

Jyrki Ali-Yrkkö

# **Nokia's Network – Gaining Competitiveness from Co-operation**

ETLA – The Research Institute of the Finnish Economy

B174 Series

Publisher:

Taloustieto Oy 2001

Cover: MainosMayDay Oy, Vantaa

Photo: Jyrki Ali-Yrkkö

Photo has been taken in the Tefen Industrial Park (Israel)

ETLA – The Research Institute of the Finnish Economy  
Lönrotinkatu 4 B 00120 Helsinki FINLAND

ISBN 951-628-335-7

ISSN 0356-7443

Printed in Tummavuoren kirjapaino Oy, Vantaa 2001

**ALI-YRKKÖ**, Jyrki, **NOKIA'S NETWORK – GAINING COMPETITIVENESS FROM CO-OPERATION**. Helsinki, ETLA, Elinkeinoelämän Tutkimuslaitos, The Research Institute of the Finnish Economy, 2000, 100 p. (ETLA B Series, ISSN 0356-7443; no. B174) ISBN 951-628-335-7.

**ABSTRACT:** Nokia is a good example of a company whose operation is more and more based on co-operation with other organisations. During the past ten years Nokia has actively built and developed its supplier network. Rather than aim to produce everything itself, the company is increasingly turning to outside suppliers. Hence, the extensive orchestration of the supply chain has become an important factor helping the company gain competitive advantage. According to this study, many suppliers have positive experiences in co-operation, which has produced mutual benefits to both partners. The most visible fruit of co-operation is that companies grow fast not only in terms of net sales but also geographically. A number of suppliers have internationalised in the wake of Nokia. In addition to plants, they have also established R&D units abroad. Due to this global operation mode, the companies have been able to offer global services also to other customers, helping them obtain new clients. Moreover, co-operation has promoted know-how among the partners. Therefore, one important outcome of co-operation has been corporate learning. This knowledge accumulation does not include only technological issues but also information about market circumstances and the requirements of the market.

**KEY WORDS:** Nokia, ICT cluster, telecommunications, network, networking, partnership, co-operation, subcontracting.

**ALI-YRKKÖ**, Jyrki, **NOKIA'S NETWORK – GAINING COMPETITIVENESS FROM CO-OPERATION**. Helsinki, ETLA, Elinkeinoelämän Tutkimuslaitos, The Research Institute of the Finnish Economy, 2000, 100 s. (ISSN 0356-7443; no. B174) ISBN 951-628-335-7.

**TIIVISTELMÄ:** Nokia on hyvä esimerkki yrityksestä, jonka toiminta perustuu yhä enemmän yhteistyöhön muiden yritysten kanssa. Erityisen selvästi tämä kehitys näkyy Nokian toimittajasuhteissa. Kaikkea ei pyritä tekemään itse, vaan mahdollisuuksien mukaan palvelu tai tuote ostetaan yrityksen ulkopuolelta. Arvo- ja tuotantoketjun hallinnasta on tullut yritykselle tärkeä kilpailutekijä. Monet yhteistyökumppanit kokevat, että yhteistyö Nokian kanssa on tuottanut molemminpuolisia etuja. Perinteisen osto-myynti -asetelman sijasta näissä suhteissa pyritään yhteiseen onnistumiseen. Selkeimmin yhteistyön hedelmät näkyvät toimittajayritysten kasvussa. Moni yritys on kasvanut nopeasti sekä liikevaihdollisesti että maantieteellisesti. Toimittajayritykset ovat seuranneet avainasiakkaitaan ulkomaille ja perustaneet sinne tehtaita sekä tutkimusyksiköitä. Tätä kautta nämä yritykset ovat kyenneet tarjoamaan globaalia palvelua myös muille yrityksille. Useat yritykset ovatkin saaneet uusia asiakkaita yhteistyön kautta joko suoraan tai välillisesti. Yhteistyö on myös lisännyt yritysten osaamista. Sekä Nokia että sen toimittajat ovat pystyneet saamaan uutta osaamista ja tietotaitoa yhteistyön avulla. Uuden tiedon karttuminen ei rajoitu vain teknologiaan vaan sisältää myös tietoja markkinoiden muutoksista ja vaatimuksista.

**AVAINSANAT:** Nokia, tieto- ja viestintäklusteri, telekommunikaatio, verkostoituminen, verkottuminen, yhteistyökumppani, yhteistyö, alihankinta.



# Contents

**Foreword**

**Preface**

<b>1. Introduction</b>	<b>11</b>
Inter-firm alliances have multiplied and deepened	12
Perspective	12
Purpose and structure of the study	13
<b>2. The Finnish Information and Communications Technology (ICT) Cluster</b>	<b>15</b>
What is a cluster?	16
Dynamics in the Finnish ICT cluster	16
Economic relevance	19
<b>3. Development of Nokia</b>	<b>23</b>
From an industrial supermarket to a focused telecommunications company	24
Customers and employees all over the world	28
Increasing research and development efforts	33
Advanced branding – a key to success	34
Nokia and its competitors	35
<b>4. Nokia – a Company with Web</b>	<b>37</b>
Make or buy? – Rationale of outsourcing	38
What to make? – The strategy of the core company	39
How to buy? – Rationale of co-operation	40
Different forms of alliances	41
Network management strategy	44
<b>5. What Does Nokia's Supplier Network Consist of?</b>	<b>51</b>
Data	52
<b>6. Impacts and Challenges of Networking</b>	<b>55</b>
The role of social capital in knowledge acquisition and learning	57
Strategies and operation practises have changed	62
Outcomes of relationships	69

<b>7. Summary and Discussion</b>	<b>81</b>
Firm dynamics behind the development of the ICT cluster	82
A big company in a small country	82
The motives and modes of networking has been changed	83
Networking as a competitive advantage	85
Are there limits to networking?	89
<b>Appendix</b>	<b>93</b>
<b>References</b>	<b>98</b>

## Foreword

In the 1990s, Nokia grew to become one of the world's leading high-tech companies. This coincided with a very rapid structural change in the Finnish economy and industry. Nokia has played a major role in the restructuring process.

Nokia has become a multinational company, but a major part of its activities are located in Finland, the original home base of the company. Nokia's role in the Finnish economy is considerable, especially in exports and R&D. Since the mid-1990s, Nokia has contributed significantly to the economic growth of the country, which has been one of the fastest in Europe.

But there is more than just Nokia. The whole information and communication technology (ICT) cluster has expanded rapidly. There are hundreds of small and medium-sized fast growing companies in the cluster. Many of them are Nokia's suppliers and partners or have their roots in the same ICT-related know-how.

The interim report of this project, *Nokia – A Big Company in a Small Country*, was published in February 2000. This study was financed by the National Technology Agency (Tekes), which we would like to thank for its support.

Helsinki, January 2001

Pentti Vartia



## **Preface**

Nokia has had an increasing impact on the Finnish economy during the 1990s. In addition to Nokia's direct impact on GDP growth, there also exist indirect effects through Nokia's supplier network.

This study concentrates on Nokia's external relationships with other companies. Hence, the focus is to consider the company as an extended enterprise. Of special interest in this study is the question of how Nokia has impacted the development of other companies.

This book is the result of collaboration on several fronts. Laura Paija (ETLA) wrote Chapter 2, the first sub-sections of Chapters 4 and 7. Furthermore, she contributed to the design and implementation of the research and provided important insights and comments through the whole research process. I wish to acknowledge the contribution of all the managers and experts who gave me their valuable time. I also would like to thank Erkko Autio (Helsinki University of Technology) for his ideas and comments on the survey, Pekka Ylä-Anttila (ETLA), Petri Rouvinen (ETLA), Heli Koski (ETLA) and Pentti Forsman (Bank of Finland) for their useful comments and suggestions. Kimmo Aaltonen (ETLA) and Laila Riekkinen (ETLA) deserve special thanks for their patience and help with editing the book. Furthermore, I would like to thank Ville Kaitila (ETLA) who revised the report and improved my English language.

Helsinki, January 2001

Jyrki Ali-Yrkkö



# I Introduction

## **Inter-firm alliances have multiplied and deepened**

The number of inter-firm alliances has multiplied during the past few years. Every day newspapers are full of news about different kinds of alliances. The alliance palette includes 'horizontal' alliances between competitors, 'diagonal' alliances between companies in different industries and 'vertical' alliances between buyers and suppliers.

One driving force behind this phenomenon is a widely accepted core competence paradigm according to which a company must focus on its core competence and outsource other activities.

Despite the fact that alliances are formed in every industry, particularly industries with time-based competition are active in making co-operation agreements with different parties. In these industries, short product life cycles, delivery times and product variety push companies to operate in networks. Moreover, these industries are characterised by a difficulty to forecast demand and future development. Hence, the role of information and knowledge is pivotal. Companies can obtain more information about the technologies, requirements and future development of the market through co-operation with other companies.

The Information and Communication Technology (ICT) industry is a good example of an industry with active alliance policy. Firms in this industry have made co-operation agreements that include all three kinds of alliances mentioned above.

In addition to a growing number of alliances, inter-firm co-operation has also deepened. Co-operation includes not only manufacturing or marketing operations, but also research and development (R&D) activities. In R&D co-operation companies often exchange highly confidential information, for example, about the latest technology. Thus, the co-operation is very deep including also strategic issues.

## **Perspective**

To arrive at a good analysis of co-operative relationships, a focused approach is needed. Hence, instead of trying to cover the entire field of alliances, this study concentrates on vertical relationships, i.e., buyer-supplier relationships.

The traditional view of purchasing as a mandatory support function is rapidly changing. Suppliers are seen as a permanent and important element of the supply chain. Rather than considering them as providers of raw materials and services only, an efficient supply chain is a competitive advantage to a firm. This wider perspective not only covers managing the flow of goods and services but also managing the entire supply process. Because many companies have outsourced activities previously done within the company, purchasing and supplier co-operation have become a part of firms' strategic decision-making.

From a supplier's point of view this development has led to closer co-operation with customers. Particularly in rapidly growing industries, suppliers are required to have the ability to grow with their customers. Hence, a number of suppliers have expanded their capacity remarkably. Moreover, they have also made customer-specific investments.

## **Purpose and structure of the study**

The question arises: Why do firms network and form alliances and what effects do these alliances have on each partner? While a number of previous studies have emphasised the importance of supply chains, only a few studies have examined concrete impacts of networking (as an example of such a study, see Yli-Renko 1999).

Rather than to view an alliance as a zero-sum game, it can be considered as a possibility to achieve a 'win-win' situation that creates mutual benefits. Hence, the aim of the study is to find out the effects of networking on firms' financial performance, structures and behaviour. Furthermore, we try to shed some light on the everyday life of companies with networks.

This study focuses on the networking of Nokia Corporation. We consider the development of Nokia after the mid-1980s, and how co-operation relationships have developed during this time. Nokia is an interesting case because the company has built a wide network of co-operation partners. Furthermore, the company operates in the telecommunications industry with a high growth rate and rapidly developing technology.

The report focuses on following issues:

- How wide is Nokia's network?
- How do networked companies operate?
- How knowledge and learning spread between companies?
- What effects co-operation has had on suppliers?
- What kind of opportunities and risks networking may create?
- Which issues have caused disagreement within the network?
- What is the future of networking?

The structure of the study is as follows. Chapter 2, written by Laura Paija, gives an overview of the Finnish ICT cluster, Chapter 3 describes the metamorphosis and growth of Nokia during the past 15 years. Chapter 4 considers the rationality of outsourcing and Nokia's network management strategy. Chapter 5 gives a description of the data and methods used in the study, and Chapter 6 analyses in detail the effects of networking on suppliers. Finally, Chapter 7 concludes and discusses opportunities and threats of networking.

2

**The Finnish Information and  
Communications Technology  
(ICT) Cluster**

## What is a cluster?

In a knowledge-intensive economy firms are dependent on the knowledge resources of other firms, in which they seek to get access. This is done by inter-firm contracts, i.e. networking. Intertwined networks can develop into a 'network of networks', or a cluster.

Clusters cross traditional industry boundaries by connecting customers, suppliers, related industries as well as the research sector via co-operative relationships, in which knowledge transfers and technology spill-overs generate new abilities and innovations. Dynamic interaction between actors strengthens the competitive advantage of the entity, and ultimately the economy in which it operates. A cluster is thus more than the sum of its components.

## Dynamics in the Finnish ICT cluster<sup>1)</sup>

During the 1990s, there has emerged in Finland an internationally competitive information and communications technology (ICT) cluster, which is the outcome of mutually enforcing dynamic relations between its actors (figure 2.1).

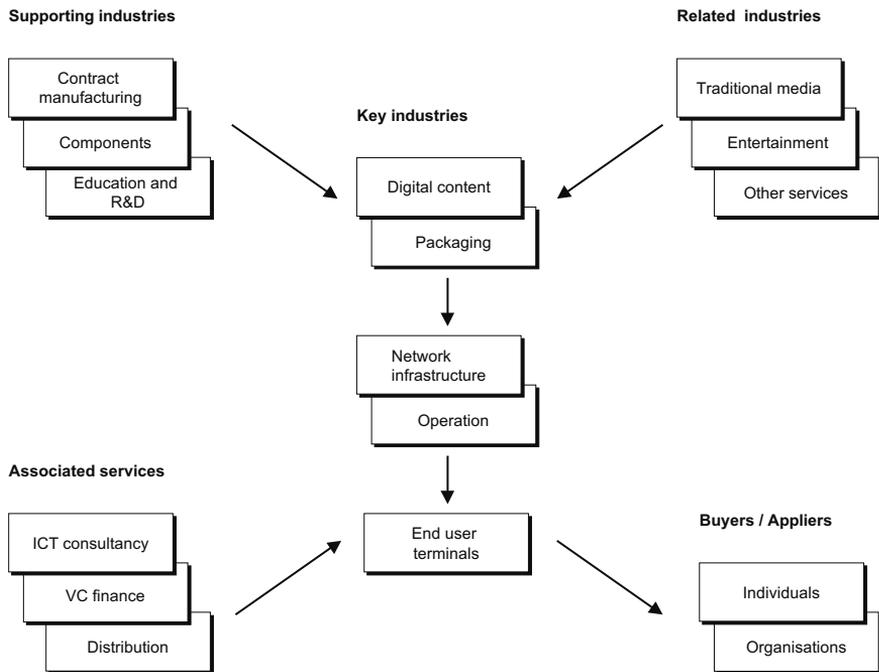
Companies in the **key industries** form the core of the cluster. The Finnish telecommunications sector has its roots in the 1880s when the first telephone companies were established. The large number of private operators – quite exceptional from an international perspective – nurtured the equipment market, which was, however, dominated by foreign equipment manufacturers (Ericsson, Siemens, ITT, Alcatel) until the gradual emergence of national equipment industry in the 1960s.

Radio technology aroused enthusiasm in a few local companies (notably Suomen Kaapelitehdas (lit. Finnish Cable Works), Televa and Sa-lora), which eventually, in the 1980s, combined their knowledge resources under Nokia's organisation. Intensive co-operation between companies and advanced operators was vital for the development of the domestic telecommunications industry.

---

<sup>1)</sup> This chapter is based on Paija (2001). The cluster framework follows Porter (1990).

Figure 2.1 The ICT cluster



The **supporting industries** have increasingly specialised in serving the ICT companies. Global growth in the demand for ICT equipment together with increased outsourcing have surged the number of new suppliers, and tuned existing companies' supply more directly towards ICT manufacturers' demands.

Indeed, growing requirements of globally operating customers have had a direct bearing on the upgrading of supplier competence. And conversely, the strengthening of the scale and scope of the domestic supplier sector has provided home-base advantage for Finnish ICT companies.

The competence of Finnish supporting industries lies in customised inputs and services, particularly in the contract manufacturing of certain parts and components (ASIC, rf-filters, hybrid circuits, silicon wafers, printed circuit boards and surface mounting techniques), electronic manufacturing services (EMS), automation and precision mouldings. In more standardised components, however, requiring mass

production facilities and efficient global distribution channels, local providers can seldom compete price-effectively with international suppliers.

The universities and research institutes have been successful in producing advanced human resources and R&D for the use of the cluster. The industry, the ICT-oriented universities (in Helsinki, Lappeenranta, Oulu and Tampere) and the public Technical Research Centre (VTI) have long traditions in technology development co-operation. The shortage of skilled labour has further activated the science-industry dialogue to better meet the increasing requirements in labour volume and skills.

The concentration of advanced ICT knowledge has attracted leading foreign manufacturers (e.g. Ericsson, Hewlett Packard, IBM, ICL, Lotus, Siemens) to base R&D centres in Finland. Nokia, too, despite its extensive global network of research centres (52 units in 14 countries), expends some 60 per cent of its total R&D input in Finland.

Digitising of content and transaction services – provided by **related industries** – is seen as the most important factor in boosting the future demand for ICT equipment. The Finnish digital content industry is still in its early stage of evolution, but the ICT cluster provides an advanced development base with sophisticated customers, developed technology platforms, and ‘intelligent’ capital provided by the newly emerged venture capital market.

The portrait of the ICT cluster is becoming increasingly blurred, as cluster actors are penetrating new – and to a large extent each other’s business areas. In addition, they merge vertically (e.g. content providers, packagers, distributors and service providers; or, business consultants, IT integrators and new media) to take hold of a wider range of the value chain. The ICT cluster is under significant restructuring.

Finally, technology-attracted **end-customers** have provided both the ICT manufacturers and service providers an advanced home market to develop consumer-oriented products. The Finnish market is, however, losing its importance in economic terms for global actors, like Nokia for whom it represents only 2 per cent of total revenue, but it still serves as an important test bed for novel product launches.

## Economic relevance

The key activities of the ICT cluster generated a turnover of EUR 17.5 billion in 1998 (see table 2.1).<sup>2)</sup> The cluster output lies heavily in equipment manufacturing, accruing two thirds of the value. The significance of software production is underestimated by the figures, since it is partly included in the production of ICT manufactures containing an important amount of embedded software and other IT services.

In 1998, the share of the ICT cluster of the GDP was 6.6 per cent, and that of Nokia 2.4 per cent. In 2000, the company accounted already for 4.6 per cent of the GDP.

The cluster accounted for 3 per cent of total employment. 21 000 of the total 75 000 cluster employees worked in Nokia. The company's disintegrated production strategy has had an important effect on cluster employment, engaging approximately 14 000 persons in the first-tier supplier firms. Total multiplier effect on domestic employment is much larger but cannot be quantified.

Some 85 per cent of the total ICT equipment manufacture were exported in 1998, representing around 20 per cent of total exports, while in 1990 the share was only five per cent.

