

**INDUSTRIAL NETWORK RELATIONSHIPS
IN THE FINNISH ICT CLUSTER**

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1.1 Introduction

In a knowledge-based economy, firms are dependent on the knowledge resources of other firms. Especially in the information and communication technology (ICT) industry, technological race and shortening product life cycles have forced companies to focus on their core-competencies and to get access to the resources of other specialised companies. This is done by inter-firm contracts, or networking. Fruitful inter-firm activities induce knowledge spillovers and accumulation as well as technology transfers, which in turn stimulate innovations.

Increased outsourcing of equipment manufacturers (OEM) and deepening partnerships with subcontractors has marked the organisational development in the industry in the 1990s. In Finland, Nokia in particular has created very confidential relations with its key partners, which enable early development of future products, and which is a precondition for the technological leadership Nokia pursues. Joint problem-solving but also delegation of solution development or larger sub-assemblies to subcontractors saves precious time and the resources of Nokia.

This working paper reports on some initial results from an ongoing project which is looking into networking patterns and their effects on firms that are in vertical relationship in the Finnish ICT cluster.¹ The sample firms have their key customers in telecommunications equipment, hardware and software manufacturing as well as in telecom operation, and they are operating in different tiers of vertical networks. As Nokia is the primus motor of the Finnish cluster, the majority of the cluster firms are, at least indirectly connected to Nokia's network.

The project is approaching the topic from many different angles (e.g. technological cooperation and knowledge spillovers, technological distinctiveness, communication and confidence, customer and industry dependence, benefits and risks of networking as well as subcontractor strategies in the different tiers of networks) which will allow a versatile research of the issue. Especially when combined with the financial statement data, the survey will provide new information about the functioning and effects of networking. Unfortunately, however, the sample size (123) will restrict the choice of statistical methods. At the early stage of the project, this paper concentrates on providing selected

¹ The project is financed by TEKES (National Technology Agent) and the project dead line is in December 2000.

summary results concerning the effects of vertical cooperation from the subcontractors' point of view.

The data was collected by a questionnaire at the end of 1999. It was sent to about 350 firms operating in the ICT equipment and service industry in different subcontracting sectors (parts and components manufacturing, software production, electronic manufacturing services, production technology provision). The firms were asked to answer the questions, concerning the above mentioned topics, with their most important customer (measured by turnover) in mind. Of the total 123 usable responses, 37 firms indicated that Nokia was their most important customer, 40 supplies Nokia as a secondary client, and 46 was not in direct relationship with Nokia, or the data was missing. The survey is being supplemented by some 20 interviews in both Nokia and the subcontracting firms.

The relevance of different questions in the sample firms were measured by a 7-step scale (Likert scale) indicating whether the firm disagrees or agrees with the statement. In the following text, scale values are interpreted as follows: 1-3 indicate disagreement, 4 imply indifference and 5-7 suggest agreement.

In what follows, we shall first have an overview on the economic factor of the Finnish ICT cluster. Secondly, the role of Nokia as a central networking company in the core of cluster will be considered since, by its extensive outsourcing Nokia has transferred a significant amount of business to its partner suppliers. Finally, we shall look at some implications of cooperative networking on Finnish ICT firms.

1.2 The Finnish ICT cluster in economic perspective²

1.2.1 The telecom-driven structural change in the Finnish economy

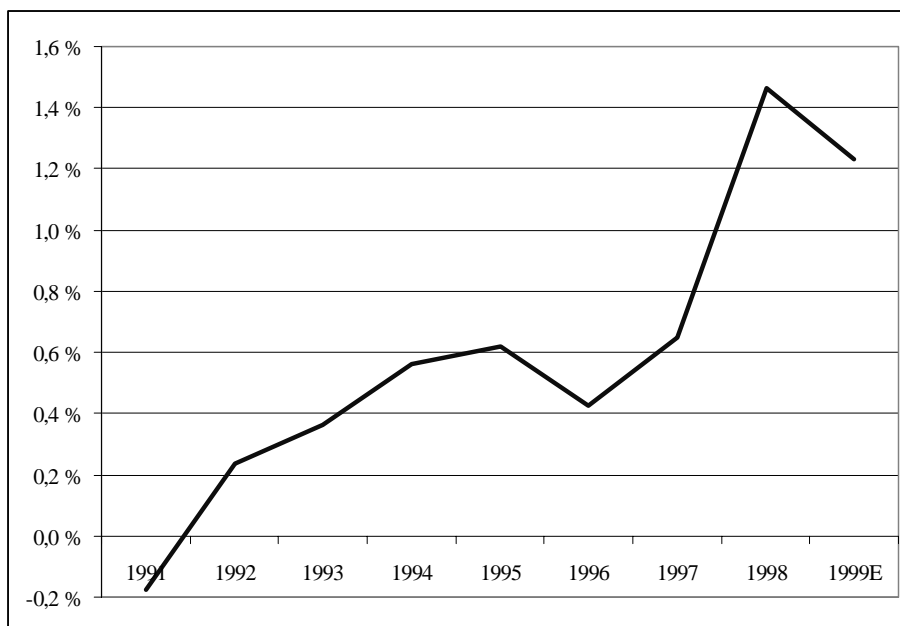
The pace and intensity of the growth process in the Finnish electro-technical industry has been extraordinary throughout the 1990s. It has led to an industrial restructuring in the former forest and metal based economy, in which knowledge has replaced capital, raw materials and energy as the dominant factor of production. During the decade, Finland became the world leader in high-tech trade surplus³ among indigenous high-tech producers. The share of electronics and electro-technical exports has almost tripled at the expense of pulp and paper and metals, representing close to 30 per cent of the total manufacturing exports.

² This section is based on the mid-report of the project (Ali-Yrkkö, Paija, Reilly and Ylä-Anttila, 2000).

