TURUN KAUPPAKORKEAKOULUN JULKAISUJA

PUBLICATIONS OF THE TURKU SCHOOL OF ECONOMICS

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CREATING VALUE IN STRATEGIC R&D NETWORKS
A Multi-actor Perspective on Network Management in ICT Cluster Cases

Sarja / Series A-3:2006

ISBN 951-564-363-5 (nid.) 951-564- 364-3 (PDF)
ISSN 0357-4652 (nid.) 1459-4870 (PDF)
UDK 65.012.2
65.012.6 (569.4) (73)
658.112.3
658.624
001
608
004

Esa Print Tampere, Tampere 2006

ACKNOWLEDGEMENTS

"At the side of a pyramid you can see what you are doing in the right proportions."

Maija Paavilainen

Although the final report carries my name on it, it is a result of many other people's efforts as well. First of all, I want to express my deepest gratitude and appreciation to Professor Aino Halinen-Kaila. She was my primary supervisor and provided guidance, help and support in every phase. Thank you, Aino, for your excellent comments. It has been a pleasure working with you!

I would also like to thank others in Turku School of Economics who contributed to this study in various ways: Professor Helena Mäkinen, Dr. Rami Olkkonen, Dr. Birgitta Sandberg, and Eeva Laine-Piippo. I would like to thank also Professor Pekka Tuominen for his encouragement, and Dr. Arla Juntunen and doctoral students, Maija Renko, Ulla Hakala and Niina Hanttu for the fruitful discussions we had.

I was privileged to have Professor Helén Anderson, Jönköping International Business School and Professor Veikko Seppänen, University of Oulu as the official pre-examiners. They offered me valuable and constructive comments on the manuscript.

My special thanks go to the case organizations for opening the doors for me to the empirical world and making this research authentic. I am sincerely grateful for those people who helped me to approach the informants in Finland and in Israel. I also want to thank Tel Aviv University for the help that I received from there.

This study is a part of Valuenet research group that was funded by the Academy of Finland in 2002-2004. Furthermore, support from the following organizations is gratefully acknowledged: Turku School of Economics, Jenny ja Antti Wihurin Rahasto, KAUTE-säätiö, OP-ryhmän Tutkimussäätiö, Oskar Öflunds Stiftelse, Turun Kauppaseuran säätiö, Turun kauppakorkeakoulun tukisäätiö, TOP-Säätiö, Academy of Finland, Hans Bang Stiftelse, Marcus Wallenbergin Säätiö, Suomalainen Konkordialiitto, Nordea Pankin Säätiö, Säästöpankkien Tutkimussäätiö and Liikesivistysrahasto. I also wish to thank Joan Nordlund, M.A., for her help with the language of the dissertation as well as Taina Paju, M.Sc., for her help at the final phase of my work.

Finally, my greatest thanks are reserved for the people closest to me: my family and friends in Finland. You have always been there for me, in spite of

the distance and provided your help in the unusual circumstances over the years when I was traveling back and forth. Special thanks to Annie, Mervi, Tiina, Heidi, Anne, Heidikki and Susanna and your families. To my friends in Israel: Michal, Varya, Alison, Marianne, Roswitha, Lilian, Susanna, Irja, Benita and Doron, you made my journey more enjoyable!

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Tel Aviv 30 June 2006

Päivi Jokela

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1 INTRODUCTION

1.1 The background of the study

The importance of industrial research and development (R&D) activities in supporting economic growth has increased in recent years, and research intensity has continued on the incline, reflecting the growth of high-technology industries (OECD 2005, 117). By definition, high technology industries invest proportionally high sums, more than 5% of their sales, in R&D with a view to increasing scientific and technical knowledge and applying that knowledge to create new products or processes (Hagedoorn 2002, 477; Jassawalla and Sashittal 1998, 238). Firms have understood the importance of R&D in maintaining or improving existing levels of profitability, supporting customer satisfaction and ensuring long-term growth in terms of company value (Biemans 2003, 514; Deschamps and Nayak 1995, 10).

Traditionally, interfirm cooperation in R&D has not been widespread, even though the public sector has been active in offering R&D services to industries (Leppälä 1995; Seppänen 2000). However, there has been remarkable growth in the number of R&D cooperative arrangements during the last two decades, and companies are not only cooperating more, they are also doing so more with overseas partners (Hagedoorn 2002, 482; Narula and Hagedoorn 1999, 284). This growth has followed the development of the high-technology industries: their share in newly established cooperative R&D arrangements has increased from a half to over 80% since the 1980's (Hagedoorn 2002, 482; Narula and Hagedoorn 1999, 286).

Cooperation has increased, in particular, between firms involved in the development of information and communication technologies, the so-called ICT cluster, in which the growing technological complexity and the rate of new products have enhanced the need to cooperate (Biemans 2003, 516; Hagedoorn 2002, 482). The ICT cluster consists of the key industries in information and communication technology and related industries, and other actors with an essential competitive role (Porter 1998). According to Vonortas (1997, 12), cooperation is often traceable back to governmental actions and technology policy, such as the subsidies paid to support cooperative projects in which firms share their knowledge and resources. In Finland the National

Technology Agency is funding many projects aimed at creating new and innovative technologies in the high-technology sector (Halme, Tiilikka and Pulkkinen 1999, 53; OECD 2002, 111).

Interorganizational relationships and networks consisting of more than two interconnected relationships, have attracted attention in the literature on marketing and strategy as a form of organizing economic activities (Achrol and Kotler 1999; Axelsson and Easton 1992; Cravens, Piercy and Shipp 1996; Gulati, Nohria and Zaheer 2000; Hite and Hesterly 2001; Håkansson and Ford 2002; Jarillo 1988; Lorenzoni and Baden-Fuller 1995; Powell 1991; Webster 1992). Research interest also in cooperative relationships in R&D, joint ventures, partnerships, strategic alliances and networks has also increased, as it has been noticed that the innovation activities of a single firm often reach beyond its boundaries to other organizations, its suppliers, customers and competitors, and to universities (Afuah 2000; Dyer and Nobeoka 2000; Dyer and Singh 1998; Hyötyläinen 2000; Håkansson 1987; Ireland, Hitt and Vaidyanath 2002; Powell, Koput and Smith-Doerr 1996; Staropoli 1996; Vonortas 1997).

The aim of this study is to describe the nature of R&D networks as intentional value-creating systems. It complements earlier research on cooperation in new product development (Hagedoorn 2002; Handfield, Ragatz, Petersen and Monczka 1999; Miotti and Sachwald 2003; Narula and Hagedoorn 1999) and R&D networks in particular (Håkansson 1987; Powell et al. 1996; Seppänen 2000; Staropoli 1998; Tijssen 1998; Vekstein 1999), *theoretically, methodologically and contextually*.

In terms of the *theoretical aspects*, the motivation is two-fold. Firstly, the aim is to *increase understanding of networks that are intentionally developed.* Intentionality in this context means that actions are taken in order to establish a network for a certain purpose. The majority of earlier research has focused on organically evolved networks, on their structures and development processes (Möller and Svahn 2003, 203). There are numerous studies applying the Industrial Network Approach, which emphasizes the long-term evolutionary character of networks (Easton 1997; Håkansson and Ford 2002), and the same approach has also been used in the study of project-based R&D relationships in the form of longitudinal analysis of competence development (Seppänen 2000). Intentionally developed networks and their management has been in focus in the following works: Ahuja (2000), Amit and Zott (2001), Dyer and Nobeoka (2000), Gulati et al. (2000), Jarillo (1993), Möller and Svahn (2003), and Parolini (1999). However, it is still relatively rare, although it is an emerging perspective, to study networks as purposefully established structures with a focus on their management. Intentionality in R&D networks means that the purpose of the cooperation is the development of a new

technology/product, and it is not just a minor part of another type of exchange. R&D networks are often project-based (Seppänen 2000), which means that the active exchange between the actors may last only a relatively short time, from few months up to a couple of years.

Access to complementary resources and capabilities that is unavailable within the single firm is a common rationale for starting R&D cooperation (Afuah 2000; Douma, Bilderbeek, Idenburg and Looise 2000; Dyer and Singh 1998; Powell et al. 1996). However, for development partners the importance of cooperation may be looking for anything from efficiency improvements and cooperation in secondary activities to joint projects that have long-term strategic significance and which require them to share and acquire competences that are necessary for their core business (Contractor and Lorange 1988; Dodgson 1992; Möller and Svahn 2003; Narula and Hagedoorn 1998, 284; Nooteboom 1999; Perks 2005; Ståhle and Laento 2001; Teece 1986). The emphasis in this study is on the latter aspect, and the arrangements are termed strategic R&D networks instead of innovation networks (Håkansson 1987, Powell et al. 1996) or issue-based networks (Brito 1999). Strategic networks can be viewed as intentional cooperative arrangements between industrial actors. By combining their competencies, these actors aim at developing products and creating value in the network. Cooperation between industrial actors, when they actively participate in joint technology/product development in R&D networks, is expected to bring strategic advantage to one or all of them, and a stronger competitive stance toward competitors (Gulati et al. 2000, 203; Jarillo 1988, 32). However, this does not necessarily mean that all participants derive immediate commercial benefits from cooperation.

