statistics, the difference in the total volume figures cannot be fully explained.

Due to the recession the volumes of the enterprises statistics for 2010 were lower than in 2008. The market values have remained at about the same level.

When combining all IT revenues reported in Finland (imports, Finnish production and production of Finnish IT companies abroad) the total volume ends up to 7.3 billion euro (see Tables 19 and 21).

**Table 37. Volumes of software product and IT services industries, main sources, B €**

| Information and source | Software products | IT services | Total Software products and IT services | Comments |
|---|---|---|---|---|
| Revenues by Enterprise statistics (Statistics Finland) | .. | .. | 6.7 | Revenues of domestic production |
| Value of the Finnish market (e.g. IDC, Market-Visio) | 1.2 | 3.0 | 4.2 | End user spending in Finland |
| The volumes estimated in this study | 1.5 | 4.5 | 6.0 | Revenues of imports and domestic production<br>Include both user and applier markets |

Figures have been rounded

In employment considerations the IT services firms are in a central position. However, the official statistics do not offer employment figures separately for software product and IT services industries. The total number of IT employees in the enterprise statistics was 44 300 in 2008 (43 700 in 2010).

This study provides separate estimates and ends up to a total of 45 000 IT employees divided into 35 000 people in IT services, 10 000 in software product industries (Chapter 9.4.1). Despite some issues concerning borderlines between software products and IT services in this study, the employment figures presented above are assumed to be good estimates.

The total number of employees includes only persons working in IT firms providing software products or IT services for external customers. The number of external IT staff outside the IT enterprise space has been estimated in the study to 5 000, rising the estimated total IT employment to 50 000[31].

[31] According to the scope of this study the companies included in the IT enterprise space receive at least a part of their revenues from user customers.

Figure 23 considers the distribution of the IT personnel in regard of the type of customers they serve and shows the share of the applier software (embedded software) of the total IT market in 2010.

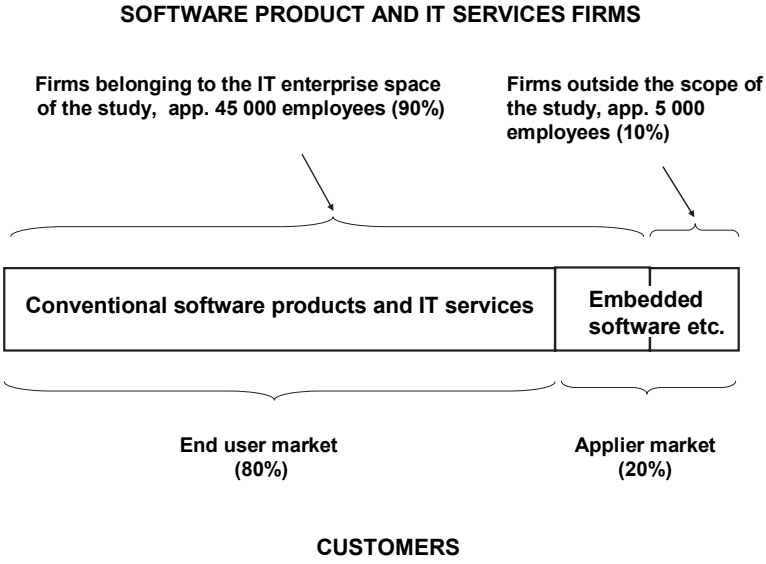



**Figure 23. IT personnel by main market segments in Finland in 2010**

The internal IT staff in different companies was outside the scope of this study.

It is assumed in this study that the volumes presented describe the size of the Finnish software product and IT services industries more accurately than any other existing data. By combining different information sources and using more precise definitions and frameworks constructed for this study, it has been possible to avoid some measurement problems related to the industry statistics. The result is a more accurate picture of the size of the Finnish IT industries. This approach has also revealed important structural issues which are not possible to point out on the basis of the official statistics.

### 11.2.2 Increasing Importance of IT Services

One major structural finding emphasizes the importance of IT services in the Finnish IT sector. It is estimated in this study that the volume of the Finnish IT services industry is three times bigger than that of software product industry, in other words, three fourths of the combined IT industry revenues reported in Finland come from IT services. In addition, the IT services employ more than three times as many people as the software product industry.

Public discussion**,** however, has largely focused on software industry (often broadly or flexibly defined) and paid less attention to the IT services. In several industry visions and technology programs the Finnish software product industry has been expected to grow and become an important driver and source for growth of both revenue and employment in the whole Finnish economy (Nukari and Forssel, 1999; Tekes, 2003; Hietanen and Nurmi, 2005). Recently the importance of IT services has gained more attention (e.g. Eloranta et al., 2010).

Thus, the findings of this study speak for a stronger emphasis on IT services.

Another result of the study with importance to the assessment of the future of the Finnish IT industries is the estimate presented of the role of applier customers for the IT services industries. On the basis of the multiple information sources used in this study the applier revenue is estimated to represent nearly a fifth of the volume of the IT services provided by companies belonging to the IT enterprise space defined in this study (Chapter 9.2). The main explanation behind the applier software volume is that IT companies included in the IT enterprise space of the study generate a significant share of revenue from embedded software and related services. The total value of the embedded market has not been estimated in this study.

The study also reveals that the IT services revenue is much more dependent on the Finnish market than the revenue created from software production. According to estimates produced in this study nearly three fourths of IT services purchased in the Finnish IT market are also produced in Finland but only a good one third of the value of software product sales comes from Finnish companies.

Even if the Finnish software product market has in the recent years grown faster than the IT services market (e.g. IDC, 2010, Market-Visio, 2011), Finnish software products and software producers have lost domestic market share to international software and become increasingly dependent on exports and other international sales. On the other hand, the growing use of international software has fueled the demand for Finnish IT services.

Analysis of the volume estimates and recent evolution in the Finnish IT sector supports an assumption that the Finnish IT production represents a decreasing share of the Finnish IT markets. In addition to IT services and software products produced outside Finland a growing number of substitutes (e.g. BPO services) are expected to replace domestic IT production in the future. On the basis of the life cycle theories it is suggested to be difficult or even impossible to forecast the evolution of industries or the volumes of Finnish IT firms (cf. Lovio, 1993). For instance, the Finnish IT services industry is about fifty years old, but still characterized by a continuous flow of new entrants providing traditional IT services.

Also the growth rate of the traditional IT services market has decreased during last years and is approaching the GDP growth rate (Andersen, 2010). In the 2000s the growth in the IT services market has been largely nurtured by demand from outside the traditional IT user market, especially from the applier market, where the growth has been stronger.

The migrating from products to services is to be seen clearly in the level of the whole Finnish ICT sector as well as in the traditional IT industries. The same trend is also in manufacturing industries outside the ICT sector (Penttinen, 2007; Kowalkowski, 2008).

The BPO services are an important route for growth for the IT firms. The BPO services provider can take a wide responsibility of the outsourced process or function including also the customer's non-IT processes. Unlike in the embedded software market, the customers usually are IT users and their needs and requirements familiar to many IT firms. Therefore it is possible for software product as well as IT services firms to enter the BPO services market.

Numerous IT firms have succeeded to find new opportunities beyond their traditional markets by providing software products and IT services to customers who use information technology in their own products or services (e.g. Nikulainen et al., 2011). The applier market has proved to be a growth path for Finnish as well as international IT firms, compensating the slower growth rates in their traditional market segments. This trend has favored especially the IT services industry.

Observations related to the effects of changes in the market environment, like globalization, to the evolution and future prospects of the IT industries are discussed separately in the following chapters. In the next chapter the observations of the study concerning the role of IT services are discussed in more detail.

### 11.2.3 Differentiating Software Product and IT Services Industries

A central starting point of this study is to increase the understanding of the size and structure of the Finnish IT industries by focusing on software product and IT services industries separately.

This study argues that the definitions and classifications behind the existing IT industry statistics do not allow an accurate enough and separate examination of the Finnish software product and IT services industries. Vague and changing definitions may lead to a distorted picture of the significance of the different IT industries and faulty business and policy decisions. Unlike the existing data sources, this study has been able to provide separate estimates of the revenue and employee number of software product and IT services industries separately by using multiple information sources and frameworks.

The software product and IT services industries are often mixed up in public statistics (TOL 2008), in industry surveys and reports and public discussion. In some contexts the reason can be a mutual relationship between software products and services which can also reflect an assumed or defined hierarchy between the two industries (e.g. software can be part of services or services part of software industry). Sometimes IT services are seen more or less as a supporting or associated function of the software product business (Ali-Yrkkö and Martikainen, 2008; Rönkkö et al., 2010). These views, however, can ignore a significant part of IT services, namely services related to foreign software products or services without direct links to any software product.

Different business logic is not the only argument supporting a clear distinction between software products and IT services and related industries. Differences between the two industries can also relate to customer relationships and competition, employment and roles of industries in business ecosystems and globalization.

Consistent definitions form the central basis for understanding the nature of the industries. In this study the term software production is a broader concept than software products and includes both software products multiplied for several customers by the software firms as well as customized software produced for one customer only. As defined earlier, the production of customized software includes in the IT services in this study.

The analysis of the top 100 IT vendor database in this study supports the view of separate analysis. The top 100 vendors were classified into four categories applying an idea of Cusumano (2004). The analysis revealed significant differences between the categories clarifying the picture of the Finnish IT industries compared to the one based on the present public industry information (see Chapter 10.3).

Software product firms typically provide services related to their own software products (e.g. Rönkkö et al., 2009, 2010) whereas a significant part of services of IT services companies is associated to software products from third parties. Some IT services firms have also own software products (hybrid firms). All IT services have no direct connection to any software (e.g. infrastructure services, hardware maintenance).

This study emphasizes the importance of understanding the different business logics and dynamics of software products and IT services. Therefore also the growing production of software for applier customers (e.g. embedded systems) is mainly considered as IT services in this study. This is because its business logic follows rather the logics and dynamics of IT services than that of software products. Also, the applier customers often purchase services, not products. The applier market has grown in the 2000s and has to a large extent compensated the rapid decline in demand for customized software of user customers.

Considering of vendors providing applier software in Finland supports the division made above: most vendors are large IT services firms and the role of software product firms has remained limited in this market. This was seen when Nokia decided to decrease its external subcontracting in 2011. The subcontractors mostly hit by the decisions were the IT services firms (cf. eg. Rönkkö et al., 2011).

In comparison to traditional software products, producing software for applier customers requires not only software skills but a combination of skills and competences from both software and services business.

The analysis of Finnish software industries often focuses only on domestic software firms. In the Finnish IT market, however, foreign IT firms have a prominent position. A significant share of, for instance, IT integration, implementation and management

services are related to foreign software products. Foreign IT firms control about a half of the value of IT services and nearly two thirds of the software product[32] purchases in Finland (Chapter 10.4).

The software surveys (Rönkkö et al., 2009, 2010) provide a good picture of the Finnish software product industry. In the latest surveys the classifications based on business models were expanded to the direction of services. Some classifications are similar to the ones used in this study, but still the service perspective of the software survey deserves further precision.

Examining the abilities of software product and IT services firms to adapt to major disruptive changes or to severe economic fluctuations reveals further differences between software and services companies.

Because of their wide range of services and related skills the IT services firms have often been better equipped to adapt to change than other IT firms. For instance, outsourcing or revenues from other continuous services can compensate a declining demand of project services. In the 2000s several IT services companies have also been able to expand beyond their traditional market by utilizing their existing skills and competences. This can be seen in the development of large incumbent IT firms during the last decades.

The growth of the Finnish software product firms, in turn, has largely been dependent on their success in export markets (e.g. Basware, F-Secure, Tekla). At the same time, however, several software product firms have lost domestic sales to international software products and to some extent also because of the migration from products to services. Several former software products firms have changed profile and transformed into hybrid or pure services firms (see definitions, Chapter 10.1.2).

In public discussion and in some studies cloud computing and especially SaaS (Software as a Service) services are considered a remarkable opportunity for the Finnish software product firms to expand their customer base and markets also globally (e.g. Rönkkö et al., 2009; 2010). Cloud computing is often considered only from the perspective of software product firms. SaaS forms only one part of the potential of cloud computing services. However, it can have significant, although different, potential and impacts also on various IT services as well as other services like business process related services (e.g. BpaaS (Business processes as a Service). Some market research firms (e.g. Gartner) expect high potential for cloud computing in business services which will expand also business process outsourcing (BPO) services offerings into new customer segments and lower barriers to use these services.

In addition, the use of cloud computing is expected to create a significant number of jobs in several industries which apply it in their customer services (e.g. IDC[33]).

[32] As defined in this study the software products can be sold and delivered in different ways, for instance, as licenses or services.

[33] IDC forecasts cloud computing to create 14 million jobs in different industries globally by 2015. (Source: IDC White Paper, sponsored by Microsoft, 2012)

In any case cloud computing is often more of a new distribution channel or business model than a new market. It can help software product firms to attract new customers or new market segments, but the true impacts of cloud computing on Finnish software product or – even more so – to the IT services industries are still uncertain.

So far cloud services have fueled investments in large data centers globally (e.g. Carr, 2008, 2010). Among the investors are major IT services firms, IT software and hardware firms as well as new players in the IT market. Some centers owned by global players are located in Finland (e.g. Capgemini, Google and HP) and these investments are expected to continue and bring new opportunities to Finland because of suitable service and production infrastructure, facilities and the available integration skills. Only a limited number of software product firms (such as Microsoft, Oracle) are able to invest in own large global data centers and extensive services offerings and infrastructure. Smaller software firms often use services of external data centers creating opportunities also for smaller services firms.

At the same time when cloud computing provides business opportunities for a growing number of IT companies it is possible that concentration increases in some IT market segments because of economies of scale, economies of scope or the network effect strengthening the global market power of some software products and services globally. In addition, the competition is fierce and new firms from other than IT industries enter the market.

The Finnish IT firms have to recognize these developments and their influences. So far there is only limited information of impacts of cloud services on IT industry revenues and revenue structures. Neither is there much information available of the impacts of global computer centers on Finnish IT services.

The emergence of new cloud computing infrastructures can also be considered as a "back to basics" development which emphasizes the role of large data centers. It is also justifiable to expect that these centers benefit the economies of scale.

### 11.2.4 Domestic IT Employment Pressured by Market Changes

Numerous issues and problems related to information of the revenue and value of IT industries have emphasized the role of employment as a central indicator of the volume of IT industries.

The growth of the IT employment has remained low in Finland in the 2000s and according to the enterprise statistics the total number of IT employees has not increased towards the end of the decade, either. At the same time Finnish IT enterprises have increased their workforce abroad, especially in lower-cost economies.

According to the Federation of Finnish Technology Industries the Finnish IT companies employed 67 000 persons in 2008. More than a fifth of them, about 15 000 persons, worked outside Finland. In 2010 the share of foreign personnel was even higher.

The biggest reasons to weak growth of domestic IT employment are the globalization and internationalization of both the Finnish IT customers and in recent years also the Finnish IT companies themselves. Large customers together with their global and lately also Finnish IT services vendors have transferred IT work from Finland to lower-cost locations abroad. Consequently IT personnel outside Finland has increased rapidly, especially in Asia and some countries in the Eastern and Central Europe following the trend familiar from several manufacturing industries.

The strategies of major Finnish IT firms and the evolution of the geographical distribution of their employees clearly supports the argument that also jobs requiring high-level skills will be increasingly transferred from Finland to lower-cost countries, especially to Asia.

Majority of Finnish IT companies having employees abroad are large companies and therefore included in the database of the top 100 IT vendors. A sample of the top 100 IT vendor database and company information analyzed for the study shows that the trend continues and especially the low-cost locations are still gaining employment.

During the last five years especially the large Finnish software product and IT services firms have actively transferred their research and development activities as well as service production to lower-cost countries. In 2010 a good 30 percent of employees of the fifteen largest Finnish-owned IT services and software firms alone worked in low-cost countries, compared to about 20 percent in 2008 and 10 percent in 2005.

Despite the high growth of numerous small IT firms in Finland they have not been able to compensate the migration of jobs from larger companies to other countries. One example shows the wideness of the gap: several hundreds of new IT companies would be needed to compensate the loss of Finnish workplaces in the late 2000s.[34] So far the growing applier market in Finland has not been able to stand against the pressure from the low-cost competition, either.

### 11.2.5 Future Expectations in Need of Rethinking

In the 2000s numerous plans and vision as well as public debate have placed great expectations on the ICT industries as an important future employer of highly educated Finnish workforce and a strong foundation for the future evolution of the Finnish national economy as well as various Finnish industries (e.g. Koski et al., 2002; Hernesniemi, 2010; Eloranta et al, 2010).

In the center of these expectations have been software production and the Nokia cluster. The software product industry in particular, has been seen as the backbone of the Finnish ICT sector and this vision has reflected also in many development and funding schemes of the ICT industries (e.g. Tekes).

[34] For instance, Tieto Corporation employed in the end of 2011 in Finland about 1 100 persons less than in 2005.

This study does not support the employment expectations attached to the Finnish IT industries. In particular, the expectations concerning the employment ability of the software product industry seem clearly optimistic. In a way this has been recognized also in the latest software surveys (Rönkkö et al., 2009, 2010) which emphasize the growing role of services for the software product firms.