³ High-tech exports/imports ratio

Behind this structural change, there is the boom in the telecommunications market in which Finland has succeeded in taking the leading position. It has a 30 per cent stake of the global mobile phone market. In the wake of the boom the industry has grown at an average 20 per cent yearly growth rate, and it has become an important contributor to the GDP. In 1999, the industry contributed to the GDP growth by 1.2 percentage points (figure 1).

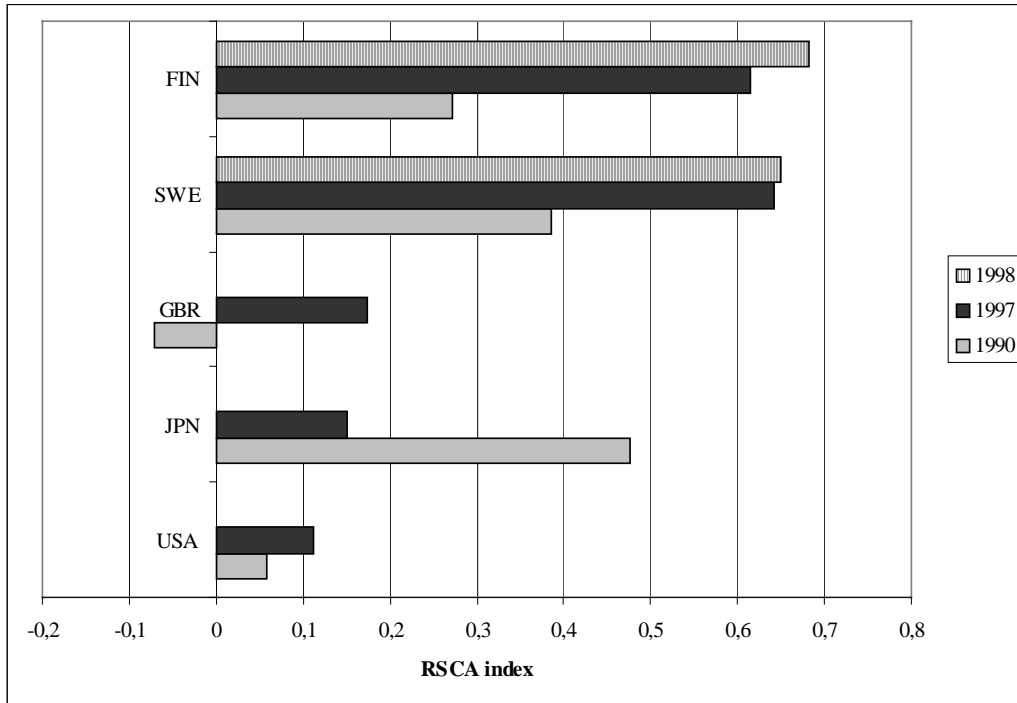
Figure 1 **The contribution of the electro-technical industry to GDP growth**



In 1998, the value of ICT export products was around EUR 7 billion which was almost 20 per cent of the total export value, while in 1990 the share was only five per cent. Finland has become the most specialised OECD country in the telecommunications equipment exports.⁴ It has surpassed Japan and Sweden in the export specialisation during the 1990s (figure 2).

⁴ Export specialisation is measured by the RSCA (Revealed Symmetric Comparative Advantage) index, which compares the export structure of a country to that of OECD. If the RSCA index equals zero, the country is as specialised as the OECD countries on average in the ICT cluster's exports. If RSCA exceeds zero the country is regarded as specialised in the cluster's exports. See Ali-Yrkkö et al.(2000) for more details.

Figure 2 Specialisation in the telecommunications equipment exports (OECD average equals zero)



Note: Year 1998 data was not yet available for the other countries.

Source: OECD

1.2.2 Nokia in the core of the ICT cluster

Even though the Finnish ICT cluster comprises of a number of successful global companies, the role of Nokia as the primus motor is incontestable. It has functioned as an engine for a whole emerging cluster⁵.

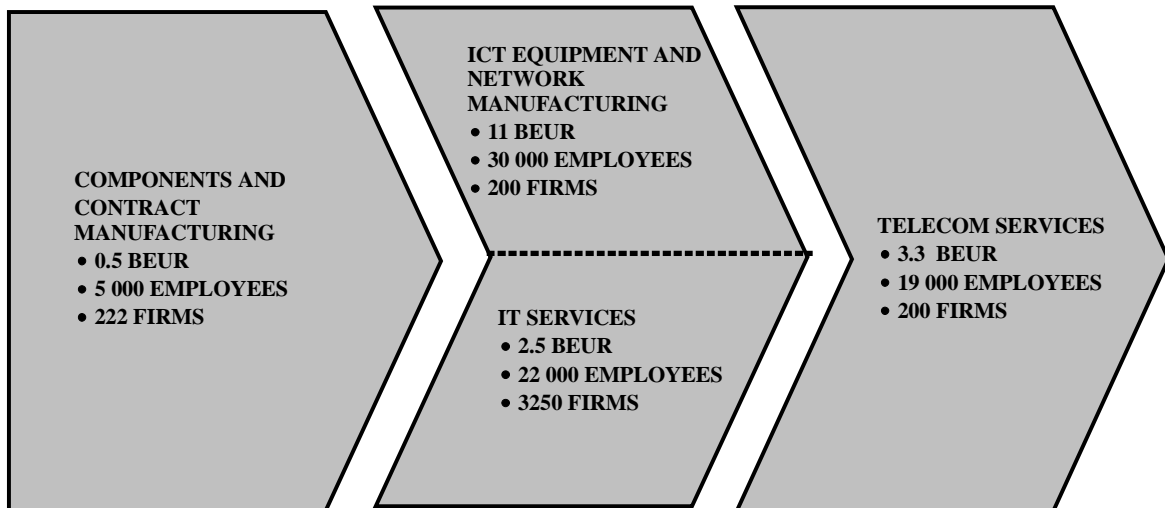
In Figure 3 the ICT cluster is illustrated as a production value chain (excluding content provision). In 1998, the turnover of the ICT cluster was about EUR 17,2 billion. With the turnover of EUR 7 billion generated in Finland⁶, Nokia's contribution to the cluster sales was 40 per cent. Nokia accounted also for an even larger share of cluster exports. (However, reliable comparison is not feasible due to inconsistencies between public statistics and corporate accounting practices.) There was approximately 76 000

⁵ In 1995, the Finnish telecommunications cluster was evaluated as a *potential* cluster, in which the cluster structure was still incomplete and the development of sustainable competitive advantage was under way (Hernesniemi et al., 1995).