**Table 2.1 The ICT cluster in 1998**

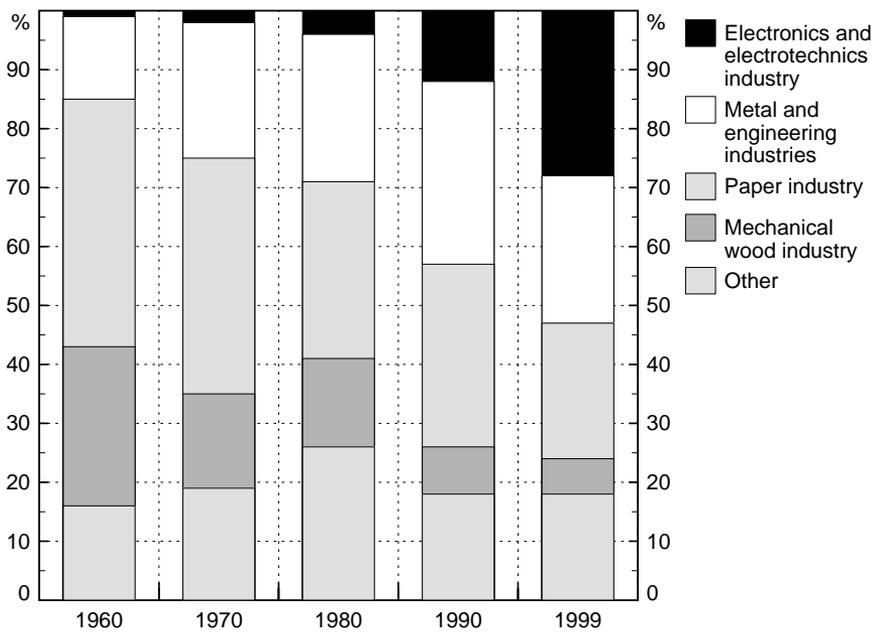
	ICT manufacturing		ICT services				Cluster (total)	
	Euros (mill.)	Share of prod.	Euros (mill.)	Share of prod.	Euros (mill.)	Share of prod.	Euros (mill.)	Share of prod.
Production	11 631	100%	3 408	100%	2 500	100%	<b>17 538</b>	100%
Value added	3 728	32%	2 045	60%	1 724	69%	<b>7 497</b>	43%
Labor cost	951	8%	682	20%	706	28%	<b>2 339</b>	13%
Exports	9 543	82%	110	3%	932	37%	<b>10 585</b>	60%
Imports	1 694	15%	150	4%	578	23%	<b>2 422</b>	14%

Sources: Statistics Finland, Ministry of Transport and Communications

<sup>2)</sup> See Appendix 1 for the NACE codes utilised in the calculation of economic indicators.

Indeed, the intensive growth of the electronics industry has led to an industrial restructuring in the former forest and metal based Finnish economy. The electronics and electrotechnics industry has caught up with the main trading sectors in export shares, rendering the economy less vulnerable to fluctuating raw material based industries (figure 2.2).

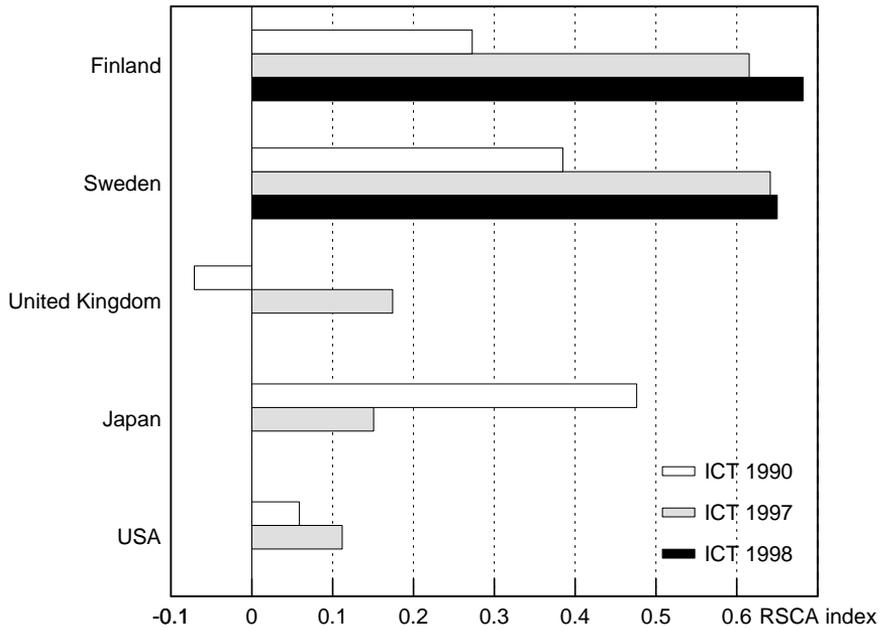
**Figure 2.2 Export shares by industry groups 1960-1999**



Source: National Board of Customs.

During the 1990s, Finland became the world-leader in high-tech trade surplus (high-tech exports/imports ratio) among indigenous producers. It is also the most specialised country in telecommunications equipment exports among the OECD countries, in other words, the share of telecommunications equipment of total exports is higher than in the industrialised countries on the average (figure 2.3). Finland's share of total OECD telecommunications equipment exports was in 1998 around 5 per cent while, to contrast, the share of total OECD exports was 1 per cent.

**Figure 2.3 Telecommunications exports specialisation (RSCA index)**



Source: OECD

Note: The 1998 data was not yet available for all countries. See Appendix 2 for the definition of the RSCA index.



**3**

# **Development of Nokia**

*This section describes some recent development and restructuring of Nokia. We start by considering Nokia's road from a highly diversified conglomerate to the focused telecommunications company that it is now. Next, we examine the company's internationalisation process and the development of its technology. The final part of this section considers Nokia in the global competition by comparing Nokia to its main competitors.*

## **From an industrial supermarket to a focused telecommunications company**

In the beginning of the 1980s, Nokia started to strengthen its position in the consumer electronics and telecommunications market by acquiring several electronics companies including Luxor, Salora and Standard Elektrik Lorenz's consumer electronics industry.

Due to the historic background and acquisitions, Nokia had no less than eleven business lines during 1986-88. Figure 3.1 shows how the significance of major lines has shifted over time.

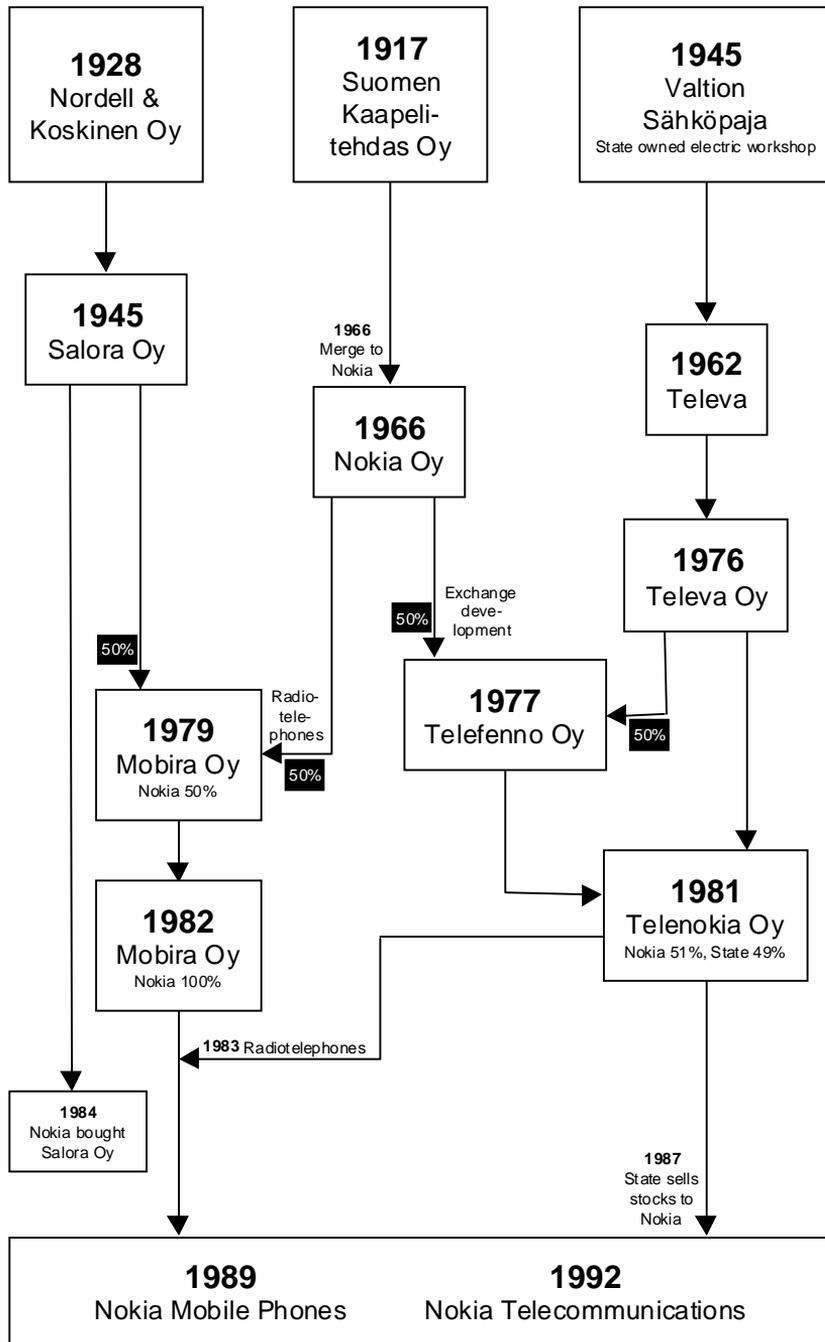
A former president of Nokia (Kari Kairamo) forecasted coming changes in 1984 (Nokia's annual report):

*"We have attempted to change the structure of the group by directing investment and research and development activities towards high-tech products and production methods. This structural change has been supported by corporate acquisitions at home and abroad. At the same time, internationalisation has also been promoted."*

Since then, Nokia has gone through a comprehensive metamorphosis. The company has acquired and, on the other hand, sold several business units. From a conglomerate with a high number of different business lines Nokia has been transformed into a pure telecommunications company.

The example of Nokia shows how the focus of a company may change over time. In order to focus on telecommunications, Nokia has divested all of its previous core competence businesses. In fact, Nokia has reinvented itself so many times that it seems almost impossible to forecast what kind of structure or core competences Nokia will have in five to ten years' time.

**Figure 3.1 History of the development of radiotelephones in Nokia**



Source: Häikiö, M. (1998), Alkuräjähdyks, Edita, Helsinki.

**Box 3.1 History of Nokia***Background*<sup>3)</sup>

The roots of Nokia go back to 1865 and the establishment of a forest industry enterprise in south-western Finland by mining engineer Fredrik Idestam. This enterprise ran a groundwood mill on the Nokia river, hence the company name.

Elsewhere, the year 1898 witnessed the foundation of Finnish Rubber Works Ltd, and in 1912 Finnish Cable Works began operations. Gradually, the ownership of these two companies and Nokia began to shift into the hands of just a few owners. Finally in 1966 the three companies were merged to form Nokia Corporation.

*History of radio technology development in Finland and in Nokia*<sup>4)</sup>

The roots of the Finnish radio technology development go back to the 1920s. The wars against the Soviet Union revealed the strategic role of radio technology whose development was initiated in Valtion Sähköpaja (lit. State Electric Works) of the Finnish Army. In the 1950s it introduced its first radio phones and automated base stations.

After the wars, Valtion Sähköpaja was organised under the PTO (the national public telecommunications operator) and renamed Televa. In the 1970s, the company started investing in digital technology. Despite in-house opposition, a couple of persistent engineers managed to proceed with their digital exchange project that ultimately led to its introduction – only a short time after the leading foreign competitors.<sup>5)</sup>

Suomen Kaapelitehdas (lit. Finnish Cable Works, founded in 1917), in turn, was a cable manufacturer for the telecommunications industry. In the 1950s, the new managing director perceived the business potential of electronics. Regardless suspicion within the company's management, innovative but costly R&D in new radio and digital technology were sustained in the 'back stage' of the factory.

The trade relationship with the Soviet Union was decisive to the development of the technical knowledge of the company. The Soviet Ministry proved a demanding but also patient customer. Thus, Suomen Kaapelitehdas had an invaluable opportunity to develop modern digital technolo-

---

<sup>3)</sup> Source: <http://www.nokia.com/inbrief/history>.

<sup>4)</sup> Source: Paija, (2000).

<sup>5)</sup> Ericsson, Alcatel, ITT and Siemens.

gy. The voluminous exports provided also necessary income and contacts to develop later exports of telecommunications equipment.

The third central company in the industry development process was Salora (founded in 1928). Like in Televa and Suomen Kaapelitehdas, radio technology was being developed aside the core activities, TV and radio set production. Unlike the two other companies, Salora was a strong TV-brand also beyond national borders and had experience of serial production and marketing.

A pivotal stimulus to the birth the Finnish radio communications industry was given in 1963 by the Finnish Army. It put out an invitation for tenders for a radiophone that was to meet challenging technical requirements. It was the first time the firms were given an economic motive to develop a radiophone, generally regarded as a toy for a marginal group of users. In fact, rather than a business opportunity, firms considered the competition a chance to give a physical form to the knowhow cumulated 'behind the curtains'. Five companies (Televa, Kaapelitehdas, Salora, Vaisala and Swedish Sonab) bid for orders. Ultimately, the Army did not have the funds to redeem the phone, thus the contestants had to look for other customers. Indeed, for all the participators the prototypes served in developing new portable phones, some of which became new export articles.

In 1966, Suomen Kaapelitehdas was merged with Suomen Gummitehdas (lit. Finnish Rubber Works) and Nokia, a 100 year-old paper factory that gave its name to the new corporation. The merger secured further R&D investments in digital technology that was now regarded as one of the strategic business areas.

In the 1970s the state-owned Televa and Nokia founded a joint venture. Combining the forces proved a crucial step towards the later breakthrough of Nokia. The introduction of the digital exchange finally in 1982 had required a lengthy, costly and laborious period of development both in Nokia and Televa. But it was with this product launch that Nokia finally convinced the market of its competence vis-à-vis foreign manufacturers. For years the exchange was for the most successful export article of Nokia

In 1979, Nokia and Salora, in turn, joined their complementary resources. The fifty-fifty owned Mobira was established to market and develop radio technology and especially the NMT terminal that was under design in the Nordic Telecom Conference. The joint venture was perfectly timed as it enabled the launch of the first NMT phone approved to the new network. Finally, in 1982, Nokia got full ownership of both Mobira and in 1987 the State's share in the joint venture, in which occasion the Finnish

telecommunications industry was organised under Nokia's roof.

The introduction of the NMT in 1981-82 marked the start of a fast-expanding new industry. The Conference had an outspoken objective to press down the prices of equipment by promoting technical compatibility and competition between manufacturers.

The Conference made active use of the manufacturers' knowledge during the NMT design phase. In Finland, Mobira was among the most active cooperators providing its expertise in terminal technology. At that time, however, the Finnish industry was not yet able to contribute to the design of the network specifications.<sup>6)</sup> There was strong pressure from the PTO's side to engage the industry in cellular exchange development. Ultimately, the alliance between Salora and Nokia (i.e. Mobira) encouraged the companies to supply an NMT base station in 1981 – which later turned out to be crucial in maintaining the position in the emerging market.

Mobira became famous for its 'crazy' organisational spirit that referred to the passionate, pioneering and risk-taking style with which it pursued its ambitious targets both in technology development and internationalisation. The same kind of stamina and general enthusiastic – if not fanatic – attitude towards new radio technology has been seen behind much of the technological progress in the Finnish telecommunications industry.

---

<sup>6)</sup> In fact, Salora had been most reluctant to start developing an NMT base station as it was focusing on terminals. Nokia instead had been directing all of its resources on the development of a digital exchange for fixed networks.

## **Customers and employees all over the world**

Up till 1980, Nokia sold approximately half of its products to the domestic market and the rest was exported. In the early 1980s, however, Nokia started to strengthen its international operations (figure 3.2).

In addition to exports, Nokia proceeded in its internationalisation by acquiring production units abroad during the 1980s. The aim was to grow rapidly and expand operations to new lines of business. According to this strategy, Nokia acquired a number of foreign subsidiaries; hence net sales and employment increased rapidly (see figures 3.2 and 3.3). The acquired units operated mostly in the electron-

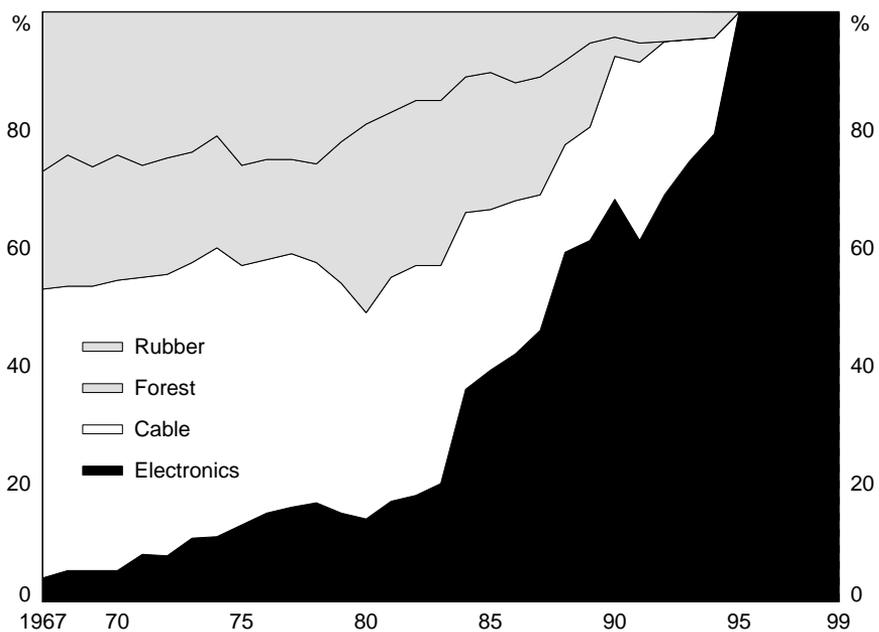
ics industry, and many of these new subsidiaries manufactured products (televisions, monitors and videos) directed to consumers. Thanks to acquired units, Nokia became the second biggest electronics company in the Nordic countries.

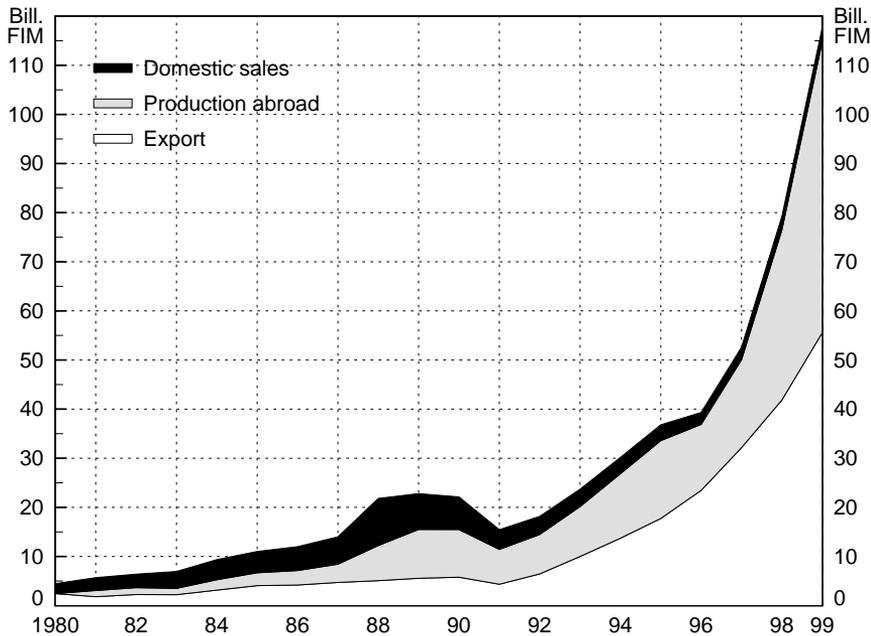
The acquired companies were mostly located in Europe. However, Nokia's mobile phone unit, called Mobira at that time, expanded by making more global alliances. Together with Tandy Corporation, Nokia established a joint venture in Korea. Tandy had experience in Asian operations, but more importantly, it had an extensive distribution network in the United States.