On the basis of employment data it is difficult to find arguments supporting the expectations of software product industry becoming a significant driver of the employment in Finland and, in fact, an important driver for growth in the whole Finnish economy. On the other hand, Nokia´s strategic move has resulted in decreasing of the number of employees in several IT services companies in Finland during the last couple of years.

As stated before, the empirical examination of this study revealed that the Finnish IT services employ in Finland more than three times as many IT professionals as the software product industry. During the past decade the personnel of Finnish IT companies has increased faster abroad than in Finland.

Forecasts concerning revenue and employment of software product businesses presented in different programs and visions (Nukari and Forssel, 1999; Hietanen and Nurmi, 2005) are already far behind. According to Nukari and Forssel (1999) the Finnish software product industry was expected to grow especially in the international markets and multiply both the revenue and number of employees by 2010. Total revenue of software industry was expected to rise close to FIM 70 billion, 50 billion (over 8 billion euro) coming from software product industry without embedded systems.

The objectives were downgraded in 2005 (Hietanen and Nurmi, 2005) but the aim was still kept in building a cluster of software product business by 2015. The cluster was envisioned to have a central role in the value chains of other industry clusters and employ 60 000 persons in Finland and abroad and generate a revenue of 15 billion euro.[35] The expected tax revenue was several hundreds of millions of euro in 2015.

On the basis of the information available also this revised objective seems too optimistic[36]. Due to globalization also the usefulness of the concept of cluster has diminished whereas dependency on international business ecosystems has increased.

Contrary to the vision, several software product firms have discontinued their software production totally or partly in the 2000s and continued as service providers for foreign software products. Even if there are success stories in the software industry (e.g. game industry) it is unlikely that the gap between vision and reality will close in the next few

[35] At least 40 Finnish firms were expected to become global market leaders and rank among the top 3 in their industries or business areas. Most of them were expected to be listed in some international stock exchange.

[36] According to the software industry survey the value of software businesses totaled app. EUR 3 billion in 2009 (Rönkkö et al., 2010)

years. To get closer to the employment expectations it would be necessary to combine the employment figures of both software product and IT services industries.

It is understandable that all impacts of globalization and the increasing role of foreign software products have been difficult to anticipate when forming the growth objectives. It is also clear that even today it is difficult to see the full impact of globalization on, for instance, employment.

On the basis on this study, however, it seems clear, that for Finland, a double challenge lies ahead: how to create new jobs and at the same time preserve the existing jobs in Finland.

Recently the economic slowdown, Nokia´s serious problems and the continuing structural changes in the marketplace have raised new concerns about the future development of the Finnish IT industries. After a long period of optimism also the mood in public discussion has turned more pessimistic.

Apart from IT employment several recent programs and public discussion, however, reflect optimism emphasizing new possibilities in exports of software products and IT services as well as value capture of revenues generated outside Finland (cf. Pajarinen et al., 2010). Another source of positive expectations is the enabling role of information technology in products and services in various industries (Eloranta et al., 2010; Hernesniemi, ed., 2010).

Following the strategic changes in Nokia in 2011 the possibility of high-skilled jobs moving out of Finland has become a more relevant topic of discussion than earlier. In research, this issue has generated questions of skills and capabilities required to remain competitive (cf. e.g., Baldwin, 2006; Grossmann and Rossi-Hansberg, 2008).

IT firms transfer also their tools, methodologies and skills to offshore countries. In time this development levels the differences between offshore countries and Finland making the competitive position for Finnish companies more challenging. On the other hand, there are indicators that the prices in offshore countries are rising.

So far, however, the importance of the Finnish IT production or the vendor field has attracted only limited attention in the public discussion or in policy plans related to the information society. In all, understanding the global developments and dynamics requires more research from several perspectives.

### 11.2.6 Evolution of IT Enterprise Space and Competitive Field

Examining the Finnish IT enterprise space and its vendor and competitive fields reveals four features, which characterize the structure of the Finnish software products and IT services industries: concentration, dominance of IT services, slow growth of the traditional IT market and strengthening position of global vendors in the Finnish market.

A few facts illustrate the concentration, even polarization of the IT industries (Chapter 10.2). In 2008 less than two percent of the Finnish software product and IT services firms had revenues exceeding 10 million euro, nine out of ten had revenues less than 2 million euro (Statistics Finland). At the same time a few large incumbents brought a major part of the IT services revenues. Several large Finnish and foreign-owned IT companies have also retained strong positions in the Finnish market for decades. It is possible to argue, that so far they have also retained rather well their jobs in Finland despite the increasing use of global production facilities and global division of labor.

In public discussion the role of small and start-up companies is often emphasized. Despite the increasing heterogeneity of IT industries this study still demonstrates the central role of large IT firms in the evolution of the Finnish IT sector also in the future.

The next few notions highlight the slow growth of the Finnish IT companies. An examination of the top 100 IT vendor database constructed for this study reveals, that for a new entrant it is difficult to push to the top. The list of the largest IT firms in Finland has remained quite constant all through the 2000s. For newcomers in the database, it has taken as long as 15 years to reach the milestone of 100 million euro derived of software products and IT services.

Foreign-owned IT companies have a longstanding role in the Finnish IT market. Many changes in the business environment seem to strengthen their position even further: international customers want international service and global software, domestic customers favor international software and services vendors in their purchases.

Another important characteristic of the Finnish market is the role of a few companies with a strong position both in the software product and IT services industries. Examples of these “hybrid” firms (Cusumano, 2004) are Tieto, Logica and Digia.

The observations presented above show that the situation of the Finnish IT vendor field is quite consistent with the arguments and theories concerning the strong position of large companies (incumbents) presented by several scholars (Chandler, 1990; Lovio, 1993; Kroeger et al., 2008).

However, the fairly stable structure of the largest IT firms does not tell the whole truth of the status of the Finnish IT enterprise space. The firm population in the space has changed in several ways in the 2000s.

One of the major findings of this study is that the IT vendor field has become increasingly heterogeneous, consisting of firms from various industries. In addition to traditional IT firms the IT enterprise space now also consists of firms whose main business is other than providing software products or IT services. In addition to the rather traditional players, such as telecom operators, business services firms or producers of embedded systems, the space also includes vendors, whose industries are difficult to define (e.g. Google, social media firms) making it difficult for IT firms to recognize the changes in the competitive environment (cf. Jacobides, 2009).

As discussed earlier, changes in the customer space drive the IT firms to expand beyond their traditional customer segments and, on the other hand, attract new types of competitors to the Finnish market. Some newcomers have operated earlier in the borderlines of IT and other industries, some have not been active in IT before.

Globalization has also resulted in a geographical change. While many Finnish customers have increased their presence in Asia, the Asian IT services vendors, especially those from India, have sought a place in the Finnish market. Unlike before, Finnish IT firms also now meet competitors which operate in the Finnish market but may have no permanent or visible activity in Finland.

Furthermore, IT firms meet a growing number of direct or indirect competitors which do not provide IT products or services but their substitutes. A part of this new competition comes from totally unexpected directions (cf. Jacobides and Tae, 2009). Just outside the IT enterprise space, often in the boundary surface, there are firms producing new substitutes for the traditional software products or IT services.

These substitutes are often enablers of information technology. Often it is difficult to classify new competition into traditional industry categories, since a company can offer both traditional software and IT services and substitutes as, for instance, in the case of many BPO service vendors (e.g. Aditro, Pretax, Itella).

The convergence of telecom and IT industries has been a popular topic for years. Despite various convergences in technologies it seems at industry level to appear as one-way evolution in Finland: several telecom operators have expanded to IT services. At the same time the operators are an important customer segment for IT services firms both in the user and applier market.

In the coming years Finnish customers are expected to increase their IT purchases abroad and from vendors and locations unknown in Finland and not possible to identify from Finnish information sources. One driver of this development are the cloud computing services offered globally.

Figure 24 on the next page demonstrates the structure and changes in the Finnish IT enterprise space increasing the heterogeneity of the industry and creating new competition from new directions.

New business models and new substitutes from new sources are a challenge as well in defining industry borders as in identifying new competition and its competitive advantages (Prahalad and Ramaswamy 2004). Google´s Android, an operating system for mobile devices, is an example of developments traditional IT firms are expected to face increasingly in the years to come.

Even if Google is the producer of the software it does not invoice it in the same way as the traditional software firms but operates outside the traditional IT industries and gets its main income from other sources, such as advertisements. Therefore, the Android business

can be considered to come either from software product or IT services, telecom services or advertising industries. Another example is Rovio, the Finnish game software producer which has expanded for instance to toy business.

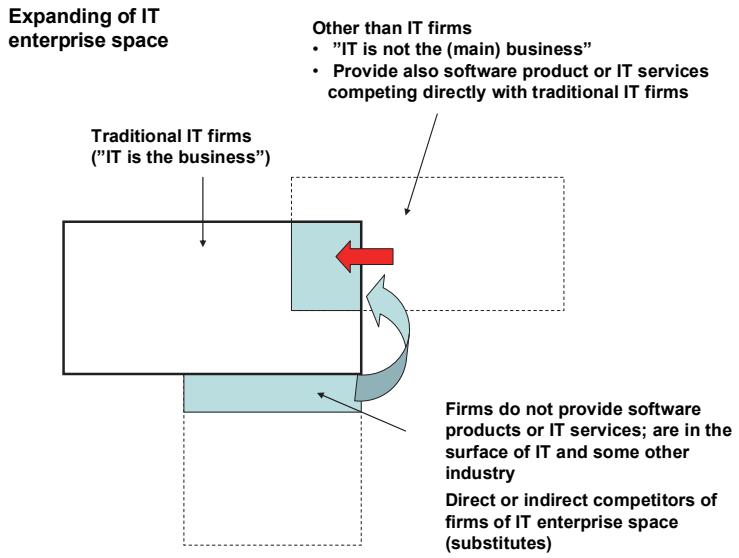



**Figure 24. Changes in the vendor field**

Lovio (1993) has identified two different roles for foreign firms in new high technology industries in small countries like Finland. One is the role of importer of new technology, the other the role of exporter of local innovations. Traditionally Finland has been very dependent on international technologies. Today, various international ecosystems and platforms provide technology and skills as well as market opportunities also for a growing number of Finnish IT firms.

Following Nokia's growth, a number of international firms entered the Finnish IT services market. Some of them are also crossing in their operations the boundaries of IT and other industries. There are, however, good reasons to argue that without Nokia many of these entrants had not been interested in entering the Finnish market. It remains to be seen, how these new additions to the heterogeneity will fare in the Finnish market.

There are only few recent examples of successful exports of local innovations by established Finnish IT companies. On the other hand, acquisitions of Finnish firms may pave the way for exporting Finnish innovations.

As far as the problems in defining industries are concerned, new business innovations challenge the industry classifications which typically are based on static and homogeneous definitions. For instance, deciding the value of new kinds of software products requires new definitions and crossing the familiar industry boundaries.

Otherwise the new businesses may be left outside the traditional IT industry statistics or indicators which for its turn would results in incomplete or inconsistent industry information.

Analysis of the trends and changes in the IT enterprise space supports the usability of the enterprise space as a framework in examining structures and evolution of IT industries. The analysis also supports the argument that the ability of official industry information to describe the real status of Finnish IT industries is incomplete. In addition, understanding the IT industry structure, the vendor field and competition require more analysis also beyond the traditional IT industries and, at the same time, more profound understanding of the dynamics and businesses of individual companies or groups of companies.

## *11.3 Discussion of Drivers of IT Industry Evolution*

Globalization as an essential factor and driver of the evolution of the Finnish IT industries was already touched in the previous discussion about the size and structure of the Finnish IT industries as well as the IT employment. It is also related and refers to a number of factors and drivers, such as unbundling of processes and even separate tasks geographically (Sako, 2005; Baldwin, 2006), changes of industry architectures (Jacobides and Winter, 2005; Jacobides et al., 2006), growing role of global platforms (Gawer and Cusumano, 2002; Gawer, 2009, 2010) and business ecosystems (Iansiti and Lewien, 2004). These factors and drivers have changed also the Finnish IT landscape by reshaping value chains across firm borders as well as division of labor between firms and countries. Impacts on employment of single firms and entire industries have accelerated since about the year of 2005.

In this chapter the influences of globalization are considered from different directions and in different contexts. The chapter starts by discussing the changing customer needs and behavior and their impacts on the Finnish IT demand. The next subjects are strongly interconnected: technological changes and innovations today are related to different platforms (Gawer and Cusumano, 2002, Gawer, 2009, 2010) and ecosystems (Iansiti and Levien, 2004) of IT industries. In the final part of discussion the value creation and capture of the IT industries are considered. These in turn, are strongly depending on platforms, ecosystems and industry architectures (Jacobides et al., 2006).

### 11.3.1 New Customer Needs Shape IT Demand

There is a vivid discussion in literature about the effects of customer needs and behavior on industries (Moschella, 2003; McGahan, 2004; Jacobides and Winter, 2005; Grönroos, 2009).

In the IT hardware markets large global producers have ruled the markets for decades. In the 2000s the general development toward global markets has profoundly changed also the software product markets and in the recent years also the IT services markets (Cusumano, 2004; Kroeger et al., 2008). Globalization has triggered a global competition

and forced the customers of Finnish software product and IT services providers to take a new look at their costs (e.g. Market-Visio, 2007).

Cost pressures together with new opportunities in new emerging markets especially in Asia, have also changed the way the big customers do business. When the operation of an IT customer becomes international or global, also its IT spending, selection of IT products and decisions on IT vendors take a new direction. In other words, changes in the customer space change also the Finnish IT market, vendor field and division of labor between different parties in the market.

Global competition also emphasizes diverse skills of IT professionals. For instance, working in large international projects requires good social and comprehensive language skills (e.g. Uljas).

A strong concentration of IT companies and heavy dependency of a few large customers have for long been a central characteristic of the Finnish IT industries. Globalization has further accentuated this feature and possibly strengthened the impacts of the different changes on the IT market. To be able to compete in the new global marketplace, many IT users as well as IT firms themselves have sought growth from acquisitions. Numerous traditionally important Finnish IT customer industries (e.g. in finance and telecom) have also moved through acquisitions into foreign ownership.

Globalization and a concentrated IT customer space together have a powerful influence on the markets. The efforts of large, international Finnish IT customers to build standardized and cost effective business processes have speeded up also standardization and harmonization of IT systems. The unavoidable next step has been a concentration of IT purchases to a fewer number of applications and vendors and next, a pressure for the IT industry as well to seek competitiveness from consolidation. (Lilius and Vuorinen, 2003; Market-Visio, 2007). In these cases the companies have lost part of their purchasing power, which, in turn, has decreased the growth potential of the Finnish IT market.

Consolidation, however, is not necessarily enough. The more international the large Finnish IT users have become, the more probably they have began to favor in their IT purchases international software products and IT vendors with global service networks. Consequently larger shares of IT budgets of Finnish customers wind up to foreign IT companies and can also be used outside Finland. Finnish software product and IT services companies feel these new developments as a tightening competition of their domestic, often long-standing customers (Lilius and Vuorinen, 2003; Market-Visio, 2007). So far the consequences have been more severe in the software product market, where in the 2000s the purchases of domestic software products have declined. This reflects the global trend of the concentration of the software product industry (Cusumano, 2004, 2010).

Lately the pressure to improve productivity and cut costs has become evident also in the public sector. Its efforts to concentrate IT organizations and systems have an effect on the

old, often very important customer relationships between public sector organizations and domestic IT software product and IT services vendors. In addition, activities to harmonize and concentrate IT systems in the public sector have resulted into an increase in the use of products and services provided by global IT vendors (e.g. recent software and IT services purchases of large Finnish cities, state government and other public organizations[37]). At the same time, there is a lively debate of issues related to IT purchasing regulations in the public sector (e.g. Tiihonen).

Standardization and concentration of both business functions and IT systems is expected to further strengthen the positions of large international IT companies.

Another change with important market effects is the increasing use of external IT services. The effects have been twofold. On one hand, especially the transferring of IT services production to external service providers has brought Finnish IT firms new business opportunities, sometimes also created new services and expanded the customer space. On the other hand the shift in the division of IT labor has brought new competition to the Finnish market and transformed the vendor field by accelerating the use of international software products and services.

The use of external services has expanded into outsourcing parts of or entire business functions or processes in the 2000s. In a way outsourcing is not entirely new in the Finnish IT sector: since the birth of data centers in the 1960s some business processes, such as payroll, have often been provided as a service. In business process outsourcing (BPO) of today, however, the content and extent of the outsourced process are wider and therefore offer more business opportunities to the IT industries than the earlier external services. The essential difference is that by using the new information technology it is now possible to have the services produced globally and also by providers outside the traditional IT industries.

In the 2000s another important development in the IT customer space is the growing demand from the applier market, largely formed around embedded systems. However, the applier market is concentrated. Its growth has been highly dependent on Nokia and few other large customers (Nikulainen et al., 2011). After Nokia revised its strategy and made major changes in its technology platforms in 2011, the risks of high dependency on one customer have materialized for many Nokia's software and IT services vendors.

Despite the decreasing role of Nokia there is still significant potential in the applier market, especially in embedded systems. The market, however, is not the same as the traditional software product market defined in this study. The software deliveries and related operations in the applier market base strictly on either industry or even firm specific customer requirements and the business dynamics and practices are closer to IT

[37] Several large cities and organizations of state government have acquired extensive applications and related services from global IT firms in recent years. In the healthcare sector major investments are expected in the coming years. Sitra has identified only 2–3 international applications which could fill the needs of the Finnish healthcare system.

services than software products. This can be the reason why, so far, the major players in the applier market have been traditional IT services vendors.