The second theoretical motivation was to complement the research on R&D cooperation and new product development (NPD), and simultaneously to add to the discussion in the literature on industrial marketing by providing perspectives on value creation in *the R&D context*. So far, the topics investigated in R&D cooperation include the profiles of companies involved (Fritz and Lukas 2001; Miotti and Sachwald 2003), and resource and competence creation as a result of cooperation, related to the partner characteristics (Mothe and Quelin 2001). There are also studies on drivers of cooperation between buyers and suppliers for product innovation (Bidault, Despres and Butler 1998), the involvement and the role of suppliers in new product development (Handfield, Ragatz, Petersen and Monczka 1999; Maffin and Braiden 2001) and on customer involvement in NPD (Brockhoff 2003, von Hippel 1988). R&D cooperation between large and small companies is also a relevant topic (Alvarez and Barney 2001; de Meyer 1999; Tether 1998),

and in particular, the role of trust in asymmetric relationships has evoked discussion (Blomqvist 2002; Blomqvist, Hurmelinna and Seppänen 2005).

Studies on value have traditionally dealt with customer value, investigating the characteristics on which customers base their choice when they are comparing alternative offerings in the markets (de Chernatory Harris and Dall'Olmo 2000, Lapierre 2000). An additional viewpoint has been developed in studies focusing on the value experienced in industrial relationships, in the exchange between supplier and customer mainly in the manufacturing context (Flint, Woodruff and Fisher Gardial 2002; Forsström 2005; Möller and Törrönen 2003; Ulaga 2003; Walter, Ritter and Gemünden 2001). These studies have only briefly referred to the existence of a larger network beyond the focal relationship, however (Möller and Törrönen 2003, Walter et al. 2001).

It is essential that actors in R&D networks expect to draw benefits from cooperation, and this is what value refers to in this study. The key area of interest is the nature of this value in the R&D context. The starting point for value creation here is innovation activity, whereas in the manufacturing context innovation is only one of many ways to create value.

Methodologically, this study enriches the research on NPD and R&D cooperation by examining real-life cases from a qualitative perspective. Each case study is constructed from the viewpoints of several organizations and informants. According to Biemans (2003, 514), NPD researchers have investigated a broad spectrum of relevant issues such as success factors (Cooper and Kleinschmidt 1995), speeding up the development process (Millson, Raj and Wilemon 1992; Nijssen, Arbouw and Commandeur 1995), the role of marketing in development (Biemans 1992; Workman 1993), and the involvement of purchasing in NPD (Dowlatshahi 1992; Williams and Smith 1990; Wynstra, Weggeman and Van Weele 2003). However, in spite of the wide range of topics, the majority of the studies have been methodologically relatively one-sided, since they are based mainly on surveys with large samples. The same observation applies to studies concerning R&D cooperation: in spite of the researchers' enthusiasm to investigate cooperation, they have failed to take account of the methodological implications. The majority of research fails to integrate multiple perspectives and continues to rely strongly on the use of single key informants (Biemans 2003, 514–517). This means that a network perspective has been relatively rare in R&D studies. The methodological choice adopted in this study, with several informants per case and per organization in some cases, widens the range of research methods that has been used so far in studies on new product development in general, and on R&D cooperation in particular. This

methodological choice aims at grasping the real-life nature of the phenomenon and presenting a holistic picture by means of deep description.

The cases investigated in this study belong to the information and communication technologies cluster (ICT), which incorporates a wide variety of cases about R&D cooperation between firms within several of its sub-industries. The observation that the largest sectoral share of R&D cooperation is to be found in the cluster has driven the study *contextually*: it is estimated that it accounts for about half of all cooperative arrangements (Hagedoorn 2002). As a whole, this mirrors the total growth of ICT, which has had an enormous impact on society and has transformed other, more traditional industries. The ICT cluster could be classified to include key industries such as terminal manufacturing (computers and mobile phones), network operation, network infrastructure, software and contents development, the supporting and traditional industries, and associated services. It is thus fragmented into different sub-industries and it has interfaces with all the other sectors that are using its applications and providing value value-added content to the infrastructure. Many of the industries are based on research and development, and the cluster itself was, for a long time, one of the most research-intensive. It includes not only a wide array of products but also ones that represent different life-cycle phases. (Hagedoorn 2002, 483; Paija 2001.)

The case networks of the study are engaged in software development. Like many industries in the ICT cluster, the software industry interacts strongly with other industries. Although some software products are sold directly to consumers, the main customer group comprises organizations that need their products and services. In fact, it has been suggested that in order to understand the development of the software industry, it is necessary to examine developments in other, related industries. Electronics, telecommunications, banking, and commerce have strongly influenced the development of the software industry in Finland, and in Israel growth has been driven by the country's military needs and the electronics industry. (Tyrväinen, Warsta and Seppänen 2004, 3–4.)

The cases examined in this study correspond to this reality: they represent not only the software industry but also other firms from industries involved in its development. It is argued that previous research has not been able to address all the issues that have arisen, since cooperation has become more widespread. For example, relationships between traditional industry customers and IT-service providers are worth studying because they are very common and the results will thus benefit a large number of business actors. These kinds of relationships are included in the cases of this study. Furthermore, the dynamics between small and large technology companies when R&D networks and partnerships are formed requires still more research.

1.2 The purpose of the study

Both theoretical and practical issues motivated this study. The need to know more about the management of intentional networks and value creation in the R&D context are the theoretical aspects driving the investigation of strategic R&D networks. Intentionality here means that the R&D networks, comprising more than two actors, were established for the purpose of product development, and the network did not exist before for other purposes, at least not in the same form. Methodologically, the study aims at capturing a real-life description of R&D cooperation in networks with multiple cases and several actors per case. Contextually, interesting and useful results are produced for the ICT cluster actors forming R&D networks. One limitation of the study is that the networks investigated concentrate more on development activities than on research.

The aim is thus to describe the nature of R&D networks as intentional value-creating systems. It is suggested that the differing circumstances have an influence on the need to mobilize networks for value creation. Furthermore, value assumes different forms in various circumstances, and this also requires suitable management activities. The precise research questions are listed below, and reflect the context of the activities, the benefits that are derived from cooperation, and how the activities should be managed in order to gain the desired benefits in intentionally established R&D networks.

1) What are the circumstances that make companies seek value creation in strategic R&D networks?
2) What kind of value is created for the members in strategic R&D networks?
3) What are the key management issues supporting value creation in strategic R&D networks?

It could be stated that the above research questions address the very essence of business relationships and networks: they would not exist without the expectation of drawing benefits, in other words creating value in the exchange. The importance of these research questions is discussed in the following sections, and the main concepts of the study are introduced in a more profound way.

Circumstances supporting value-creating cooperation in strategic R&D networks

Research on interorganizational relationships and networks highlights the importance of taking the context into account. The context of connected relationships has a key role in this study as well, as the first research question

concerns the circumstances that trigger network formation. Cooperation can be triggered as a result of a certain event or a culmination of several events related to technological, social and economic developments that require interorganizational cooperation and thus the establishment of relationships and networks.

The context is called the macro environment in research on industrial marketing (Anderson, Håkansson and Johansson 1994), but in this study the circumstances refer to the environment of the organization, thus drawing on traditional marketing literature. It is suggested that the influence of the environment will reach firms through technological-, industrial- and market-level factors. The characteristics of technology and its newness, and the way it is progressing, may influence the need to cooperate as such. Close analysis of the current situation in the market is fundamental since, together with speculations concerning how the situation might develop in the course of time, it affects decisions about product development and consequently about cooperation. The developments within the industry relate closely to the technology and the market levels, since the industry forms a background for the development of new products and their targeting to markets.

The circumstances in which organizations are functioning are not always even. In some cases the need for R&D cooperation may be greater than in others. This does not imply that in other, different circumstances companies would not form networks, but rather suggests that they may do so for different reasons. Thus, the first research question also assesses the significance of the circumstances as a company-level decision to start cooperation in each case network in the light of the value-system construct: is there a connection between the value system and the motivation and need for cooperation?