⁶ The value of Nokia's exports from Finland is used as a proxy for the value of gross production as the domestic sales represent only 2-3% of the company's total sales.

employees in the cluster, of which around 30 per cent (21 000 persons) worked in Nokia's Finnish subsidiaries.

Figure 1 The production value chain in the ICT cluster – turnover, employment and number of firms in 1998



Sources: Statistics Finland

Note: IT services include IT consultancy, software supply, computer hosting, data processing and equipment maintenance

Nokia is a typical network company which outsources the majority of the production process and concentrates on its key competence areas, namely product design, R&D and brand management. One of its key strategies is to engage actively in R&D co-operation with technology firms to induce innovation and to stay in the technological lead. It has many strategic R&D partnerships, both with small innovative enterprises and leading international ICT companies.

Nokia has engaged the majority of the Finnish electronics industry – directly or indirectly - in the production process, and it is constantly looking for suitable new candidates to be attached to its network. The number of first-tier subcontractors is estimated to total some 300 companies. It is estimated that the effect of Nokia on the employment of these firms is some 14 000 employees. As the production network consists of several tiers, Nokia has important multiplier effects in the cluster that cannot be readily quantified.

In 1997, the estimated value of partnership outsourcing was EUR 0.5 billion in Finland, thus almost 10 percent of the turnover.⁷ The corresponding figure for 1998 was more than twice as high, reaching EUR 1.2 billion, and the share has risen to 14 percent of the Finnish subsidiaries' sales.⁸

Finally, in focusing on the telecommunications business Nokia has disengaged itself from some fifteen firms. Most of them have developed successfully, and today, half of them are under foreign ownership. In other words, Nokia has given birth to number of firms which have obtained an important role in the cluster. On the other hand, Nokia has acquired, mainly abroad, recently established small firms operating in its present strategic areas to absorb and induce future technology.

As indicated above, the Finnish ICT cluster is not Nokia alone. Finnish subcontractors have several customers in the ICT cluster that have also expanded their outsourcing and intensified cooperation with subcontractors. For example, Sonera, the leading telecom operator is an important collaborator and demanding customer to a number of innovative internet and mobile technology developers.

In addition to local OEMs, the subsidiaries of leading ICT multinationals are important strategic partners for Finnish software companies. Many multinationals (e.g. ICL, IBM, Siemens, Hewlet Packard, Ericsson, Lotus) have intensified their R&D activities and cooperation with local firms during the past years. Finnish R&D units are considered as knowledge sources or training centres from which employees are sent to other units to distribute the latest information on technological innovations, especially on wireless communication. The Finnish market is also used as a test laboratory for new innovative products and services.

1.3 Partnership experiences in the Finnish ICT cluster – some early findings

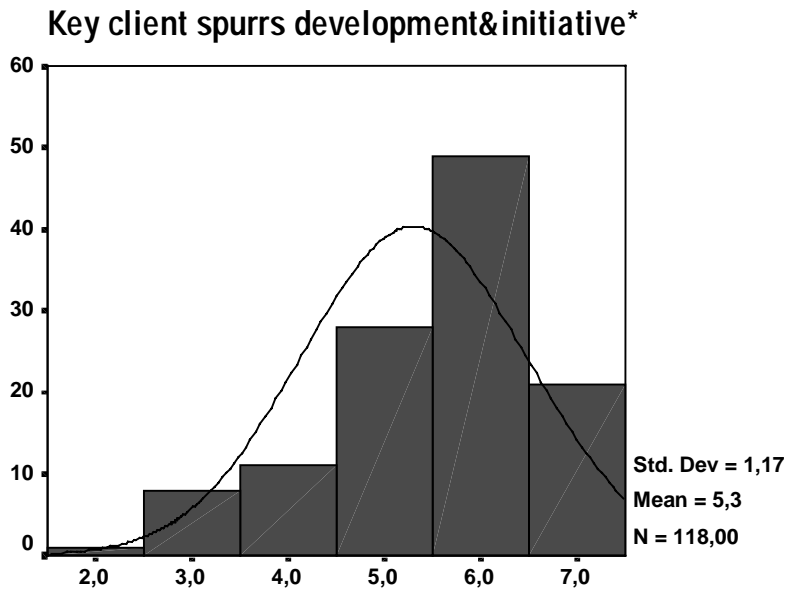
1.3.1 Technology development structures in partnerships

In order to “unlock mutual competitive advantages” (Hines, 1994) the OEM can apply different strategic tools to stimulate innovative spirit in the supplier network. On the base of the survey, in the Finnish ICT cluster, customers are considered markedly important

⁷ Partnership outsourcing involves customised solutions and co-operation between the buyer and the subcontractor. It is distinguished from standard outsourcing which refers to the purchase of “catalogue products”.

⁸ Data source: Nokia

motivators of new ideas and initiatives. The relationship with the main customer contributes to technological enhancement in the subcontracting firms.



*Sum variable

Demanding clients can gain further benefits from outsourcing by relying on their suppliers expertise in product design and problem solution. Instead of providing e.g. product drawings or exact specifications to the supplier, efficiency in many forms can be increased by delegating some of the responsibility of the product and/or process design to the subcontractor. Naturally, the extent of the supplier involvement varies according to the outsourced product and the deepness of the partnership.