As seen above, for IT firms there are many sides in internationalization, globalization and related phenomena. They have opened new competition but also new growth possibilities. In addition to the new market openings in Finland, many Finnish IT firms have been able to start their own international operations in the footsteps of their Finnish customers. Consequently the Finnish IT vendor field is now more clearly than before divided into domestic and international actors.

From the perspective of an IT firm the changes in customer needs and behavior in the global world on the 21st century are exogenous and difficult to influence. It is possible to answer and prepare for the changes by improving ones agility to react in changing situations (cf. Hamel, 2000; Prahalad and Ramaswamy, 2004; Kim and Mauborgne, 2005; Doz and Kosonen, 2008). This may be a challenge to IT vendors used to concentrating on strictly defined market segments or having a follower type of strategy.

Expansion beyond the traditional IT market has increased both the total market and market potential for IT services vendors. At the same time, the structure of customer and IT enterprise space and the boundaries of software products and IT services industries are changing continuously. All these developments are a challenge also to research: it is difficult to apply static definitions and classifications in analyzing the evolution of dynamic industries. (Cf. Hamel and Prahalad, 1994; Hamel, 2000, Kim and Mauborgne, 2005).

### 11.3.2 Impacts of Technology Waves

Every significant technology wave (e.g. Malerba et al., 1999; C. M. Christensen, 1997; G. A. Moore, 2000; Moschella, 2003) has reshaped the Finnish IT industries and their boundaries, as well as expanded their markets and customer segments.

For instance, mini computers resulted in production of packaged software, business model innovations and related new offerings (e.g. turnkey model). The PC wave, in turn, reshaped the Finnish software industry by bringing to the market a wide range of foreign software products. This invasion forced Finnish software firms step by step to standardize their offerings and also prepare for international competition. In the IT services market the PC wave brought about new user support services (help desk etc.) and paved the way for the growth of outsourcing services. Globally technology changes have forced several large technology firms (e.g. IBM) to migrate to services (Gerstner, 2002; Chesbrough, 2003) changing the market positions of services vendors.

The Internet has created new services and applications and formed the basis for globalization of IT services which again has transformed and restructured entire value chains and ways to produce IT services. This has led to a new global division of labor and changed competitive positions of different IT services vendors also in the Finnish market. Another Internet-driven trend, the rapidly growing cloud services, is expected to affect

significantly the evolution, business opportunities and also roles of both software product and of services companies.

Internet technology has played a key role as the main driver of growth for several Finnish software firms. Among these are F-Secure, Basware and Rovio. Today the Internet and mobile technologies form the basis for developing game software.

Despite its massive impacts on enterprises, public organizations and citizens as well as industry borders the Internet, however, has not reshaped the traditional IT vendor field in Finland as much as anticipated in early 2000s.

During the technology boom around the year 2000, a record number of IT firms were listed in the Helsinki stock exchange, fueled by high expectations created by the Internet and the "new economy" (cf. Tapscott et al., 2000). Most of these firms, however, were not startups but already established in the Finnish IT market. All of these nearly twenty firms belong to the top 100 list in 2008. On the other hand, only a handful of firms founded during the technology boom and listed with high hopes in the stock market, have been able to climb to the top 100 group and none to the top 30. Outside the top 100 list there are a number of small firms providing hosting or Internet related software services.

In recent years mobile technology has played a central role both in developing new applications and services. At the same time mobile technology has fuelled production of embedded systems which demand external research and development services. For several IT vendors catching this market opportunity has meant expanding beyond their traditional customer base. At the same time, numerous small Finnish enterprises from different IT industries have been able to find new application areas and distribution channels for their products and services.

Major technological waves and disruptive innovations have typically reshaped traditional industry borders. The Internet has, however, made the drawing of industry borders more difficult. It has brought about companies which can often be classified to several industries (e.g. Google, social media companies). This evolution has also formed new types of business ecosystems, some of them utilizing new business innovations.

This development supports the argument that today technological innovations and changes are largely related to new platforms and business ecosystems. These will be discussed in more detail in Chapter 11.3.4.

Disruptive and other major impacts can also be seen in offerings and business models both software product and IT services industries. Internet utilization is a natural part of all software products or IT services today. It is, however, difficult to estimate accurately how much of the growth of software product or IT services industries has been contributed by the Internet.

Examining the Finnish IT vendor field supports the assumption that the IT services firms have retained their positions quite well despite major structural or technological changes

and technology waves like globalization and the emergence of the Internet. The main means to adaptation have been education in the case on technological change and transferring work from Finland to lower-cost countries in the case of globalization.

All through the change, the basic requirements to the IT firms have remained the same: the services offered have to meet the customer needs and the skills and expertise needed (for instance in systems design or outsourcing services) have to be in place.

In any case, companies in the IT services industry need time to adjust in order to acquire the new skills needed in the changing environment. Therefore, new technology waves or other developments have rarely displaced existing IT services firms. Instead, after major changes, large IT services companies have often chosen acquisitions or mergers to benefit from new technology and economies of scale or economy of scope (cf. Hoch et al., 2000; Kroeger et al., 2008). This has been seen also in Finland in the early years of the Internet wave.

In the software product industry the effects of technology changes appear differently. The effects of a new technology come faster and can result in profound changes both at product and firm levels. In addition, other technology-linked changes like the standardization trend have favored some software products shrinking the living space of others.

The list of major software product firms in Finland reveal still other developments: foreign-owned firms control an increasing share of the Finnish software market and a growing number of Finnish software vendors have been forced to look for new business opportunities like migrating to services.

By applying the idea of trajectories presented by McGahan (2004) it is possible to illuminate the different impacts of changes in the playing field on businesses like software product and IT services industries with different business models.

The IT services industries and also separate IT services typically follow the progressive trajectory. The software product industries, on the other hand, are divided: some follow the projective trajectory, but a great many can also adopt the creative trajectory. This is the case when, for instance, a technology change can make a product obsolete very rapidly (e.g. Visicalc, dedicated word processing systems) or a product can make even a global breakthrough very quickly (e.g. Angry Birds). The latter is possible because new platforms and business ecosystems offer distribution channels which enable a company to reach wide audiences and a strong growth in a short period of time.

On the basis of the analysis of the vendor field this study supposes that the technological waves have in the early phases changed the Finnish vendor field less and more slowly than often anticipated. Instead, the strong impacts are to be seen in the form of new business models and services as well as in the expanded use of information technology. Each new technological wave has significantly expanded customer bases and also created new customer needs (e.g. Moschella, 2003).

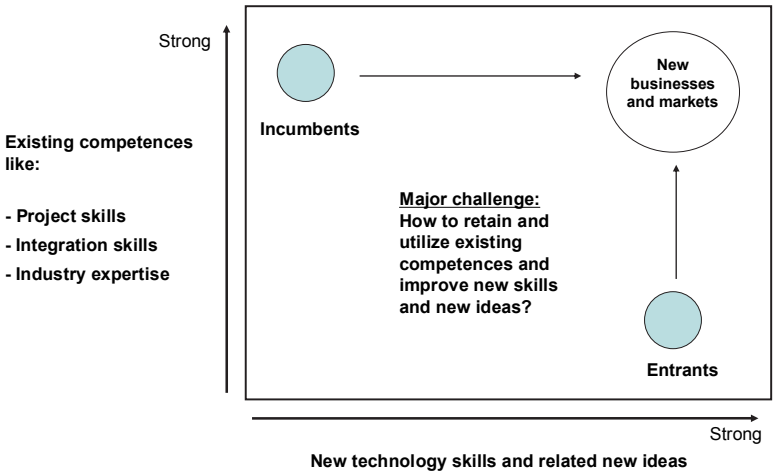
### 11.3.3 Entrants and Incumbents

Major technological and other changes have often argued to bring forth new market leaders (cf. Moschella, 2003). On the other hand, research findings about the success in new industries (Chandler, 1990; Lovio, 1993) support the argument that old firms which have been successful in other industries have succeeded also in new industries. The framework of Anderson and Tushman (1990), in turn, focuses on existing technological competence and helps understand industry discontinuities and the structure of the Finnish IT enterprise space.

In spite of several technological waves and other disruptive changes large incumbent IT services firms in Finland have been able to dominate especially the Finnish IT services industry since the 1960s and 1970s. The top 10 list of Finnish IT vendors considered earlier (Chapter 10.5) demonstrated the role of incumbents. Only very few firms have been able to push to the group of top 10 or even top 100 vendors during the past two decades. The growth rates presented in the industry level may give too dynamic picture of the developments.

From the perspective of IT services vendors the changes and evolution have been "competence-enhancing" (Anderson and Tushman, 1990) preserving existing capabilities (see Chapters 2.2.1 and 4). In software industries, instead, retaining a dominant position seems to have been more difficult.

Figure 25 demonstrates the different positions of incumbents and newcomers in the beginning of a new technological wave.




Applying the idea of competence enhancing (Anderson and Tushman, 1990)

**Figure 25. Entrants and incumbents in early phase of technology wave**

Especially in the IT services industries incumbents often have strengths which help them survive discontinuities. These strengths, such as project management and integration skills or industry knowledge, may take a long time to obtain and therefore can also be obstacles to new market entrants. On the other hand, newcomers are often the first ones to learn and adopt new technologies (cf. Chesbrough, 2003). However, slow adoption of new technologies and related products or services among customers can help incumbents to compete against the newcomers (cf. Adner and Zemsky, 2005). The incumbents are often able to benefit from their existing customer relationships, often also from a better understanding of customer needs. On the other hand, the customers also know their vendors and rely on their expertise. In some cases this may impact on pace of adoption of new technologies. The interviews of executives of user enterprises support these assumptions.

In the IT services industry the 'mother' industries (cf. J. F. Christensen, 2008) have remained rather static since 1960s and 1970s (see Chapter 10.6.). Similarly, the roots of major Finnish IT services firms are in those decades. New technologies may bring forth new sub-industries which often converge with mother industries or their sub-industries (J. F. Christensen, 2008). In the early phases of technological change emerging firms attempt to build a new industry (or niche). Typically, however, these often very technology oriented newcomers will in time converge with existing companies.

There are also several examples of emerging industries rapidly converging with existing "mother industries" and becoming a part of the offering of incumbent IT services firms (cf. J. F. Christensen, 2008). On the other hand, a high share of firms which started their business during a disruption have discontinued or merged with incumbents or other firms. New technology often remains a niche. New entrants often have difficulties in stabilizing their foothold in the market. This has been seen during several technological changes, for instance, in the Internet wave (e.g. J.F. Christensen, 2008). In the beginning new firms seemed to take the emerging market, but soon many incumbents became major providers of Internet-based products and services.

Even though the Internet has radically increased the demand and changed the use of information technology, only few Finnish entrants of the internet wave have been able to become significant players in the market. Several incumbents, for their part, have become strong providers of many internet-based products or services.

Major IT services vendors typically provide several types of services, such as design, integration and different maintenance and management services. These also create a basis for outsourcing services and make the services vendors less vulnerable to changes at sub-industry level than companies specializing in a narrow services area.

The findings about the structure and growth history of Finnish software products and IT services firms have important policy implications. In public debate a strong base of growth companies or "building a hundred new Vaisalas" are often presented as a goal in securing lasting growth to the high-tech industries and national economy. Often the role of large IT incumbent firms has gained less attention in these considerations.

### 11.3.4 Emergence of Platforms and Business Ecosystems

As discussed in the theoretical part and in the beginning of the empirical part of the study many enterprises attempt to strengthen their competitive positions and "architectural advantages" (Jacobides et al., 2006) in the market by forming industry platforms (Gawer, 2009, 2010) or business ecosystems (J. F. Moore, 1993, 1996; Iansiti and Levien, 2004).

In assessing and understanding the status and structure of the Finnish business ecosystems and industry platforms behind them, the platform topology presented by Gawer (2010) is a useful tool. The topology comprises three main types of platforms, internal, supply-chain, and industry platforms. The topology also demonstrates the transition from internal platforms to supply chain platforms and further to industry platforms. Gawer defines industry platforms as "building blocks" that can be products, technologies, or services. The platforms form a foundation for developing complementary products, technologies, or services (Gawer, 2009, 2010).

Business ecosystems (Moore, 1993, 1996; Iansiti and Levien, 2004) have become a popular topic in the public discussion concerning the Finnish ICT industries. However, defining the terms and boundaries of ecosystem often remains inaccurate. So far there are not many Finnish-owned real business ecosystems.

The high level of concentration and polarization of the Finnish IT industry and the strong role of foreign-owned IT firms also support the assumption that only a limited number of Finnish-owned software product or IT services firms have or could be able to form significant industry platforms or business ecosystems and become powerful platform owners. More often the question is rather of supply chain platforms (Gawer, 2010).

In the Finnish IT sector the major business ecosystems are formed around platforms (products, technologies or services) owned by global product firms, such as Apple, Microsoft and SAP (cf. Cusumano and Gawer, 2002). Nokia has built some business ecosystems around its platforms such as Symbian and OVI. However, the global transformation of the mobile industry platforms and ecosystems (e.g. Ballon, 2009a, 2009b; Basole, 2009) and Nokia's strategic decisions in 2011 have strongly shaken both Nokia's existing ecosystems and widely also the Finnish IT industries, especially the IT services industry. Linux, for its part, has gathered a large number of firms and firm networks around the Linux ecosystems globally, but its financial implications on the Finnish IT sector have remained small.

Nokia's new strategy and the debate around it in the early 2011 reflect the trend that the competition in the IT industries has shifted more to a competition between ecosystems. The success of an industry platform can be evaluated by the extent of the networks it is able to attract. The competitiveness of a platform is considered to improve, if the major IT vendors join the network. Nokia and many other large enterprises have had to choose between forming or retaining their own or joining someone else's ecosystem as a complementor. The challenge is to choose the winning ecosystem.

Traditional IT services firms themselves have seldom been able to build remarkable ecosystems. Usually they act as complementors in several ecosystems of software producers providing, for instance, integration services for ERP applications (e.g. Accenture, Capgemini, Logica and Tieto). Recently new services using communication networks (Internet, mobile) have become significant platforms or business ecosystems (e.g. stores of Amazon, Apple and Google), providing distribution channels also for Finnish software products and IT services.

The concept of ecosystem has widely replaced the cluster-based considerations of firm populations and firm networks. Several major business ecosystems have expanded and formed global networks of IT firms. Also numerous Finnish IT companies belong to ecosystems crossing both geographical and industry borders. One way to concretize this development is to examine participants and their relationships in large ERP projects of global enterprises.

Some global IT firms have extensive ecosystems in Finland, connecting thousands of IT professionals from different types and sizes of Finnish IT software and IT service or customer firms[38]. For instance, the major Finnish IT services firms belong to many ecosystems (e.g. those owned by Microsoft and SAP) and provide related services to their customers. Software product firms, in turn, typically utilize technologies or other platforms in their own products. The client base consists of both users and appliers.

IT companies utilize different platforms or ecosystems and related collaboration for several reasons. They might want to:

- find new customers or improve existing products or services
- look for new partners or collaboration and subcontracting networks
- get new distribution channels to new customers with small investments and marketing efforts
- expand beyond their traditional market and customer base, for instance to applier customers

The motivations of using a platform and the different relationships between the IT firm and its customer can vary greatly, because the level of control over the technology and the relationship vary greatly in different situations. The different variations are illustrated in Figure 26 on the next page.

From the perspective of this study platforms can be divided into two main categories; ICT and non-ICT platforms. ICT platforms are typically technological or software platforms, provided (owned) by ICT firms. Most often the keystones (platform owners) and complementors are both ICT enterprises.

The other main category of platforms consists of non-ICT platforms. In Finland these are often provided by applier customers of the IT firms. At the moment, most of these

[38] IDC (2009) has estimated that ecosystems of Microsoft alone consist of about 17 000 IT professionals working in different kinds of IT firms and in various industries.

platforms are in manufacturing industries and can be defined as supply chain platforms (Gawer, 2010) which use software or external IT services.

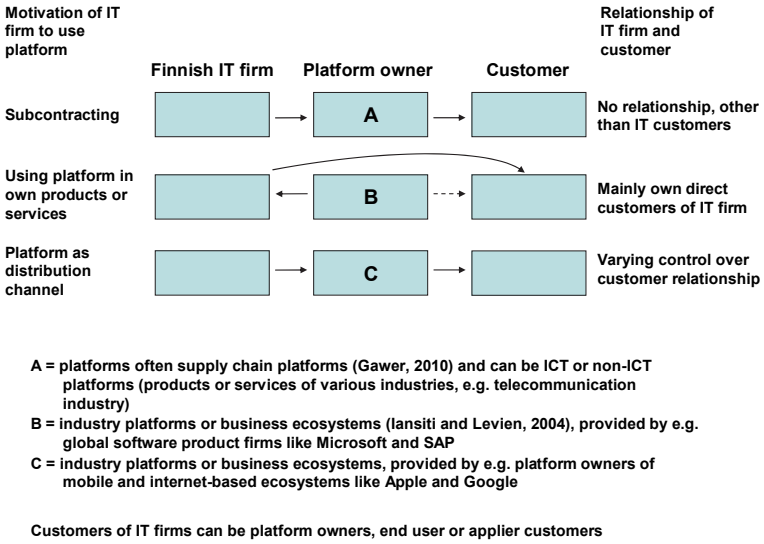



**Figure 26. Motivations to utilize different kinds of platforms**

It is increasingly difficult to draw a line between ICT and non-ICT platforms. As mentioned earlier, during the last few years a growing number of new business ecosystems have been based on platforms which can be classified as service platforms (cf. Gawer, 2010).