The value-system construct is based on the notion that each product or service requires a set of value activities performed by a number of actors, which form a value-creating system (Möller and Svahn 2003, 205; Parolini 1999, 59–68). According to Möller and Svahn (2003), the nature of these activities and the resources involved vary according to the related technological change. Similarly, the technological change determines how well known they are. If it is very small, the actors developing the products form a stable value system, which is characterized by well-known actors, activities and technologies. The second option is that the change is more notable, but all the previously mentioned dimensions, actors, activities and technologies are still relatively well known, forming an established value system: in this case the firms have a need for incremental improvements and there is no great uncertainty connected to the functioning of the system. By way of contrast to these two value-system descriptions, the third value system in the model of Möller and Svahn (2003), emergent value system, is

characterized by radical innovations, and unknown and often also new actors that are introducing new technology products. The first two systems, the stable and the established, are discussed as one in this study, since together they form a sufficient contrast to the emerging value system.

Although the value-system continuum is rather simple and abstract (Möller and Svahn 2003, 206), and in reality a network may consist of actors representing two or all three value systems, for this study it provides a basic tool for classifying R&D networks, and consequently also provides a basis for comparing networks as it is suggested that the different value system characteristics set different requirements for network management. Möller and Svahn (2003) suggest that the better the value system can be defined in terms of actors and activities, the simpler it is to manage and to assess its value-creation potential. In the emerging value system on the other hand, unknown actors and activities may complicate the management and make it difficult to observe the opportunities for value creation. The value continuum provides a platform for a comparative setting, and thus for bringing the results of all cases together, in addition to facilitating discussion of each one separately.

Relational value in strategic R&D networks

Creating value through business relationships is becoming one of the most discussed topics in the marketing literature, thus reflecting the reality in which it is the raison d'être of cooperative relationships (Walter et al. 2001, 372). Burton (1995, 313) emphasizes the fact that companies establishing strategic arrangements are commercial not charitable organizations, with an eye on gain: the partners feed certain input into the venture and hope to get certain things out of it. This output is called relational value in this study, and comprises the multiple benefits that are gained through relationships in R&D networks and that are perceived by the key decision makers (Flint, Woodruff and Gardial 1997, 171; Möller and Törrönen 2003, 109; Walter et al. 2001, 372).

Studying relational value thus has practical relevance. It is suggested that if companies are aware of the value-creation possibilities in the network in the early phase during which it is mobilized, they may reap the benefits earlier and focus their actions so as to support the activities that could bring value in the later phases. Many researchers also emphasize the fact that the basis of the management of networks is to understand how the value is created (Ståhle and Laento 2001, 40; see also Campbell and Wilson 1996; Möller and Svahn 2003; Parolini 1999).

Earlier studies discussing value creation in industrial relationships have mainly adopted either a supplier or a customer perspective in the manufacturing context (Flint et al. 2002; Möller and Törrönen 2003; Walter et al. 2001), although there are a few exceptions: Helander (2004), for example,

analyze value in the R&D network context through actors, activities and resources. It is likely that these frameworks apply only partially to this study, in which case their insufficiencies are addressed and they are modified to fit the R&D context better and to facilitate examination of the network perspective.

It is suggested in earlier frameworks (Möller and Törrönen 2003, 109; Walter et al. 2001, 372) that value can be created through *direct value functions* that describe it, and that this has an immediate effect on the partners, including the profit, volume and safeguarding functions. Value can also be created through *indirect functions*, which are supposed to have an oblique effect on partners due to the connected relationships of the partner firms, and which include access, marketing and scouting (Möller and Törrönen 2003; Walter et al. 2001).

Managing value creation in R&D networks

Many studies have shown that interorganizational cooperative arrangements often fail, or do not meet the objectives that are set for them (Barringer and Harrison 2000; Duyesters, Kok and Vaandrager 1999; Dacin, Hitt and Levitas 1997). This could also be interpreted to mean that one or all of the network members never realized the expected value. It is suggested in this study that value creation could be supported by means of efficient network management. It is essential for companies to recognize the essential management issues and their role in relation to the different value-system characteristics in order to ensure that the network members will be able to realize the value they seek.

In this study the management issues that follow earlier suggestions include *mobilization, visioning, strategizing and guarding* (Burton 1995; Douma et al. 2000; Lundgren 1992; Möller and Svahn 2003; Lorenzoni and Baden-Fuller 1995). It is claimed that the activities they include cannot be presented in a certain order, but that they take place simultaneously, and may sometimes continue through the network life cycle. For example, when the network is mobilized the visioning and strategizing are necessary in the early stages, although these processes may still be going on when it starts its operations.

One of the first steps in managing the network and proactively influencing its value creation is *mobilization*, which includes *searching and identifying* the right partners with matching resources. Conducting negotiations and preparing detailed contracts for starting R&D cooperation may be a long process and may require several phases, since multiple levels of internal approval must often be sought in each company. (Möller and Svahn 2003, 209; Lorenzoni and Baden-Fuller 1995, 147; Ring and Van de Ven 1994.) This phase is crucial in the strategic R&D network in particular, since it may be difficult, costly and time-consuming to change the constellation after the development project has started.

In order to create value, the network members have to know their environment. *Visioning* the network implies making sense of the opportunities and the threats. It is about making a map for its future and trying to see its evolution. There may be one strong actor leading others and envisioning the business in question, but this requires a solid understanding of the business field and a strong business position. (Möller and Svahn 2003, 215.)

Strategizing in the network refers to achieving a strategic fit among the members in terms of the goals and the importance of the network (Douma et al. 2000, 587). When the goals are set for cooperation, companies can assess the contribution that the partners will be able to offer, which will be part of the perceived value. The goals of the network should be specified and articulated well in advance, so that the companies involved do not start promoting their own, individual goals (Håkansson and Sharma 1996, 110; Möller, Rajala and Svahn 2005). Value creation may be impeded if the network members are not committed to the goals. Another strategizing task is to make sure that the members prioritize the network tasks over their other tasks, thereby ensuring the progress of their joint activities.

The purpose of network *guarding* is to make sure that being party to network cooperation does not endanger the individual firm's competitive position (Perks and Easton 2002; Burton 1995), and to prevent unwanted know-how leaks (Burton 1995). One actor, a core company, may be more influential in network management: it may start envisioning, initiating, mobilizing and coordinating the strategic network during its existence, as well as leading it through the necessary changes (Doz et al. 2000, 242; Dyer and Singh 1998, 666–668; Lorenzoni and Baden-Fuller 1995, 147; Möller and Svahn 2003, 209). These network-management issues also reflect the intentionality of the network: it is mobilized for a certain purpose and the other activities are needed to support this purpose.

The theoretical positioning of the study

Theoretically, this work draws on the studies of interorganizational networks and alliances. Firstly, the Industrial Network Approach is a theoretical extension of the Industrial Marketing and Purchasing Group's interaction approach, which has emerged since the 1980's and is focused on supplier-customer relationships in industrial markets. Sharing common with research on distribution channels and the transaction cost approach, it describes networks as interconnected business relationships: interdependent actors control and exchange resources in complicated business markets by engaging in activities (Håkansson 1987; Håkansson and Snehota 1995; Johanson and Mattsson 1987). Research on social networks has also influenced this study (Powell 1990; Powell et al. 1996).

The second theoretical domain comprises the emerging perspective of network governance in strategic management (Ahuja 2000; Amit and Zott 2001; Dyer and Nobeoka 2000; Gulati et al. 2000), which is influenced by the resource-based view[1] of the firm. Current literature on strategic management acknowledges the importance of relationships, and particularly with regard to the RBV emphasizes that critical resources may reside outside firm boundaries and be the source of competitive advantage (Dyer and Singh 1998). A firm's network could be seen as an inimitable resource in itself, and as a means of accessing others' inimitable resources and capabilities (Gulati et al. 2000). This brings it close to the Industrial Network Approach in that its main concern is to make the best use of the resource constellation.

Views on cooperation have also been moving closer to those of the Industrial Network Approach. The literature on strategic management has emphasized the fact that "strategy is about winning" (Grant 1998, 3). According to Gadde et al. (2003, 2), this implies that someone else has to lose in the traditional zero-sum contest type of relationship. Even if there are cooperative elements present, the focus has been on how firms could improve their performance in competitive interaction with other companies (Sanchez and Heene 1997, 303). According to the Industrial Network Approach, the competition aspect is less important and interdependence and coevolution more important (Gadde et al. 2003, 2), hence the strategic scope shifts from pursuing a victory over others to making it together with customers and suppliers, distributors and development partners (Ford Gadde, Håkansson, Lundgren, Snehota, Turnbull and Wilson 1998, 107).