Subcontractor involvement in the design and development phase is likely to lead to a more efficient production process implementation as the supplier has better knowledge of his own manufacturing capacities. It also gives the firm an incentive to look for more efficient solutions to the customer needs. In short, higher control on problem solving offers the supplier an opportunity to develop his own technology, which is an effective means of upgrading supplier competence and knowledge enhancement – which, in turn, accrues to the benefit of the client. Time-based competition is another motive for supplier involvement. Reliance on each participant's core competence enables concurrent production which shortens time to market.

Subcontractor involvement has been applied famously in the Japanese automotive industry. Standard sourcing relationships, in which suppliers were assigned to provide the

customer with ordered goods⁹ have been developed by engaging the subcontractor in the design process. With shortening product life cycles also in the ICT industry, new-fashioned supplier strategies have found their way to the ICT equipment manufacturers' repertoire, as well.

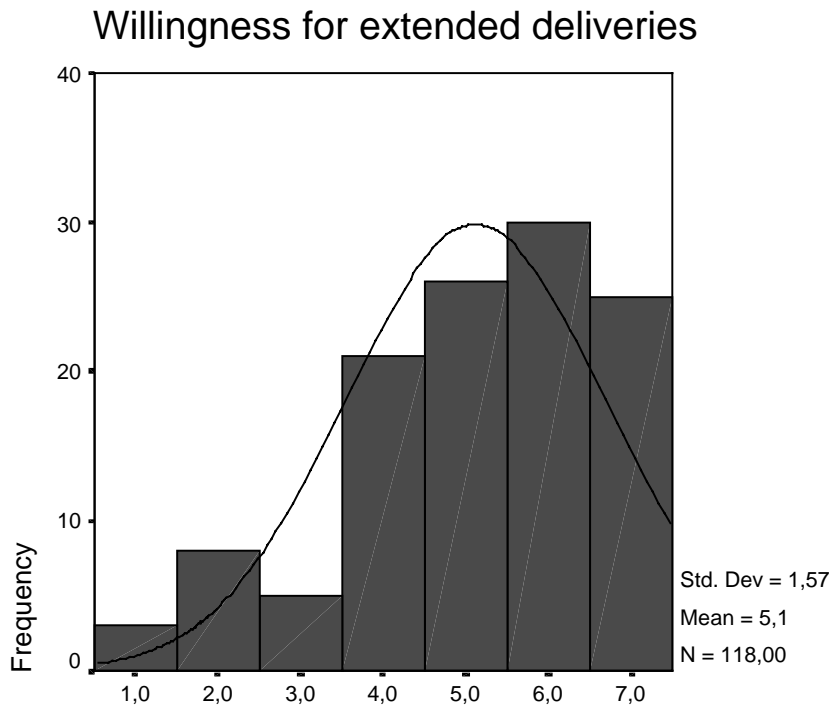
In the survey, firms were asked to indicate how new technology is developed in their organisation, i.e. to what extent the client is involved in the technology design phase. ICT subcontractors develop their technology independently (67% of the firms indicating scale values 5-7) nearly as often as they do it together with the client (70%). But, equally frequently suppliers design products using their own technologies and expertise to comply with a customer-specified need ("black box") (70%). In this sample, ordered goods represent the least frequent but still important case in outsourcing (41%).

The data does not indicate that there would be a clear pattern concerning which kind of suppliers participate in the technology design and development phase and which do not. In all, it seems that even in cooperative relationships technology is developed both alone and in cooperation. According to the interviews, the nature of the product 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 needs. As pointed out earlier, the deepness of the partnership as well as supplier competence are also determinant factors in design outsourcing.

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

Even though OEMs have started to rely increasingly on their partners' expertise and capacity during the 1990s, the development process of the novel mode of subcontracting is still in progress. There are still plenty of opportunities to be reaped. For example, the data implies that the suppliers would be willing to expand further the client relationship. Most of the companies (69%) would be inclined to take more responsibility in the form of larger sub-deliveries.

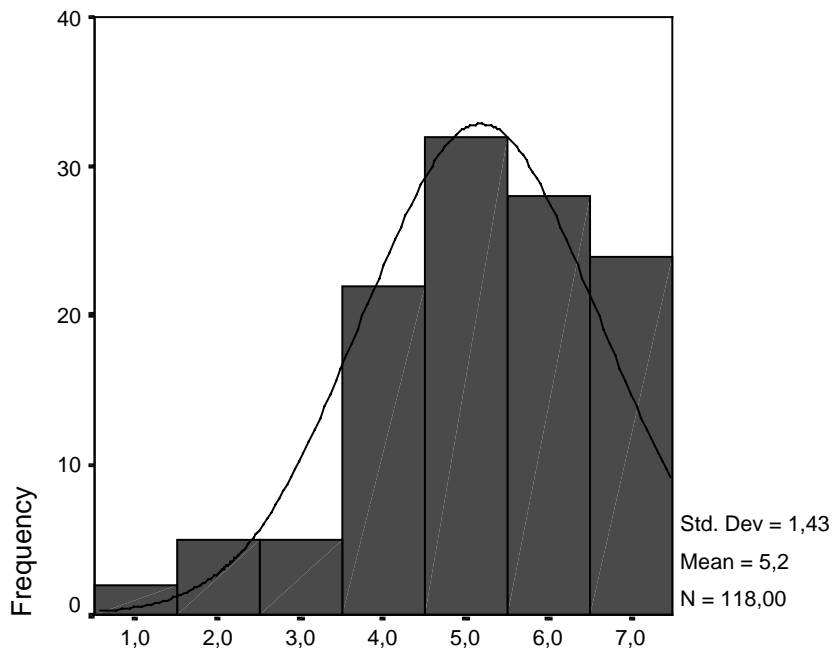
⁹ Ordered goods refer to parts manufactured according to drawings provided by the client. See Hines (1993) for a survey in the Japanese automobile industry.