Non-ICT platforms may vary by industry and consist of different technologies, products or services. Platforms of applier customers are often customer-specific and less standardized than most IT platforms. This puts more pressure on the IT vendors to provide new skills and competences for the platform. For example, in the metal industry (e.g. paper machines) the end product can be built on several supply chain platforms all including also information technology.

The complexity of these structures might explain why, so far, IT services firms have mainly chosen to focus on embedded systems for communication technology products or services which are based on more standardized platforms. The results of the study concerning the production of embedded software (Nikulainen et al., 2011) support these arguments.

Applier customers typically use information technology as an enabler in their products or services. IT firms are needed to help develop, produce, or maintain the customer's products or services and to act as one member of a group of application suppliers. IT firms do not normally compete with applier customers. Instead, they compete against

each other in order to obtain the strongest possible position in the value network or supply chain of the customer. The competition has increasingly come from lower-cost countries (e.g. from India).

The platforms differ clearly in respect to the relationship between the platform members and their customers. Some platform owners allow the members to serve their own customers directly and freely and allow the members to control and manage their customer relationships (e.g. ecosystems of Microsoft, Linux). In other business ecosystems, the customer relationships of the members are controlled by the platform owner (e.g. Apple). For instance, Apple can act in the role of a gatekeeper and restrict the power of operators (Ballon, 2009a, 2009b), also in Finland. Platforms and ecosystems can provide ICT or other products or services and they can be examined by products and services they provide.

For this purpose a framework (Figure 27) has been constructed for this study utilizing different theories (Ballon, 2009a, 2009b; Gawer, 2009, 2010). The framework helps consider together the different products or services of the platform and the different degrees of control over of the customer relationships by the platform owner (cf. Ballon, 2009a, 2009b) and thereby makes it possible to demonstrate and assess the growth opportunities and trajectories for the future evolution of the Finnish software product and IT services firms.

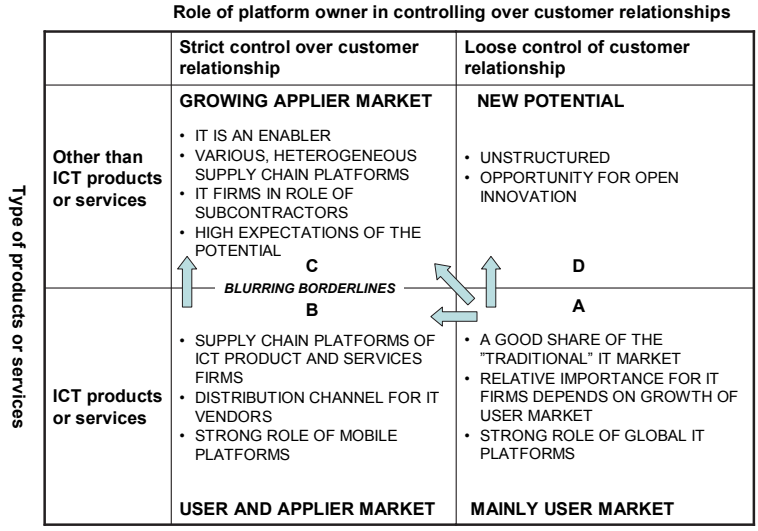



**Figure 27. Classifications of market spaces formed by platforms and ecosystems**

The framework's four quadrants represent existing or potential market spaces (segments) for Finnish software product and IT services firms. Analysis of the existing and expected content of these quadrants utilizes the findings of the status and development of the IT industries and their customers discussed in the previous chapters.

In the framework the quadrant A represents the traditional IT market consisting of platforms and business ecosystems like those of large software product companies (e.g. Microsoft, Oracle and SAP). This market space provides IT products or services mainly to user customers. The platform owners exercise no or only minor control over the customer relationships of the complementors. It is still t be seen how the cloud computing will influence this market space.

The quadrant B, on the contrary, represents platforms where the control over the customer relationships is strong and the customers can be both user and applier customers (quadrant B).

This market space consists of two main market segments: applier customers and global platform providers. The applier customers use information technology and related expertise in their products or services (e.g. embedded systems or R&D services for devices of telecommunication industry). Major part of the embedded software produced in Finland belongs to the quadrant B (see Nikulainen et. al., 2011).

Recently the market segment of global platforms (e.g. mobile platforms) has become a fast growing market for software product and IT services vendors globally. Cloud computing is fueling this development. Platform owners like Apple provide global distribution channels and visibility for numerous IT enterprises, including small Finnish software firms. Network effect has an important role in the growth. The customers are users of information technology and increasingly also consumers.

The quadrants C and D in the framework include platforms providing other than ICT products or services. High expectations have been placed on these market segments; a favorable economic development in Finland will require that information technology and related expertise are increasingly applied as enabler in different industries**,** products and services (Eloranta et al., 2010; Hernesniemi, ed., 2010).

The market space described by quadrant C is characterized by strict control over customer relationships by platform owners. This market consists of strong supply chain platforms (Gawer, 2010) whereas real business ecosystems are more difficult to identify.

Platform owners are the customers and IT firms serve them as subcontractors representing just one category among different types of subcontractors. In practice, this segment is fragmented and still largely unspecified consisting of numerous platforms, such as industry or firm specific platforms. In spite of all this, these types of platforms form an emerging market open for different software products and IT services as well as new business ideas and innovations. The business logic is very similar to applier customers in the quadrant B. In both market spaces B and C embedded software provides major business opportunities.

Building embedded systems is an important but not the only market potential of applier segments. There are also ecosystems or industry platforms formed around services like trading or financial services (Gawer, 2010). At the same time, it is increasingly difficult

to draw a clear line between different platforms producing IT or other products or services (e.g. some platforms of Apple and Google).

The fourth market space in the framework, the quadrant D, has so far remained unstructured, "a wild card". The products offered are other than ICT products or services. The control over the customer relationships is loose or nonexistent. However, this market can create new business opportunities and provide also space for open innovation. Rovio, for instance, has utilized this opportunity by expanding from software products e.g. to toys and playgrounds[39].

Despite their different growth potentials all four market spaces may also provide basis for new industry architectures and create new industry advantages (Jacobides et al., 2006; Jacobides and Tae, 2009). In addition, various existing and potential ecosystems present important and challenging areas for research.

For several Finnish software product firms (e.g. game software) the global ecosystems or platforms provide an increasingly important distribution channel. Several public activities and projects have participated in efforts to develop ecosystems for Finnish products or technologies (e.g. Tekes, Tivit).

### 11.3.5 Value Creation and Capture

In recent years globalization has generated a fair amount of literature and a lively debate of the issues of value creation and capture. Changes in the modes of value creation and their industry level and macroeconomic implications have been addressed in research from different perspectives starting from the trend to unbundling (Baldwin, 2006) and changing industry architectures (Jacobides et al., 2006) and more recently platforms and business ecosystems (Gawer, 2009, 2010; Tee and Gawer, 2009). In Finland the value creation has been studied from a product perspective (Pajarinen et al., 2010). As one line of the debate, considerations of the location of headquarters seem to be increasing (e.g. Pajarinen et al., 2010).

The questions of value creation and capture also concretize very clearly the difficulties related to the measuring of the volumes of the IT Finnish IT industries, one of the central topics of this study.

In the 2000s globalization has highlighted the problems related to the quality of information concerning the IT industries (Sako, 2005, 2006; Baldwin, 2006; Jacobides et al., 2006). Globalization has also resulted into migration of IT production and services or even separate tasks from Finland to other countries, most often to lower-cost economies. Now an increasing share of software products and IT services are not produced and used in the same country. This makes it at the same time more essential and more difficult to retrace from the official statistics or other public information the real value of the Finnish

[39] In this study only revenues generated from software products and IT services are included in IT industry volumes.

IT production and understand the chains of value creation and capture (cf. Jacobides et al., 2006; Tee and Gawer, 2009; Pajarinen et al., 2010).

The more complicated and dynamic the chains of value creation become, the more difficult it is to form a realistic picture of the Finnish IT industries from industry information. It is often based on vague definitions, sometimes conflicting starting points, varying data collection methods and often weakened by different reporting practices of companies.

In the 2000s, internationalized Finnish enterprises have increasingly made corporate-level contracts with global IT companies of software product and IT services purchases, such as outsourcing services. There is, however, no information of the distributions of value creation and capture of services like outsourcing services which are produced and used in different countries.

Thus international IT services contracts are a good illustration of the increasing measurement problems concerning IT services industry. An increasing part of all IT services sold in Finland include services and subcontracting produced outside Finland. In addition, several foreign firms operate in Finland but have no subsidiaries or offices in the country. Another related issue to consider is the global cloud computing services. A further measurement problem is the varying reporting practices of IT vendors reporting of service contracts covering production and customers in several countries. In practice, the reported value of services like international outsourcing deals can depend on the country where the contract is signed or the invoice placed (see Figure 28), not where the service is produced or used.

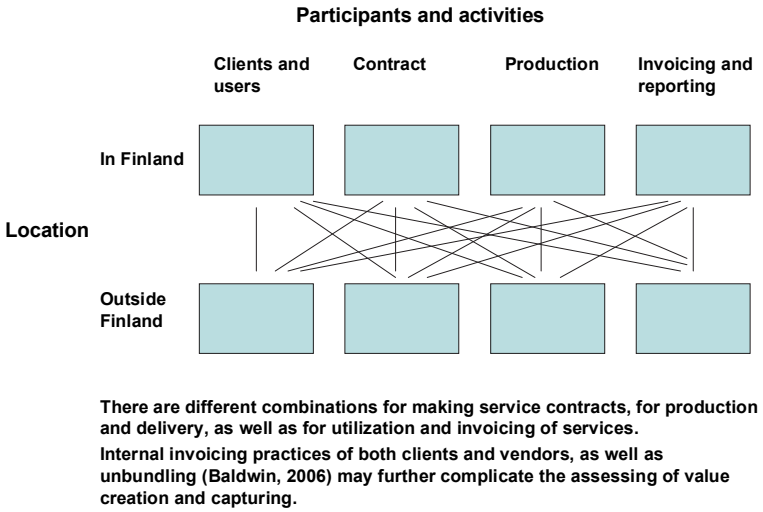



**Figure 28. Unbundling and rebundling of production of IT services**

The fact that an increasing part of IT services purchased by Finnish enterprises are produced and consumed abroad (Market-Visio, 2007) raises new questions concerning the export and import statistics of software products and IT services. In order to interpret the statistics correctly, it is not enough to understand the structure and contents of the information but to analyze also the company practices like centralized purchasing and internal invoicing of the customer enterprises.

Examining the export statistics (see Chapter 9.5) offers a demonstration of this issue, noted in several contexts (e.g. Eloranta et al., 2010; Pajarinen et al., 2010; Pajarinen and Rouvinen, 2012). According to the official statistics the Finnish IT services exports jumped from 1.3 billion euro to 5.6 billion in 2008, twice the value of the Finnish IT services market. The sudden leap has been explained as a consequence of internal transactions of customers of IT firms as well as a change in the practices of compiling the statistics. However, the statistics do not offer any distribution between "the real IT services exports" and internal invoicing. It is reasonable to assume, that similar problems concern also the imports of IT services and assumably also the exports and imports of software products.

In all, it is difficult to get foreign trade figures of software products. A part of information can be included in exports and imports of IT services, another part is classified into the category of licenses and royalties but not reported separately.

From the Finnish point of view, naturally, the important question is the portion of domestic value creation. The information would be crucial for calculating or estimating the value of the Finnish IT industry and its productivity. Another challenge is to understand the measurement issues from the perspectives of user and applier markets and their production.

Pajarinen et al., (2010) have examined in detail the value creation of one Nokia phone model. A central conclusion of the study is that because of the unbundling of global value chains the physical assembly (production) and the geography of the value added of the whole supply chain have less and less to do with each other. The main cause of the problem is internal invoicing between the headquarters and country offices.

Similar information is not available of the production of Finnish software products or IT services or their value creation and capture. It is, however, reasonable to believe that the arguments presented by Pajarinen et al. (2010) are valid and applicable to them also. This would imply that the Finnish export statistics include an undefined amount of software products and IT services produced abroad. In other words, some part of the value of IT services exports does not necessarily have any real connection to Finnish IT services production. At the same time IT services produced outside Finland, for instance in lower-cost economies, generate some value also to head offices located in Finland even if the services are used outside Finland.

The varying reporting practices and policies of international IT companies cause even further problems which can weaken the credibility of IT industry information. For

instance, some Finnish subsidiaries of international software product firms report the whole value of their sales in Finland, others only the sales commissions received from Finland. In some cases market studies are the only way to get volume estimates.

As referred before, globalization, concentration of industries, international acquisitions and the rapid internationalization of IT industries have raised questions about the meaning of the location of company headquarters to the Finnish economy. In the early 2000s there were concerns in Finland about the country becoming a daughter company economy. One of the main concerns expressed was the importance of keeping at least research and development activities of Finnish enterprises in Finland. At the same time the flight of electronics industry to Asia was widely discussed, but not necessarily seen as a problem from the perspective of employment or tax revenues in Finland (cf. Braunerhjelm and Lindqvist, 1999).

At the moment, the global positioning of functions and tasks has again increased the interest in the location of head offices (Pajarinen et al., 2010). One reason to this interest can be a new understanding of the value creation in global operations. According to Pajarinen et al. (2010) the location matters from the perspective of the Finnish national economy.

In fact, moving the headquarters of a Finnish company abroad has been rare (cf. Ali-Yrkkö and Ylä-Anttila, 2002). More often the changes of headquarter locations have happened as a result of foreign acquisitions in Finland. The move of major Finnish enterprises (e.g. Merita, Sampo Pankki, Sonera) to foreign ownership has strongly influenced the amount of IT spending in Finland and changed the competive positions through IT vendor selections.

The wider impacts of this evolution are to be seen in other that IT areas; the headquarters attract also other business services, such as legal or advertisement services (cf. Braunerhjelm and Lindqvist, 1999) and therefore losing the headquarters usually means also losing many types of business services from Finland.

## *11.4 Challenges in Measuring Finnish IT Industries*

One of the main objectives of this study is to asses the ability of the existing information, definitions and indicators to describe the status, structure and evolution of the Finnish IT industries and their vendor and competitive field. In addition some ideas and views to improve the relevance of IT industry information are presented and discussed.

A thorough examination of the available information of the Finnish ICT sector reveals several measurement related problems. In consequence it is difficult to build a clear and consistent understanding even of the size and structure of the sector.

Industry information produced by statistical authorities is largely based on theories and needs of economists (Bain, 1968; Porter, 1980, 1985; Utterback and Suarez, 1993;

McGahan, 2004). The purpose is to provide long-lasting and comparable data covering long periods of time. The industry information has a crucial role, for instance, in the statistics of national accounts in which rather static definitions are required. Thus the use of long-lasting and static definitions and classifications is to some extent understandable.

However, the present approach is increasingly being questioned in dynamic industries like the IT industries (Jacobides and Winter, 2005, Sako 2005, Baldwin, 2006). Globalization, related unbundling and the growing dependency on global value networks and ecosystems set new requirements especially for enterprise and foreign trade statistics which again impact the statistics of the national accounts. Some economists suggest that the basis for industry statistics is shaken (cf. Sako, 2005, Baldwin, 2006; Weaver, 2007). Some scholars (e.g. Jacobides et al., 2006 ; Tee and Gawer, 2009 ; Pajarinen et al., 2010) emphasize the importance to understanding of the value creation.

The empirical analysis and observations in this study have raised several issues related to the measurement, indicators and their usability. In this study it is suggested that the present public information available does not meet the information needs related to changes in the IT industry structures, volumes and employment. To obtain information about structural and other changes, about customer needs and behavior or developments in the vendor field and competition requires using a wide range of different information sources. In addition, the available information is often conflicting because it is based on different sources, starting points and definitions.

The ecosystem of Finnish IT industries used as the main framework of this study has proven to be helpful in understanding the structure, dynamics and driving forces of the Finnish IT sector. It also allows a consideration of separate IT industries from the perspectives of supply and markets. The other framework used, the IT enterprise space provides a flexible tool for analyzing the structure and changes of the IT vendor field and competition. Operational frameworks constructed for this study have helped to define and estimate total volumes and revenue and employment distributions to describe software product and IT services industries.

Utilizing the flexible frameworks and firm populations does not mean abandoning the concept of industry. If defined in a flexible way the concept is still usable as a common term to refer to various firm populations. For some purposes even the strictly defined and static concept of industry can be needed (McGahan, 2004).

The empirical considerations in this study prove that to understand the Finnish IT industries it is necessary to combine and analyze information from multiple sources. This is seen in attempting to assess and estimate the volumes of the software product and IT services industries. The industry information collected and published by Statistics Finland describes the production and related volumes of IT industries. A top 100 IT vendor database was constructed for this study to complement this data with more precise information of the vendor field. Information of the demand and market side was obtained from market research. In addition several other sources were needed to complement and deepen the IT industry data.