Strategic R&D networks, value systems as contributing to the circumstances for cooperation, value creation in the network, and network management are the main themes in Chapter two, which lays the theoretical foundation of the study. When strategic R&D networks are described, ideas have been adapted mainly from the literature on strategic management. The same domain has given guidelines in establishing the basis for comparing the different value systems and circumstances, although the Network Approach

[1] This approach has its origin in Penrose's (1959) seminal work, and it has been developed further by several researchers (Grant 1996, Barney 1991). According to the resource based-view of the firm, differences in firm performance are related to variance in resources, in other words to heterogeneity. Valuable, rare, imperfectly imitable and non-substitutable resources form the basis of competitive advantage, whether they are financial, technological, human or organizational (Barney 1991, 101-102). However, resources alone are not sufficient, and need to be combined with competencies and capabilities if their value is to be exploited to its full potential. Competence could be defined as an ability to sustain and coordinate the deployment of assets, whereas capabilities are "repeatable patterns of action that employ the firm's assets and that involve individual and organizational knowledge, skills and competencies" (Mothe & Quelin 2001, 115; Barney 1991).

and the literature on innovation and technology management has also been there in the background.

Studies focusing on value creation in customer-supplier relationships (Walter et al. 2001; Möller and Törrönen 2003; Werani 2001) form the basis of the discussion on value in this study. The discussion network management was inspired by the literature on industrial marketing research and strategic management. Although some similar patterns are to be found in the two domains, concerning network mobilization (Lundgren 1992; Doz et al. 2000) for example, the latter emphasizes the intentional and purposeful nature of established relationships and networks more, and has many suitable constructs to offer, such as network goal orientation (Douma et al. 2000) and the role of the core company in managing the web of partners (Doz et al. 2000; Jarillo 1988).

1.3 Research methodology and design

The strengths of the qualitative research approach in general, and of case strategy specifically in network research, guided the methodological choice in this study (Dubois and Gadde 2002; Halinen and Törnroos 2005). Case strategy allows deep and holistic description of phenomena that have vague boundaries with the context, which is complex and dynamic by nature. Another unique strength of the case study is its ability to deal with a wide variety of evidence, including documents, interviews and observations (Halinen and Törnroos 2005; Yin 1989, 20–23). This methodological choice allows the use of abductive reasoning, a research logic that combines both inductive and deductive elements (Coffey and Atkinson 1996; Dubois and Gadde 2002; Kelle 1995). The existence of a theoretical framework gives guidelines to the empirical work, but not too strictly, as new themes discovered during the field work influence its reformulation.

The basic unit of analysis in this study is a network formed for a product development project. The boundaries of the case network were set according to the relevancy of the actors in it. Networks focused on development projects were located so as to allow the names of the other important actors to emerge in the first interviews in one organization, which made the configuration of the network possible. However, before entering the first organization the researcher had pre-knowledge that the companies were involved in a suitable development project.

There are four cases in this study, and they form well-comparable case pairs. The first pair focuses on the development of financial applications. These companies are embedded in a context that has features of a stable and

established value system in that they develop solutions for markets that already exist. The case networks of the second pair operate in an environment that has more features of an emerging value system. The companies in question aimed at developing video compression and video streaming, i.e. digital video technologies. The markets were still emerging at the time the solutions were being developed.

A short description of the cases is presented in this sub-chapter. Three of the four were considered successful in that they had managed to build up the network and had produced the desired outcome. However, this does not mean that all the expectations of the network members had been met. In spite of its failure, the fourth case was included since it provides very interesting viewpoints concerning the network mobilization attempts made by a start-up company. Its technology was promising, but the company did not have enough capabilities to deal with its business relationships or to reach agreement on R&D cooperation.

Case A) A strategic R&D network in the development of an e-banking solution

The first case concerns the development of an e-banking application that took place between a Nordic financial institution, an IT consultant that had been its trusted partner for many years, and a technology platform provider. The e-banking solution was developed in a post-merger situation in the bank in order to achieve unification on the Nordic level. The market circumstances, with the increasing use of Internet banking services, was an incentive to start the development for both the bank and the IT consultant, and it would also give them the rights to the product. It was essential for both parties to be able to utilize each other's competence in the project. All in all, it was relatively clear to them what kind of value could be created through the relationships. For the technology provider and the IT consultant this project provided remarkable reference value and the possibility to use the joint development to promote new business with the same partners. After the bank had mobilized the network, the challenge faced in its management was the matching of the internal goals of the whole group of banks in the Nordic countries and between the bank and the IT consultant. Because of the extent of the project and the large number of participants, on the management level issues such as the coordination of tasks and communication sometimes caused bottlenecks. The project was prestigious for all of the partners, and especially for the IT consultant as it was mainly responsible for running it. There was thus a feeling that it had to be carried out successfully no matter what the price was. On a large scale, this project could be well planned in advance, since the needs were known and the improved solution would only replace the previous one. The case description is presented in Chapter 4.2.

Case B) A strategic R&D network in the improvement of a financial information system

The second case is comparable to the first one since the objective of this development project was to provide an improved financial solution to a group of purchasing organizations that were providing financial services for kibbutzim and moshavim in Israel. These organizations, as customers, were deeply involved in the development, which was carried out in cooperation with a software developer, a consultant, and a company providing Internet technologies. The aim of the project was to improve the existing information system by adding a new interface, and thus the change was incremental.

The willingness of the purchasing organizations to start the project was based on a desire to present a modernized image. As with the Nordic e-banking project, this one, too, could be well planned beforehand, although it was difficult for the purchasing organizations to reach an understanding of the details. They valued the competence of the software developer, which had accumulated during their long relationship and speeded things up. The project was eventually finished successfully and on time. The software developer aimed at providing top service for the purchasing organizations, since it was crucial for them to be satisfied and thus to continue the relationship in the future. However, the relationship ended soon afterwards because the consultant that had been involved in the cooperation persuaded the key person from the software developer to move to their firm. The consultant had been hired for the network by the customer group, which wanted advice on questions related to technical issues and partner search. The case description is presented in Chapter 4.4.

Case C) A strategic R&D network in the development of a video streaming solution

The third case, the actors in which were located in Israel and the U.S., includes a supplier that cooperated with a customer and a standard provider in order to create a solution for video streaming. The main circumstantial influence came through the situation in the industry and the market, in which radical change was taking place. The American customer did not have time for in-house development of the video streaming solution, which was to be part of their offering to cable broadcasting companies that were starting to up-grade their equipment. Instead, the company had to quickly acquire technology from a small Israeli firm that had the necessary competence for its development. The Israeli company was in such a financial situation that it was forced to cooperate with the American company, although strategic considerations went against the arrangement to some extent: the company was afraid that the large partner would absorb the knowledge. The American company assigned the Israeli one to work with a third party, the standard provider, in order to

provide a high-quality product. The case description is presented in Chapter 4.6.

Case D) The formation of a strategic R&D network for the development of a video-compression solution

The fourth case is an Israeli start-up, which had a very interesting technology, but which lacked the resources to complete the development. The aim of technology was to send video on low bandwidths through the Internet and mobile terminals. It was considered a breakthrough and it had better qualities than the competing technologies, which implies radical change. The start-up tried to make the technology known by introducing it in the right forums, and some companies really became interested in its activities. It then attempted to start cooperation with international, world-class companies as well as with small Israeli-based companies, and all but one lead to no concrete actions. The single half-successful network formation attempt also failed, since the potential partner did not have enough money to pay for the development. Weak visioning and strategizing formed the bottlenecks in the network mobilization. The start-up was lacking a focus in its business development. Some of the problems were related to the uncertain environment and the market, which was not yet ready for the solution. To some extent, the start-up did not know how to handle the contacts it had, or how to develop a strategy. The case description is presented in Chapter 4.8.

Outline of the study

Chapter 2 comprises the theoretical part of the study. It begins with an introduction to the key concepts of research and development and to the research approaches that have been used in earlier R&D studies. This is followed by an overview of network research, the nature of strategic networks being discussed in particular. The value system framework, which is used a basis for comparing networks, is presented together with the circumstantial factors. The concept of relational value and the initial value framework are also introduced, as are network-management issues. The chapter concludes with a summary of the theoretical framework, in which the key ideas and concepts of the study are integrated.

Chapter 3 discusses the methodological choices made, and justifies the chosen qualitative approach and the case-study strategy that has been applied. The other sections show how the empirical cases were located and accessed, and how the data was handled. Qualitative assessment concludes the methodological considerations.

Chapter 4 begins with an introduction of the ICT cluster, and creates the links between it and the cases in question. This is followed by the case descriptions and their analyses. A related case analysis directly follows each case

description. The discussion is broadened in Chapter 5, which presents a cross-case analysis of the previously described and separately analyzed cases. Chapter 6 summarizes the study and sets out the conclusions, the managerial implications and the avenues for future research on strategic R&D networks.

2 CREATING VALUE IN STRATEGIC R&D NETWORKS

2.1 Introduction to R&D

Strategic R&D networks are the main focus of this study. In order to facilitate understanding of their nature and the purpose, this chapter begins with an introduction to R&D.