Thus, the 1980s were a decade of growth and internationalisation for Nokia. Net sales grew five-fold during ten years, and a substantial amount of this growth was obtained by acquiring foreign companies.

Today, Nokia is a highly internationalised company with a number of production and R&D units in Europe, Asia and America. Furthermore, the company sells its products in to more than 130 countries. Its increased foreign activities have been mirrored in the location

**Figure 3.2 Sales of Nokia by industrial group, %**



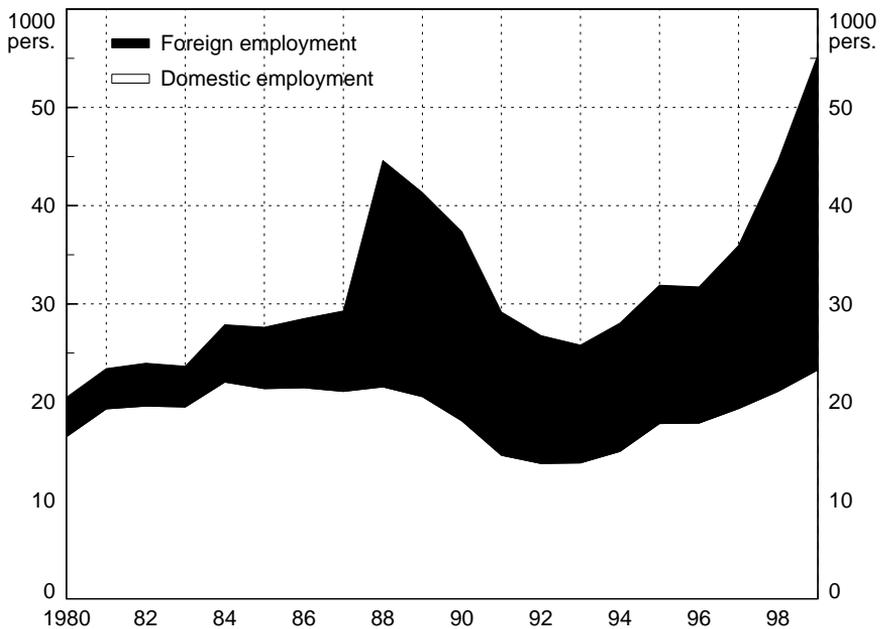
**Figure 3.3 Net sales of Nokia, bill FIM<sup>7)</sup>**

of personnel. Thus, more and more employees are working in business units outside Finland. However, despite the rapid expansion of foreign production, Nokia has increased its exports from Finland, as well. Therefore, Finland remains an important place for Nokia to create value-added.

Figure 3.4 shows how the number of personnel has developed during the past twenty years.

However, in the early 1990s Nokia ran into a crisis. It had just invested heavily in new businesses when the Finnish economy went into a severe recession. Nokia started streamlining its activities towards the electronics industry. Due to heavy losses and the decreased strategic significance of some business lines, the company decided to sell a number of business groups. The business lines to be sold included, for example, the forest industry, distribution of electricity and the rubber industry businesses. The heavy divestment program was also

<sup>7)</sup> Production abroad has been calculated by subtracting exports from foreign sales.

**Figure 3.4 Foreign and domestic employment of Nokia**

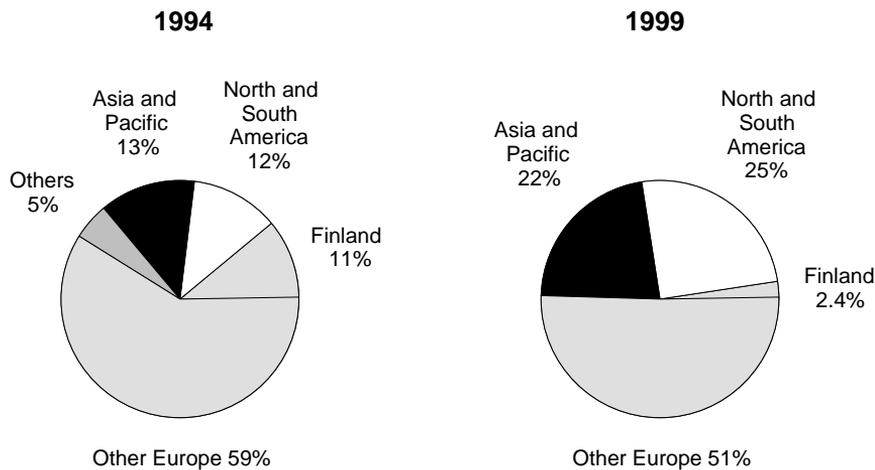
reflected in the number of employees which decreased by 15 000 between 1989 and 1993.

In 1992, Jorma Ollila was appointed CEO. Under his leadership Nokia made a major strategic decision to focus on telecommunications by divesting its non-core operations. The most recent large divestments took place in 1996, when Nokia sold its cable industry operations and television business. Thus, Nokia focused more and more on the telecommunications industry.

A booming telecommunication business has pushed Nokia to rapid growth. During the past five years (1995-1999), the company has grown on average more than 30 percent a year. Furthermore, Nokia has grown mainly internally without major acquisitions. In fact, Nokia has acquired only few companies whose contribution to group net sales or personnel is slight. The acquired companies have been small firms specialised in Internet technologies.

The high growth rate has become a challenge for Nokia. The increased sales have reflected in increases in capacity. In addition to

**Figure 3.5 Net sales of Nokia by market area**



the fact that Nokia has outsourced more and more its operations, the company has also increased its own capacity. As a result, the company has recruited several thousands of employees in the past few years. Nokia has increased its personnel in Finland, but now the focus has become more international.

The fast growth of the Finnish telecommunication industry has led to shortage of qualified engineers in Finland. Companies operating in the ICT cluster have difficulties in finding new employees. Thus, it is hardly surprising that the number of Nokia's staff outside Finland has increased. Furthermore, Nokia's market focus is increasingly global, for currently the company sells less than 2.5 percent of its products in the domestic market.

Figure 3.5 shows how net sales were distributed in 1994 and 1999. Europe still brings more than a half of Nokia's net sales and South and North America account for nearly one fourth. However, the significance of the Asia/Pacific region has substantially increased during the past few years. While in 1994 its share was 13 percent of net sales, in 1999 the share had risen to 22 percent. The United States, China, the UK and Germany were the most important individual countries.

## Increasing research and development efforts

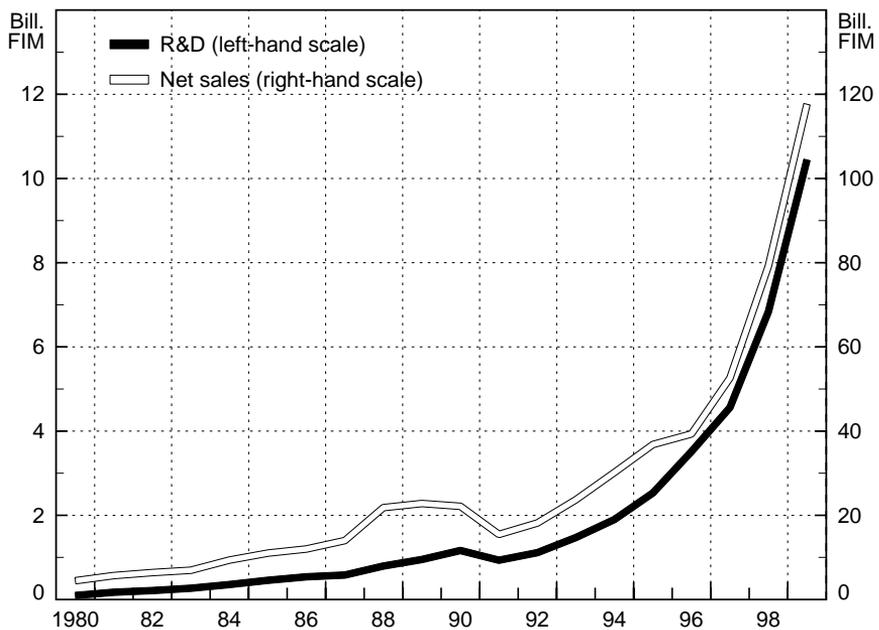
Nokia's investment in R&D increases year after year following closely the growth rate of sales. In the past few years, the growth rates of both net sales and R&D have accelerated.

Developing new models and technologies for the third generation mobile systems has required additional R&D investments including new R&D centres. In addition, the company's R&D personnel has grown from 10 000 to 17 000 during the past two years, and currently roughly 30 percent of the total personnel work in R&D.

The growth rate of R&D investments has been particularly fast during the end of the 1990s as Nokia has focused more and more on telecommunications. Furthermore, the increased growth rate of technology development has forced Nokia to increase its R&D efforts in order to respond to tighter competition.

The company has expanded its global R&D network. As a result, with R&D units in twelve countries, Nokia has 44 R&D centres world-wide (in 1999).

**Figure 3.6 R&D and net sales of Nokia, bill. FIM**



During the 1990s, the share of Nokia Mobile Phones (NMP) of total R&D expenditure has grown. While in 1992 the R&D costs of Nokia Networks (before Telecommunications) clearly exceeded those of Mobile Phones, in 1999 the situation was turned controversial. Thus, the development of cellular phone models has required more and more R&D efforts.

## **Advanced branding – a key to success**

Investment in R&D alone does not guarantee success in the market. The high growth of Nokia's sales shows that the company has advanced well in selling and marketing, too. It has created a well-known brand.

An American company called Interbrand ranks companies according to their brand values. As the first non-American company, Nokia has been ranked in 5<sup>th</sup> position, while the top ten list is dominated by American companies, such as Coca-Cola, Intel and Microsoft.

Generally, successful branding is an endorsement and indication of quality. Thus with a well-known and respected brand image a company can mark its product prices above those of its less known competitors. Brands, then, are one of the most important and valuable assets for many companies.

In addition to technology, Nokia's success is a consequence of understanding consumer needs. Unlike its competitors, Nokia understood rather early that in order to make mobile phones desirable, one also has to make them look attractive. Accordingly, Nokia put a lot of effort into designing their products. They replaced the former angular appearance with a rounder design.

Moreover, an effort was made to make the user interface of mobile phones easy to use – to make a phone as simple to use as possible. Another noteworthy change of direction was seen in Nokia's style of marketing.<sup>8)</sup> In the early 1990s, the advertising style for cellular phones was changed. Instead of advertising the mobile phone as a status symbol, Nokia began to market it as a regular consumer product without the stamp of luxury.

---

<sup>8)</sup> Pulkkinen (1996) in Lemola & Lovio (1996).

The change of marketing style was revolutionary, for, after that, not only businesses but also private individuals bought more cellular phones.

## Nokia and its competitors

Heavy investment in telecommunication R&D, successful marketing and rapid internationalisation have made Nokia to one of the leading telecommunication companies in the world. This subsection compares Nokia to its major competitors, Ericsson and Motorola.

Measured by net sales, Nokia is currently smaller than its main competitors. However, the company is more focused on cellular products than Ericsson or Motorola. Contrary to its main competitors, Nokia does not manufacture semiconductors. Thus, the company has chosen the strategy of buying semiconductors from the market instead of producing them itself.

Due to the high growth rate of Nokia, however, the size differences between the companies are narrowing. The growth rate of Nokia is considerably faster than its main competitors. There are at least two reasons for this. First, as mentioned earlier, Nokia is more focused on the fast growing cellular business. Second, Nokia has managed to expand its market share. The demand for Nokia's cellular phones has

**Table 3.1 Major telecommunication companies in the world, 1999**

	Nokia	Ericsson	Motorola
Net Sales, bill. FIM	117.6	144.9	172.5
Return on investment, %	55.4	19.0	5.5
Earnings before taxes, bill. FIM	23.3	11.0	6.5
% to sales	19.8	7.6	3.8
R&D expenditures, bill. FIM	10.4	19.0	19.2
% to sales	8.9	13.1	11.1
Year-end employment	55 260	103 290	na
Global market share of mobile phones (7-9/2000)*	30.6	9.7	13.3

\* Source: Dataquest.

been particularly brisk in the past few years. As a result, the annual growth rate of Nokia Mobile Phones averaged approximately 55 per cent during 1997-1999.

There are notable differences between the profitability of the three companies. Measured by ROI (return on investment) or by operating profit, the yield of Nokia is clearly above its competitors.

The size of Nokia is still smaller than its main competitors. The difference, however, is disappearing. Furthermore, Nokia does not invest as much as Ericsson or Motorola, but Nokia clearly outperforms its competitors in financial terms (see also Ali-Yrkkö et. al., 2000).

4

# Nokia – a Company with Web

*A shift in the production paradigm towards increased specialisation and outsourcing has made supplier management a central function of the firm. A successful firm cannot afford aloofness in supplier its relationships, whose role grows with increased business focus.*

*Nokia provides an illustrative example of a firm that has gone through an organisational transformation induced by such strategic considerations. Next we shall have a general look at the rationale for outsourcing and inter-firm collaboration.*

## **Make or buy? – Rationale of outsourcing**

In order to maximise efficiency, the firm needs to make an assessment of the organisation of a production phase, or ‘transaction’ in the language of Williamson (1985). Both integration (‘to make’) and outsourcing (‘to buy’) of the production phase incur governance costs, or ‘transaction costs’ from planning, implementing and controlling the job.

The choice between make or buy decisions is seldom unambiguously the first best. There are trade-offs related to the divergent incentives of the buyer and the supplier.<sup>9)</sup> Transaction costs are also vitally related to the existing in-house core skills. Activities in which a firm has embedded expertise are extremely costly, if not impossible to contract out. Correspondingly, functions only distantly related to the firm’s core competencies are primary candidates for outsourcing.

In order to enforce efficient fulfilment of an outsourced transaction, firms make contracts. Contracts can be seen as an intermediate arrangement between hierarchies and markets, combining the coordination ability of the former and the flexibility and incentives of the latter.

Ultimately, the arrangement minimising the cost of transaction determines the organisational boundaries of the firm. But, as pointed out by Langlois & Robertson (1995), the boundaries of a firm – a function of its core competencies – are dynamic in the sense that firm-

---

<sup>9)</sup> For example, highly transaction-specific assets lower the incentive of an outside actor to make the required investments. Also, uncertainty increases transaction costs by complicating the formulation of a complete contract, which in turn, gives rise to opportunism. Finally, frequency of the transaction is a factor that tends to reduce the cost of writing a contract; recurrent transactions generate routines that increase cost efficiency in inter-firm arrangements (Williamson, 1985).

specific knowledge tends to spill over to the market. Increased know-how in the market thus enables the firm to gradually contract out more specialised activities.

## **What to make? – The strategy of the core company**

The primary task of the firm is to identify and enhance its distinct, inimitable and non-substitutable competencies (Prahalad & Hamel, 1990). The resource view of the firm (originating from Penrose, 1959) emphasises firms' heterogeneity in absorbing, cumulating and exploiting knowledge resources. Thus, competencies are mostly firm-specific and path-dependent, residing tacitly in employees hands and heads, organisational structure, procedures and corporate culture (Nooteboom, 1999a).

The resource view has implications for firms' interaction, or networking, since specialisation on certain resources makes the firm dependent on other firms for complementary assets. Consequently, the firm needs to enhance its attractiveness as a network partner by enhancing its competitive advantage. The stock of competencies virtually defines the firm's power position in the network, and thus, the external resources to which it can get access (Forsgren et al., 1995).

As Hamel et al. (1989) point out, global competition has been characterised by a battle over key technology-based competencies that fuel new business development. A successful firm needs to build and enhance embedded skills that breed new generations of products. Therefore, it is dangerous to outsource the production of key technology-based core products without running the risk of surrendering core competencies indispensable in transition to the next product generation (see also Prahalad & Hamel, 1990).

Indeed, there is a limit to the extent the firm can outsource its activities without running the risk of hollowing out its core activities. A careless outsourcing strategy can make the company increasingly dependent on its suppliers, who may ultimately turn into competitors.<sup>10)</sup>

---

<sup>10)</sup> See e.g. Chesborough & Teece (1996), Prahalad & Hamel (1990), and Lorenzoni & Baden-Fuller (1995) for illustrative case studies.

“Outsourcing can provide a shortcut to a more competitive product but it typically contributes little to building the people-embodied skills that are needed to sustain product leadership. Nor is it possible for a company to have an intelligent alliance or sourcing strategy if it has not made a choice about where it will build competence leadership.” (Hamel et al., p. 84)

Lorenzoni & Baden-Fuller (1995) formulated, on the basis of their study of successful networked companies, an agenda of critical competencies that needs to be nurtured in-house. These include (in slightly modified form):

- The vision – a perception of the industry structure and development trend; orchestration of the partner network to realise the vision.
- The brand – investment in brand management.
- The partners – developing mechanisms for selecting and managing partner network.
- The climate – creating an atmosphere of trust and reciprocity in the network.

Thus, successful networked firms perceive themselves as ‘strategic centres’ who “reconcile the flexibility of market relationships with the long-term commitment of hierarchically centralised management” (ibid., p. 146).

## **How to buy? – Rationale of co-operation**

As companies focus on cumulating their core skills they necessarily run the risk of not perceiving opportunities and threats in other fields. Complexity and variability of technologies and markets further increase uncertainty caused by imperfect knowledge. To enlarge its cognition, the firm needs complementary external sources of knowledge, which must be adequately distant to provide novelty, yet proximate to allow for understanding and appropriation (Nooteboom, 1999a).<sup>11)</sup>

A contract provides a right of entry to other firms’ knowledge resources, which provide diversity and novelty, required by innovation (Nelson & Winter, 1982, *cif.* Nooteboom, 1999a). Knowledge

---

<sup>11)</sup> Nooteboom suggests that mergers and acquisitions may destroy the ‘cognitive distance’ crucial in providing novelty of knowledge.

sharing provides a shortcut in the development of technology.

A crucial function of the firm, as seen e.g. by the Uppsala school (see e.g. Forsgren et al., 1995 and Aoki et al., 1990), is then to manage the set of its contracts, or network relations. This includes building, establishing and maintaining favourable network relations, and co-ordinating activities related to partner firms (cf. Paasche et al, 1993).

However, contract making is problematic and costly in a complex and unstable environment. It is also difficult to capture and contractually enforce creativeness and flexibility in transactions.