From OEMs' point of view, concentrating the outsourcing to a fewer key suppliers would increase efficiency in coordination by decreasing the number of supplier interface, but it would also lead to deeper interdependence. The majority of the firms (71%) would also be willing to increase the level of joint-design and collaborative development with the client. Apparently, firms have comprehended the benefits of long-term mutual commitment and they are ready to go further.

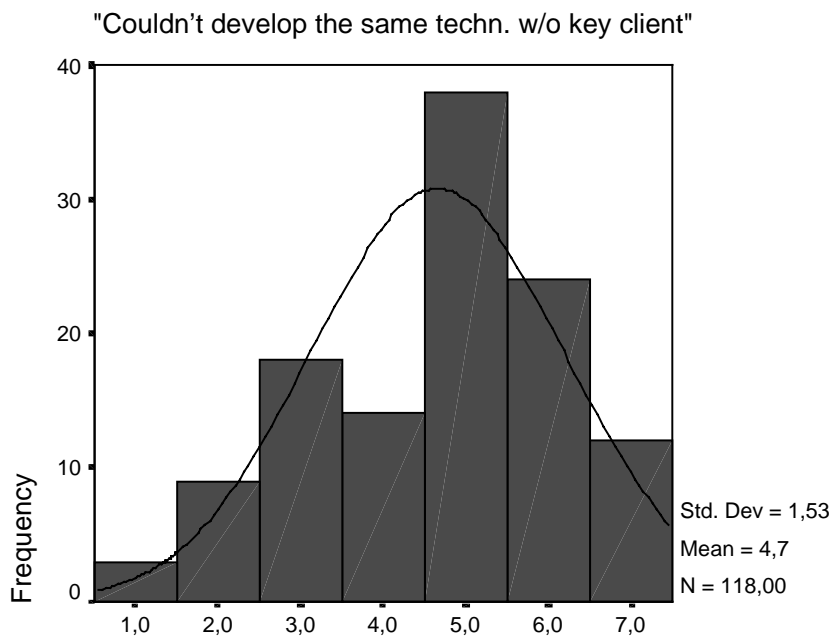
For the OEMs, these results may be good news as the tendency in OEMs' outsourcing is towards larger sub-assemblies and fewer direct supplier interfaces. These are important strategic issues, which include great opportunities but risks, too.

Willingness for more R&D collaboration



Not surprisingly, partnerships are usually found irreplaceable in the supplier firms. Technology development seems to be quite dependent of the main client. There are two and a half times as many firms (63%) in the sample who think that they could not create the same technology without their main customer as there are those who are less dependent of the collaboration (25%). Only twelve per cent of the firms imply indifference towards the importance of client involvement in technology development.

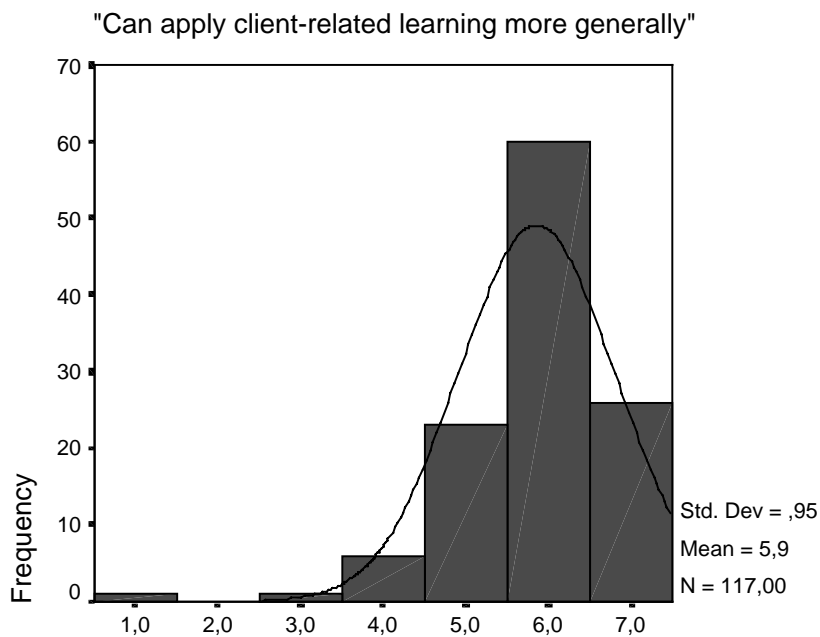
Client dependence in techn.development



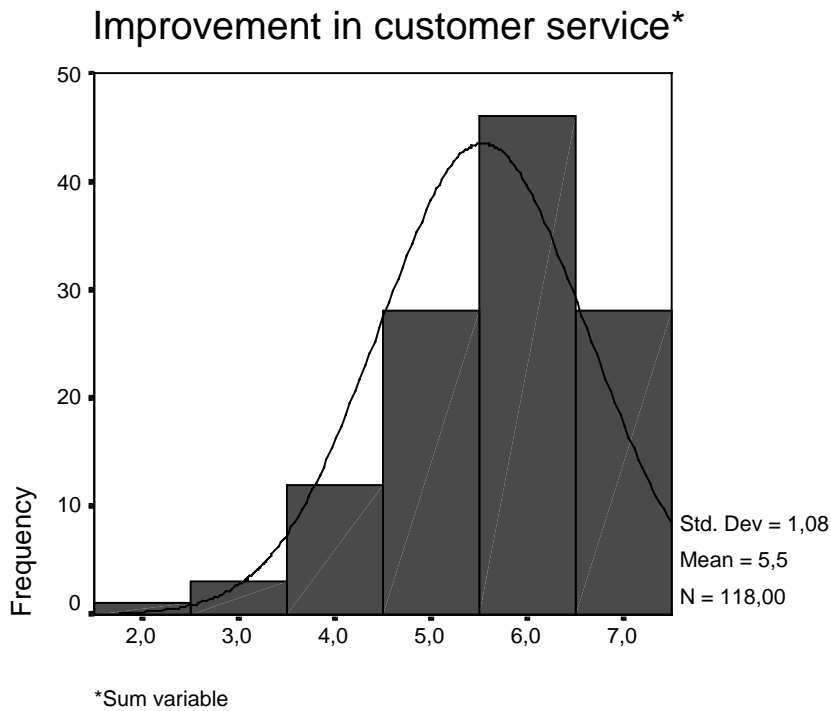
1.3.2 Demanding clients are important references