2.1.1 Definition and economic significance

At the beginning of this work R&D was defined as an activity that is undertaken in order to increase scientific and technical knowledge and to apply that knowledge to create new products or processes (Hagedoorn 2002, 477; Jassawalla and Sashittal 1998, 238). The first abbreviated word, research, refers to the systematic approach to the discovery of new knowledge, especially in the academic world. It can be classified as either basic or applied research. The aim with the former is to gain greater knowledge or understanding of a subject without specific applications in mind, while applied research involves the use of existing scientific principles for solving a particular problem (Hirshfeld and Schmid 2005, 1; Trott 1998, 182).

The second part of R&D refers to product development, which means the systematic use of the knowledge gained through basic and applied research to produce useful materials, devices, systems or methods. Development activities are similar to applied research, but they clearly focus on products (Hirshfeld and Schmid 2005, 1; Trott 1998, 182). However, according to Trott (1998, 172), in the industrial context the term research is much more generic and involves both new science and the use of old science to produce a new product, which sometimes makes it difficult to determine when research ends and development begins. R&D refers to development activities in this study, and therefore the following paragraphs focus on product development.

R&D is an extensive and critical corporate activity. The development of new products may strengthen the existing business or drive new businesses. Viewed as a sub-process of innovation, it is about turning business

opportunities into tangible products, which are important means of competition in the long run. (Trott 1998, 112–184.) The significance of R&D has been growing worldwide in absolute numbers and as a proportion of the gross domestic product. R&D expenditure has been estimated at 800 billion USD, three-quarters of which is used by large industrial countries, in other words the US, Japan, China, Germany and France, although several small countries also have a key role: Israel, Finland, Sweden, Denmark, Taiwan and Singapore. The following tables show the expenditure of the leading countries in absolute numbers and as a proportion of GDP (Hirshfeld and Schmid 2005, 2).

Table 1 The countries with the largest expenditure on R&D in absolute numbers (Hirshfeld and Schmid 2005, 2)

Country	Billions of dollars	Country	Billions of dollars
USA	285	**Taiwan**	11
Japan	107	**Sweden**	9
China	72	**Israel**	6
Germany	54	**Finland**	4
France	37	**Denmark**	4
UK	31	**Singapore**	2

Table 2 The countries with the largest expenditure on R&D in relation to GDP (Hirshfeld and Schmid 2005, 2)

Country	Share of GDP %	Country	Share of GDP %
Japan	**3.1**	**Israel**	4.9
USA	**2.7**	**Sweden**	4.3
Germany	**2.5**	**Finland**	3.4
France	**2.2**	**Denmark**	2.5
UK	**1.9**	**Taiwan**	2.1
China	1.2	Singapore	2.1

The case companies of this study are located primarily in the small R&D-intensive countries of Israel, Finland, Denmark and Sweden, which appear in the table. Networks were also established, or there were attempts to establish them, with overseas partners, mainly in the US. Israel ranks highest in R&D intensity with its R&D expenditure of 4.9% of GDP, partially due to the development efforts of the military industries.

2.1.2 The major research approaches to R&D

New product development is largely about assembling knowledge, and there are several models that describe this process. The linear R&D model describes it as a series of linked activities. The key activities that need to be managed include the generation of ideas and the observation of business opportunities, the consequent development of a product concept, specifications and prototype, testing the product technically, and testing the market before the final introduction. Screening and evaluation are continuous activities related to every stage of the development. These activities are illustrated in the following figure.

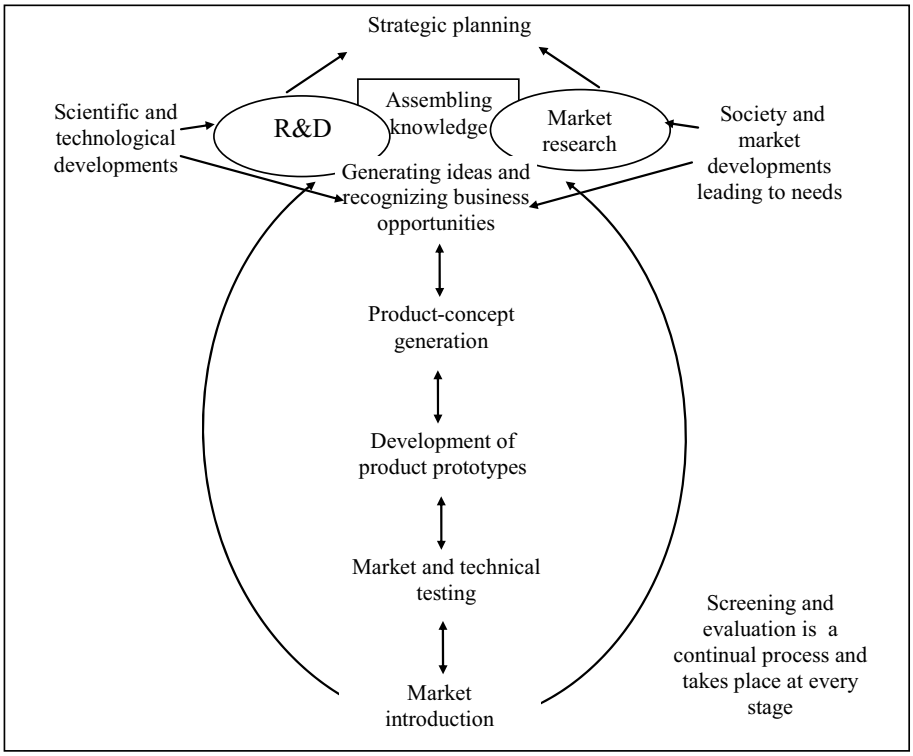

Figure 1 The new product development process as a series of linked activities (Trott 1998, 141)

There are models other than the linear model in use, and each one emphasizes a certain aspect of new product development. Departmental-stage models are based on the linear model of innovation and they show how each department involved – R&D, engineering, manufacturing and marketing – is

responsible for certain tasks. These models have been criticized, however, because the perspective is too insular. By way of response there are models describing cross-functional teams, which include members from each department and are thus in a key position to improve interdepartmental communication. Another set of models, decision-stage models, represents the new product development process as a series of decisions that need to be taken in order to push the project forward (Trott 1998, 129; Cooper and Kleinschmidt 1993).

According to Lindman (1997, 17), industrial new product development is, in many ways, bound to other management functions within firms as well as to the external conditions in which they operate. Given its complex nature, R&D spans a number of theoretical disciplines and corresponding management fields. Lindman (1997, 17) summarized the major research approaches, which are illustrated in Figure 2. This study adds the network perspective to Lindman's list, and also draws on the resource-based view of the firm, as shown in the figure.

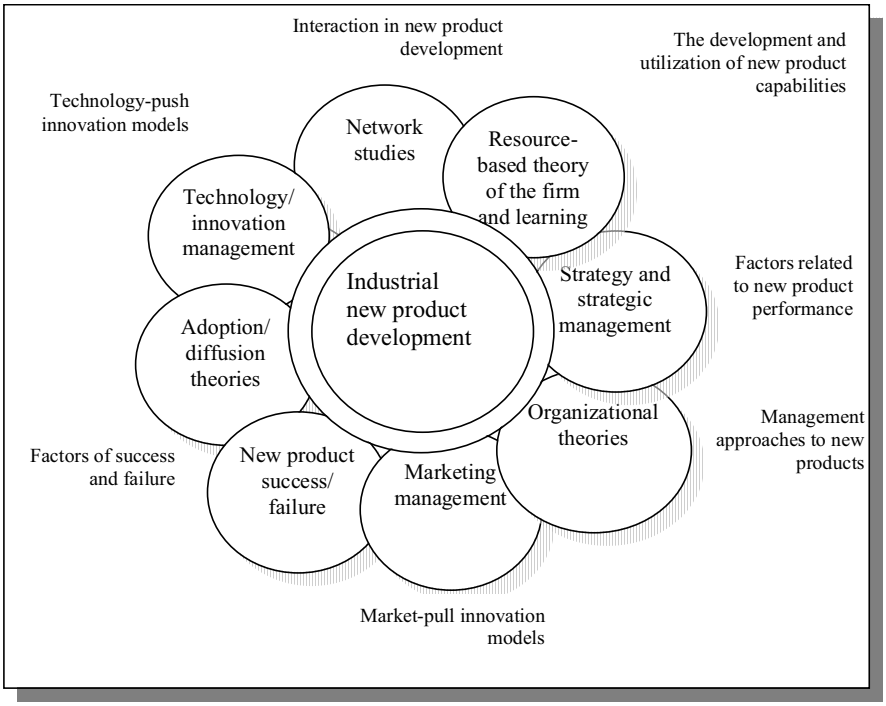

Figure 2 The major research approaches in R&D studies (adapted from Lindman 1997, 17)

Since new product development involves intrafirm and interfirm learning, as well as the development of resources that distinguish the firm from other

firms, it has motivated researchers to use the research-based view of the firm and theories about learning. A connection between new product development and business strategy is established through the growing complexity and considerable financial demands, and this calls for a strategic management approach. Organizational theories are used in NPD research to search for ways to manage the development in an efficient way.