In order to diminish transaction costs incurred by contract formulation firms are increasingly looking for non-contractual ways to enforce mutually beneficial relationships. Short-term contracts are replaced with long-term agreements to build trust and reciprocity.<sup>12)</sup> Cumulated sense of confidence can work as a powerful means to decrease the need for all-encompassing formal contracts and to create an atmosphere of mutual commitment and positive problem solving (e.g. Helper, 1993; Hines, 1994; Lorenzoni & Baden-Fuller, 1995).

## **Different forms of alliances**

Despite the emphasis on vertical relationships in the above discussion, firm interaction takes different configurations depending on the dimension and depth of the relations. Nokia is an illustrative case of a company operating in the core of a multidimensional network environment (figure 4.1). Owing to the loose every-day usage of the concepts related to different forms of firm relationships the basic characteristics of different forms of co-operation will be discussed next.

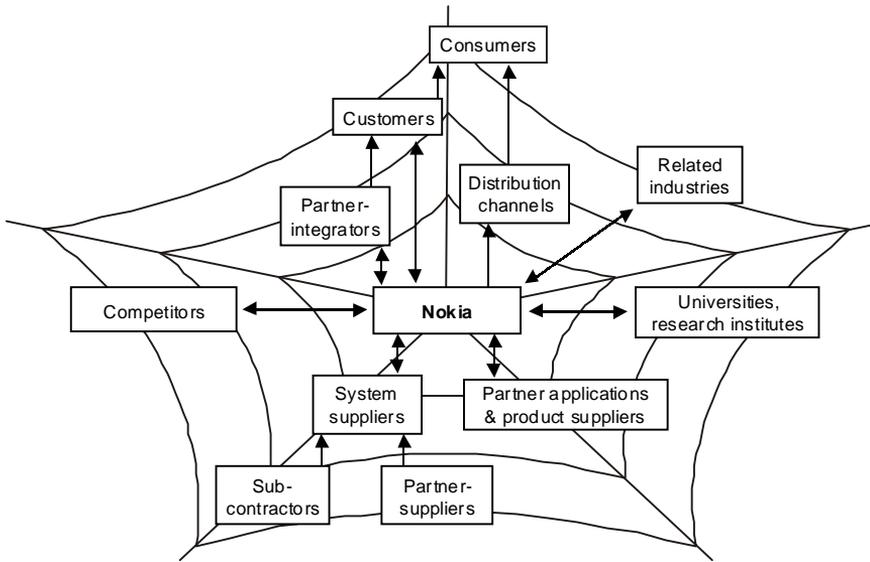
### ***The dimensions***

According to Nooteboom (1999b), an alliance is the general term for a number of inter-firm relationships that go beyond pure market transactions. The dimensions of alliances can be categorised as horizontal, vertical and diagonal.

---

<sup>12)</sup> See e.g. TT (Confederation of Finnish Industry and Employers), 1997.

**Figure 4.1 Nokia's network environment**



Horizontal alliances refer to collaboration between firms that are in a competitive relationship in some phase of the value chain. Competitors enter co-operation to enhance their core competencies through complementarities, yet simultaneously limiting the partner's access to proprietary skills.

Horizontal alliances are often formed to develop a de-facto technology standard to spur growth in a future market, in which the partners intend to compete with compatible products and applications. Nokia is a member of standard forums like Bluetooth Special Interest Group, and WAP Forum, whose mission is to set standards and to enable a mass market for wireless information devices.

R&D co-operation with universities and research centres is also regarded as horizontal, since it is usually targeted at core competence development.

Diagonal alliances, in turn, aim at 'market making'; i.e., developing new applications or product combinations with companies in third industries. For example, Nokia develops mobile banking services, intelligent home appliances and health-related applications together with respective service or product suppliers, like Nordea Bank,

Whirlpool and ENACT Health Management Systems.

Finally, vertical alliances are established between buyers and suppliers in the production value chain, and thus refer to the organisation of a production phase, discussed in section 4.1.

As to Nokia, supplier (upstream) alliances involve joint development of specialty inputs and sub-systems. Customer (downstream) alliances, in turn, engage network operators in co-operation to design and develop solutions to fit their future requirements. Specialised IT companies, so-called systems integrators, are also a part of the vertical production chain by providing compatibility and interoperability among different vendors' equipment in client technology environment.<sup>13)</sup>

### **The depth of relationship**

In addition to the dimension, inter-firm relationships differ also in their depth. As vertical alliances are the focus of this book, we shall next consider different supplier strategies that vary in the intensity of co-operation.

Supplier strategies can be illustrated within a continuum indicating the depth of co-operation (figure 4.2).<sup>14)</sup> The least sophisticated form of supplier relationship is characterised by price competition, used primarily in the purchase of standard components requiring basic production technology. The number of suppliers is kept high to increase independence and to stimulate competition. There is no knowledge interchange between parties beyond routine operative contacts. Price competition upholds an atmosphere of indifference and uncertainty, suppressing client-related investments and product development by the supplier.

At the other end of the continuum, as the most comprehensive form, there is strategic partnership in which supplier involvement is utilised to increase innovation, specialisation, quality, and price efficiency. Delegating planning and production responsibility to the sup-

---

<sup>13)</sup> Downstream relations with distribution channels are excluded as they do not fall under the definition of alliances.

<sup>14)</sup> See Hines (1994) for an in-depth analysis of four different levels of supplier relationship.

plier aims at effective technology solutions, and allows the firm to focus on its core activities. Mutual commitment is supported by long-term contracts, in which price efficiency is pursued, not in every transaction, but over an extended time period. Communication between partners is intensive and confidential taking place in all organisational levels, and ranging from operative to strategic issues.

Close interaction is likely to spur innovation and knowledge transfers on both sides of the partnership, accruing ultimately to the benefit of both parties. Owing to its confidential and all-embracing nature, the number of strategic partnerships in the supplier portfolio cannot be high.

Between these two extremes of the continuum there is a variety of intermediate styles applicable in supplier strategy formulation.

In the following discussion supplier is used as a generic term for an input provider, with no indication to the depth of the relationship. Subcontracting, in turn, refers to standard outsourcing with an emphasis on price factors, while partnerships are used to describe inter-firm relationships which take use, to a varying extent, of complementary assets to induce synergy and mutually beneficial knowledge transfer.

**Figure 4.2 Supplier strategy continuum**



## Network management strategy

### *History of outsourcing and subcontracting in Nokia*

The width and depth of Nokia's co-operation with other companies have changed remarkably during the past twenty years. From pure sub-

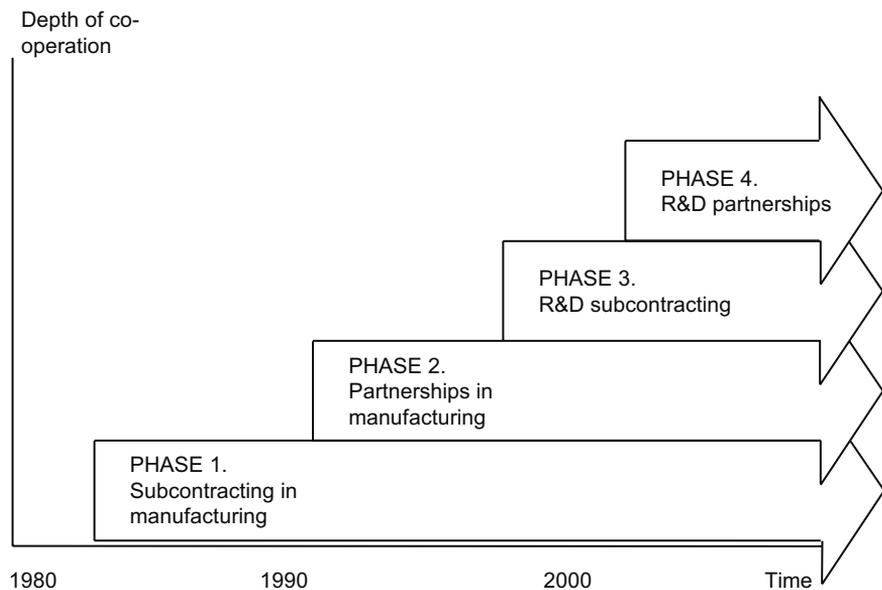
contracting, co-operation has now moved toward partnerships.

The development of Nokia's co-operation with supplier companies can be categorised into four steps. It is noteworthy that different phases do not fully exclude one another. Hence, co-operation takes place in different phases and forms at the same time.

In the 1980s, co-operation with other companies was mostly traditional subcontracting (phase 1). With the exception of a few companies very close co-operation did not exist. Nokia used subcontractors mainly as buffers to stabilise its manufacturing capacity. At the time, the amount of subcontracting depended on business cycles with no systematic co-operation strategy.

The 1990s marked profound changes. The global telecommunications market exploded and also Nokia benefited from this growth. Volumes of telecommunications products rose strongly and Nokia started to ponder new manufacturing strategies. This development also had an impact on the co-operation with other companies as outsourcing was now seen as an alternative to in-house manufacturing. In a larger

**Figure 4.3** The development Nokia's co-operation with its suppliers

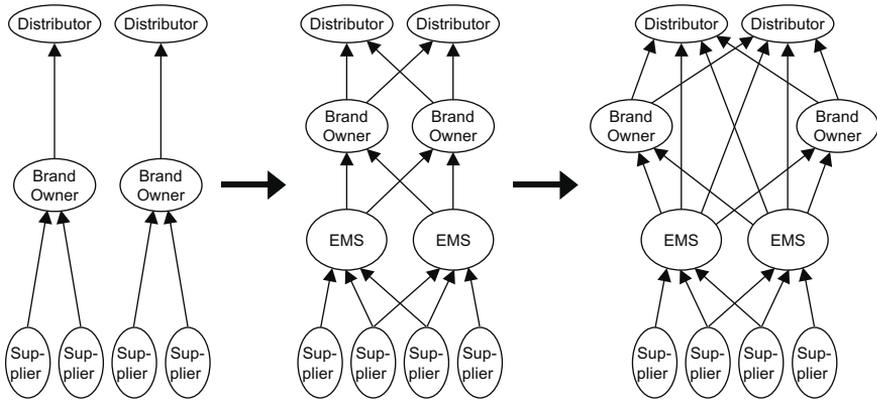


scale, this option was first used in the manufacturing of accessories (phase 2). At the same time, Nokia started a search for long-term co-operation partners. Consequently, subcontracting and co-operation became more systematic when subcontracting and outsourcing were seen as a permanent mode of manufacturing operation instead of a way to stabilise the utilisation rate of capacity.

In the latter part of the 1990s, co-operation was gradually expanded from accessories to other areas. Nokia started to use more and more component providers and manufacturers. Due to high demand, shorter life-cycles of products and increased weight of foreign sales, Nokia had to place more emphasis on logistics. Moreover, as described earlier, there was an acute need to distinguish product life-cycles from production-equipment life-cycles. As a consequence, Nokia among other telecommunications vendors, reorganised its supply chain and started to use assembler services more than before (figure 4.4). Electronic manufacturing service (EMS) providers base their business idea on serving a large number of customers in varying industries and phases of technology, applying the most advanced technology first in fore-runner sectors and then gradually in other sectors. Thus, by pooling the products from different generations of technology, EMS providers are able to prolong the service life of production facilities. In this way they have resolved the vendors' original problem which is related to the mismatch life spans of product and production technologies.

EMS companies, or more generally sub-system suppliers, also serve to alleviate the co-ordination task of vendors by organising the suppliers of parts and components under their direct management. Hence, the re-organising process led to a decreased number of direct suppliers because many suppliers began to deliver their products to the assembler or system suppliers instead of to Nokia. In the production of telecommunications equipment, the role of Nokia is gradually tapering to being a co-ordinator of few key suppliers.

But there were also changes other than just reorganisation. During the past few years, Nokia has also started to use software and R&D subcontractors (phase 3). Consequently, in addition to manufacturing companies, Nokia's network also includes companies specialised in the software development. However, this is a very new form of co-operation. Despite long-term agreements, in many cases the rela-

**Figure 4.4 The re-organisation of supplier network**

tionship can be classified as subcontracting rather than a true partnership because invoicing is usually based on hours rather than results.

In the near future, also co-operation in R&D and software will change toward partnership (phase 4). This will probably lead to suppliers not being paid extra for their development efforts but rather if the product is successful, profits being shared between the partners. Hence, the supplier should take more responsibility for long-term development and also bear more financial risk. In other words, moving toward true partnership will lead to changes in risk sharing and also the sharing of the rewards from R&D co-operation.

In sum, Nokia's co-operation modes have changed remarkably during the past fifteen years. Co-operation has become deeper and it has been expanded to new areas. However, the different phases of co-operation do not fully exclude one another. Hence, while today the focus is on partnerships, the company continues to use subcontracting. Increased networking and outsourcing raises a question about the limits of networking. Can a company outsource everything? We will consider this question in more detail in the concluding chapter.

### **Selection process of suppliers**

The tendency toward long-term relationships places great challenges to choosing suppliers. The breaking in of a new supplier is time-con-

suming and includes issues such as auditing, contracting and training among other things. Not all firms are compatible to become supplier. Consequently, companies must choose their suppliers carefully. As a consequence, Nokia has developed standardised practises and auditing processes for potential suppliers.

The first requirement of a potential supplier is its economic health. The financial position of the supplier should be stable thus making possible long-term co-operation without a great risk of bankruptcy. It also indicates that the supplier is able to invest in new capacity. However, economic health is only a basic requirement for co-operation, for the entire auditing list includes dozens of items such as the supplier's management, technical skills, security and environment issues. Depending on the industry of supplier, an auditing team typically includes persons specialised in issues, among other things, quality systems, sourcing, production and technology. Fulfilling the items of the auditing list forms a basis for potential co-operation, i.e, the necessary conditions, but these criteria are not sufficient conditions for co-operation.

There are also 'softer' criteria for co-operation. Often, these issues are difficult to measure. They include the values of the supplier and a company culture match, as well. Co-operation will not be successful if partners' values and ways of action deviate significantly from one another. Furthermore, it is important that the potential supplier has goals and visions. Thus, in order to reach its aims, the supplier should be keen to develop itself, for instance, by training its personnel. The purpose of development and learning makes possible a reciprocal exchange of knowledge and know-how. Hence, it is important that suppliers have the willingness and the ability to develop their own operations.

The careful auditing process with standardised practises shows that co-operation and networking are seen as an important and constant operation mode. Nokia searches for dynamic partners and subcontractors with visions and views about the future in order to find and develop long-term relationships with reciprocal learning.

**Building and developing supplier relationship**

A key element in successful co-operation is continual development. Rather than to see co-operation as a stable situation, companies must never stop their efforts for developing their operations for better performance. The primary objective should be to make the entire chain more effective.

Often, co-operation begins with the transfer of know-how between the partners, for example, by lending employees to partner. Hence, in the early phase of co-operation, companies should make sure that both parties have the necessary know-how. Furthermore, in order to create synergy between different firms in the demand chain, the integration of partners' processes is often necessary. For example in software development, companies may integrate their development tools, while in manufacturing it is important to make sure an effortless refining of extension.

Improving the efficiency of the supply chain means not only optimising material flows but especially information flows. Therefore, it is necessary to build an infrastructure which assures an efficient exchange of information between the parties. All parties must name the persons who are responsible for the exchange of information. In addition to these persons, it is important that there exists direct communication between other employees, too. Direct discourse between different levels and functions without the necessity to pass information 'up-over-and-down' through functional hierarchies makes it possible to exchange information in real time. In addition to this personal communication, another element of efficient communication is the use of modern information technology. If necessary, partners should modernise their information systems. The aim should be to enhance transparency between the companies.

Successful co-operation is often expanded to new areas. One example of broadened co-operation is geographical widening. Plant-to-plant or unit-to-unit collaboration is expanded to other units within the companies. Often this leads to global co-operation agreements. Moreover, through successful co-operation the supplier may obtain the status of a first-tier supplier with greater responsibility.

It seems that in the future, Nokia's network will be reorganised

into larger sub-networks. While the manufacturing network has already been organised into different levels, including first-tier partners, second-tier partners and so on, it is probable that in the long run similar development will also occur with R&D partners. Thus, first-tier partners take care of contacts to other companies operating in their own respective sub-networks. On the other hand, this change will also mean that the first-tier supplier has to take more responsibility for product or technology development.

5

What Does Nokia's Supplier  
Network Consist of?

*In this chapter we start to look at Nokia's supplier network in Finland. While this chapter gives an overview of suppliers, following chapters will consider the impact of network relationships on the companies.*

## **Data**

As described in the first chapter, the main focus of the study is to consider the effects of networking on companies. In addition to company growth and other easily measurable key figures, our special interest is on knowledge sharing, learning and other qualitative issues. Therefore, public databases that only include financial statements were not useful. Consequently, a wide questionnaire was designed based on existing literature and on exploratory interviews.<sup>15)</sup>

The questionnaire was sent at the end of 1998 to more than 300 Finnish firms operating in the ICT equipment and service industry in different supplying sectors such as part and component manufacturing, software development and electronics manufacturing services. The firms were asked to answer the questions with their most important (measured by net sales) customer in mind. Of the 123 usable responses, we selected those companies which had reported that their main customer is manufacturing telecommunications equipment or that their main customer delivers its products to a manufacturer of telecommunications equipment. After this selection, a total of 83 companies were left that we could use for a proper analysis. Thus, the database includes companies belonging either to the first-tier or the second-tier network of a manufacturer of telecommunications equipment.

Most of the questions in the survey were in the form of statements. The relevance of the different questions to the company was measured with a 7-step scale (Likert-scale) indicating whether the firm disagrees or agrees with the statement. Scale values were interpreted as follows: 1-3 indicate disagreement, 4 implies indifference and 5-7 suggest agreement with the statement. In addition to the statements, firms were also asked to provide some quantitative data such as net sales and the key customer's share in total revenue.

---

<sup>15)</sup> We would like to thank professor Erkko Autio of Helsinki University of Technology for his help in designing the questionnaire.

In addition to the survey, we also made interviews in order to deepen our knowledge about networking. The questions were based on issues that came out in the statistical analysis of the survey. The total number of interviews was 15.

The following table gives some basic information about our survey data.

**Table 5.1 Descriptive statistics of key ratios of the sample firms (in 1998)**

	Mean	Median	Std. Deviation	Min.	Max.	N
Turnover, mill. FIM	164.4	25	421.1	0.4	2346.3	79
Employees	193	32	455	1	3085	83
Return on investment, %	27.6	28.1	32.6	-52.1	92.6	60
Operating profit, %	9.6*	9.3	28.5	-136.7	41.3	62

\* Two outliers were eliminated from the data when calculating the mean of operating profit.

As table 5.1 shows, the sample firms are on average rather small. Median turnover is only FIM 25 million per year and the median number of employees is a bit over 30. However, our sample also includes big companies, for the turnover of the biggest company was FIM 2.3 billion and employed more than 3 000 persons.

The companies operate in many different fields including manufacturing business like component and contract manufacturing as well as software development. Table 5.2 gives an overview of key figures of the companies by sectors. Companies have been grouped into four categories, namely component providers, electronics contract manufacturing, software and planning systems and others.