The firms can utilise the fruits of technological cooperation in other contexts too, which increases their competence in the customer market. Nearly all of the firms (93%) think that they can apply the technical skills acquired in the key-client relationship in favor of other clients as well.

Applicability of client-related skills



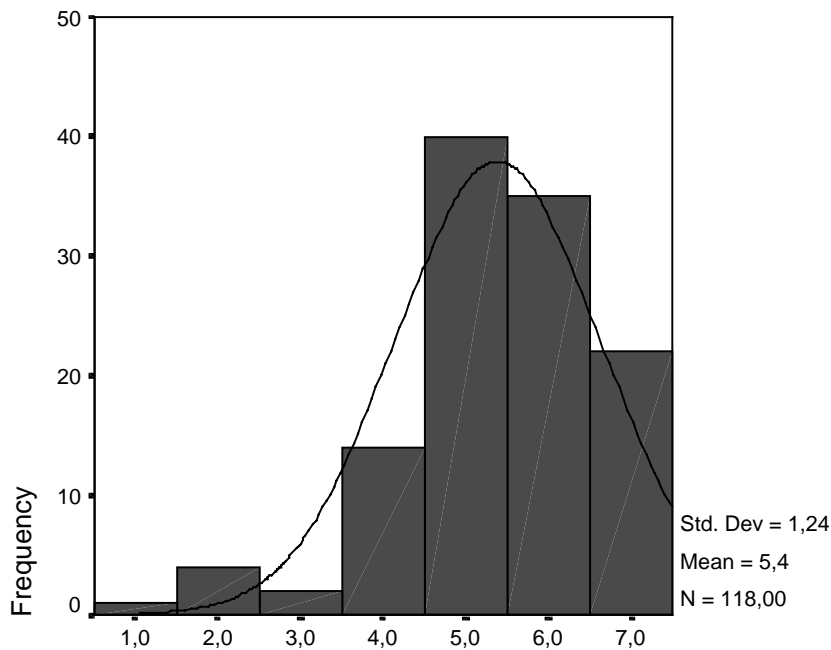
The key-client relationship has also improved importantly firms' ability to better understand the requirements of the market and to better serve other clients .This relates partly to the firms ability to internationalise their operations. As a truly global actor, Nokia has contributed, directly or indirectly, to the internationalisation of a number of Finnish suppliers. In the foreign markets, established partnerships are a valuable asset of which customers want to take advantage. Nokia's first-tier subcontractors, in turn, try to encourage their key suppliers to follow behind. Despite many challenges small and medium sized firms are likely to encounter in global markets, internationalisation opens up new market potential that is a welcome opportunity for firms born in a small home market that Finland represents.



The partnership with the main customer serves as a reference for the great majority of the companies (82%), which has eventually realised in the expansion of the customer base (see figure below). It is noteworthy, that the reference has been valid also in other industries (for 61% of firms), which serves as a means of decreasing industry dependence.¹⁰

¹⁰ The boom in the telecommunications industry occupies practically the whole capacity of many SMEs, which makes them heavily reliant on one customer segment's demand. Client and industry dependence is a central issue in the on-going study.

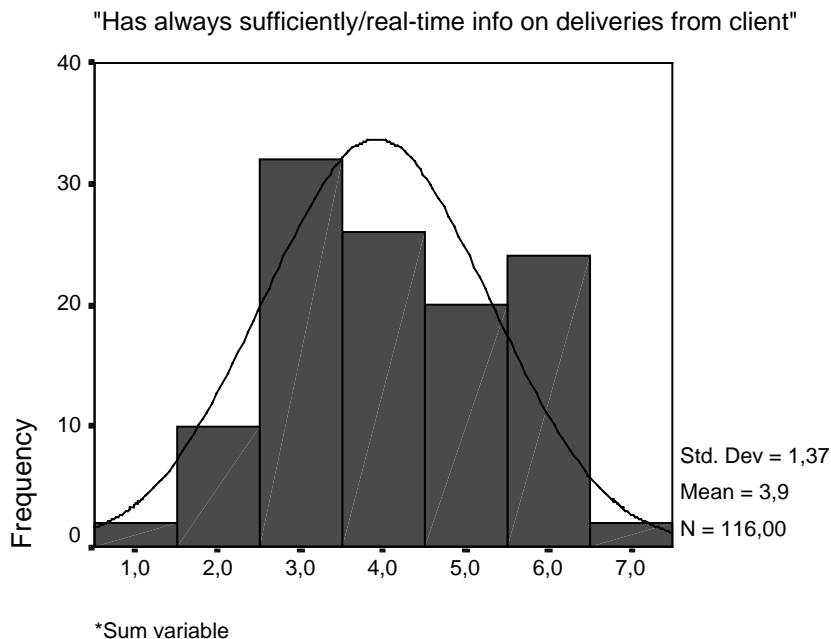
Client reference expanded customer base



1.3.3 Partnerships induce operational improvements

Most of the subcontractors (84%) have made improvements on their business operations as a consequence of customer's proposals (7a). To a certain extent, this finding can be connected to the need of OEMs and their suppliers to integrate their key processes. In order to manage material and information flows in the network, collaborating partners develop and integrate their processes. Transparency of information and JIT (just-in-time) deliveries based on demand pull, are among the main objectives in network management, which require investments in customised process development. The data implies - and supports the feedback received in the interviews - that timely delivery of market demand information is still a critical area of development in the supply chain management. Unexpected drops as well as booms in client deliveries represent one of the most serious risks especially in contract manufacturing.