The tracking of sources of product innovation follows two major evolutionary courses, technology-push and market-pull. In the former, the research is conducted from a technology-management perspective. It has been stressed that scientific discovery is the driving force behind new product development, and that the need is, in fact, created for the market. The ideas for the new products will flow from the organization's knowledge base. The starting point in market-pull innovation models is an observed need on the consumer side, and the emphasis is on marketing management. Interaction between the two standpoints has proved to be necessary for the success of new products, and in reality an accepted view is that there is a need to balance both marketing and technical factors in order to manage the new product efforts properly. In general, an understanding of what successful product development demands has become crucial, and a number of standard prescriptive models have been established. (Trott 1998.)

Adoption and diffusion theories are needed to understand the decisions of users of new products to exploit the innovation fully. Adoption is suggested to comprise several ingredients, such as the advantages the product has over those it is replacing, the past experience and the needs of the user, the easiness of understanding the product, and its technology, performance and use (Lancaster and Taylor 1988). Each new product is developed with a view to gaining large-scale acceptance, although the forecasting of future sales is a matter of great uncertainty. There are major intermediating factors influencing the acceptance of the product, and not all of them are under management control: the number of competitors, the reputation of firms, the relationships between and confidence among potential adopters, and standardization. (Lindman 1997, 38.) Although R&D investment is fundamentally beneficial, these uncertainties make it difficult to know precisely where to invest and when to stop pouring money into a project that looks likely to fail but could yet deliver profits (Trott 1998, 178).

This study adds the network perspective to the approaches that could be used in R&D research. This perspective is inspired by real-world developments: the process of new product development is often divided among firms rather than being focused on a single organization (Biemans 2003). When several actors participate in the development, they interact throughout the process and by exchanging various resources. Examining the

phenomenon from the network perspective thus corresponds well to the reality. The network approach makes it possible to combine the views of the different actors involved and to paint a rich picture of the phenomenon under study.

2.2 Networks as a governance structure

Industrial networks encompass sets of horizontal and vertical relationships with other organizations – suppliers, customers, competitors or other entities – and the various relationships within them also cross the borders of industries and countries (Gulati et al. 2000, 203). A basic characteristic of a network is that the relationships are connected, which means that exchange in one relationship is conditioned by exchange in another (Cook and Emerson 1978). The literature on networks suggests that they can be studied as formal governance structures (Johanson and Mattsson 1992, 207; Powell 1991), representing an alternative to markets and hierarchies, two traditional modes of coordination (Williamson 1985).

Large, vertically integrated hierarchies tend to be inefficient in terms of governance, particularly in knowledge-rich and turbulent environments, since they fail to adapt quickly due to their commitment to established structures (Achrol and Kotler 1999, 147; Powell 1991, 272). In market transactions each firm aims at fulfilling its own internally defined needs and goals and puts no emphasis on trust in its relationships. Prices are assumed to contain all the necessary information about availability and the need for resources. However, markets are not able effectively to respond to situations in which the emergence and convergence of technologies require more intensive knowledge exchange between companies (Johanson and Mattsson 1992, 207; Powell 1991; Webster 1992, 4).

Networks, on the other hand, are flexible, open to their environments, and characterized by mutual orientation, which greatly enhances their ability to transmit and absorb new knowledge and skills. Since the value of knowledge and skills is not easily measured, it is difficult to trade in the market or manage in hierarchies. This gives some background to the reasoning that networks are especially useful in the exchange of highly sophisticated technological knowledge, which is tacit and difficult to codify, and includes know-how, technological capabilities and production technologies (Grabher 1993, 10; Powell 1991, 272).

According to Powell et al. (1996, 119), learning has an important role in networks, and cooperation can compensate for the lack of internal skills. At the same time, however, the resources provided by the network can further

develop and strengthen the existing skills in the organizations. Again, in comparison to hierarchical organizations in which the strong ties created between functional units cause the members to act alike and to produce redundant information, the network creates dense ties with actors coming from different functions, and with different interests and knowledge bases (Achrol and Kotler 1999, 147). It is essential for companies not only to maintain these ties, but also to learn to transfer knowledge through them and to locate themselves in network positions that enable them to keep pace with the most promising scientific and technological developments (Powell et al. 1996, 119–120).

Although a network may be a source of multiple benefits for companies, it can also be a constraint. Dependence on other organizations holds back change, and the actions in the relationships have to be synchronized (Håkansson and Ford 2002). Therefore, according to Grabher (1993, 9), it is advantageous for firms in networks to preserve some of their autonomy in relation to their exchange partners. This so-called ‘loose coupling’ prevents them from being locked into specific relationships and offers more favorable conditions to considerably broaden interactive learning and innovating than markets and hierarchies (Grabher 1993, 10). In other words, it is essential in networks to aim at maximizing the benefits of flexibility, and at the same time to avoid deep dependence on other organizations.

Avoiding dependence does not mean that the goal of the firms in the network is to drive the hardest possible bargain in the immediate exchange, which is typical of markets, but rather that they act in a reciprocal manner in a longer time span. Grabher (1993, 8) condenses the key points by stating that the contributions of each partner are thus expected to reach balance not in every single act of exchange but rather over the entire relationship. This requires an expectation of continuity, which sometimes increases when partners gain knowledge about each other (Doz et al. 2000, 242).

This knowledge may serve as a basis for mutual orientation. The parties in the network draw upon it in communication and problem solving that concern technical matters, contracting rules, and the standardization of rules and processes, products and routines (Johanson and Mattson 1987, 339). Mutual orientation thus implies a set of rules that are formed, reinforced and modified through interaction, whereas it also creates a frame for the subsequent interaction (Grabher 1993, 9). Every network actor should bear in mind that, in general, all of the relationships could be considered 'investments', since certain 'asset specificity' is created immediately when a new one starts and knowledge about the partner starts to accumulate.

2.3 R&D networks as strategic networks

The networks that are examined in this study are called strategic networks. The existing literature also refers to value-creating networks (Campbell and Wilson 1996, 131), issue-based nets (Brito 1999, 93), extended organizations (Boarman and Clegg 2001, 795), strategic enterprise networks (Hyötyläinen 2000, 11), and innovation networks (Håkansson 1989). Nearly all these studies offer useful insights for this study too, but the initial suggestion, strategic networks, seems to be the best choice. The aim in this section is to explain why this is so.

Before entering into more profound discussion on strategic networks, it is necessary to narrow down the meaning of the term network. Möller and Svahn (2003, 204) pointed out that there is a distinction between a "network of organizations" and a "network organization". The former refers to any group of independent organizations or actors that are connected through exchange relationships. According to the Industrial Network Theory, any market could be described as this kind of macro network (Axelsson 1995). On the other hand, the network organization, a smaller unit, can be distinguished by the quality of the relationships between the actors: by the density, multiplicity and reciprocity of the ties, and a shared value system defining membership roles and responsibilities (Achrol 1997, 58).

The interest in this study is directed to the latter, but with certain reservations: it is accepted that the network organization is part of a larger external network, but with less dense ties than the IMP view would hold, and it is therefore called an environment. It is natural that the network and its environment are interconnected: what happens in the latter affects the network organizations, and at the same time the organizations are creating events in the environment.

Purposeful network formation for strengthening the competitive position

Jarillo (1988, 31) defines strategic networks as long-term, purposeful arrangements among distinct but related for-profit organizations, which are independent along some dimensions and thus not completely dependent on each other. Other researchers have pointed out that the members in strategic networks do not necessarily have to be for-profit organizations, and may also include non-profit ones, at least temporarily, such as governmental bodies and university-based research institutions (Möller and Svahn 2003, 205). It is acknowledged here that industrial actors may be either profit or non-profit organizations. Strategic networks can be used to give companies a stronger competitive position, and to gain or sustain competitive advantage vis-à-vis competitors outside the network, which explains why the term 'strategic' was

chosen to describe them. Relationships are essential to their competitive position and the coordination takes place through adaptation. (Jarillo 1988, 32–33.)