The problems and obstacles related to the information of the Finnish IT sector have been identified and discussed in different contexts in the earlier chapters of the study. Table 38 links the major changes to the business, the factors challenging the information production and the main framework of this study.

The changes in the IT markets and industry have profound effects on the industry structures, competition and employment and therefore also to the national economy. This accentuates the need for more reliable industry information.

A few examples concretize the practical problems related to measuring the IT industries.

In the industry statistics both software products and IT services are included in the same industry category. Therefore the statistics do not offer revenues or other volumes of the software product and IT services production separately. This has already led into commonly held faulty understanding of the size of the respective industries in Finland. At present, however, there are no other sources for this data.

The employment has become an increasingly important indicator to describe the sizes of the IT industries. So far however, the public sources have not been able to provide separately information on employment in software product and IT services industries and only limitedly on the structures of personnel, such as distributions by professions, skill levels and location.

Another practical problem concerns the foreign trade statistics. Globalization has made it more challenging to get reliable information of imports and exports of software products and IT services. The statistics are not able to make a difference between external and internal transactions of IT firms or customer companies (e.g. Hernesniemi, ed., 2010; Pajarinen et al, 2010). As a result the trade statistics are not able to describe imports or exports of the Finnish IT industries. Same difficulties have been identified also in Sweden (Gozzo, 2009).

A further weakness is the scarce supply of information related to embedded systems and applier market. At the same time the relative importance of the traditional end user spending has declined diminishing the significance of user spending as one of the main indicators to measure the usage of information technology at company, industry or country level.

Unlike most public statistics market research firms analyze the IT sector mainly from the market perspective using their own definitions and classifications. Compared to the statistical authorities, they can and often are forced to adapt more flexibly and quickly to the needs and requirements of their customers and can therefore be able to avoid some of the validity issues. There are, however, some concerns regarding the reliability of market research information. The key question is the willingness of international research firms to invest in local expertise in following and analyzing the circumstances and industry structures in small countries like Finland.

**Table 38. Issues and weaknesses in IT industry information**[40]

| Object of information | Factors impacting on information needs | Deficiencies in information or problems to be solved |
|---|---|---|
| Definitions and classifications | Definitions based on different needs and starting points (e.g. national accounts, industry architecture)<br>Changing information needs | Static nature of official industry definitions and slow reaction to changes<br>Software products and IT services produced outside the official IT industries not included in the statistics |
| Structure and evolution of the whole IT sector | Dynamic nature of IT industries; e.g., dis-integration of industries; shifting borders of firms and industries<br>Global division of labor; unbundling especially in production of IT services; value chains, geographical dispersion of processes and separate tasks (cf. Sako, 2005; Jacobides et al., 2006; Baldwin, 2006; Tee and Gawer, 2009) | Issues of relevance<br>Difficulties to separate domestic and international operations<br>Inaccuracies in imports and exports figures caused by internal invoicing and transactions between countries<br>Insufficient information about value creation and capturing of IT services and software products |
| Supply side of IT sector (production and imports) | Production increasingly outside Finland<br>Increasing imports and exports of software products and IT services<br>Growing importance of embedded systems<br>Growing role of alternative products and services (substitutes)<br>New competition from unexpected directions and different industries | Software products and IT services not reported separately; same firms may produce both software products and IT services but information difficult to get separately<br>Enterprise statistics (codes 62-63, TOL 2008) include both software products and IT services<br>Incoherent information of imports of software products<br>Embedded systems inadequately specified<br>IT personnel reported at high level of aggregation, limited information of structures of IT personnel (professions, skills etc.) |
| Demand side of IT sector (market and customers) | Geographical dispersion of customers<br>Growing importance of other than user-customers (appliers)<br>New customer needs and buying behavior difficult to detect<br>Direct software and IT services purchases from outside Finland (e.g. services from lower-cost countries, cloud computing services) | Limited information on demand of software products and IT services by customer segments (users and appliers)<br>Information of IT usage and market often offered only by market research firms |
| Vendor field and competition | Strong role of foreign IT firms<br>Perceiving of competitive field and identification of new competitors increasingly difficult | Information of performance and volumes of foreign IT firms in Finland often difficult to obtain<br>New competitors, products or services difficult to fit into existing classifications |

Other information producers such as various research organizations and individual researchers or research projects concentrate on selected and often specified areas. In addition the information from other sources is often more unstructured and also based on

[40] The issues considered refer to issues related to software products and IT services. It is reasonable to believe that part of them has also wider relevance.

separate information needs. No existing information source provides a total picture of the Finnish IT sector or separate IT industries.

## 11.5 Consistency of Findings and Literature

This chapter summarizes the relationships, consistencies and inconsistencies of the findings and observations of this study and the literature.

On the basis of the findings and observations discussed in Chapter 11 it is possible to argue that the status and evolution of the Finnish IT software product and IT services industries follow several of the trends and developments discussed in the literature (Chapter 4).

Various global changes can be seen to effect the volumes, employment and structure of the Finnish IT industries in many ways. Globalization, for instance, has changed the IT customer behavior and markets, reshaped industry borders, value chains and division of labor both in Finland and globally (cf. Sako, 2005; Jacobides et al., 2006; Baldwin, 2006).

In addition to globalization technological changes and business innovations are seen to be blurring the borderlines between IT and non-IT industries as well as between the Finnish IT companies and their customers (c.f. Hamel and Prahalad, 1994; Prahalad and Ramaswamy, 2004; Vargo and Lusch, 2004; Sako, 2006; Jacobides and Winter, 2005; Jacobides et al., 2006; Grönroos, 2009). Several developments in the Finnish IT enterprise space and competition as well follow ideas presented in literature (cf. Anderson and Tushman, 1990; C. M. Christensen, 1992 and 1997; Lovio, 1993; Adner and Zemsky, 2005; Cusumano et al., 2006; J. F. Christensen, 2008).

The Finnish IT industries are increasingly dependent on various technology platforms and global business ecosystems (cf. Gawer and Cusumano, 2002; Iansiti and Levien, 2004); Gawer, 2009, 2010). Migration from products to services is happening in both the IT (cf. Cusumano, 2004; Gerstner, 2004; Cusumano et al., 2006) and other industries, e.g. manufacturing (cf. Oliva and Kallenberg, 2003; Penttinen, 2007; Kowalkowski, 2008; Eloranta et al., 2010).

As to the differences between literature, official IT industry information and often also public debate, several inconsistencies have been found. The inconsistencies are mainly related to the measurement of the IT industries and are largely caused by different definitions applied in measurement.

The study also presents a number of results and information which are new and have not been published before. Utilization of frameworks constructed for this study in analyzing and measuring the Finnish IT sector is a new approach. Contrary to public debate the study emphasizes the strong role of IT services industry from perspective of revenues and employment. The role of software products is seen in the study more limited than often

assumed and argued. The study also emphasized the importance of large firms (incumbents) as well as the significant contribution of foreign-owned IT companies in the Finnish IT software product and IT services industries. In addition attention is put on importance of imports international products and services.

By using the frameworks as analysis tools and combining data from multiple sources the study has also been able to provide new (more specific estimates and distributions of volumes and employment of IT industries and their markets as well as of the vendor field. It is suggested in the study that these estimates are more precise than the ones presently available in any other data source.

Due to the higher level of detail and accuracy the frameworks and information offered by the study can help assess the basis for the future evolution of the Finnish IT industries.

# 12 Conclusions

The purpose of this study is to contribute and increase knowledge and understanding of the Finnish IT industries, the Finnish IT vendor field and competition as well as to provide new information and theory for consideration and analysis of IT industries. This chapter summarizes the major findings and conclusions made to answer the research questions of the study.

The first research question concerns the status of the Finnish IT industries by applying theoretical frameworks (Chapter 12.1). The second research question answers the question of the basis for the future evolution of the Finnish IT industries (Chapter 12.2.). Finally, the third research question seeks answers how well definitions and indicators available describe the Finnish IT industries (Chapter 12.3.).

## *12.1 Status of Finnish IT Industries*

The first research question is formulated as follows: ***What is the status of the Finnish IT industries studied by applying theoretical frameworks to assess and describe their size and structure?***

The first research question is answered in Chapters 12.1.1–12.1.6. Chapter 12.1.1 is divided into answers to the four sub-questions of the first research questions regarding the theoretical framework of the study and the main factors affecting the Finnish IT industries. The following chapters (12.1.2–12.1.6) summarize the findings of the study regarding the main characteristics which describe the status of the Finnish IT industries and the structure of the IT enterprise space.

### 12.1.1 Frameworks and Changes Affecting Finnish IT Industries

This study describes, analyzes and measures the status and structure of the Finnish IT industries in 2008. A few major developments are considered up to the year of 2011. The study focuses on the software product and IT services industries and related markets (as defined in the Chapter 3.4). The year 2008 was chosen for analysis as the last year of "normal growth" before the recession which greatly impacted also on the Finnish IT sector.

The following four sub-questions specify the first research question. Answers to these questions are summarized as follows.

***Question 1a: Which frameworks and theories help provide a realistic and relevant picture of the Finnish IT industries?***

To identify and understand the different changes and their impacts on the Finnish IT industries the study has utilized traditional industry theories, theories and literature on

innovations and other major structural changes as well as on expansion by IT firms beyond their traditional markets (see Chapter 4). The changes are different by impacts: some reshape industry borders and vendor field (firm populations), others influence businesses and operations of IT enterprises

To answer the first research question and to provide a realistic and relevant picture of the Finnish IT industries a number of frameworks were constructed for the study (see Chapter 7.6). The ecosystem of Finnish IT industries, formed by applying the literature of business ecosystems, provides the overall framework of this study. It is complemented with operational frameworks that help in defining main concepts, analyzing the structures and measuring the volumes of the IT industries.

The ecosystem of the Finnish IT industries provides "the big picture" which helps regard the IT vendor field and IT market as well as changes and dynamics influencing them (Chapter 7.3). The IT vendor part of the ecosystem, the IT enterprise space, has been formed by using the idea of economic and industrial spaces (cf. Schumpeter, 1942; Lovio, 1993). The IT enterprise space is a framework for considering changing firm populations, industry borders and competition. For a deeper understanding of the structure and development of the IT market, the customer space defined in this study divides customers into two main groups: user and applier customers.

On the basis of empirical consideration and analysis this study proposes that these frameworks provide a useful tool to consider the software product and IT services industries in a more systematic way than otherwise possible relying on the existing public information. An essential improvement facilitated by the use of frameworks and multiple data sources is the possibility to regard software product and IT services industries separately and thereby clarify the profound differences between these two parts of the IT industries.

***Question 1b: How does globalization influence the Finnish IT industries?***

Globalization is the most important of the many exogenous and interconnected forces behind the recent evolution of the IT industries. It has changed profoundly the landscape of the Finnish IT sector. Globalization contributes to a number of factors and developments that reshape value chains across firm borders as well as division of labor between firms and countries. This can be seen as unbundling of processes and separate tasks geographically, as changes in industry architectures and as a growing role of global platforms and business ecosystems (Chapter 2.4). Impacts on employment of separate firms and entire industries have accelerated in Finland during the past ten years.

With globalization the imports of IT services from low-cost economies have increased. Several Finnish software product firms have transferred their software development and production functions as well as jobs to lower-cost locations (see Chapter 9.4.2).

All these development have implications also to the measuring of IT industries. The changes mentioned above make it increasingly challenging to separate imports and

exports from other international activities and related internal transactions of companies. Therefore it has also become more difficult to know where the value of IT production is created and captured.

***Question 1c: What are the influences of changing customer needs and requirements on the Finnish IT industries?***

One of the main conclusions of this study is that changes in customer needs and behavior in the 2000s have been more profound than in the earlier decades and therefore also their effects on the growth and structure of the Finnish software product and IT services industries are more prominent than after earlier changes. Even if the central role of customers most probably will prevail, in public discussion or even in research customers tend to get less attention than changes like globalization and technological developments.

In the study four developments related to customers and the IT market can be emphasized. Most of them are directly of indirectly connected to globalization.

Firstly, the internationalization of Finnish enterprises has profoundly changed the behavior of companies also as IT customers. As a result a larger part of IT budgets of Finnish companies is used outside Finland. In recent years a second development related to new customer needs has continued to impact the IT industries: Finnish firms and other organizations have increased their purchases of IT services from low-cost countries (see Chapters 8.1.2–8.1.3).

The third major development in the IT customer space is connected to the industry structures. During the last couple of decades numerous Finnish companies have been acquired by foreign firms. With the acquisitions a considerable part of IT decisions are now taken outside Finland (e.g. finance and telecommunications industries). As the acquired companies follow the sourcing practices of their mother companies, the use of international software products has increased and project or outsourcing services purchases been directed to global IT services vendors. The Finnish IT vendors feel the changes as a decrease in the domestic end user market.

The fourth major change, also related to the customer space, in turn, has created new opportunities to Finnish IT industries. The increasing use of information technology in products and services in different industries has accelerated the growth of the applier market. This has had a key role in securing the growth of several Finnish IT service firms in the 2000s.

Another major change of the 2000s is the growing importance of the consumer market and its impacts, for instance, on ecosystems related to mobile technologies. The developments in the consumer market are largely outside the scope of this study and are not considered separately (Chapter 6.2).

One more important development deserves to be mentioned. The internationalization of the customers as well has been a significant driver for several Finnish IT firms to seek

international presence for themselves. Many have followed their Finnish customers to international markets.

***Question 1d: What are the drivers of change inside the software product and IT services industries?***

The drivers changing and reshaping the Finnish software product and IT services industries in recent years are largely connected, directly or indirectly, to globalization and changes in customer needs and behavior. The changes have increased the role of IT services in the Finnish IT sector.

Global software product companies have strengthened their positions in the Finnish application software market since the late 1990s reflecting global concentration. Finnish customers have increasingly favored the offerings of global software producers. As a result, Finnish software product firms have lost domestic market shares and their growth has become increasingly dependent on exports or services. Also Finnish software product firms have been tied closely to global platforms and business ecosystems. On the other hand, these as well as cloud computing have provided new business opportunities for several Finnish software product firms. Infrastructure software as well as application and systems tools market has already earlier moved into the hands of international companies.

IT services firms**,** in turn, have been able to benefit from the developments in the software product industry by providing services for international software products. Due to user requirements, several IT services have a stronger dependency on domestic production than software products. This has helped the IT services industry in facing the challenges of a declining share of the traditional user market.

Migration from software products to services (including cloud computing) is a global trend. The growing use of information technology in products (e.g. applier market) and services (e.g. business services) has increased business opportunities for the Finnish IT services industry in the 2000s. Several IT services enterprises have been able to respond to this demand and have expanded beyond their existing markets and offerings utilizing their existing competences and skills. To some extent, also the structure of the IT vendor field has contributed to this development.

### 12.1.2 Services Dominate the Finnish IT Industries

The Finnish software product industry has been expected to grow and become an important driver and source for growth of both revenues and employment in the whole (Chapters 9.3.3–9.3.4). The empirical analysis in this study paints a different picture and does not support these expectations.

One of the main results of this study regarding the structure of the Finnish IT industries reveal and emphasize the important role of the IT services industries in the sector. This development follows global trajectories. Software product industry is increasingly concentrating globally (cf. Cusumano, 2004, 2010).

By combining different information sources and using frameworks constructed in this study it has been estimated that the volume of the Finnish IT services industry is three times bigger than that of the software product industry (Chapter 11.2.1). In addition, IT services also have a crucial role as employers of IT professionals (Chapter 9.4.1). This development has resulted into a very strong position of IT services companies among the largest IT vendors in Finland.

The IT services comprise one half of the value of the IT spending of the Finnish end user market. It has been estimated in this study that applier customers bring nearly one fifth of the IT services sales of firms belonging to the IT enterprise space of this study. The applier sales contain software provided as customized services as well as different outsourcing and management services. So far the applier market has been more important for the IT services companies than for the software product firms (see Chapter 11.2.2).

The applier customers use information technology as a part of their products or services sold to their own customers. The offerings for user customers consist of services which help develop, run and manage the customers' business operations and processes.

The Finnish IT market is more important to the Finnish IT services industry than to the software product industry. About 75 percent of IT services purchased in the Finnish market are produced locally whereas only a good third of the value of software products comes from Finland forcing software product firms to seek growth from exports (Chapters 9.3.3 and 9.3.4). In addition, software product firms increasingly expand or migrate to services.

In the 2000s the growth of several IT services firms has based on entering new customer segments or on expanding services offerings (e.g. embedded software, business processes outsourcing, cloud computing) targeted for existing and new customers. In spite of different technological or structural changes during the last decades the IT services firms, however, have largely been able to utilize their existing expertise and skills and retain their positions (see competence-enhancing, Chapters 4 and 2.2.1).

### 12.1.3 Employment Key Indicator of IT Industry Size

Issues and obstacles in receiving accurate information of revenues and values of the IT industries have increased the value of employment as a central indicator to describe the size of the Finnish IT industries.

Among the main results of this study are two findings regarding IT employment. The first of them is the estimated distribution of personnel between software product and IT services industries, information which cannot be obtained separately from the official statistics or other available public data.