Availability of real-time information*

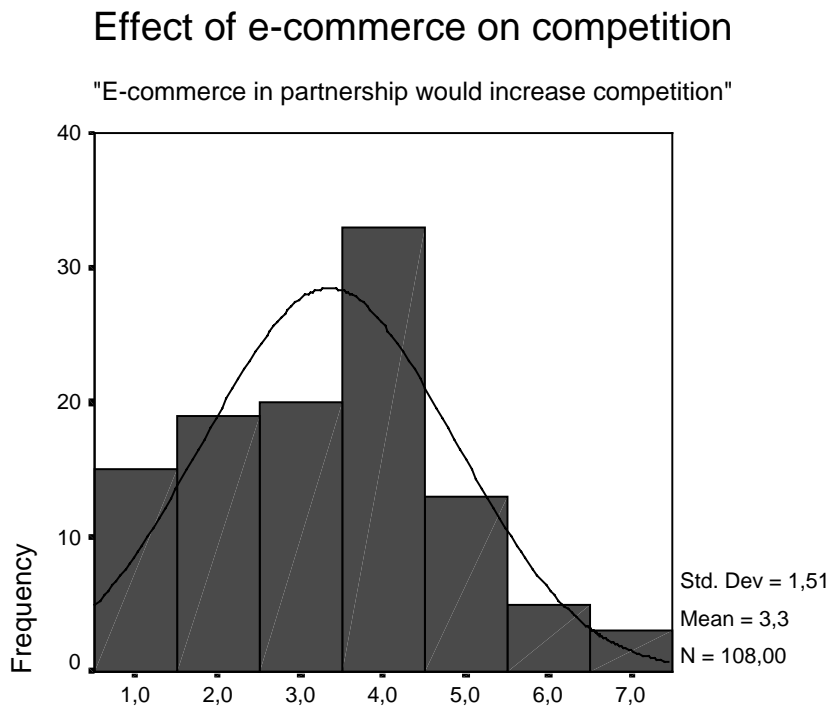


Internet-based communication systems within the production network (an extranet) are anticipated to greatly increase efficiency in network management at low cost (as compared with e.g. EDI technology). As the Internet penetration in Finland is very high – in fact the highest in the world (11% in 1999), extranets are likely to become part of firms' everyday life in the near future. The data suggests that for some 60 per cent of the firms, going over to Internet-based commerce with the client would not require important investments.

There is plenty of practical evidence of this as in a number of firms, electronic communication systems are already the main medium of interchanging operational data between key customers and suppliers. Not only orders, but especially documents and drawings in the design phase are transferred electronically.

Even though the electronic market place is anticipated to increase bidding among suppliers, key subcontractors are not likely to be among the price competitors. Strategic partnerships are based on continuous cooperation and problem solving which provide the customer high value-added through confidence and knowledge accumulation. This kind of subcontracting is not subject to price bidding. Problems are solved jointly and the price decision is taken by consent after mutual consultation. In the sample, a half of the firms do not think electronic commerce would increase markedly competition in their key

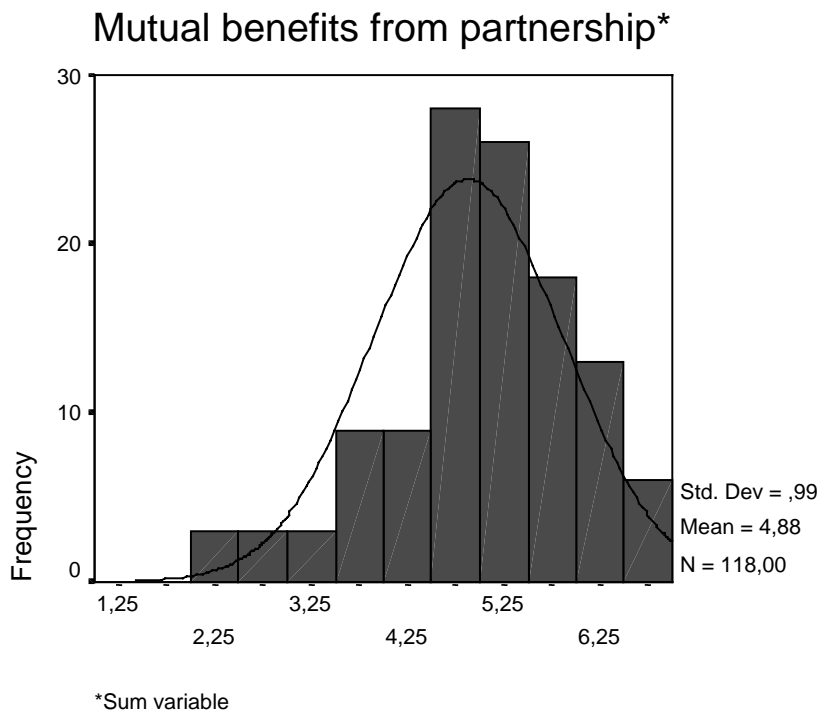
relationship. As many as every third company does not express a clear view on this question.



1.3.4 Mutual benefits are distributed between partners

A factor that can be connected to mutual benefits of partnership imply that subcontractors' overall experiences in partnership have been positive(see figure below). It is noteworthy that small firms are more often satisfied than their larger counterparts.¹¹ Thus, there is no signal that the large customers would exploit their market power vis-à-vis small firms. To some extent this may relate to the sectors in which subcontractors operate. Small firms, who indicate satisfaction in pricing are predominantly software companies. Large companies, in turn, are mostly represented in the component production and electronic manufacturing services, where stiff competition presses margins. Deeper analysis of this point may reveal new aspects of networking.