Möller and Svahn (2003, 205), as well as Staropoli (1998, 16), stress the intentional structure of strategic networks. This means that firms try to design these networks for their specific purposes. This notion is in line with the view put forward in this study, which stresses the goal orientation of strategic networks. The intentional nature of networks is also emphasized in Brito's (1997) study, in which they are called issue-based nets. Brito (1997, 93) defines them as aggregations of actors who share mutual interests in order to cope with a collective issue by changing or preserving the shape of the network in which they are embedded. These nets are subsets of overall industrial networks and may be either formalized or non-formalized. Actors in issue-based nets attempt to influence their environment according to their own interests, and thus they can function as a means of inducing change or preserving stability. (Brito 1997, 93.)

In this study the "issue", or the intention of the companies involved, is to develop a technology, a product or a service, and it would therefore be possible to call the networks innovation networks, as the IMP-based study conducted by Håkansson (1989) suggests. However, since innovation as such is not the main focus here, another concept, the strategic network, was chosen. In order to distinguish intentional networks from other arrangements, Möller and Svahn (2003, 205) called them "nets" instead of using the longer expression "network". However, this study follows the majority of studies and adopts the latter expression.

The depth of cooperation, the temporal dimension and an emphasis on value creation in strategic networks

Tsupari et al. (2001, 10) discuss the depth of cooperation and the temporal dimension related to strategic networks. They suggest that cooperation is wide and deep, implying that several corporate functions, such as research and development, human resources and marketing, cooperate with the respective functions in other companies. They, like Jarillo (1988, 31) suggest that the actors in a strategic network aim at long-term cooperation. This notion requires slight modification in the context of this study. First of all, it may be true that the more corporate functions that are involved in the cooperation, the deeper the impact usually is. According to Ståhle and Laento (2001, 93), R&D cooperation between companies is strategic when the partners are pursuing strategic benefit for themselves by combining their knowledge bases. This implies that in these relationships the whole knowledge base of the firm, or at least a major part of it, has to be revealed to the partner for common use. This refers directly to cooperation within research and development, since the goal

of combining knowledge bases regularly is the development of new products or services. This clearly has significance for companies as far as the new product is concerned. R&D cooperation may also involve relationships that are based on transactional exchange rather than deep involvement. Ståhle and Laento (2001) call this operational partnering. The commitment to the relationship is weak and companies are continuously looking for new, more competitive partners. The added value in the partnering is created through specialization and cost cutting, and its nature is thus more mechanical. It does not require reciprocity to the same extent as strategic partnering, which in essence requires exposing one's core competence and sharing it with other actors in order to achieve sustainable competitive advantage.

The temporal dimension in R&D networks is also different and has different significance than in the strategic networks that have been described by other researchers (Tsupari et al. 2001, 10; Jarillo 1988, 31). R&D networks do not necessarily exist for a long time, since they are often project-based and therefore their duration has been at least roughly defined beforehand. This implies that long-term duration does not necessarily make a network strategic. The impact of a strategic R&D network on the actors and their business may be very deep and far-reaching in the future, however, since the decisions made concerning research and development in general dictate the future position of the firm.

Since creating value for the members is always the main objective in strategic networks, some studies use the term "value-creating networks" to describe their nature (Campbell and Wilson 1996, 135; Cravens et al. 1996, 212; Parolini 1999, 59–68). The key idea behind value-creating networks is that the value creation extends the network boundaries: no one actor alone could reap the benefits that the network as a whole is able to reap (Cravens et al. 1996, 212). It is suggested that the process of simultaneously lowering costs and raising the performance level is essential for members of value-creating networks. The cost advantages related to specialization in narrowly defined functions could, in fact, be seen as a formation mechanism for such networks. (Campbell and Wilson 1996, 135; Cravens et al. 1996, 212; Parolini 1999, 59–68.)

Value-creating networks could be especially valuable for small and medium-sized enterprises (SMEs) forming cooperative regional or strategic enterprise networks that enable them to achieve synergies and to challenge together large competitors, which would not be possible for any of them alone. The network provides support, for example, if some investments can be avoided because it gives the opportunity to cut overlapping activities. (Hyötyläinen 2000, 25; Levin 1998, 398–399; Nassimbeni 1998, 543;

Nooteboom 1999, 64; Tsupari et al. 2001, 7.) Table 3 below summarizes the different network terms that have been discussed previously.

Table 3 Emphases of network organizations

Term used	**Description of the network**
Strategic network	A stronger competitive stance against competitors. Long-term, purposeful arrangements.
Issue-based network	The network has been established around a goal, which may be product development, a marketing project, etc. There is a central "issue" around which the members are coalescing.
Innovation network	The actors have formed the network in order to use each other's resources in the innovation process.
Value-creating network	Value-creating aspects are related to cooperative arrangements: lowering costs and at the same time raising performance is the main focus.
Extended organization	These forms stress changing corporate boundaries, and making them obsolete both between and within organizations. Decentralization and disintegration are addressed in these descriptions.
Strategic enterprise network	The role of SMEs based in certain regions is emphasized in the formation of these networks. The SMEs strive for competitive advantage by joining forces on a regional basis.

Bringing together the major dimensions of the definitions presented above produced the following definition of the strategic network as referred to in this study.

Strategic networks are intentionally formed for a certain purpose, which in this study is cooperation in R&D. Such networks consist of industrial actors, vertically and horizontally related to each other, and sometimes also universities and governmental actors. Their aim is to strengthen their competitive position by combining their competencies and thus creating value for themselves. The duration of these networks is often predetermined, but their impact on their business may be long-term.

Figure 3 below gives the key dimensions of strategic networks extracted from the above definition.

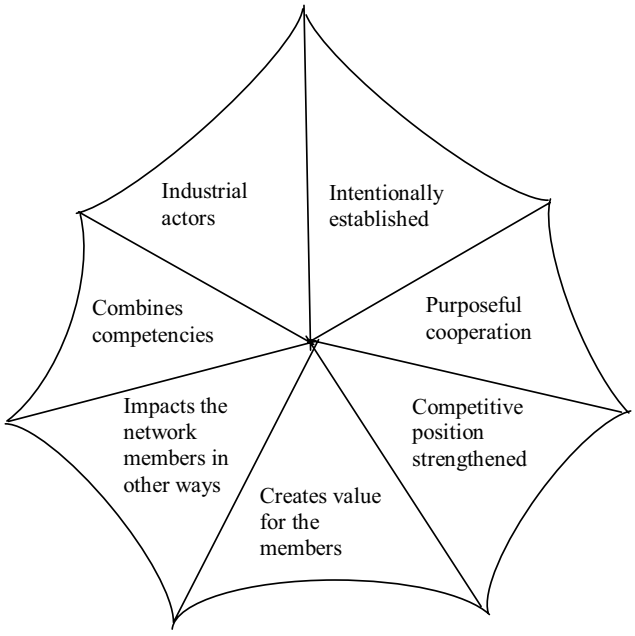

Figure 3 The key dimensions of strategic networks

The vertical and horizontal relationships appearing in the definition refer to the firms' relative positions in the supply chain. Vertical relationships are established between customers and suppliers, and horizontal relationships between competitors. This division is rather one-dimensional. Boundaries between different actors and their positions in the supply chain are becoming blurred, particularly in the cluster under study, as one actor may simultaneously be a supplier to another actor in one area, but in some other area may be its competitor. This description of the "direction" of the relationships in the network, however, helps in understanding the nature and management of the cooperation.

2.4 Circumstances for value-creating cooperation in strategic R&D networks

Companies have been increasingly cooperating in R&D following the developments in the high-technology industries since the 1980's (Hagedoorn 2002; Dodgson 1992, 228). Cooperation has become more common in an

environment that is characterized by knowledge-intensive and complex products, technological and market uncertainties, and continuous innovation (Dodgson 1992; Douma et al. 2000; John, Weiss and Dutta 1999; Roberts and Liu 2001; Pisano and Mang 1993). The following sub-chapters review the circumstances that surround R&D cooperation on the technological, industry and market levels, and points out features that directly affect the need to start cooperation. The necessity of entering into R&D cooperation as a company-level decision is also briefly discussed.

2.4.1 Technological-level circumstances

2.4.1.1 Features of technological knowledge

A fundamental concept in technological development is knowledge, which forms the basis of the technology products, is expensive to produce and difficult to transfer. Technology products are thus manifestations of knowledge and related know-how because of their remarkable knowledge content: technology has been defined as "scientific knowledge applied to useful purposes" (John et al. 1999, 79). It is, in fact, difficult to make a distinction between product and technology, since the technology is embedded in the product. Moreover, process technology, which is part of the production/delivery system, also belongs essentially to the product (John et al. 1999, 79; Moriarty and Kosnik 1989). Räsänen (1999, 55) emphasized the high knowledge content in the definition of high-technology products. Other criteria that are used to define high technology include the number of technical employees, the amount of research and development outlay, and the number of patents filed in a given industry (Mohr 2000, 5). Alahuhta (1990, 19) profiled high technology as technology-intensive industries spending more than 5% of their sales on R&D activities, and argues that the R&D expenditure has to be used for product rather than manufacturing-process development. According to Pento (1990), high-tech products are risky and capital-intensive, and although they have a long development cycle from the basic research to commercialization, their economic life cycle is short.