The employment figures accentuate further the role of IT services. IT services employ over three times more people than the software product industry (Chapter 11.2.3). It is estimated in this study (Chapters 9.4.1 and 11.1.3) that, when including also enterprises

outside the scope of this study, the total number of IT employees providing software products or IT services for external customers is about 50 000 in Finland. Nokia and internal IT staff of non-IT companies are not included in this figure.

Another important employment-related result of the study is that the global developments reshaping economies and industries are clearly visible also in the Finnish IT-employment figures and strongly support the conclusion made, that many expectations and estimates of the strength of the IT industries as drivers of the economy are overly optimistic.

Since the late 2000s the growth rate of IT employment has slowed down in Finland while, at the same time, recruiting has increased abroad, especially in lower-cost countries. One fourth of the personnel of the Finnish IT enterprises in 2010 was employed in their foreign subsidiaries (Chapter 9.4.1).

The data in the top 100 IT vendor database supports the conclusion that large IT companies have been most active in transferring jobs from Finland. In 2010 a good 30 percent of the employees of the top fifteen Finnish-owned IT services and software firms alone worked in low-cost economies compared to about 10 percent in 2005. Meanwhile the number of employees in numerous small IT firms has grown rapidly in Finland. This growth, however, has not been able to compensate the migration of jobs from larger companies to other countries. At the same time, globalization and popularity of offshore services has increased employees working in Finland on projects, but employed by a foreign company with no office in Finland.

### 12.1.4 Concentration and Strong Role of Incumbents

Despite the continuous changes in the IT enterprise and market spaces the Finnish IT vendor field has remained rather stable and concentrated during the whole history of IT in Finland. The Finnish IT vendor field is characterized by a few central features: concentration, even polarization, and a strong role of foreign-owned IT firms and large incumbent firms.

The top 100 IT vendor database constructed for the study illuminates the concentration, even polarization, of the Finnish IT industry. It has been estimated in this study that in 2008 the 100 largest IT companies generated nearly a two thirds of the total revenues in the software product and IT services market and employed a good two thirds of the Finnish IT personnel. In 2008 there were among the 100 largest vendors only about thirty Finnish-owned vendors employing more than 100 persons and among the top 10 vendors not one Finnish ‘pure’ software product firm. According to market studies (e.g. Market-Visio, 2010) the ten largest IT services vendors control two thirds of the Finnish IT services market.

Analysis of the top 100 IT vendor database reveals a worrying element in the industry: the growth of the IT companies is slow. There are a few ”newcomers” among the largest IT vendors, but it has taken all of them more than 15 years to reach a revenue of 100 million euro or the number of 1 000 employees.

In public discussion stable and strong position of a few large incumbent companies in the Finnish IT market has often been claimed to hinder or slow down the innovativeness of the Finnish IT industries. These incumbents have, however, managed to keep their strong position among the providers of large IT customers and also their crucial role as employers in the industry.

Consideration of the top 10 IT vendor list constructed for the study (Chapter 10.5) shows clearly the strong position of the large incumbents (e.g. Tieto, Logica, IBM). To defend their market position the major Finnish and foreign incumbent IT firms have reacted to change e.g. with numerous acquisitions and mergers, resulting in further converging at both firm and industry level. The evolution of foreign-owned IT firms has followed the guidelines or arrangements decided outside Finland at corporate level, including acquisitions and mergers.

### 12.1.5 Strong Role of Foreign-owned IT Firms in Finland

The role of foreign-owned IT firms in the Finnish IT sector is often underestimated in public discussion. Several studies concerning the Finnish IT industries concentrate solely on Finnish-owned firms (e.g. Rönkkö et al., 2010). Neither is it easy to get a clear understanding of the role of foreign IT enterprises in Finland on the basis of public statistics.

On the basis of this study, however, it is undisputed, that the foreign-owned IT firms have a crucial role in the Finnish IT sector: they control significant shares of the Finnish software product and IT services industries as well as major platforms and business ecosystems in the IT sector.

It is also worth noting that foreign IT firms are big employers in Finland. It has been estimated in the study that in 2008 they employed about 40 percent of the Finnish IT employees and generated about 60 percent of the total revenue of the Finnish IT market (Chapter 10.4). Foreign-owned IT firms are also well positioned among the largest IT firms. In recent years they have still increased their direct and indirect dominance.

In the 2000's changes in customer needs and behavior as well as globalization have strengthened the role of foreign-owned IT companies. Large Finnish customers have favored international and global vendors in their software applications purchases as well as in international projects and outsourcing contracts. In turn, the resulting loss of big domestic customers have made especially smaller and mid-sized Finnish IT services vendors increasingly dependent on smaller domestic customers. Many software firms, for their part, have chosen to concentrate on niche areas and left the mainstream applications and software product markets in Finland to international software producers.

The strengthening role of international software products and IT services firms in Finland has resulted in loss of market shares of Finnish-owned IT firms especially in the user market. The financial reports of major IT vendors support the conclusion that after 2008 the share of the domestic production in the Finnish IT market has continued to decline.

Therefore it is reasonable to assume that also in the future Finnish-owned IT firms will be competing of declining shares in their domestic markets.

### 12.1.6 Heterogeneity of IT Enterprise Space

In continuing to answer the first research question, another essential observation made in the study deserves to be noticed: the increasing heterogeneity on the Finnish IT enterprise space. Apart from the main focus of the study, software product and IT services firms, the space includes a variety of non-IT firms providing software products or IT services. A growing number of future new players is assumed to come from outside the IT industries. Some are new types of competitors difficult to classify to any existing industry category others provide alternative solutions or services substituting existing software or IT services. This again reshapes the vendor and competitive fields and markets of the IT sector. It is estimated in this study that in 2008 one tenth of the software product and IT services revenue as defined in the study was generated by firms belonging to other than IT industries**.**

The heterogeneity of the IT enterprise space is underlined by another important trend. There are numerous companies providing IT services for Finnish customers but operating outside Finland and having no local office or contact point in the country. The increasing number of firms providing cloud computing services belongs to this group.

During Nokia's successful years a number of international firms entered the Finnish IT services market. There are, however, good reasons to argue that without Nokia many of these entrants had not been interested in entering the Finnish market.

This study supposes that the increasing diversity of the vendor field supports the use of the framework of IT enterprise space as a tool in the study. It provides a wider perspective but also a more precise picture of the IT industries than possible on the basis of considerations based on traditional industry categories and classifications. The framework also helps to identify new kinds of competition in the IT field.

## *12.2 Basis for Future Evolution of Finnish IT Industries*

The second research question is formulated as follows**:** ***What is the basis for the future evolution of Finnish IT industries?***

Answering the question requires firstly identification of important issues having influence on the future evolution of the Finnish IT sector. Chapter 12.2.1 summarizes these findings and is divided into three sub-questions. Chapters 12.2.2–12.2.6 concentrate on evaluating, on the basis of the findings of the study, the major opportunities and challenges expected to shape the Finnish IT industries in the future. The purpose is not, however, to provide exact guidelines, propositions or forecasts for the evolution of the Finnish IT industries.

### 12.2.1 Determinants and Opportunities for Future Evolution

The following three sub-questions specify the second research question. Answers to these questions are summarized as follows.

***Question 2a: What are the determinants of the evolution of Finnish IT industries?***

The following developments and trends are identified in the study as the main determinants of the future evolution of the Finnish software product and IT services industries:

- globalization continues to shape both the Finnish IT industries and the customer space impacting further the division of labor, employment and value creation
- new customer needs and behavior expand and shape the customer space and customer relationships of IT companies
- the user and applier markets open new growth paths and opportunities to IT firms
- international players are expected to further strengthen their role in the Finnish market partly through acquisitions of Finnish IT companies
- Finnish IT industries are increasingly dependent on international technologies and innovations

Figure 29 demonstrates the ecosystem of the Finnish IT industries, a framework used in the study also to describe the playing field for future evolution.

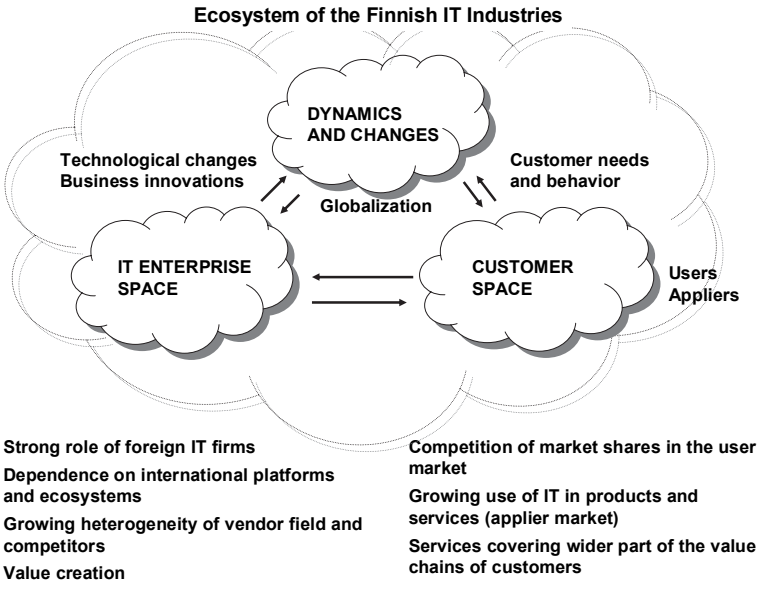



**Figure 29. Major determinants of the future evolution of IT industries**

On the basis of the analysis and findings of this study it is suggested that the Finnish ecosystem of IT industries continues to face profound changes which have become stronger and global in the 2000s. Unexpected impacts may come from new technologies and business model innovations. The observations of this study support the finding of Iansiti and Levien (2004) who suppose that companies today inhabit ecosystems that extend beyond their own industries.

It is important to take notice that from the perspective of the Finnish IT sector most developments and drivers of the evolution are exogenous. Therefore, often the only way to survive is to adapt to the changes. This emphasizes the importance of early recognition of the new developments and agility to grasp the new opportunities. However, they may be difficult to detect and identify beforehand.

Since the late 1990s internationalized Finnish enterprises have favored large global software product and IT services firms. Recently also large public organizations have started to move to the same direction. Standardization and concentration of both business functions and IT systems is expected to further strengthen this development. Therefore it is evident, that the strong presence of international software and IT services firms in Finland continues to shape the future evolution of the Finnish IT industries.

***Question 2b: How do international competition, international technological platforms and business ecosystems influence the evolution of the Finnish IT industries?***

New technology and technological innovations most often appear in Finland in the form of new platforms and business ecosystems. Globalization and international competition make Finnish IT companies increasingly dependent on international technological platforms and business ecosystems. This again has profound influences on the Finnish IT industries and their markets in the coming years.

Globalization will reshape industry architectures, industry borders and global division of labor as well as structures of vendor field and competition. At the same time transferring IT jobs from Finland is expected to continue. A good part of new competition comes from different and unexpected directions, often from outside IT industries. At the same time the IT enterprise and market spaces will become more diversified and heterogeneous. A growing number of different alternatives and substitutes will enter the marketplace and compete with existing software products and IT services.

Several Finnish software product and IT services companies will have to seek growth beyond their existing customer base and offerings. Global concentration of software product industry will further decrease domestic market possibilities and force the Finnish software product firms to seek growth from exports and services. The universal migration from products to services accelerates this development. On the other hand, global business ecosystems will also provide new business opportunities.

The IT services companies, on the other hand, are able to benefit from international technologies, business ecosystems as well as migration from products to services in

several ways. Since the late 1990s the IT services companies have had strong role as complementors in several international business ecosystems like those of SAP and Microsoft. In the coming years the Finnish applier customers represent a growing market segment especially for IT services vendors.

Many changes and developments in new technologies and business ecosystems are difficult to foresee and prepare for. Their impacts on the evolution of the Finnish IT industries largely depend on how well the IT firms and their customers are able to recognize, react and utilize different opportunities.

***Question 2c: How are the Finnish IT industries able to create value and gain competitive edge in the international competition?***

Globalization, business ecosystems and changing industry architectures have raised questions of value creation and capture (Chapter 11.3.5). The crucial question is how to get the value created and captured by software products and IT services to benefit the Finnish IT industries and the whole Finnish economy. This question gets more attention also in public discussion when, at the same time, an increasing number of Finnish IT companies have moved through acquisitions into foreign ownership and Finnish IT firms have established production facilities in lower-cost locations.

The global positioning of company functions and tasks and a new understanding of the value creation have again increased the interest in the location of head offices and company ownership also in regard to the IT industries. The location of the headquarters impacts on value capture; this has provoked questions if emerging IT companies are sold abroad too easily. Moving into foreign ownership quite regularly also leads to transferring the head office, often also production out of Finland.

It is also important to see the connection between value creation and value capture. Due to globalization the value creation of the IT industries is increasingly happening outside Finland. Therefore the value capture of this production largely depends on the location of the head office.

This study emphasizes the importance of the domestic IT services industry also from the perspective of value creation. The IT services industry is labor-intensive and already a significant employer in Finland. An IT services firm creates value in Finland despite the origin of its ownership or the location of its head office. In the form of e.g. salaries and taxes a significant part of the value created is also captured in Finland.

In software products the value creation and capture are somewhat different. Finnish software product firms create and capture value by employing in Finland as well as generating license and other revenues of their products whereas the value creation and capture of foreign-owned software firms largely depends on their employment in Finland.

The findings and observations of this study support the following three conclusions related to the value creation and capture. Firstly, keeping head offices in Finland can

ensure the value capture even the production is outside Finland. Secondly, it is important to retain labor-intensive IT services firms and their productions in Finland for both creating and capturing value. And finally, by expanding beyond existing services and markets it is possible to strengthen the Finnish IT industries as well as to build more potential for value creation.

This study supposes that to some extent at least the ability to create value in a country indicates international competitiveness.

### 12.2.2 Utilization of International Technologies and Ecosystems

Changes in the business environment are often seen only as threats, whereas the opportunities brought by change get less attention. On the basis of the findings of the study three types of future opportunities are addressed. This chapter discusses utilization of international technologies and ecosystems.

New technology and technological innovations most often appear in the form of new platforms and ecosystems. The future evolution of the Finnish IT industries largely depends on the ability of the IT firms and customers to recognize the possibilities of various global platforms and ecosystems and utilize them successfully in their businesses. IT firms have to have a good understanding of the changes in customer needs and behavior, the customers need information of possibilities and alternatives information technology can provide.

The influence of international platforms and ecosystems is expected to materialize in several ways. They can offer IT firms new business opportunities but also new roles as complementors in industry platforms and business ecosystems. Thus the platforms and ecosystems can change industry architectures (Jacobides et al., 2006), which in turn can make it easier to alter the work division among industry participants. In this way also value creation and capture are effected (Tee and Gawer, 2009).

Basically the Finnish IT firms are not heading to a completely new ground: in the past two decades the Finnish IT industries have already become very dependent on international technologies and ecosystems as seen very clearly in the enterprise software market (e.g. SAP). For numerous Finnish IT firms international ecosystems have new business and new customers, sometimes also helped them expand their business abroad. On the other hand the international technology platforms and ecosystems will also bring about new type on competition. More Finnish IT firms will face open competition with companies having no operations in Finland.

The relative role of traditional IT user market is expected to decrease in Finland, but the applier ecosystems or supplier platforms (Gawer, 2009, 2010) are expected to bring significant growth potential for Finnish IT companies (Eloranta et al., 2010). Grasping the opportunities, however, often requires the company to expand beyond its existing customer base.

So far, the largest networks of IT firms providing products or services for the supply chain platforms in Finland have developed around Nokia. The recent difficulties of Nokia have shown the vulnerability of the networks. Gawer and Henderson (2007) find it obvious that members of a network share a common fate and can rise and fall together.

Observations of the structure of the Finnish IT industries and the vendor field support the conclusion that the future evolution of the Finnish IT industries cannot be built on the assumption of building new industry platforms or business ecosystems around Finnish IT technologies or services. This type of development usually takes a long time and is often also coincidental. Besides the Nokia cluster there are very few Finnish innovations having significantly increased or boosted the Finnish IT industries[41].

### 12.2.3 Expansion beyond Existing Market Segments

One direction for IT companies to find new opportunities is to expand beyond their existing market segments or even industries. A wide number of literature discusses these issues from different perspectives (Gawer and Cusumano, 2002; Oliva and Kallenberg, 2003; Cusumano, 2004; Gerstner, 2004; Iansiti and Levien, 2004; Sako, 2005, 2006; Jacobides et al., 2006; Cusumano et al., 2006; Penttinen, 2007; Kowalkowski, 2008; Gawer, 2009, 2010).

Intensive global competition, declining growth in the traditional user market and decreasing share of the domestic IT market force Finnish IT companies to seek growth from new directions. This is seen as an expansion beyond their traditional customer base and offerings. Especially software product firms are increasingly dependent on exports and other international sales.

Due to the developments in the traditional IT user market this study demonstrates the increasing importance of pursue a foothold in the value chains of the existing user customer organizations and in the applier market. Both directions are expected to provide significant growth opportunities in the future. In addition, the growing role of the Internet and mobile ecosystems and platforms will increase the importance of the consumer market and create demand for both new and existing IT companies. More IT services firms will directly or indirectly benefit from the growing consumer market (e.g. data centers, cloud services).