As can be seen from table 5.2, there are some notable differences between the groups. First, software and R&D companies are smaller than companies in the other groups. The size difference remains regardless of whether we consider turnover or the number of personnel. Second, return on investment of software and R&D companies clearly exceeds corresponding values in the other groups. However, if we consider operating profit the situation changes. Thus, the good per-

**Table 5.2 Some key figures by sectors, medians and means (in parenthesis)**

	R&D and software (N=24)	Component manufactures (N=22)	Electronic manufacturing services (N=22)	Others (N=15)
Turnover, mill. FIM	4.5 (111)	67 (141)	34 (243)	14 (163)
Employees	13 (105)	93 (216)	80 (312)	19 (127)
Return on investment, %	43 (42)	23 (16)	31 (28)	25 (29)
Operating profit, %*	6.1 (11.2)	7.4 (5.6)	11.3 (11.1)	7.7 (10.8)

\* Two outliers were eliminated from the data when calculating the mean of operating profit.

formance measured by the return on investment is due to a faster velocity of capital, which in turn is probably due to a smaller amount of capital invested.

We will use the survey and interviews when we consider the impacts of Nokia on its partners and subcontractors. The impact includes issues such as company growth, technology development and knowledge acquisition.

# 6

## Impacts and Challenges of Networking

*This chapter concentrates on the effects that customer relationships have on suppliers. Section 6.1 focuses on the role of social capital and exchange of information in customer relationships. Section 6.2 will examine in more detail the impact of customer relationship on operation practises, and Section 6.3 focuses on the outcomes of relationships.*

## **The role of social capital in knowledge acquisition and learning**

We use a microeconomic approach to study social capital. The focus is on the role of social capital in companies' inter-organisational relationships. The traditional economic view only includes capital and labour as factors of production. Despite increased interest toward social and other immaterial factors, these factors have not received much attention in the economics science. However, many recent studies (see e.g. Leana & Van Buren 1999, Yli-Renko 1999), particularly organisation studies, have suggested that social capital, i.e., organisations' inter- and intra-organisational relationships, also plays an important role in the modern production process.

There is no single definition of social capital. Coleman (1990) suggested that social capital is composed of institutional relationships between people. According to Putman (1990), social capital is related to social networks, the norms of society and trust, while Fukuyama (1995) argued that social capital should include the ability of people to work with one another for the common good. Also, Coleman and Putman highlighted that the essential feature of social capital is to work in favour of mutual advantage.

Based on a statistical analysis (see Appendix 3), we have decomposed social capital into three factors, namely social interaction, trust and the quality of information. Social interaction reflects the existence of social relationships between partners, while trust relates to partners' faith in each others' moral integrity and their confidence in mutual goodwill (Ring & Van de Ven 1992, 1994). By the quality of information we mean the correctness of the information and the extent to which information is exchanged between partners in real time. These components will be considered in more detail in the following sub-sections, where we analyse the role of social capital in knowledge

acquisition and learning.

**Technological level has increased**

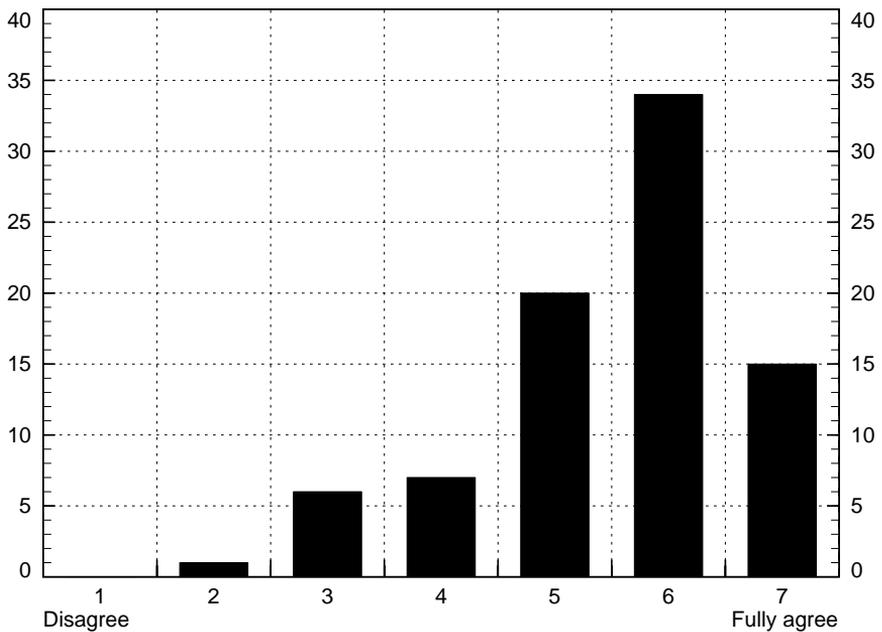
During the past few years, not only co-operation in production but also co-operation in research and development (R&D) has become common. This has had a positive effect on the level of technology of suppliers (figure 6.1).

The key customer relationship has helped many companies develop their technology. In order to understand the channels through which technological know-how is shared, it is necessary to consider co-operation at the practical level.

Usually suppliers and key customers have common teams which meet frequently. These teams work together in order to solve different kinds of problems. Furthermore, some companies lend their employees to their partners. As one director said:

*“In fact, we may soon reach a situation where it is impossible to distin-*

**Figure 6.1 We obtain valuable technical know-how from the key customer relationship (number of answers)**



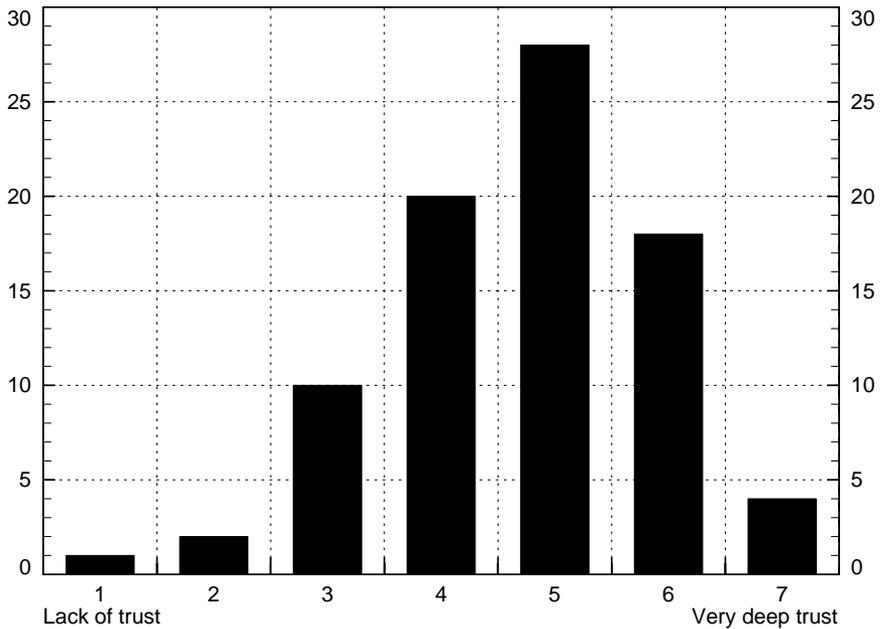
*guish between the two organisations. Instead, the activities of the organisations will become overlapping.”*

This way, the employees of the supplier and customer get to know each other gradually. These personal, social ties between the partners can be referred to as social interaction. In addition to social interaction between customers and suppliers, relationships originating in previous work places or companies have played an important role in molding present business relationships. Several managers of supplier companies have previously worked in the key customer company. Thus, they know the staff in the customer company personally and, furthermore, they are familiar with the operation practises and habits of the customer.

The long-term relationship along with positive common experiences gradually generates trust between the partners. In particular, partnership requires deep trust between the partners, for in these relationships the companies may exchange highly confidential information about, e.g., strategies, future technologies and products. The essential feature of successful co-operation is that partners are able to trust that no information leakages will occur and that their partner has the ability to put into practise the issues agreed upon. Trust is also required in the situation where the client serves not only as a customer, but also as a pilot for new technology. In this kind of a relationship, the supplier may deliver products which are not fully finished. Arrangements like this are one manifestation of early-stage involvement where key suppliers are involved in the very early phase of the production or planning process. Such a practise brings considerable benefits to the companies. First, partners' ability to introduce new models and products frequently to the market may improve when their key suppliers have the possibility to suggest improvements already at a very early phase. Second, suppliers obtain more time to adjust their capacity and technology for future needs.

Our data shows that most of the companies feel that there exists deep trust between the partners (figure 6.2). However, creating trust has required time. Trust may grow with time as both partners obtain positive experiences from the relationship. One manifestation of trust is expressed in lack of heavy detailed contracts, which indi-

**Figure 6.2 Trust in the key customer relationship (number of answers)**



cates contractual governance flexibility. It is often time consuming and costly to modify detailed formal contracts every times conditions change. Moreover, trust decreases fear of opportunism and therefore reduces control costs (Bradach & Eccles 1989).

However, trust is fairly culture-related. Thus, a global company like Nokia needs to adapt to local variations and limitations in partnership development. For example, in Anglo-Saxon countries contracts are usually carefully drafted and enforced by law. By contrast, in Finland there is a long tradition of informal co-operation between companies, which has had an important effect on the development of, e.g., telecommunications technology. Informal agreements have been almost as significant as formal contracts indicating deep personal trust between partners. However, globalisation has necessitated for more formal contractual habits also in domestic agreements, though it seems that there is still plenty of room for flexible interpretation.

Especially in the ICT industry, also the quality of information plays an important role in technology development. Information about

changes in market requirements and environment has to be circulated quickly throughout the entire chain. During the past few years, the role of information has been emphasised more when outsourcing and networking have become more common. Supply chains have become longer including different organisations in different companies. Hence, communication is more complex than within one organisation. In response to the increased need to exchange information in real time, suppliers as well as their customers have developed and invested in IT (information technology) systems. As one director put it:

*“Internet, Intranet and Extranet, they are all extremely important in transferring information in real time.”*

### **Improvement in customer service and customer relationship as an information channel**

In addition to technical know-how, social capital also facilitates other kind of knowledge acquisition. Our interviews confirmed our preconception that suppliers often obtain latest market information through their key customer relationship. Hence, not only do suppliers get information of the needs of the customer, they also become more aware of the views of other potential customers and also of the competitors in the supplier market.

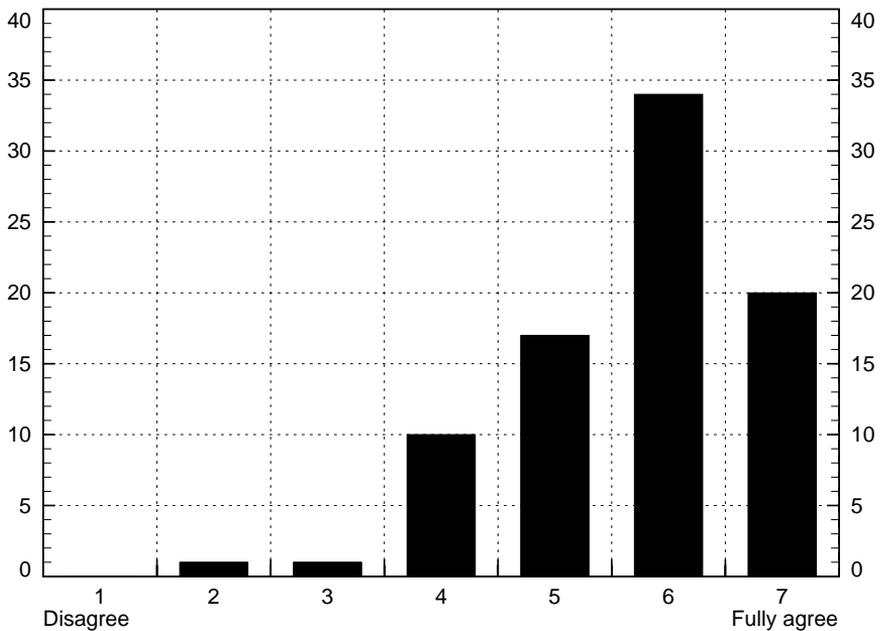
Consequently, social relationships constitute an efficient information channel between partners. Obtaining real-time information about the market and competitors is very important particularly to small and medium-size companies whose possibilities to get such information via other channels are limited.

Trust between the supplier and key customers affects knowledge acquisition by improving the efficiency of knowledge transfer. Deep trust between the partners facilitates the exchange of confidential information which may, in turn, lead to an interactive relationship where both partners will learn.

As the supplier learns from customers' needs and their ways and business practises, the partner firm may improve its own services and processes (figure 6.3).

Through close co-operation with a big company, a number of small and medium-sized companies have obtained valuable experience

**Figure 6.3 Our customer service has improved through the experiences from the key customer relationship (number of answers)**



of operation practises of large companies. For instance, one important lesson learned from large companies is contracting, for big companies are used to making rather detailed contracts with their partners. This experience helps suppliers to improve their own governance of contracts also with other partners. The importance of contracts is highlighted particularly in the situation where a company is starting its internationalisation.

Our analysis strongly suggests that social capital, i.e., personal relationships, the quality of information and trust, has contributed to the acquisition of knowledge (appendix 4). Our results confirm earlier observations that social interaction plays an important role in learning (Yli-Renko 1999). Moreover, earlier claims that the co-operation in production networks requires trust and an undistorted exchange of information (e.g., Ranta 1999) is supported by our results.

According to the interviews, one of the most important aspects of partnership is that there is a direct discourse contacts through out

the whole organisation covering not only the top management, but that also employees at each level discuss with the equivalent level in a partner organisation. Personal relationships, trust as well as information exchange have helped in reciprocal learning from partnership.

## **Strategies and operation practises have changed**

### ***The ability to react to changes has improved***

The fast growth of customer companies along with the rapid development of technology and shorter lifecycles of products, has led to a time-based competition which, in turn, has also reflected on the operations of suppliers.

Customers' requirements have forced suppliers to shorten their delivery times. Due to efficiency improvement programmes, the lead times of production have shortened drastically. Hence instead of weeks, delivery times are now measured in days or hours. This makes it possible to react rapidly to changes in demand without big inventories. Furthermore, a great number of companies have changed their daily operation time from working in one shift work to working in many shifts.

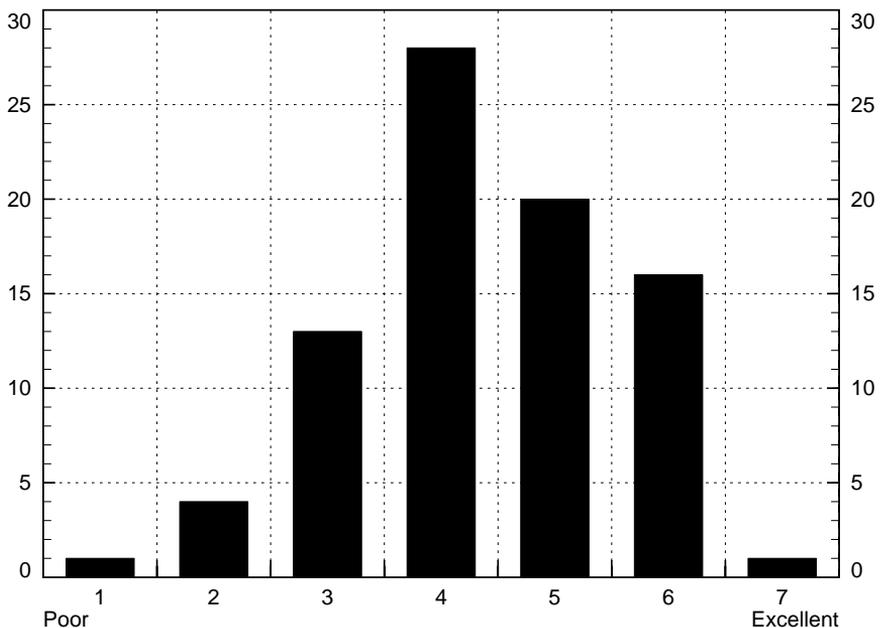
However, particularly in component manufacturing and EMS (Electronics Manufacturing Services) business, the need for readjustment not only means an increase in capacity but also enhanced ability to operate in the environment where the demand for their products or services goes frequently up and down. This creates a great challenge for companies for instance in terms of personnel and the utilisation rate of capacity. A number of companies use students as a labour reserve. When demand goes up, the company is able to increase its personnel by hiring students part-time. On the other hand, when demand decreases and the company no longer needs extra employees, it will only use only its permanent personnel.

For some companies, fluctuations in capacity cause an increase in inventories, which, in turn, increases the amount of money bound in inventories. Sometimes the reason for capacity fluctuations is more in management or in the organisations rather than in the rapidly changing environment. Thus, the fluctuations are due to a lack in the exchange of information (figure 6.4). For example, the supplier does

not receive the information that customer's inventories are filling up, or the demand for the final product is less what had been estimated. As a consequence, the supplier is not able to adjust its operations gradually, but it has to cut down production process suddenly.

Despite the fact that information systems have been improved, there is still work to be done in order to improve the exchange of information through out the entire supply chain. Because many suppliers operate according to forecasts made by their key customer, it is important that all partners and subcontractors obtain updated information about demand and updated forecasts. If the forecasts do not materialise, inventories of suppliers may fill up or the utilisation rate of capacity may stay below what had been estimated. Hence, distortions or delays in the flow of information is a potential source of instability that may amplify the effects of small fluctuations in demand (see Forrester 1958 and Ranta et. al. 1999). Therefore, it is important to update forecasts frequently and make sure that every company in the entire supply chain has the same information.

**Figure 6.4 Real-time information obtained from the key customer (number of answers)**



In sum, until now most of the work done in order to improve the operation of supply chain has focused on optimising material flows. As a consequence, flexibility and the ability to react to fluctuations has improved. However, in the post-industrial economy, knowledge, rather than capital or labour, plays a central role. Particularly, in a sector where the speed of technological development is rapid, such as in the ICT industry, knowledge is the most important factor behind the success of companies. Thus, in addition to material flows, companies should optimise their information flows through the entire supply chain. In the future, Internet-based information systems may help to improve the transparency of the entire supply chain, so that all parties in the chain see the current situation all the time. However, face-to-face contacts are still needed.

### ***Taking advantage of information technology***

As described earlier, the significance of the exchange of information becomes pronounced when supply chains become longer and incorporate more and more companies. Close co-operation with the key customer has pushed suppliers to develop and modernise electronic information systems. Electronic communication systems are already the main tool to exchange of operational data between key customers and suppliers. Furthermore, some companies have built production management systems that are integrated into the systems of the key customers.

It seems that the efficient use of information technology is a competitive advantage for many companies operating in the network of Nokia. These systems serve as an excellent channel in the exchange real-time information through the supply chain. Without well-functioning information systems, it would be difficult to manage a complex network with ever shorter life-cycles of products. Furthermore, the importance of information systems will increase in the future.