¹¹ The sample was categorised in two size groups using the median sales (EUR 3,3 million) as the criterion for small and large firms.



A closer look on the elements behind mutual benefits from partnering reveals, for example, that the majority (64%) think that the risks inherent in a partnership are in balance with the rewards from it. The same number of firms think that the client even allow them good profitability. This is in line with the result that the partners reach mutual consent of prices without marked difficulty (64%). There is still a group (less than 20% of the sample) that look at the other side of the coin: the reasons and conditions behind the discontent in some firms will be subject to deeper analysis.

In all, there are positive indications that even though clients are often aware of the cost structure of the supplier (the so-called open books basis) they still allow profitable pricing to the subcontractor. Benefits from cooperation are distributed to both partners, which is the dogmatic objective of networking. This is vital especially in the hi-tech sector where firms need to accrue financial resources to invest in R&D. Under too tight target cost pricing subcontractors easily cut down expensive R&D investments, which is fatal to technological development.¹²

¹² See e.g. Semlinger (1993) and Helper (1993).

1.3.5 Conclusions

Technological race and globalisation are the main factors behind the stiff competition in the ICT market. In this kind of operational environment there is no time or resources in any firm to do everything alone. Consequently, the 1990s has witnessed important changes in organisations' structure and attitude towards outsourcing. Companies focus on their core competencies and rely to an increasing extent on the resources of subcontracting firms. In order to achieve the most efficient outcome firms construct confidential long-term partnerships with their suppliers. In these interfirm relations knowledge accumulate and transfer in both sides generating process and product innovations.

On the basis of an early overview on the survey data collected in Finnish electronics subcontracting firms there are clear indications that the nature of subcontracting has changed towards closer cooperation and joint problem solving. But there are still plenty of opportunities to be reaped as the firms are willing to go further and deeper in partnerships.

However, R&D cooperation is not done at the expense of independent technology development: cooperative and self-reliant development are equally frequent in firms. There are many firms that regard own product development as an important means of retaining or increasing independence of clients. The more generic the product, or the less strategic position the supplier has in the network, the more important it is for the firm to improve its skills in different fields of the core competence.

As the global market puts tremendous strain on the OEMs performance, they are also very demanding in their vertical partnerships. The effects can be recognised in the data which indicates that the key customer has a role in spurring development and initiative in the firms. In addition, it seems that the challenge has been accepted in the firms since they are willing to take more responsibility in the partnership.

A partnership with an advanced client serves as an important reference which opens the doors of new clients and markets. Especially in the wake of a customer like Nokia many firms have widened their operations not only outside home market but also in other industries.

Measured by different characteristics of partnership, Finnish firms have most frequently positive experiences of close client relationship. Pecuniary benefits accrue also to suppliers, and notably, small enterprises are more frequently contented than their larger counterparts. In a relationship with huge asymmetry in market power this can not always be taken for granted.

However, the real nature of a partnership will be tested in downturns. It is not to be forgotten that one central motive for networking is risk sharing. As long as there is enough cake for everybody, the party goes on.

The data indicates that firms accept the client risk as a natural part of the business, and that they consider their risk being in balance with the rewards of the relationship. However, there is an important amount of firms that are heavily dependent of their key client (figure 4). Without speculating any reasons for a downturn, the risks of too high client/industry specialisation are evident. High dependence is in no-one's interest, and also the dominant OEMs have emphasised that excessive dependence is a risk for the functioning of the network.

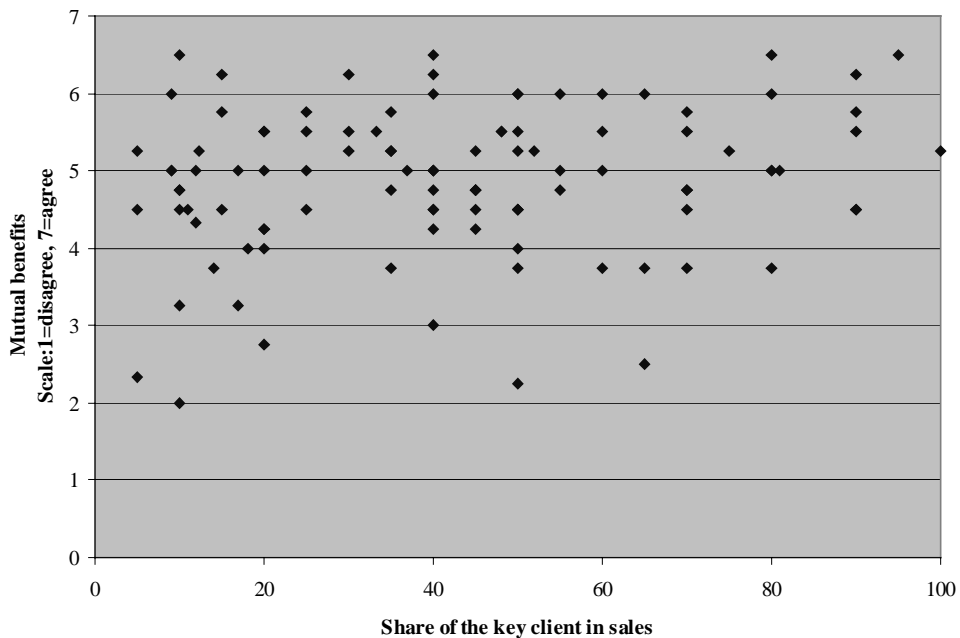


Figure 4 Mutual benefits* and dependence in partnership

*Mutual benefits of partnership is a factor summing up different expressions of cooperative business.

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