All these developments bring profound changes in the customer relations of IT firms. The expenditures increasingly move from IT budgets and spending to the customer's other budget categories. This, in turn, diminishes the role of internal IT departments and transfers decision making and budgets closer to the service users (cf. Carr, 2008).

[41] Despite global success Finnish-based Linux operating systems has not generated significant revenues to the Finnish IT market.

### 12.2.4 Identifying and Utilizing New Service Opportunities

A major trend of migration from products to services lies behind many opportunities for future evolution and growth of the Finnish IT industries. The IT companies are increasingly dependent on new types of services reacting and responding to the customer needs and ongoing changes in the markets. They provide new opportunities and growth paths for both software product and IT services companies and are often are closely related to expanding beyond their existing market segments.

To take the opportunities offered by change individual IT companies often are required to be flexible and able to develop, change offerings and ready to cross industry borders. Also new ways to deliver the services to customers are needed.

This study emphasizes two main categories in expanding beyond the existing services of an IT firm. The role of IT for the customer differentiates these two opportunities. The first category consists of services which help develop, run and manage the customer's business operations and processes and cover a larger part of the value chain than IT products or services (e.g. business services like business consulting and business process outsourcing services). The second category consists of services provided to applier customers who use information technology as a part of their products or services sold to their own customers.

Cloud computing is becoming an increasingly important distribution channel and a way to reach new customers. Its rapid growth accelerates the migration from products to services and restructures both the software product and IT services industries. For IT firms cloud computing provides in the first place a new distribution model, for the customers a new IT consumption model. Since cloud services are often based on international platforms and ecosystems, they can lower market entry barriers and open opportunities for smaller players to catch a global audience (e.g. Angry Birds).

In all, the cloud computing market is open for various new services and business innovations. In Finland cloud computing services are largely seen from the perspective of software production. This, however, is only a part of the potential. In several IT and also business services sectors applying of cloud computing increases in coming years.

There are also a few issues to consider. Cloud computing provides new business opportunities, but it can also accelerate concentration in some market segments because of economies of scale, economies of scope or the network effect all of which strengthen the market power of some software products and services globally.

In the manufacturing industries two major trends continue to influence the demand of information technology in the coming years.

Firstly migration from products to services (Penttinen, 2007; Kowalkowski, 2008) sets new requirements for IT systems. Secondly information technology will be increasingly used in products and services which, in turn, enhances the importance of applier market.

The applier market generates demand for embedded software and related services (Eloranta et al., 2010; Hernesniemi, ed., 2010) typically based on customer-specific supply-chain platforms (see Gawer, 2010). The applier customers represent a new and growing market segment for many vendors but the IT skills needed are often similar to those applied in the user market. Production of embedded software follows the business logic of customized software. This is why embedded software is mainly included in IT services in this study (Chapter 11.3.1).

The challenge and also an opportunity concerning the future prospects in the embedded software and services market in Finland is the fact that so far the external customer base in this segment has been very concentrated (Nikulainen et al., 2011). Expanding to other industries is crucial. On the other hand, a significant share of embedded software is still produced internally providing potential for external outsourcing services.

All these services discussed can still be considered as emerging and partly unstructured markets. However, on the basis of the analysis and results in this study it is justifiable to assume that different services form a strong basis also for the future evolution of the whole Finnish IT sector. Despite some success stories it is, however, difficult to believe that, without any major coincidence, the Finnish software product industry could rapidly become the growth driver in the Finnish IT sector.

### 12.2.5 Preparing for New Alternatives and Competition

A growing number of alternatives and substitutes to existing software products and IT services enter the market to satisfy a certain type of customer need. In the IT market this is seen as competition from new and often unexpected directions. Jacobides and Winter (2005) argue that all firms filling a certain customer need can be considered to belong to the same industry in spite of their official industry classification.

Another trend of substitutes or alternatives includes services which reshape or blur the borders of different industries. This evolution can be seen, for instance, as a type of combination of a technological wave and a business model innovation. Several companies from other than traditional IT industries (e.g. Amazon, Google) have accelerated this development.

It is reasonable to assume that an increasing number of new substitutes or alternatives of software products or IT services will in the future come from outside the prevailing IT enterprise space and change considerably the rules and roles of the game (c.f. Jacobides et al., 2006; Jacobides and Tae, 2009).

The vendor's industry is often insignificant to the customer. For IT firms the challenge is to identify a new competitor early enough. The essential problem is not always the technology but the firm's ability to understand the customer needs and behavior. The Finnish debate, however, often tends to focus on technology issues overemphasizing technological skills.

### 12.2.6 Central Issues in Ensuring Growth Opportunities

In the beginning of the 2010s the Finnish IT industries face numerous domestic and global challenges. Even if the future of the Finnish IT industries is being painted rather dark in many contexts, the development provides also opportunities for companies who are able to recognize the many changes including those in customer behavior and needs.

Turning the opportunities into successful businesses requires above all two things: firstly identifying and ensuring the strengths of the Finnish IT vendor field and secondly retaining and developing the skills and expertise of the Finnish IT personnel.

During the last few years the question of retaining and even increasing IT employment in Finland has become increasingly topical. On the basis on this study it seems clear, that Finland will have to face a double challenge: it will be necessary to create new jobs and at the same time find ways to preserve the existing ones in Finland.

The public discussion often concentrates only on Finnish-owned IT firms or focuses on ways to reinforce the IT entrepreneurship and ensure the establishment of new IT companies in Finland.

On the basis of the findings this study, however, to secure future IT employment it is important to recognize also the importance of existing IT companies. Special attention needs to be paid on that that also the incumbent and foreign IT firms (partly overlapping) retain their operations and employees in Finland.

Establishment of some global data centers in Finland and the interest of foreign investors in several software product firms (e.g. game software) indicate that there are possibilities to persuade more international companies to establish operations in Finland. In attracting foreign IT investments Finland, however, lags far behind some European competitors like Ireland.

Several studies as well as the public discussion concerning the future evolution of the Finnish ICT industries emphasize software related skills and expertise as the major drivers of growth in the IT industries (e.g. Hernesniemi, ed., 2010; Eloranta et al., 2010; the debate around Nokia's new strategy in early 2011). In these contexts all IT professionals have often been considered as one group in spite of the significant differences between professions, e.g. software engineers and consultants.

The Finnish IT companies provide a wide range of expertise usable both in Finland and abroad. Together the Finnish software product and IT service industries form a significant cluster of experts with different software and services skills. In addition, a notable number of software experts is working in other than the traditional IT industries.

Observations of this study justify the view that combining high-level expertise in software development (technology) with skills and knowledge of service business create a necessary ground to develop competitiveness also in the expanding applier market. On

the grounds discussed above it is reasonable to assume that this will be easier for IT services firms than for software product firms. One of the strengths of the Finnish IT services companies is the versatile structure of their personnel. They employ both software professionals and a wide range of experts in different customer industries and business processes. This forms a significant base for expansion of both services offerings and customer base.´

From the perspective of small software product firms these developments call for a closer collaboration with larger vendors as well as migrating from products to services. Another issue is: how to keep successful fast growing newcomers in Finland.

Nevertheless, for most IT companies the message is clear: the recent market developments emphasize the necessity to build competencies to grab new business opportunities also outside the traditional IT market. It is also important to note, that providing products or services for various platforms and ecosystems requires from the IT firms new resources, competences and technological skills as well as flexibility and agility.

A supply of well educated people and long-standing customer relationship with the Finnish telecom cluster have often been seen as valuable assets behind Nokia'a rise in the 1990's (e.g. Häikiö, 2002, Eloranta et al., 2010). Later collaboration with Nokia provided many Finnish IT companies valuable experience and skills for a global business environment and competition. It is justifiable to assume that this experience has given valuable skills and practices useful also in other industries like manufacturing (cf. Eloranta et al., 2010).

As far as the Finnish employment prospects are concerned, it is essential to focus on all competencies needed in global competition. In this competition more than technological skills are required. In international competition and cooperation, for instance in large international projects, good social and language skills are essential.

## *12.3 Assessing IT Industry Information*

The third research question concerns the measurement of the Finnish IT industries and is formulated as follows: ***How well does the existing information describe the Finnish IT industries?***

The research question is approached in the study by analyzing and assessing the definitions and indicators used in official statistics and other information sources and by assessing how well they describe and explain the Finnish IT industries and markets and their status and dynamics. The purpose was to identify key issues and weaknesses in definitions and measurement of the IT industries and, on the basis of the findings, propose views or guidelines for their improvement. This study does not, however, provide an unambiguous or general model or framework for defining and measuring an industry.

One of the main starting points of the study is the assumption that there is a gap between the existing public information and the size, structure and evolution of the Finnish IT industries. In this study new information and theory are provided in order to shrink the gap which has not been systematically examined before.

The general observation of the study is that the information offerings concerning the Finnish IT industries are incoherent and base on different starting points and needs. Main part of the public information of the Finnish IT industries is provided by Statistics Finland which produces a wide range of well structured data based on different theories and continuous information needs. The public information sources provide limited or no data at all of the demand side of the IT sector. From the IT industry perspective the most important information produced by Statistics Finland relate to the Finnish production and foreign trade.

Other information producers like market research companies, other research organizations and individual researchers or research projects concentrate on selected and often specified areas. Market research firms focus on the demand side of the ICT sector providing a significant share of all Finnish IT industry information. This information is mainly subject to a charge and often targeted only for the customers of research companies.

A significant part of information used in this study is based on one-time projects. There are, however, also some continuous data sources, such as the software industry surveys and Tietoviikko 250 rankings.

No existing information source provides an overall picture of the Finnish IT sector or separate IT industries. Also, the main focus in the available information is on quantitative data. Qualitative analysis of structural changes influencing IT industries, such as impacts of globalization, new technologies or business models, gets little attention. The quality of information as such is not a problem.

One of the major issues in dynamic industries like IT industries is the static nature of definitions (e.g. Jacobides and Winter, 2005; Baldwin, 2006; Weaver, 2007). The issues and also critics are largely connected to the definitions and classifications of industries and related data. Changing of definitions is not easy due to different needs, e.g. those of national accounts. Even if the need for long-lasting and static definitions and classifications is understandable, the information they produce does not serve well the needs of many information users.

This study concretizes and confirms one of the main starting points of the study: the information available is incoherent and largely inconsistent. Getting comprehensive information of volumes of the Finnish IT industries requires data from multiple sources. Also the definitions require specification. The importance of using multiple information sources is further accentuated by the need to consider both the product and market sides of the sector in order to get an overall picture of the field. Because of the dynamic nature of IT industries it is not reasonable to expect an overall picture from one source.

This study has identified and proposed views or guidelines for improving definitions and measurement presented (Chapter 11.4). Among the issues requiring more accurate data than presently available from existing information sources are:

- volume distribution by industries like software product and IT services industries
- data of foreign trade of IT industries, including distributions by software products and IT services
- more detailed information of IT personnel
- value creation and capturing
- information about IT vendors

In this study, a number of frameworks (Chapter 7) were constructed for describing, analyzing and measuring Finnish IT industries. Combining data of several sources the frameworks have proven useful in obtaining more precise information of the Finnish IT industries. Some of this information would be impossible to obtain from any other information source. For instance, in analyzing the vendor field and competition IT enterprise space provides more precise and flexible framework than existing industry categories. Thus the frameworks help shrink the gap between existing information and the reality of Finnish IT industries.

The most important improvements by the study in the information about the Finnish IT industries are:

- new information of the volumes and structure of the Finnish IT industries
- separate estimates of the size and employment of the software product and IT services industries
- new information of importance of foreign-owned IT firms as well as of applier customers
- structure and evolution of the vendor and competitive fields

Analysis based on the use of these frameworks and empirical information supports the assumption that information based on current, rather static definitions and classifications provides only a partial and imperfect picture of the Finnish IT industries. Another reasonable assumption is that the ability of the official industry information to describe the evolution of IT industries is becoming weaker due to different structural and technological changes.

Globalization and growing dependency on global value networks and ecosystems set new challenges particularly on enterprise and foreign trade statistics (cf. Jacobides and Winter, 2005; Sako, 2005; Jacobides et al., 2006; Baldwin, 2006, Pajarinen et al., 2010).

This makes it increasingly difficult, for instance, to get accurate values of the Finnish production of IT products and services or information on where the value is created and captured. At the same time the value of income reports of the IT companies is diminishing, because the reports do not include detailed information of transferring development and production of software products and IT services outside Finland.

The ability to get information separately of the different parts in the IT industries is accentuated among other things by the developments described earlier (Chapter 9 and 10) emphasizing the number of employees as an increasingly important indicator in measuring the size of IT industries in Finland.

Empirical considerations support the proposition that the coverage, validity and also reliability of information concerning the Finnish IT sector might be improved by applying more flexible industry definitions and classifications. This proposition is consistent with views presented by several economists (Jacobides and Winter, 2005, Sako 2005, Baldwin, 2006). Unfortunately remarkable improvements are not to be expected in the short term, since the changes should deserve EU-level or even wider changes in international industry classifications and data gathering practices.

At the same time major structural changes as well as changes in customer needs and behavior and in the marketplace increasingly require up-to-date knowledge and understanding of the evolution of IT industries, their structures as well as changes in the vendor field and competition.

At the moment a good share of the IT sector information is quantitative. Understanding the structural and other changes and their effects on the IT industries and its customers requires more qualitative information. To understand IT firms and their businesses also analyst expertise and skills are needed. Today the main sources of qualitative and company data are the market research and analyst firms or separate research activities.

Improving the IT industry information demands significant human and financial investments. This study does not suppose or name any actor to take the responsibility of these tasks. The actors may be different professional information producers, like statistical authorities, market research firms or other research organizations. Also extensive scientific research is required. In addition to continuous data collection, also different ad hoc research is needed. Statistical authorities have already taken some steps to this direction. Market research firms proceed according the needs of their customers. At the same time several separate research activities have been launched by different public sector organizations. In this study it is proposed that to meet the increasing information requirements cooperation between different organizations should be intensified. In addition an increase in analyst skills and good understanding of businesses and industries are essential prerequisites.

## *12.4 Contributions of the Dissertation*

### 12.4.1 Scientific Contribution

The main purpose of this study is to contribute and increase the knowledge and understanding of the status, structure and evolution of the Finnish IT industries as well as the Finnish IT vendor field and competition. At the same time the purpose is to provide new information and new theory or pre-theory.

To increase the understanding of the Finnish IT industries this study has applied especially the descriptive approach, to some extent also explanatory and exploratory approaches (cf. Olkkonen, 1994). The nature of the study is empirical. The IT sector is mainly considered from the perspective of firms and industries that produce or provide software products or IT services.

To help perceive, analyze and understand the status and evolution of Finnish IT industries various frameworks have been constructed for this study. The overall framework is based on the idea of ecosystems and covers both the supply and production (IT enterprise space) and market (customer space) sides of the IT sector as well as related dynamics. By combining different operational frameworks with empirical information this study has been able to provide new and more profound information and understanding of the Finnish IT sector than it is possible to receive from existing information sources. As the result, this study provides an important step in improving the understanding of the structure and dynamics of the Finnish IT industries as well as the vendor and customer communities. Based on these outcomes, the study suggests a wider use of these kinds of frameworks in examining IT industries.

Compared to the traditional industry definitions and classifications the IT enterprise space, applying the idea of the economic space (Schumpeter, 1942; Lovio, 1993), forms a more flexible and versatile tool for examining and analyzing IT industries. The examination provides concrete evidence that the Finnish IT sector is increasingly dependent on vendors coming from other than "official" IT industries. Further, this kind of analysis helps to perceive and identify the growing diversity of the vendor field and the competitive environment (including new substitutes) as well as demonstrates increasing difficulties in anticipating changes and evolution of IT industries.

Applying the frameworks constructed for examining the volumes of IT sector provides support for the assumption of an inaccurate and conflicting picture of the Finnish IT sector. In addition, examining the Finnish IT sector or separate IT industries often focus only on Finnish production or activities of Finnish IT firms. Compared to the existing information this study clearly points out the importance of imported IT products and services and the strong role of foreign-owned IT firms in the Finnish market. These are examples of issues that are difficult or even impossible to perceive by using information from existing sources.

The findings support critique and theories that question the applicability of current definitions and classifications of industries in examining dynamic industries, such as ICT industries (cf. Hamel and Prahalad, 1994; Jacobides and Winter, 2005; Baldwin, 2006). The empirical analysis of this study provides observations and analysis of drivers and factors, such as globalization and the global division of labor continuously blurring industry borders and reshaping the structures of IT industries. The findings support the argument that "industry is not given" (Jacobides and Winter, 2005; Sako, 2005). The relevance of industries in the traditional sense has decreased, favoring the use of theories which provide a broader and more dynamic way to consider the IT sector from both production and market sides.

The findings of the study support the hypothesis that presently it is difficult to get a comprehensive picture of the Finnish IT sector. The existing information of the Finnish IT sector can be characterized as incomplete and inaccurate, at worst even misleading because of inaccurate and static definitions and classifications. Despite these problems, this information is widely used for several purposes, e.g. for economical analysis and as a basis for decision making.

To avoid or decrease these problems this study emphasizes the importance of knowing the definitions used. Examining of software and IT services industries provides strong evidence for this argument.

An important new data source for this study has been the database of the top 100 IT vendors constructed for this study. The firm level information in the database has been a valuable tool in analyzing the structure of the Finnish software product and IT industries and assessing the credibility of the statistical and other public industry information.