The ongoing project is to develop an electronic marketplace or an Internet-based network system. This electronic commerce (e-commerce) system would, at least to some extent, replace the existing point-to-point connections between any two companies. Hence, the system would bring together suppliers, customers, logistics service providers

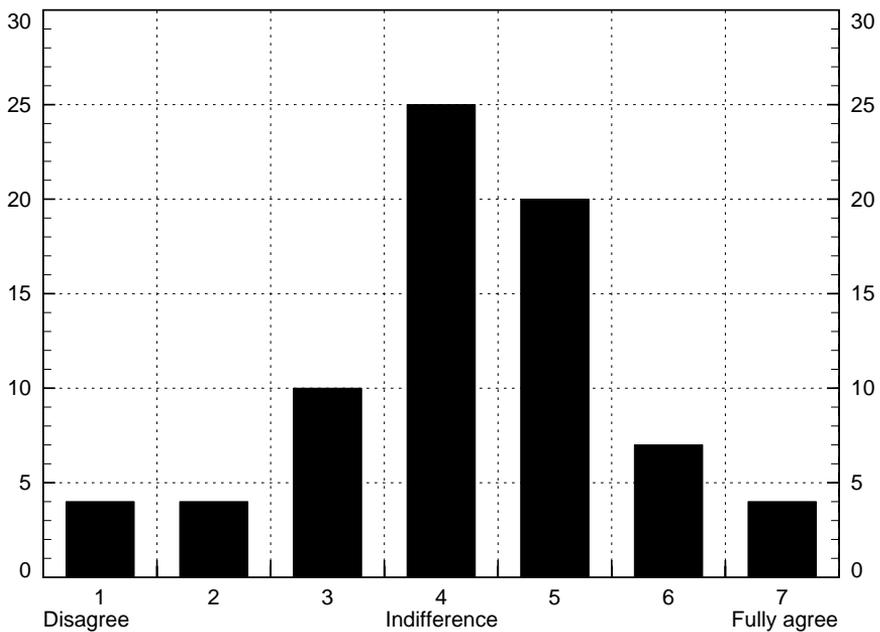
and other relevant actors. The system like this may benefit the companies by enhancing communication between them and by reducing the costs of information systems (e.g. compared to EDI technology).

Figure 6.5 shows how suppliers see the impact of e-commerce on their position.

There are two alternative ways to interpret the figure. First, companies do not have a clear view about the impact of e-commerce. Second, a small majority of the companies sees that their competitive position will improve slightly with electronic commerce.

Hence, in the latter case, quite many companies see that going over to e-business may improve their position in the market. Furthermore, as much as 60 per cent of the companies announced that moving toward e-business does not require heavy investment, while only one in four companies reported a need of major investments. Consequently, it seems that the companies have a rather good readiness to operate in electronic marketplaces.

**Figure 6.5 If our customer uses more electronic business in sourcing, it will improve our position in relation to our competitors (number of answers)**



However, some companies reported that e-commerce may also have drawbacks. Disadvantages may occur if electronic commerce leads to open auctions in branches where they are not suitable. E-commerce with open auctions suits well with acquiring standard components or products, but goods and services which require customisation with deep and long-term co-operation are not so suitable for open auctions. It is feared that open auctions will lead to a practice where price will become more important decision factor in decision-making than knowledge accumulation and trust. This would endanger long-term partnerships because suppliers would no longer have the incentive to make customer-specific investment and to develop their operations with the partner because co-operation would perpetually be subject to price bidding.

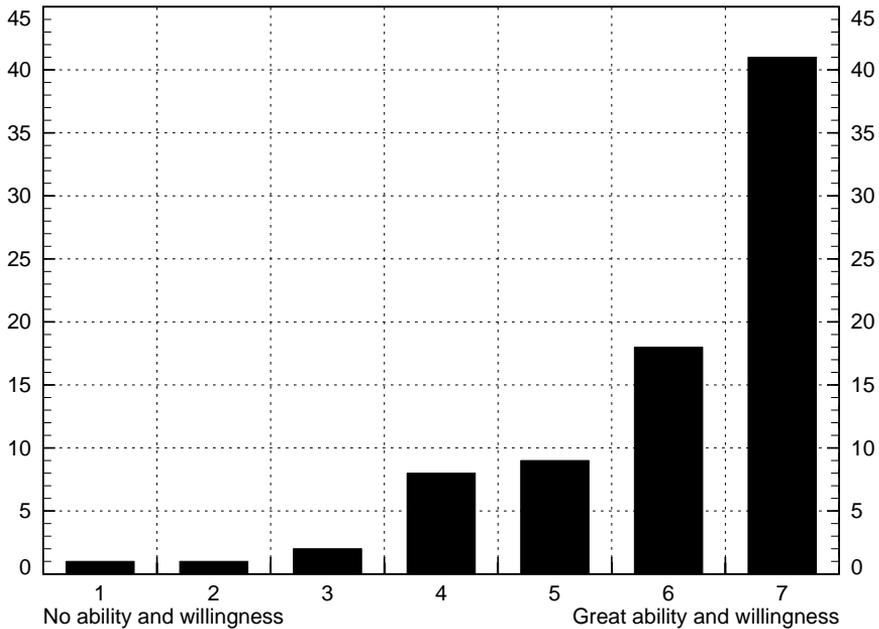
### ***Internationalisation***

Nokia's global operations have also had a bearing on the operations of its suppliers. Many supplier companies have started or increased their international operations including foreign trade and production abroad.

Increased foreign sales not only include direct exports to Nokia's foreign units, but also foreign production, for many small and medium-sized companies have started more demanding international operations in the wake of Nokia. Hence, not only sales and marketing units have been established abroad, but also a number of production plants have been established all over the world. Operations have not been constrained in Europe but they also include Asia and America. Furthermore, the group of companies that has internationalised on the heels of Nokia is becoming ever larger. In addition to Nokia's direct subcontractors and partners, also second-tier suppliers have started to expand their operations globally. Hence, Nokia's partners are building their own network abroad by using, to some extent, the same partners than they use domestically.

Despite the fact that a number of partners already operate internationally, there are many companies with only limited experience in international operations. Naturally, smaller companies often operate more locally than larger ones. However, almost all companies in our data (figure 6.6) reported that they are able to start deliveries or ex-

**Figure 6.6** The ability and willingness to expand international operations (number of answers)



pand their deliveries abroad if their customers so require. Hence, the key customer has a possibility to use, at least to some extent, the same supplier network abroad as they do in their domestic operations.

In sum, as a truly global actor Nokia has contributed, both directly and indirectly, to the internationalisation of a number of Finnish companies. Instead of the fact that Nokia uses both local and global partners, it seems that in the future, it is more interested in suppliers capable of global operations. These suppliers operate in several continents and their plants are located in logistically suitable places. The tendency toward global suppliers first occurred in EMS business and in component manufacturing but it will also probably take place in software development. Moving toward global partnerships adds pressures for small and medium-sized companies because their capability to operate globally is limited. Thus, the challenge of these companies is to grow rapidly and internationalise their operations. We will come back to this issue in the next section.

**Box 6.1 Case Eimo\***

Eimo is a Finnish company which produces technically demanding precision moldings. In 1999, company's net sales were as much as EUR 78 million, while 5 years earlier the corresponding figure had been EUR 19 million. The focus of the company has changed with time. Hence, while in early years the company manufactured plastic buttons, now mobile communications accounts for more than 90 per cent of its turnover.

Eimo's strategic goal is to be a key and strategic supplier to its customers. Hence, the company aims to carry overall responsibility starting with prototypes and ending with the production molds required in mass production. Product and production planning are carried out together with customers by utilising both companies' special know-how. The operation mode is based on long-term agreements, trust and open communication between the partners.

Close co-operation has required customer specific investment in logistics and communication systems, which connect the supplier and the customer tightly together. If conflicts appear, agreements are interpreted in a way that does not endanger co-operation.

Particularly in the telecommunications market, the only way to obtain big customers with large orders is to offer long-term agreements. The ability to react rapidly to changes is an important factor of success. Therefore customers seek suppliers with delivery reliability, quality systems, solidity and special know-how. In many cases, the price of deliveries is not defined before the planning phase has ended and real costs are known.

Close co-operation has pushed Eimo to expand its operations geographically. In 1999, the company established a factory in the Netherlands, and in 2000, Eimo has expanded its operations to United States and China. Key customers wish that their key suppliers follow them abroad. By using familiar suppliers, customers can avoid the costs caused by the search and auditing of new suppliers.

The decision to choose a partner is important for both to the customer and the supplier. Specialisation makes them interdependent. Therefore success depends heavily on the partners chosen. On the one hand, demanding partners help Eimo to develop itself, and on the other hand, these improvements strengthen Eimo's credibility and position in the network.

\* The case has been published earlier in Ollus et. al. (1998), in Finnish.

## Outcomes of relationships

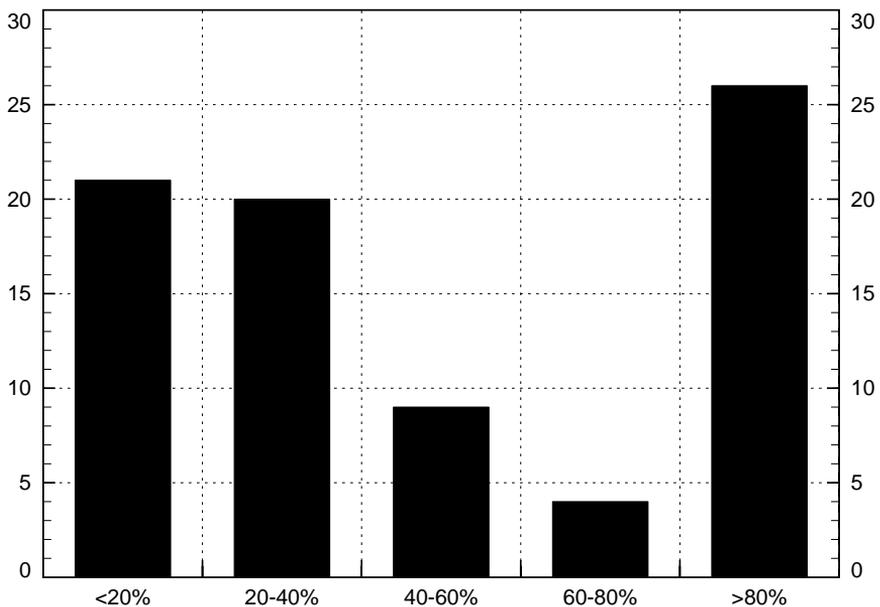
### Many companies have grown rapidly

In the long run, knowledge accumulation and changes in operation practises should at least somehow reflect in the outcomes of the companies. The most visible part of the effects is that companies grow fast. In the heels of Nokia, a number of its partners and subcontractors have indeed grown rapidly (figure 6.7). Turnover has risen and they have also increased capacity and personnel.

Figure 6.8 shows that the growth rates of the companies have been very rapid. In terms of net sales, as much as three out of four companies have grown faster than 20 per cent a year. Furthermore, there are many companies whose growth rate has been clearly faster exceeding 80 per cent. Most of these companies are rather small but there are also some bigger ones.

For many small and medium-sized companies, this growth is the

**Figure 6.7 The growth rate of the companies (number of companies by growth group), 1996-1998**



most important goal. There are several reasons for this. First, key customers in the telecommunications industry, often grow very rapidly and require that their suppliers are able to grow with them. Second, in order to get a key-supplier status, the companies have to be large enough. There seems to be a tendency that customers are decreasing the number of direct suppliers.

Thus, customers would like to reorganise their network by selecting key suppliers which, in turn, build their own sub-network. The driving force behind this development is a willingness to decrease the number of direct contacts. Managing relationships with a large number of suppliers is very time-consuming and takes a lot of effort. Due to re-organisation, a part of suppliers will become a part of the key supplier's network, instead of having a direct contact to the key customer. Thus, they lose direct contact to with key customer. Third, companies try to grow large enough in order to achieve some critical mass. Size often brings scale benefits and may also improve credibility.

### **Key customer has helped to obtain new customers**

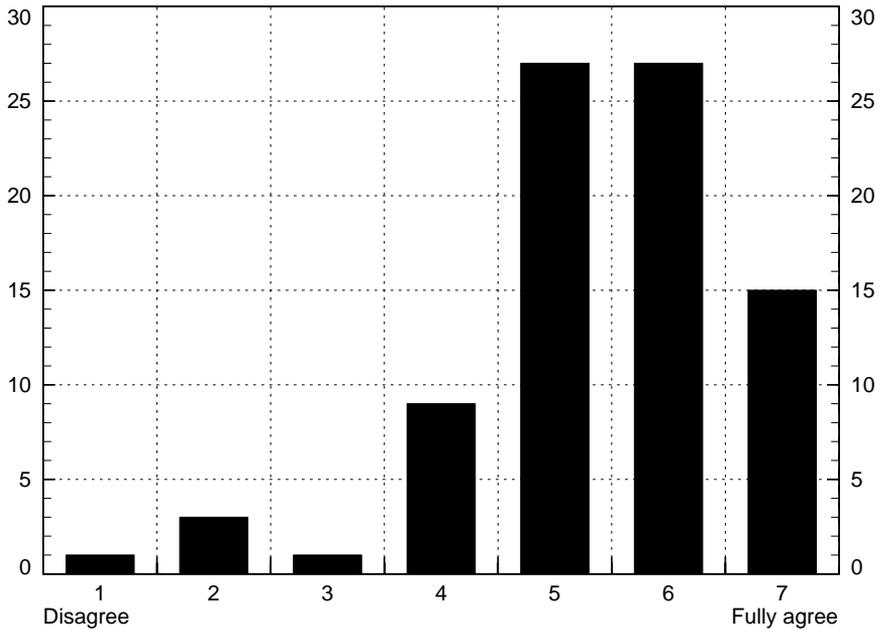
In addition to growing with the key customer, the key customer has often affected on supplier's growth via an indirect way.

Figure 6.8 shows that key customer relationships have contributed to a widening of suppliers' customer base. Most of the companies have obtained new customers through their key customer. For some companies the reference list has served as a quality certificate, while some companies report that their customer base has widened as the key customer has recommended them to other suppliers. In these cases, the customer's motive may be that the entire supply chain would work better if components and systems were identical. As one manager said:

*"Nokia has recommended our software to their other subcontractors and partners in order to avoid conversions in data transfer. This way, we have got new customers".*

The key customer relationship has also improved firms' ability to understand market requirements better. Moreover, with modern electronic communication systems, audited quality systems and greater flexibility companies can also improve their services to other custom-

**Figure 6.8 The key customer relationship has helped us to obtain new customers (number of answers)**

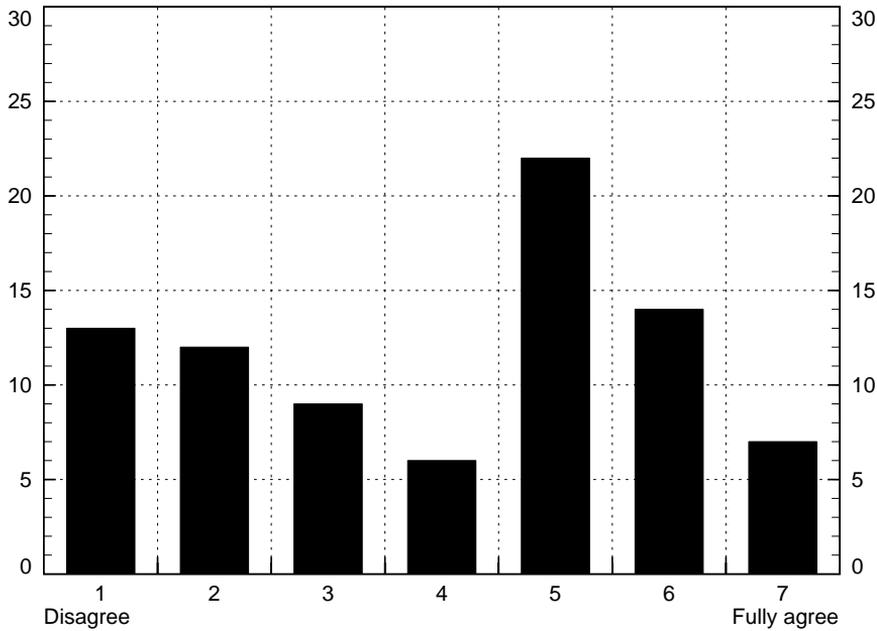


ers. Improved services have also helped companies expand their customer base.

It is noteworthy, that the customer reference has been valid also in other industries, which means decreasing industry dependence. However, dependence has not only decreased, for in some cases suppliers have renounced other sales possibilities (figure 6.9).

The companies were posed the following statement: We have discarded other sales possibilities in order to fulfil the needs of our key customer? A 7-step scale was used indicating whether the company disagrees (values 1-3) or agrees (values 5-7) with the agreement. As shown in figure 6.9, a number of companies have neglected other sales possibilities.

**Figure 6.9** In order to fulfil the needs of the key customer, we have cut down other sales possibilities (number of answers)



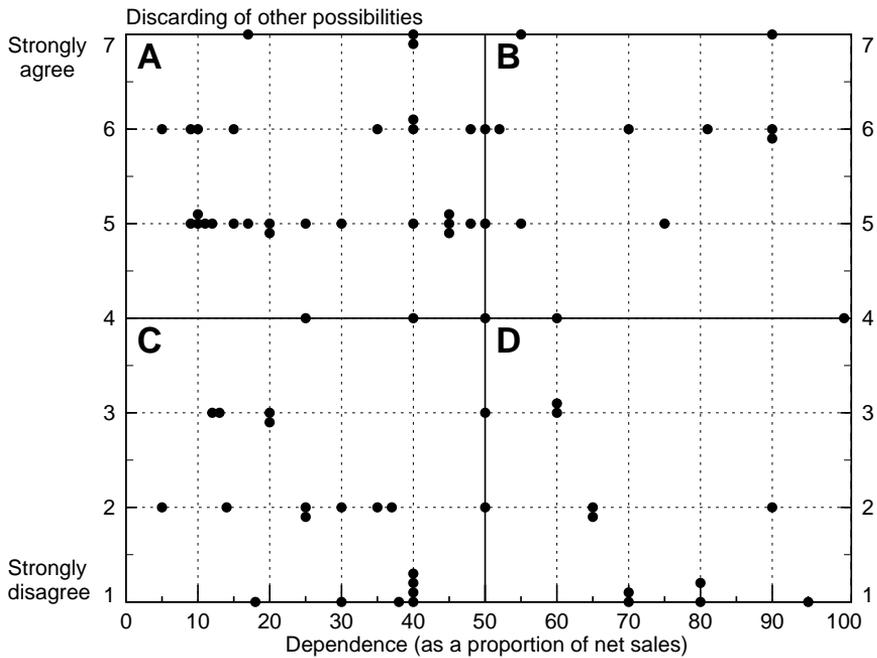
The next step is to analyse the effects of discarding other sales possibilities on dependence (figure 6.10).

The vertical axis describes to what extent the company has discarded other sales possibilities in order to fulfil the needs of its key customer. The horizontal axis describes the dependence on a single customer (as a proportion of net sales).

### **Type A company**

Type A companies are characterised by a focused customer strategy without high dependence on a single customer. The company has faced an over-demand situation in which it has increased its sales to its key customer despite there having been other potential customers. However, dependence has remained relatively low.

**Figure 6.10 Discarding sales possibilities and dependence (N=73)**



**Type B company**

Type B companies are characterised by an aggressive growth strategy. These companies have chosen a growth strategy based on the success of a single customer. Hence, like type A companies, also companies belonging to this group have faced an over-demand situation. Regardless of their high dependence, these companies have sold their products to their key customer rather than to other companies.

**Type C company**

In group C, companies have not increased sales to their key customer at the cost of decreased sales to other customers. There are two alternative explanations for this. First, the company has had enough capacity relative to demand. Consequently, it has not faced a situation where it would have had to choose whom to sell its products. Second, rather than increase sales to its key customer, the company has sold its

products to other customers. In both cases, dependence on a single customer has not become high.

### **Type D company**

Companies in this group are very dependent on their key customers. The latter is very important for the company because otherwise sales would be much lower. Roughly speaking, the key customer has been company's only possibility to reach its current size.

In sum, there are many companies which lack production capacity and therefore they have had to choose whom to sell their products. This observation can be linked to the discussion on the lack of components in the telecommunications industry. While a number of ICT companies have suffered a shortage of components, it seems that Nokia has not faced equal difficulties in its sourcing. A potential reason for this is that suppliers are more satisfied with their co-operation with Nokia than with other customers. As many suppliers have an possibility to choose whom to deliver their products, they select a customer that provides an opportunity for common benefits.

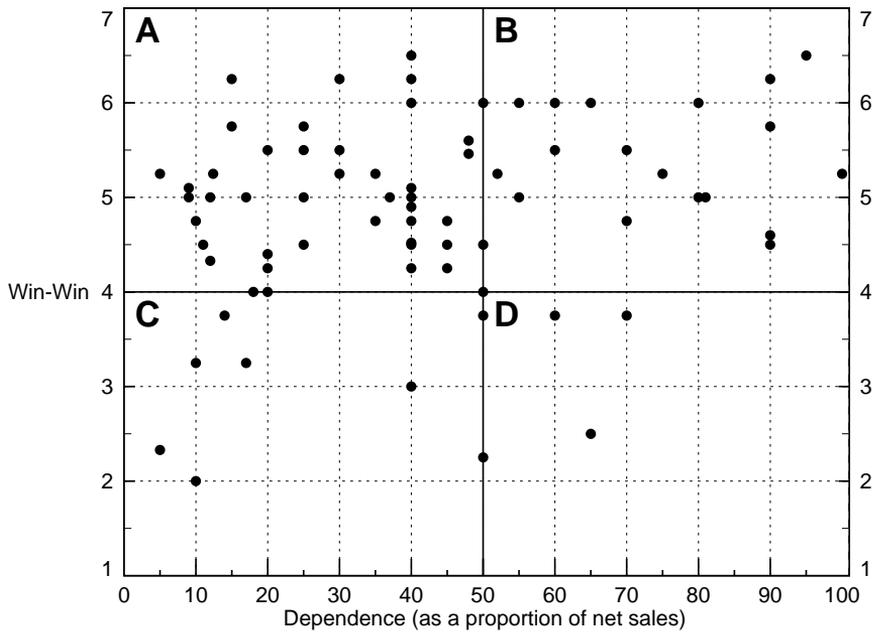
### ***Risk and profit sharing in a relationship***

We continue by considering the most important aspects of any business relationship namely risks and rewards. First, we will study risk and common benefits of the key customer relationship from the supplier's point of view. Then, we continue with a discussion of the fruits of R&D co-operation and how to share them between the partners.

The figure below describes risks (dependence) and rewards (win-win) in the key customer relationship. It should be noted that our data does not only cover Nokia's first-tier network, but also a wider perspective of the whole network. Moreover, groups groups A through D do not necessarily consist of the same companies as the groups in figure 6.10).

Figure 6.11 describes risk and reward in the key-customer relationship. The vertical axis of the figure describes common benefits (win-win) and the horizontal axis shows dependence (as a proportion of net sales) on the key customer.

**Figure 6.11 Mutual benefits and dependence**



Common benefits of the relationship have been measured by a variable describing the win-win aspect of the relationship (see appendix 5). Thus, the win-win variable measures the supplier’s perception of the quality of the relationship. The interpretation of the scale is the following: the bigger the better. If the value is above four, the company views the relationship as a true partnership with reciprocal benefits. If the value is below four, the company feels that the relationship is not a partnership type and the companies do not share profits and goals.

**Type A relationship**

Type A relationship characterises the fact that the relationship yields benefits to both partners. However, the company is not too dependent on one customer. Consequently, the relationship yields benefits but it does not inflict high dependence or risk for the company.

**Type B relationship**

In a type B relationship, the benefits remain reciprocal. In contrast to a type A relationship, the company is highly dependent on its key customer. A large share of net sales comes from one customer which means a high risk to the company. As a temporary solution, type B relationship may be a good strategy for young companies or companies who try to grow rapidly. The company increases sales to one customer in order to grow fast and obtain a critical mass. However, in the long run, the key challenge for companies belonging to this group is to widen their customer base.

**Type C relationship**

Type C relationship is a traditional business relationship without true partnership. Companies do not share their goals or profits. Instead of aiming for common benefits, buyer and seller companies pursue their own interests. On the other hand, this relationship does not typically represent a substantial share of the supplier's turnover.

**Type D relationship**

This type of a relationship includes high risk with rather low benefits. Thus, the company's strategy should be either to decrease dependence or to change the relationship in order to obtain more benefits from it. An example of a company operating in a type D relationship is a firm which has a standard product but only one big customer.

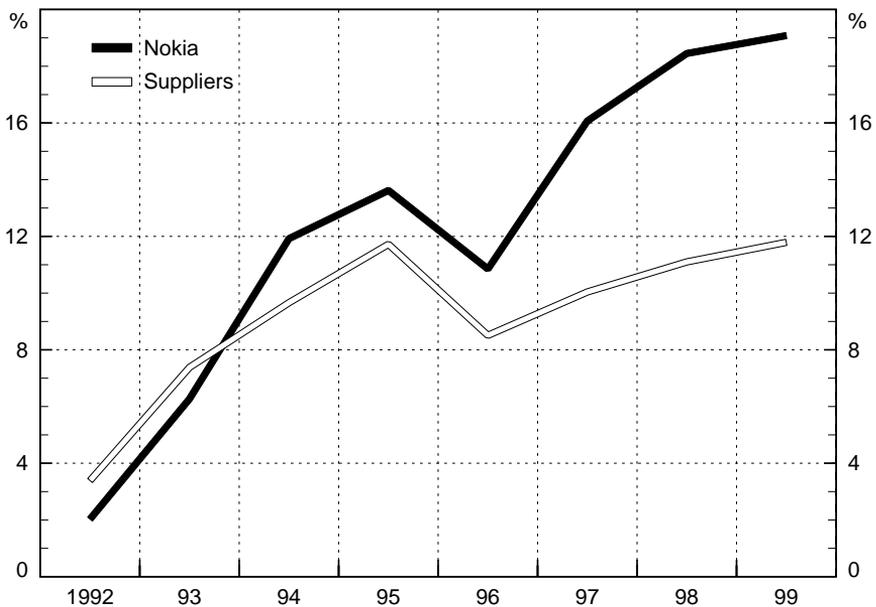
Most of the companies in our data feel that their relationship with their key customers is of the win-win type. In other words, the relationship is a true partnership with the partners sharing their goals and benefits (see also figure 6.12). Partners are not only looking out for their own interests, but also offering their partners a possibility of making money even at a slight cost to themselves. Only a few companies report their dissatisfaction with their key customers.

As shown in figure 6.11, a majority of the companies in our data belongs to group A. Hence, the relationship is a true partnership with reasonable risk. The second largest group is type of B. At least in the long run, these companies should focus on widening their customer base. An interesting result was that in terms of win-win there were not

big differences between different type of suppliers.<sup>16)</sup> Statistical tests showed that the only significant difference was between software companies and EMS companies. Software companies' key customer relationship was more win-win type than in EMS companies. However, the difference was only weakly significant indicating that also the EMS group included many companies with win-win relationships.

In addition to the dependence in terms of net sales, another risk element is composed of customer-specific investments. At least in the short run, this customer-specific capacity can hardly be used with other customers. Of the companies whose dependence on one customer is at least 50 per cent (groups B and D) more than four out of five have made big customer specific investments, while of companies with

**Figure 6.12 Comparison of operating income-% between Nokia and its suppliers (N=15)\***



\* The data covers 15 of Nokia's largest Finnish supplier companies (component manufacturers and EMS companies). The list of the largest suppliers is based on our questionnaire.

<sup>16)</sup> As described in Chapter 5, our data can be divided into four groups, namely 1) software and R&D companies, 2) component manufacturers, 3) electronic manufacturing service companies and 4) others.

smaller dependence only one out of two has made such investments. Companies were also asked for their outlook on the development of their dependence during the next three years. Interestingly, one-half of the companies with high dependence are going to decrease their dependence. Hence, there is a small group of companies with a very high risk profile.

The win-win aspect in co-operation can also be described in absolute terms by comparing the financial performance of the key customer and its suppliers (figure 6.12).

Nokia's profitability and suppliers' profitability have developed hand in hand (figure 6.12). In the latter part of 1990s, Nokia's financial performance has increasingly exceeded that of its suppliers but the overall trend has been similar in both. One reason to the improved performance of Nokia from 1996 to 1997 can be found from structural change. After 1996, Nokia not operated in the TV and cable industry anymore.

### ***Intellectual property rights (IPR)***

One of the central issues in R&D co-operation is intellectual property rights (IPRs), namely as patents, trade marks and copyright. IPRs help companies protect their immaterial property. The critical question is, who will obtain IPRs.

When companies or organisations develop some technology together, they have to reach an agreement on the owner of the results. Naturally, all partners have an interest in obtaining the IPRs because they will make it possible to use the results of co-operation in a wider sense. Thus, IPRs play an important role in future development possibilities. Without IPRs the company does not have the possibility to fully utilise the results of co-operation by selling the product or technology to other customers. The supplier would be tied to its partner with no possibility of operating independently in the market with the technology developed.

As one director said: *“IPRs are a fundamental part of business because the value of the company is usually connected to IPRs.”*

Based on interviews it seems that IPRs are an issue which needs clarifying. Particularly, suppliers with heavy investment in R&D, such

as software companies and some component manufacturers, are keen to obtain IPRs. Having the rights, company can sell the results of development also to other customers.

In the survey, firms were asked how new technology is developed in their organisation, i.e. to what extent the client is involved in the design of new technology. According to the results, suppliers develop their technology independently (66% of the firms indicating scale values 5-7) nearly as often as they do it together with their clients (70%). But, equally frequently suppliers design products using their own technologies and expertise to comply with a customer-specified need ('black box') (68%). In this sample, ordered goods represent the least frequent but still important case in outsourcing (51%).

The data do not indicate any clear pattern in the suppliers' participation in the design of technology and development. In all, it seems that even in co-operative relationships technology is developed both alone and in co-operation. The nature of the product that is produced under subcontracting seems to be one factor that defines the operational model. For instance, assembly service providers usually design the production process independently of the client. Parts and components as well as software solutions, in turn, may vary from ordered products to joint-developed or self-designed solutions depending on the customer's needs.

Thus, close co-operation in the development of technology does not exclude firms' own development activities. Firms invest independently in R&D that allows them to increase their technological distinctiveness, product variety and independence of clients. Also, firms aim at conceptualisation of customised solutions and innovations in order to bring down unit costs.

Even though many OEMs (Original Equipment Manufacturer) have started to rely increasingly on their partners' expertise and capacity during the 1990s, the development process of the novel mode of networking is still in progress. There are still plenty of opportunities to be elaborated. For example, the data implies that the suppliers would be willing to expand further the customer relationship. Most of the companies (75%) are ready to increase R&D co-operation with their customer.



7

## Summary and Discussion

## **Firm dynamics behind the development of the ICT cluster**

The 1990s witnessed the rise of an internationally competitive ICT cluster in Finland. Even though a number of driving forces behind its development can be distinguished, the strong ICT sector is largely the outcome of mutually enforcing, dynamic cluster relations, which have intensified during the 1990s.

The Finnish telecommunications sector has been evolving for over a hundred years. The first telephones companies, established in the 1880s, were equipped by foreign manufacturers until the gradual emergence of the domestic telecommunications equipment industry, since the 1960s. Intense co-operation between the operators, the industry, and the research sector was vital in sharing and accumulating knowledge in radio and digital technologies.

The public sector had a central role as a demanding customer for the emerging industry. Particularly, the Nordic telecommunications administrations agreed upon the creation of a common analogue mobile network (NMT), launched in the early 1980s. Involvement of the industry in the development of the technical specifications gave the Nordic manufacturers a head start in the opening global market.

The shift to the third generation of communications technology, enabling wireless connection with the Internet, will shift the focus of industrial activities on content provision. In Finland, the advanced ICT cluster, together with the newly emerged venture-capital market, provides good preconditions for the development of the digital content industry.

## **A big company in a small country**

Nokia has had an increasing impact on the Finnish economy during the 1990s. The company has become global with operations in more than 100 countries. However, also exports from Finland have increased considerably, and we estimate that in 2000 Nokia accounts for as much as 30 per cent of Finland's total exports. Furthermore, its share of the total Finnish GDP is more than 4.5 per cent and of business sector R&D 35-40 per cent (Ali-Yrkkö et. al., 2000).

Many firms in the Finnish ICT cluster co-operate with Nokia. Hence, in addition to having 25,000 employees in Finland (in June 2000), Nokia's impact on overall employment is clearly larger. The company has contributed to employment in many small and medium-sized enterprises. We have estimated that in 1998, Nokia employed more than 14,000 employees in its Finnish first-tier subcontractor and partner companies. This does not account for the total employment of these companies, but only those employees who are working with products which are delivered to Nokia. In the year 2000, the corresponding number of people is roughly 18,000-20,000. However, because the network is composed of several tiers and there is a substantial impact on other industries (e.g., transportation, construction, etc.), Nokia's total effect on the national economy is difficult to quantify accurately.

### **The motives and modes of networking has been changed**

Nokia, among other leading telecommunications companies, has formed hundreds or thousands of alliances with other companies, universities and research institutes. High growth, capacity constraints, shortened product life cycles and uncertainty about future technology and applications motivate companies to form different kinds of alliances.

The palette of possible alliances includes horizontal alliances between buyers and suppliers, vertical alliances between competitors, and diagonal alliances between companies in different industries. Hence, the field is too large to cover in one study. Our focus was on vertical alliances because their effects on economic development can be measured more accurately than those of the other forms of alliances.

### ***From renting hands to strategic partnerships***

Purchasing and sourcing were for a long time considered only as the management of companies' inputs into the organisation (Burt & Soukup 1985). These commodities had to conform pre-set quality levels and delivery times at the cheapest price. Today, purchasing and sourcing are often seen as a strategic function of firms' strategic planning proc-

esses.

The motive for networking has changed over time. The traditional motive for co-operation between companies was the need to acquire more capacity during periods of strong economic growth without the need for own investments. Still in the 1980s, supply co-operation with other companies was mostly subcontracting without longer-term contracts and aims, hence the main purpose of co-operation was to stabilise fluctuations in capacity. Nowadays, there are also other important motives for co-operation.

In the 1990s, the core competence paradigm was adapted also in supply-chains. Operations outside the key competence area were outsourced. Particularly in the ICT sector, the high growth rate with rapidly changing technology pushed companies to consider whether they should 'make or buy'. Hence, purchasing and sourcing have become a strategic issue. Nokia too started to search for long-term suppliers. When co-operation was seen as a permanent operation mode, it was deepened and it also spread to other manufacturing sectors. Thanks to increased co-operation, a part of Nokia's resources were freed for other purposes.

During the latter half of the 1990s, co-operation gained new features. A driving force behind the changes was the fast growth and development of the ICT industry. Furthermore, new models of mobile phones with many variations were launched more frequently and the importance of a global logistics chain was emphasised. As a consequence, Nokia re-organised its manufacturing suppliers into sub-networks. Thus, some suppliers started to deliver their products to Nokia's first-tier suppliers instead of to Nokia itself. This led to a decreased number of direct manufacturing suppliers. Furthermore, Nokia used more services provided by EMS (Electronics Manufacturing Services) companies than it had before by outsourcing the entire supply chain of some models of mobile phones. Hence, in some cases, an EMS company took over the responsibility for the whole chain, i.e., it would buy components, manufacture the product and then deliver it to the distributor. At no time does the product go to any of Nokia's own units. The telecommunications industry has followed the same path as the PC-industry where Dell has been a pioneer in networking. As in the PC-industry, in the telecommunications industry,

too, EMS companies operate in several supply chains and also serve competitors.

The high speed of technological development and shortened life cycles of products push companies to invest in R&D. In addition to its own investment in R&D, Nokia acquires technology and knowledge from outside the company. By co-operating with innovative companies and institutions Nokia obtains access to their knowledge and capacity. Consequently, during the past few years, Nokia has also used R&D subcontractors and partners.

It seems that R&D co-operation will change, too. Today, it bears more likeness to subcontracting rather than to true partnership. In the future, partners will take more responsibility for developing the products onward. Hence, the partner should have the capability of developing the product or technology fairly independently. Increasing responsibility means that invoicing is based more on the results than on time. This will probably change also risk and reward-sharing between the partners.

In sum, traditional supplier-buyer relationships have changed drastically during the past fifteen years. Starting from capacity sourcing, Nokia has been advanced toward strategic partnerships. These long-term relationships with knowledge sharing and learning have become common particularly in fast-changing industries. By networking, companies have got access to the resources of other companies. The tendency toward long-term agreements indicates that creating co-operative relationships is a time consuming and also expensive process, which is why companies try to avoid short-term co-operation. With the help of increased co-operation, companies have good possibilities to improve or retain their flexibility. If circumstances change, they have better ability to change the course than those companies which do everything themselves (see also Lorenzoni & Baden-Fuller 1995).

## **Networking as a competitive advantage**

As described earlier, the role of an efficient supply chain is emphasised in industries with time-based competition. Short product life cycles, delivery times, rapid technological development and large product variety create a great challenge to companies. The management of

an efficient supply chain has required distinguishing product and production technology life cycles from one another. Networking has been the answer to these challenges and requirements.

### **Mutual benefits have been achieved**

Our examination suggests that achieving mutual benefits from co-operation has not only been liturgy but also reality in the Finnish ICT cluster. A majority of suppliers is of the opinion that co-operation has created benefits to both parties. Moreover, the financial performance of Nokia and of its major Finnish suppliers have developed hand in hand. In terms of profit sharing, relationships in the Finnish ICT industry are similar to those in the European car industry. The profits of customers and suppliers move together and in the same direction, whilst the profit levels are dissimilar (Hines 1994).

Mutual benefits can not be achieved without partnership thinking by all parties. Hence, the focus must be on overall optimisation – not benefits to one party achieved at a cost to another, i.e., the objective of reducing costs does not mean reducing the partners' profit margins.

The growth of the key customer has significantly contributed to the growth of suppliers. Many small companies have become medium sized, and medium-sized companies have become large ones. The significance of the growth effect becomes emphasised in small countries like Finland. Due to a small domestic market, companies have to search for growth from abroad. In this respect, close co-operation with a big company has been very important because the co-operation has provided many small and medium-sized suppliers an indirect access to the global market. As of late, many suppliers have started more demanding international operations in the wake of their big key customer. Suppliers have established production units near the plants of their customer. The international operation mode together with the bigger company size has helped many suppliers expand their customer base. Moreover, co-operation with a well-known company has served as a good reference. In sum, a number of companies have grown with their key customer, but as they have grown they have also obtained new customers that, in turn, have diminished their dependence on a single

customer.