Examining the IT market typically focuses on "traditional" user market and spending, resulting in only a restricted picture of the use and customers of the information technology. Approaching the IT sector from perspectives of both supply and market side helps to perceive and understand the increasing role the applier market, as well as the role of information technology as an enabler in various industries. The literature and public debate of the needs and behavior of customers are often restricted to the user market. The findings of this study support the necessity to recognize also the requirements of applier customers.

This study addresses significant differences between software product and IT services industries as well as in related enterprise structures and competition. As a result, a clear opinion is presented. The distinctions of production and business dynamics between software products and IT services require more attention both in research and in practical actions. This need is emphasized by the assumption that the evolution of the Finnish IT sector is increasingly dependent on IT services and related business models and practices. This study complements this view by categorizing IT firms by applying the classification presented by Cusumano (2004).

Globalization is one of the major drivers of the Finnish IT industries and shapes both software product and IT services industries. The findings indisputably indicate that the globalization has already resulted in significant transition of IT jobs, including higher-skilled IT jobs from Finland to lower-cost economies. There are no visible signs of efficient means to slow down this development.

This study strongly recommends increasing research activities concerning the impact of globalization on higher-skill jobs and employment in Finland.

For assessing the basis for future this study has also analyzed the importance of platforms and ecosystems from the perspective of Finnish IT industries and provides a framework that helps to discuss business opportunities and future evolution.

### 12.4.2 Managerial Contribution

This study provides two main types of contributions for IT industry leaders, managers and decision makers as well as their customers: it helps to understand the status and evolution of the Finnish IT industries and provides frameworks and tools to analyze and interpret transition and volumes of the IT sector.

In the 2010s the Finnish IT industries face different domestic and global challenges and threats. Major changes, such as globalization and an increasing dependency on global ecosystems reshape business environments and ways of doing business. The study presents and analyzes these developments from various perspectives. The picture of the Finnish IT industries is not as dark as painted in several contexts. The recent development provides also opportunities for companies which recognize the different changes including those in customer behavior and needs.

Developments in the customer side force many IT firms to seek growth by expanding or migrating beyond their current markets or offerings. This often requires new skills and competencies. This study also emphasizes significant role and value of the existing competencies and skills in the expanding. In addition, this study emphasizes the role of IT services companies as important source of software skills and expertise in Finland.

One of the major messages for business leaders and managers is the urgency of being prepared to meet an increasing heterogeneity in industries, markets and competition. This requires freedom from prejudice, agility and flexibility and also more information of changes and their influences. In practice this means readiness to cross industry borders, new alternative products and services as well as ability to identify new competition coming from different industries and directions, increasingly from outside Finland.

The findings of this study suggest that the use of information technology in products and services is still emerging in Finland. Different technology and service platforms as well as versatile application of new services infrastructures like cloud computing, provide growth opportunities for both IT and other industries. A good share of the new opportunities is in markets where an individual IT company has no control over the end user (e.g. several ecosystems and supply platforms). This may also require from companies changes in attitudes and new thinking.

This study emphasizes early identification of various changes and apprehension of their impacts. In a fast changing environment different frameworks constructed in the study provide managers in both IT and other industries tools for understanding, analyzing and evaluating the real importance, crucial volumes and size classes of the ICT sector from different perspectives.

This study support the views that IT expenditures increasingly move from IT budgets to other budget categories at the same time transferring the decision making and budgets closer to users of services of the customers. This requires from managers a good understanding of the developments of the total IT costs and their structure.

## 12.5 Credibility of the Study

The main purpose of this study is to contribute and increase the knowledge and understanding of the Finnish IT industries as well as of the Finnish IT vendor field and competition. One of the main starting points of the study was the lack of consistent and accurate information of Finnish IT industries. The focus is on software product and IT services industries.

The nature of the study is empirical applying the hermeneutic theory of interpretation. The study follows the principles of action analytical approach and represents qualitative research. According to the hermeneutic theory this study primarily attempts to understand the Finnish IT industries by using descriptive, explanatory and to some extent also exploratory approaches (cf. Olkkonen, 2004; Yin, 1994).

The main challenge has been to obtain information that enables to describe the Finnish IT industries as accurately as possible. This study has attempted to improve the credibility (e.g. Creswell and Miller, 2000) in several ways as discussed in Chapters 6.1.2 and 6.1.3.

Evaluating the credibility of this study emphasizes both the credibility of the information used and the results derived on the basis of this information. In order to improve the credibility of the information applied it has been necessary to collect more accurate information on the Finnish IT industries than presently available from different information sources.

The credibility of this study depends how well the findings and results are able to describe the Finnish IT industries emphasizing the importance of definitions, concepts, terms, data and information sources available. Improving the credibility has required specifying concepts and definitions, building various frameworks and providing new information to facilitate a deeper and more multifaceted analysis of the Finnish IT industry.

Various procedures such as triangulation (Denzin, 1978; Yin, 1994; Creswell and Miller, 2000; Tuominen and Sarajärvi, 2002; Johansson, 2003) and thick rich description have been used to improve the credibility (Chapter 6.1.3).

Measurement and evaluation of the volumes of the Finnish IT industries are crucial part of the study. To improve the credibility, attention has been put on efforts increasing construct and internal validities (cf. Yin, 1994) as discussed in Chapter 6.1.2. Construct validity is important in establishing correct operational measures for the concept studied. The necessary improvement of construct validity has also increased the internal validity which demonstrates, how well the results and findings correspond to the reality.

Better construct validity has helped to build the database of the top 100 IT vendors which is one of the results of the study and specifies and deepens the picture of the Finnish software product and IT services industries as well as structure of the vendor field and competition.

It has also been discussed in the study if the findings are generalizable or transferable (Chapter 6.1.2) beyond the study's research environment (cf. Yin, 1994).

Most information used as well as observations and conclusions presented in the study are based on public sources, such as public statistics, public research reports or company information (Chapter 6.4). The data and information sources are largely open and available for all reviewers and readers. The use of public sources enables, at least to some extent, to repeat the data collection (cf. Yin, 1994) with same results.

Various information sources and multiple methods have been used in data gathering. In this study this information is assumed to be credible in its own contexts. Instead, usability of a single information source in describing the IT industries as a whole is more limited, representing more limited construct or internal validity from the perspective of this research.

Triangulation has helped perceive and collect dispersed information and identify inconsistencies between different data and sources. It has also helped specify definitions as well as concretize and construct frameworks to evaluating, sorting and combining various data from multiple sources.

The experience of the researcher has helped to find and select appropriate information sources and data as well as to identify firms belonging to the population of the study. Tools, methods and practices by work experience in research and analyst enterprises have helped in constructing frameworks as well as in evaluating volume data, such as revenues and number of employees. Practical experience of the IT companies has also been useful in evaluating and selecting enterprises to the database of top 100 IT vendors.

The observations and findings are based on information presented in this study and the conclusions have been made on the basis of known facts and by using frameworks formed for this study. The experience of the researcher has had a valuable but indirect and complementary impact on the results.

## *12.6 Limitations of the Study and Topics for Further Research*

This study has some limitations. The accuracy depends largely on the quality of the underlying data. It should be kept in mind when interpreting the results and conclusions that they are based on heterogeneous information and estimates made in the study. On the other hand, one of the objectives of the study was to assess the usability of the information available. The information used is based on public data sources. Even the top 100 vendor data base is largely constructed on the basis of public company information.

The information available has set some limitations for the study and forced to remain at a rather high level of aggregation in some analysis. For example, the information of the exact numbers of IT employees as well as of their professional structures is not available. A more profound analysis would have required distinct research activities not possible to

conduct in this study. However, one of the main objectives of the study, increasing the understanding of the Finnish IT industries, has been possible to obtain by using existing information and applying different frameworks. Simultaneously, the overall picture of the Finnish IT sectors and various observations and conclusions also provide a ground to assess the basis for future evolution.

In selecting and evaluating different information sources the experience of the researcher has been utilized. In this way the study has benefited also from the tacit knowledge of the researcher. On the other hand by relying on multiple information sources, it has been possible to avoid personal opinions or evaluations.

This study concentrates on companies providing software products or IT services. For this reason not all IT industries are included. In addition, production of embedded systems is only partly covered.

The empirical analysis and observations of the study have resulted in several ideas and proposals for further research. Firstly, applying new theories and arguments related to industry architectures, platforms and ecosystems (e.g. Jacobides et al., 2006, Gawer, 2009, 2010) needs a more profound understanding of the Finnish IT industries.

Secondly, the existing information of the Finnish IT sector provides only a partial picture of the Finnish software product and IT services industries. Neither separating software products and IT services nor information of the applier market are possible to obtain at the moment. Also more specified information of employment as well as exports and imports of software products and IT services are needed and require separate research activities. Another important topic for further research are embedded systems.

Lastly, the strong role of foreign IT companies in the Finnish IT markets, international ecosystems as well as new kinds of competitors of IT enterprises increase the need to improve the understanding of the vendor field (IT enterprise space) and the roles of various companies providing software products or IT services or their substitutes.

# PART VI: SUMMARY

## 13 Summary

The major starting point of this study has been that the prevailing way to examine the Finnish IT industries and industry information often results in rather limited and even skewed picture of the Finnish IT industries. The main purpose of this study is to contribute and increase knowledge and understanding of the status, evolution and measurement of the Finnish IT industries as well as of the Finnish IT vendor field and competition.

The main focus of the study is on software product and IT services industries which form an increasing part of all ICT production in Finland and 70 percent of the Finnish IT market. The study has considered and analyzed these industries from different perspectives and assessed influences of the major changes on production and marketplace of software products and IT services. The Finnish IT industries have been approached by examining, describing and analyzing their status and structure in 2008 and in certain aspects also their evolution up to the year 2011.

Particular attention has been paid to globalization, technological changes and changes in customer needs and behavior. Behind these choices is discussion about Finnish IT firms being increasingly forced to react to powerful exogenous changes and having only limited possibilities to influence the direction of the evolution of the Finnish IT sector.

Several frameworks have been created for as analysis tools. The overall framework of the study, the ecosystem of the Finnish IT industries, illustrates "the big picture" including both, the IT vendor field and IT markets as well as changes and dynamics influencing them. The IT vendor part of the ecosystem, the IT enterprise space, provides more flexible framework than existing industry categories for considering IT firms, changing firm populations and industry borders. The customer space of the IT industries has been divided in analysis into two main groups: user and applier customers. Additional operational frameworks have been constructed to analyze the structure and to measure volumes of the Finnish IT industries having made it possible analyzing and measuring from both production (supply) and market (demand) perspectives.

The analysis is mainly based on empirical data and information from multiple public sources and interviews of executives. A special top 100 IT vendor database has been constructed for the study in order to get more accurate understanding of the size and structure of the software product and IT services industries as well as their vendor field. The database complements other information because it contains company level information and has therefore been a valuable tool in getting more precise information of the Finnish IT industries and assessing the usability of the statistical and other public industry information.

The study estimates that the total volume of the Finnish IT industries in Finland accounted for about 6 billion euro in 2008. Because of the economic downturn and

changes in the marketplace there has not been considerable change in the total volume in the recent years.

The volume estimate of the study consists of the domestic production and imports falling in the same size class with the production data from Statistics Finland. However, the figures are based on different definitions and partly different data and therefore are not comparable. The contribution of the study is, that the estimates give a more precise picture of the size and volume of the Finnish IT industries. Using also company level information has made it possible to estimate separately the volume of software product and IT services industries, information not available before from other sources.

The findings of the study confirm the significant role of IT services in the Finnish IT industries. In various plans and visions great expectations have been put on the software product industry to grow and become an important driver of IT employment and income in the Finnish economy in the 2000s. This study suggests differently: The software product industry has not been able to meet the growth expectations. Instead, relatively the role of IT services has become stronger during the recent years.

The employment figures mark the importance of the IT service industries. They employ more than tree times as many IT professionals as the software product industry in Finland. It is estimated in the study that the software product and IT services industries together employ about 45 000 persons in Finland. The number of external IT staff outside the IT enterprise space of this study has been estimated to total about 5 000 employees. The worrying development from the point of view of the national economy and future prospects of the economy is that in recent years the growth of overall employment of the IT industries in Finland has been weak or even slightly negative. This trend was seen already before the changes of Nokia.

The employment figures show clearly how the globalization reshapes the Finnish IT industries. About a fourth of all employees of Finnish IT companies were working abroad in 2010. In large IT companies the percentage is even higher. In 2010 about 30 percent of the employees of the top fifteen Finnish-owned IT services and software firms worked in low-cost economies compared to about 10 percent in 2005. Despite the high growth of numerous small IT firms they have not been able to compensate the migration of jobs from larger companies to other countries in recent years.

The study reveals a few features characterizing the Finnish IT vendor field: concentration, even polarization, strong role of foreign-owned IT firms and large incumbent firms in the market. At the same time, however, the vendor field is becoming increasingly heterogeneous; an increasing number of new vendors and competitors come from other than traditional IT industries expanding the supply of new substitutes and alternatives for existing IT products and services.

The study also considers the future opportunities of the Finnish IT industries from the perspectives of existing and potential markets and attempts to bring some views to public debate.

Technological changes and related innovations, globalization and new business models continue to be the major drivers of the evolution of the Finnish IT industries. One of the main conclusions of this study is that changes in customer needs and behavior in the 2000s have been more profound than in the earlier decades and therefore also their effects on the growth and structure of the Finnish software product and IT services industries are more prominent than after earlier changes. This emphasizes the importance of understanding changes in customer needs and behavior.

Globalization is the most important of the many exogenous and interconnected forces behind the recent ongoing and future evolution of the IT industries. It has already changed profoundly the landscape of the Finnish IT sector and is connected to a number of factors and developments. Changes in industry architectures reshape the value chains and the division of labor across firm borders and firms and countries. At the same time role of global technology platforms and business ecosystems is strengthening.

According to the study the Finnish IT enterprises as well as their customers have become increasingly dependent on global ecosystems and platforms, applications and IT services provided by global vendors. A central manifestation of globalization and an important observation of the study is that in growing amount domestic IT production is being replaced by products and services produced outside Finland. As a result also IT decisions are increasingly made outside Finland.

In the last few years a declining share of the revenue of the Finnish IT firms has come from the Finnish end user market. This accelerates the urgency to seek growth from exports and from expanding beyond existing markets and offerings. New opportunities are provided by user and applier customers as well. In the 2000s the growth of the Finnish IT services industry has largely come from customers (applier customers) which utilize information technology in their products which they sell to their customers.

Finnish IT firms have increasingly to seek growth beyond existing markets and offerings. In practice this means readiness to cross industry borders, new alternative products and services as well as ability to identify new competition coming from different industries and directions, increasingly from outside Finland. This requires freedom from prejudice, agility and flexibility and also more information of changes and their influences. As a prerequisite of future success for the Finnish IT industries the study emphasizes the importance of combining IT service skills, competences and practices with high level software skills.

High expectations of future growth are raised by the increasing use of international technology platforms and business ecosystems. They form a basis for also other than traditional ICT products or services to build new market opportunities. To take part in these developments require that information technology and related expertise are increasingly applied in Finland in different industries and other organizations as an enabler in various products and services. For Finnish software product firms the various global platforms and business ecosystems provide an important distribution channel. Several software firms have high expectations of cloud computing.

The roles of software product and IT services firms in this market are often mixed in public discussion. This study emphasizes the role of IT services companies as providers of embedded software.

Another important argument relates to the employment of Finnish IT professionals. To be able to secure IT jobs in Finland it is not enough to pave the way for the startup companies but give special attention also to retaining the operations of the large incumbent and foreign-owned IT companies in Finland. The foreign-owned companies generate more than half of combined software product and IT services revenues and employ nearly a half of the workforce of the 100 largest IT vendors in Finland.

The global positioning of company functions and tasks and a new understanding of the value creation have recently raised questions about the location of production and head offices as well as company ownership also in regard to the IT industries. This study supports the arguments of ensuring IT production in Finland. For instance, domestic services create value despite the ownerships or location of the head office of services firms.

Globalization has a connection even to the measurement of IT industries. For instance, it is increasingly difficult to get accurate information of IT exports and imports, because the transactions include an increasing amount of internal transactions of the companies.

This study has identified and discussed several issues and factors that may make it difficult to get accurate information of the status, structure and evolution of the Finnish IT sector. On the basis of findings and observations this study contributes a list of views and actions that may provide a basis for improving the information of the Finnish IT sector. One of the messages of this study is to emphasize the importance to understand the definitions and starting points of each information sources.

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**Interviews:**

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Interviews of IT industry executives and key persons (informal interviews):
Yrjänä Ahto, toimitusjohtaja, Fujitsu Finland Oy
Arto Herranen, toimitusjohtaja, Enfo Oyj
Ari Järvelä, johtaja, Suomi ja Baltian maat, Tieto Oyj
Mika Ollikainen, tutkimusjohtaja, Market-Visio Oy
Mikko Rönkkö, tutkimuspäällikkö, TKK, SBL
Johan Sandell, toimitusjohtaja, Oy International Business Machines Ab
Setälä, Risto, toimialajohtaja, Tekes
Juhani Strömberg, kehitysjohtaja, Itella Oyj
Heikki Tiihonen, markkinointijohtaja, Logica Suomi Oy
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