In addition to company growth and financial performance, another important effect of networking has been learning and knowledge accumulation. Close co-operation with joint development work requires a frequent exchange of information between the partners. Hence, the key customer relationship has served as an important information channel. It does not only mean a transfer of knowledge from customers to suppliers, but also vice versa. Therefore, knowledge accumulation has been reciprocal. If one party lacks some technical know-how, other parties can transfer that know-how to it. Common teams that include employees from different organisations have also proved fruitful in terms of new ideas and innovations. It seems that in many cases, close co-operation has created an innovative atmosphere. The success of Nokia – the flagship of the Finnish ICT cluster – has also spurred other companies develop their operations. Furthermore, in addition to technological issues, suppliers have obtained market information through their key-customer relationships. Particularly, small and medium-sized companies highlighted this fact because big companies often have better possibilities to acquire information about market requirements, competition and market trends.

We conclude that it is very unlikely that Nokia would have been able to achieve its current success without good suppliers. In other words, we see that one competitive advantage of Nokia is their ability to orchestrate the supply chain. It does not only mean to improve the chain's efficiency in terms of costs, but more importantly the capability to create an atmosphere with initiative. Hence, instead of doers, partners are also problem solvers and initiators.

### **Challenges of networking**

In some cases, close co-operation has also brought difficulties. First, the lack of real-time information has caused great capacity fluctuations. Typically, a demand-pull sourcing agreement is based on the demand forecasts of the customer. Suppliers have to reserve capacity also for the optimistic forecasts but the company's real sales are dependent on actual demand. Consequently, updated demand information is crucial in fast-changing industries such as the ICT industry.

Any distortion in information is a potential source of instability in the supply chain causing great fluctuations in the utilisation rate of capacity (see Ranta et. al. 1999). Due to lack of information, the companies are not able to adjust their operations smoothly. As the network consists of a large number of companies, it is important to ascertain that the entire chain has real-time information about expected demand and in it changes.

Second, dependence on a single customer may constitute a high risk for companies. While our analysis shows that the majority of companies in our data is not too dependent on their key customer (in terms of net sales), there does exist a group of companies with relatively high dependence. In some circumstances, high dependence is a good growth strategy for the company but in the long run the risk becomes too high. Therefore, in order to diminish the risk, these companies should actively attempt to widen their customer base or to increase sales to other customers.

The third possible drawback of networking is related in issues related to IPRs (Intellectual Property Rights). If all the fruits of R&D co-operation, such as patents, copyrights and trademarks, are left to the partner, a company's possibility to utilise the results of co-operation is very limited.

Networking as an operation mode may also have some other weaknesses. The success of a company does not only rely on its own operations but also the operations of the other members in the network. Consequently, the operations of one company have an effect on the whole network. From a large customer's point of view, one weakness in networking is a tremendous difference in size between the partners. Very often the needs of a large company exceed the capacity of a smaller company. The ability of smaller companies to take risks is often low compared with the needs of a bigger partner. If a big company splits the project to small parts, project management becomes complex as the amount of interfaces to companies multiplies.

In the future, technology leakages to competitors constitute a risk. This may occur, for example, if a competitor buys one of the partners with strategically important information on another partner's operations. It is also possible that a partner starts to compete with its former partner.

## **Are there limits to networking?**

It seems that networking as an operation mode will become more common. This does not only mean that outsourcing will spread to new areas, but also that partners and subcontractors will build and develop their own sub-networks. Nowadays, while a number of suppliers cooperate closely with their key customers, co-operation with their own suppliers is less profound. Hence, one of the challenges these companies face is to develop their own supplier networks.

Inter-firm relationships do not only become common, they also become deeper. Knowledge-sharing and learning play a key role in these relations. Companies not only exchange product-related information but also strategic information about the future prospects and the latest technology under development. Consequently, at least the most important partners are involved already in the phase, where the company is only just planning a new product or model. In addition to the possibility of giving comments and suggestions on how to improve the product, early participation makes it possible to prepare for future demand. Thus, in response to forecasts, suppliers are able to invest in new capacity. This kind of early-stage involvement is not rare in the Finnish ICT cluster. However, many suppliers see their capability of having an effect on the process or on the product as too limited. Hence, benefits may be acquired if the key customer incorporates its key suppliers into the stage where technologies and other important issues are decided.

Increased co-operation and outsourcing raise a question about the limits of networking. Can a company outsource everything? The simple answer is no. We argue that there are at least three processes that cannot be outsourced. First, a company must have some core, such as know-how, technology, a key resource or brand, which has not been outsourced. Otherwise, the company is just an empty shell. However, this does not mean that the core cannot change over time, because companies can gradually change their core in response to changes in the operation environment. Second, another key element is industry-specific know-how. The company understands the market, demand and trends in the industry. Firm must also have a vision about coming developments and tendencies. Without visions and an ability

to follow the latest development, the company will drop out of business. The third important factor is the ability to manage the production process of a product. Efficient governance of network requires good understanding of the role of each party across the entire supply chain. Pursuing common benefits does not only require optimising material flows but also the information flows between several organisations. Moreover, the efficient management of the supply chain requires the ability to create an atmosphere of trust and reciprocity. Without these it is hard to achieve a flexible relationship that fosters creativity.

If the company were to outsource these three elements; its core, its industry specific know-how and the orchestration of its supply chain, it would face a great probability of losing its competitive position in the long run.

### ***Networking from the national economy's point of view***

From the point of view of national economy, one threat of increased networking is the difference in size between suppliers and customers. The needs of the key customer are so great that the ability of small or medium-sized companies to deliver such volumes is limited. As a consequence, big companies seek suppliers and partners capable of delivering. These partners should have global operations and the ability to make sufficient investments. The creating of partnerships always requires investments such as allocating people to manage these relationships, new exchange of information and co-ordination of activities. All these require effort and involve costs. Therefore there seems to be a tendency toward a limited number of first tier suppliers. However, in addition to large suppliers, big companies also need highly focused local suppliers. It seems that in particular middle-sized EMS companies may suffer from this development. But small size may be a problem for software companies, too.

Despite the fact that at the moment the majority of the companies in our data reported mutual benefits from their key-customer relationship, the situation may change with the business cycle. The ICT and particularly the telecommunications industry have undergone a long upturn during the past ten years. The next downturn will show

whether the companies are ready to share the benefits also when growth is less rapid.



## Appendix

### Appendix I

#### The NACE codes utilised in the calculation of economic indicators for the ICT cluster

##### ICT Manufacturing

32100	Manufacture of electronic components
30020	Manufacture of computers etc
31300	Manufacture of insulated wire and cable
32200	Manufacture of radio transmitters etc
32300	Manufacture of radio receivers etc

##### ICT Services

###### *Telecom services*

64201	Telephone communication
64202	Other telecommunications
64203	Data transmission services

###### *Software and IT services*

72100	Hardware consultancy
72200	Software consultancy and supply
72300	Data processing
72500	Maintenance of office machinery etc

## Appendix 2

Measuring the export specialisation of a country

Specialisation of a country in product exports can be measured by RCA (Revealed Comparative Advantage) index, which is calculated as follows:

$$RCA_{ij} = \frac{X_{ij} / \sum_i X_{ij}}{\sum_j X_{ij} / \sum_i \sum_j X_{ij}}$$

where  $X_{ij}$  is the exports of the cluster  $i$  from the country  $j$ , and  $\sum_i X_{ij}$  is total exports from the country  $j$ . The nominator calculates the share of the OECD cluster  $i$  (the sum of the cluster  $i$  exports from all the OECD countries) of total OECD exports.

RCA can be scaled between  $-1$  and  $1$ , which yields **RSCA** (Revealed Symmetric Comparative Advantage) index. If RSCA index equals zero, a country is as specialised in the cluster  $i$  exports as the OECD in average. If RSCA index exceeds zero, the country is specialised in the cluster exports.

### Appendix 3

#### Social capital measurement items and factor loadings

Items	Trust	Real-time information	Social interaction
<b>TRUST</b>			
In this relationship, we can trust that confidential information does not leak to our competitors (8h)	.699	.366	.119
We have open co-operation in very confidential issues, too (8I)	.801	.153	.158
Our key-customer informs us of their strategic plans and objectives (8g)	.807	2.348E-02	.147
<b>QUALITY OF INFORMATION</b>			
Usually we have enough information in order to predict our customer's need for deliveries (8a)	.290	.702	5.270E-02
We always have real-time information about changes in deliveries (8b)	.147	.772	.114
We always know the right contact person in our customer's organisation (8j)	-1.403E-02	.734	-8.390E-03
<b>SOCIAL INTERACTION</b>			
Our personnel has a direct contact with the responsible organisation level of our customer (8l)	1.894E-03	.194	.734
We personally know our customer's employees (8m)	.170	2.951E-02	.869
We have close social contacts with our customer (8n)	.373	-.100	.625

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

The table presents the factor loadings from the confirmatory factor analysis suggesting that there exist three latent or unobserved constructs, namely trust, real-time information and social interaction. The Cronbach alpha coefficient for the trust construct is 0.74, for the real-time-information construct 0.67 and for the social interaction construct 0.63. The Cronbach alpha for the social capital construct that includes all the above statements is 0.75.

## Appendix 4

### Correlation analysis (Pearson-correlations, 2-tailed)

	Social interaction	Trust	Real-time Information	Learning
Social interaction	1.000			
Trust	.387***	1.000		
Information's real-time	.161	.403***	1.000	
Learning	.197*	.208*	.270**	1.000

\*\*\* Significant at the 1 per cent level, \*\* significant at the 5 per cent level, \* significant at the 10 per cent level.

	Market knowledge learning	Technological learning	Learning (summary variable)
Social interaction	0.144	0.277**	0.235**
Trust	0.251**	0.168	0.238**
Real-time information	0.156	0.249**	0.237**
Social Capital (summary variable)	0.269***	0.247**	0.306***

\*\*\* Significant at the 1 per cent level, \*\* significant at the 5 per cent level, \* significant at the 10 per cent level.

	Real-time information	Capacity fluctuations are not a problem	Trust	Win-win	Technological learning	Learning
Real-time information	1.000					
Capacity fluctuations are not a problem	.309***	1.000				
Trust	.403***	.359***	1.000			
Win-win	.464***	.325***	.437***	1.000		
Technological learning	.156	-.038	.251**	.208*	1.000	
Learning	.237**	-.114	.238**	.205*	.756***	1.000

\*\*\* Significant at the 1 per cent level, \*\* significant at the 5 per cent level, \* significant at the 10 per cent level.

## **Appendix 5**

### *Win-win variable*

The variable has been measured by combining answers to the following claims:

We easily attain mutual understanding in terms of prices.

In this relationship neither side takes advantage of the other even if the opportunity arises

Our customer allow us good financial performance

Our responsibility to bear risk in relation to benefits of the relationship is fair proportion.

The Cronbach alpha for this construct was 0.73, indicating high reliability.

### *Learning variable*

The variable has been measured by combining answers to the following claims:

The relationship has helped us to develop our technological know-how (7f).

We can utilise more widely the technical know-how originated from this relationship (7h).

Through this relationship we have understood better requirements of the market (7i).

The experiments of this relationship help us to serve better also our other customers (7j).

This relationship has taught us to make better agreements with other customers (7k).

The Cronbach alpha for this construct was 0.67.

## References

- Ali-Yrkkö, J., Paija, L., Reilly, C. & Ylä-Anttila, P. (2000). *Nokia – A Big Company in a Small Country*. The Research Institute of the Finnish Economy, B162 series, Taloustieto Ltd, Helsinki.
- Aoki M., Gustafsson B. & Williamson O. (1990) (eds.), *The firm as a nexus of treaties*. London: SAGE Publications.
- Bradach, J. & Eccles, R. (1989). Price, authority and trust: From ideal types to plural forms, *Annual Review of Sociology*, 15, pp. 97-118.
- Burt, D. & Soukup, W. R. (1985). Purchasing's Role in New Product Development. *Harvard Business Review*, Sept-Oct, pp. 90-96.
- Forrester, J. (1958). Industrial dynamics – a major breakthrough for decision makers. *Harvard Business Review*, pp. 36-63.
- Forsgren M., Hägg I., Håkansson H., Johanson J. & Mattsson L.-G. (1995), *Firms in networks – a new perspective on competitive power*. Acta Universitatis Uppsaliensis, Studia Oeconomiae Negotiorum no. 38, Uppsala.
- Hamel G., Doz Y. L. & Prahalad C.K. (1989), *Collaborate with your competitors – and win*. *Harvard Business Review*, Jan-Feb 1989, pp. 133-139.
- Helper S. (1993), *An exit-voice analysis of supplier relations*. In: Grabher G. (ed.), *The embedded firm – On the socioeconomics of industrial networks*. New York: Routledge.
- Hernesniemi, H. & Lammi, M. & Ylä-Anttila, P. (1996). *Advantage Finland – The Future of Finnish Industries*. ETLA Series B 113, Sitra 149. Taloustieto Oy, Helsinki.
- Hines P. (1994), *Creating world class suppliers. Unlocking mutual competitive advantage*. London: Pittman Publishing.
- Koski, H. (1998a). *Liberalisation, Regulation and Universal Service Provision in the European Telecommunications Markets*. ETLA Discussion Papers No 650, The Research Institute of the Finnish Economy.
- Koski, H. (1998b). *The Impacts of Regulatory Reform on the Global Telecommunications Sector*. ETLA Discussion Papers No 649, The Research Institute of the Finnish Economy.
- Langlois R. & Robertson P. (1995), *Firms, markets and economic change*. London: Routledge.
- Leana, C. R. & Van Buren, H. J. (1999). Organizational Social Capital and Employment Practices, *Academy of Management Review* 24(3), pp.538-555.

Leiponen A. (2000). *Essays on the Economics of Organizational Knowledge: Innovation, Collaboration and Organizational Complementaries*, Forthcoming, Helsinki School of Economics, Helsinki, Finland.

Lemola, T. & Lovio, R. (1996). *Miksi Nokia*, Finland, WSOY, Helsinki.

Lorenzoni, G. & Baden-Fuller, C. (1995). *Creating a Strategic Center to Manage a Web of Partners*. *California Management Review*, vol. 37, no. 3 pp. 146-163.

Ministry of Trade and Industry (1999), *KTM-Toimialaraportti – Elektronikan sopimusvalmistus*. <http://ktm.tt-tietopalvelut.fi/ktm/fin/select1.html>

Niininen, P. (1999). *High Technology Investment, Growth and Productivity, empirical studies of Finnish data*, Helsinki School of Economics and Business Administration, Series A-158, Helsinki, Finland.

Nooteboom B. (1999a), *Innovation and inter-firm linkages: new implications for policy*. *Research Policy*, 28, pp. 793-805.

Nooteboom B. (1999b), *Inter-firm alliances – analysis and design*. London: Routledge.

Ollus M. (1996), *Verkostotalouden lähtökohdat*. In Ollus M., Ranta J. & Ylä-Anttila P.(eds.), *Yritysverkostot – kilpailua tiedolla, nopeudella ja joustavuudella*. Helsinki: Taloustieto.

Ollus, M., Ranta, J. & Ylä-Anttila, P. (1998). *Yritysverkostot – kilpailua tiedolla, nopeudella ja joustavuudella*, Sitra, Helsinki, Taloustieto Ltd.

Paasche T., Pettersen A. & Solem O. (1993), *Network theory – a critical review*. In: *Proceedings of the conference on the development and the strategies of SME's in 1990's*. Vol 1. August 26-28, 1993, Mikkeli, Finland.

Paija L. (1999), *Yritysverkostot: Miksi, miten – ja miksi ei?*. In Ollus M., Ranta J. & Ylä-Anttila P.(eds.), *Yritysverkostot – kilpailua tiedolla, nopeudella ja joustavuudella*. Helsinki: Taloustieto.

Paija L. (ed.) (2001), *The Finnish ICT cluster in the global digital economy (forthcoming)*. ETLA – The Research Institute of the Finnish Economy.

Paija, L. & Ylä-Anttila P. (1996). *The Impact of Structure and Competition on Employment in the Telecommunications Cluster – Case Finland*. ETLA Discussion Papers No. 549. Paper presented at the OECD Workshop on Economics of the Information Society, Istanbul Dec. 14-15, 1995.

Pajarinen M. & Ylä-Anttila P. (1999): *Cross-border R&D in a small country – The case of Finland*. Taloustieto Oy, Helsinki.

Penrose E. (1959), *The theory of the growth of the firm*. New York: Wiley.

- Porter M. (1990), *The Competitive Advantage of Nations*. New York: The Macmillan Press Ltd.
- Prahalad C. K. & Hamel G. (1990), The core competence of the corporation. *Harvard Business Review*, May-June 1990, pp. 79-91.
- Ranta J. (1999), Verkostoyritykset. In Ollus M, Ranta J & Ylä-Anttila P. (eds.) *Verkostojen vallankumous*. Helsinki: Taloustieto.
- Ranta J. (1997), Time based competition: From flexible manufacturing to production networks and virtual enterprise. Working Paper 13/1997. Helsinki University of Technology, Department of Industrial Management.
- Ranta, J., Makkonen, S. & Korhonen, H. (1999). On the Dynamics and Control of the Demand-supply Chains. Helsinki University of Technology, Department of Industrial Engineering and Management, Working Paper 22/1999, <http://www.tuta.hut.fi/people/jranta/desupdyn.pdf>.
- Ring, P.S. & Van de Ven, A. H. (1992). Structuring cooperative relationships between organizations, *Strategic Management Journal*, 13. pp. 483-498.
- Ring, P.S. & Van de Ven, A. H. (1994). Developmental processes of cooperative interorganizational relationships, *Academy of Management Review*, 19(1) pp. 90-118.
- Rouvinen, P. & Ylä-Anttila, P. (1999). Finnish Cluster Studies and New Industrial Policy Making, in *Boosting Innovation – The Cluster Approach*”, OECD.
- Tsoukas H. (1996), The firm as a distributed knowledge system: A constructionist approach. *Strategic Management Journal*. 17 (Winter Special Issue), pp. 11-25.
- TT (Confederation of Finnish Industry and Employers) (1997), *Teollisuuden tuotantoyhteistyö 1993-1999*. Interim report.
- Väänänen T. (1996), Yhtymäjohtamisen ja kansallisen kehikon muutos. In Lemola & Lovio (eds.), *Miksi Nokia, Finland?* Porvoo: WSOY.
- Williamson O. (1985), *The economic institutions of capitalism*. New York: Free Press.
- Yli-Renko, H. (1999). Dependence, Social Capital, and Learning in Key Customer Relationships: Effects on the Performance of Technology-Based New Firms, Ph.D. Dissertation, Acta Polytechnica Scandinavica IM 5.
- Ylä-Anttila, P. (1999), The Finnish Innovation System in Global Competition, in Kuusi and Schienstock (eds.), *Transformation towards a learning society*, Sitra 213, Helsinki.