The investments that are required in the development of high-technology products are thus often extensive. High-technology industries are characterized by a high unit-one cost structure, which means that the cost of producing the first unit is very high relative to the costs of reproduction (John et al. 1999, 80). An example of an extremely costly process is in

biotechnology, where a new drug may cost $200 million to develop. Sharing the R&D investment between partners may help in avoiding duplication effort in the development process if the companies are working in the same field. It could also enable faster entry into the market and project payback, and the costs of cooperation could be even less than the investment costs incurred by each firm working alone. (Dodgson 1992, 231–4.) Tether (2002, 964) argues that companies that have difficulties financing projects tend to cooperate in R&D.

It has been suggested that knowledge varies from the tacit (uncodified) to the explicit (codified). Codifiability of technology, in other words the ease with which it can be encoded, has an impact on how quickly and extensively it can be transferred and diffused. If technological knowledge can be codified, in other words described in terms of formulae, blueprints and rules, it is possible to transfer it easily and quickly from firm to firm. In the opposite case, when it is "tacit", it is acquired only through experience and face-to-face interaction. Cooperation potentially provides a mechanism whereby close linkages between different organizations allow sympathetic systems, procedures and vocabulary to develop. These systems may encourage the effective transfer of knowledge and allow the partners to "unbundle" discrete technological assets for that purpose. (Dodgson 1992, 227; Hall and Andriani 2003; Mowery 1988; Polanyi 1966; Tidd, Bessant and Pavitt 2001, 225.)

2.4.1.2 Type of technological change

If corporate research and development aims at acquiring knowledge in an additive way, which implies that the development process builds upon the existing pool of individual skills, organizational routines, and general knowledge, the results are incremental innovations (Hall and Andriani 2003, 149). In other words, they are continuations and extensions of existing methods, practices and products that are already on the market and are thus evolutionary in nature (Mohr 2001, 16). Innovativeness manifests itself in performance improvements and product-cost reductions and repositioning (Booz, Allen & Hamilton 1982).

The product life cycle model (Abernathy and Utterback 1978) places incremental innovations in the transitional and mature phases of technology products. These are phases that occur in the middle of the life cycle, which begins with the fluid phase and ends with the discontinuities phase. In the latter two the developed new knowledge has the potential to disrupt the existing "state of the art", and to introduce emerging technologies and science-based innovations that could create a new industry or transform the existing

one. These are called “discontinuous” (Lynn, Morone and Paulson 1996, 8), “radical” (Day and Schoemaker 2000, 2) or “disruptive” innovations (Christensen 1997, xv) in the literature. The process of developing radical innovations is more complicated since they may require significant unlearning of existing knowledge and routines, and leapfrogging to a new type of knowledge (Hall and Andriani 2003, 149). They are thus totally new not only to the market but also to the company (Booz, Allen & Hamilton 1982; Kotabe and Swan 1995, 622).

The value-system construct used in this study is based on the notion that each product or service requires a set of value activities, varying from the well-specified to the radically changing, and performed by a number of actors forming a value-creating system (Möller and Svahn 2003, 205; Parolini 1999, 59–68). When positioned along the value continuum, illustrated in Figure 4, incremental innovations are set in the stable and established value system, in which the actors are producing and delivering known products. Since their value activities and capabilities are basically known, the risk involved in developing new products is decreased. Cooperation between different members aims at pursuing efficiency gains in terms of production or logistics and time compression, rapid growth opportunity, and access to a wider customer base. There are various management tools that improve operational efficiency, such as time-based management and Total Quality Management that are used by suppliers and customers (Möller and Svahn 2003, 206; Porter 1996, 63). Cooperation leads not only to efficiency improvements in the existing system, but also to more effective solutions turning into new business opportunities (Möller and Svahn 2003, 207).

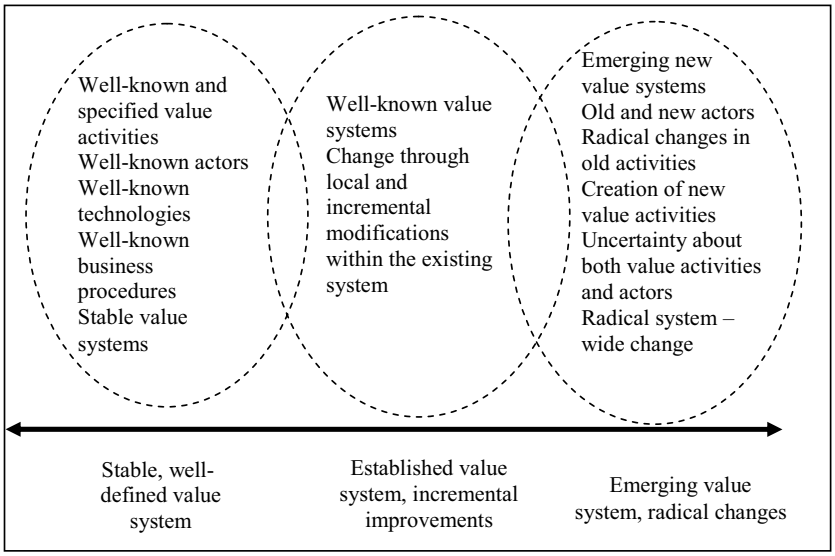

Figure 4 The value-system continuum (Möller and Svahn 2003, 207)

Radical innovations are to be found at the right-hand end of the continuum, which describes emerging value systems and are thus created by actors wishing to commercialize new technologies, products and business concepts: the solutions are significantly more effective than the existing ones. These networks are future-oriented and they may require radical changes to existing value systems and in the creation of value activities. Another inherent feature is the uncertainty related to these activities and to the actors and their capabilities. Cooperation in emerging value systems requires complex learning processes, and interorganizational relationship formation is difficult to specify in advance. (Möller and Svahn 2003, 206.) It seems that firms in emerging value systems in particular have a higher propensity to cooperate in R&D: Tether (2002, 964) found that innovations that were developed in cooperation were often new to the market and new to the firm. In general, companies that produce radical innovations are research-oriented, which implies that they have high expenditures on R&D, or in other words high R&D intensity (Miotti and Sachwald 2003, 2).

2.4.2 Industry- and market-level circumstances

The high degree of uncertainty in the emerging value system makes it more demanding to manage than stable and established value systems (Möller and Svahn 2003). Although continuous change and instability characterize their dynamic environment, there are also so-called opportunity windows that

follow the social, political, technological and economic changes. By developing new products and process innovations companies can successfully utilize the new trends that emerge. Innovative strategies do not necessarily fit very stable environments, in which change is slow and predictable. (Naumanen 2002, 105.) Since the technology, the infrastructure and the customers in the value system have to be redefined or created anew, the earliest pioneering products enter the market amid a high level of technology and market uncertainty, which refers to the low amount of information available concerning the products and their use (Day and Schoemaker 2000, 5; Moriarty and Kosnik 1989; Naumanen 2002, 106). These two types of uncertainty are discussed here separately, but they are interrelated. The technology supplier is responsible for overcoming and managing the technological uncertainties in the best possible way in order to achieve its acceptance by customers. However, the behavior of the market may also dictate further development needs, which could lead to new technological uncertainty. The following sub-chapter discusses these technological and market uncertainties in more detail. The notion of convergence and complexity in technology products and their impact on the formation of R&D cooperation is introduced in Chapter 2.4.2.2.

2.4.2.1 Technological and market uncertainties

Technological uncertainty in general revolves around the lack of knowledge concerning the future direction of technological development (Quelin 2000, 479). It arises partly from the simultaneous development of several technologies, when the pace of progress and complementarities are often difficult to forecast because of the multiple factors that affect techno-economic progress. Moriarty and Kosnik (1989) suggest that there are five sources of technological uncertainty.

Firstly, there is a lack of knowledge about the product's functional performance – whether it will do what the seller promises. Secondly, the delivery timetable may not be met. For example, the tendency of computer hardware and software manufacturers to miss promised delivery dates for new products is the rule rather than the exception. Thirdly, the limited data on how the technology behaves in the field increases the uncertainty surrounding the service that will be provided by the supplier.

Fourthly, the use of technologies might have unanticipated side-effects. Physical dangers (e.g., the impact of cellular phones on one's health) that are unknown during the launching phase might exist, and this raises questions concerning product liability (Day and Schoemaker 2000, 90). Fifthly,

technological uncertainty may arise for reasons to do with technological obsolescence – whether and when the market will turn to another technology to replace the current generation of products. The risk of obsolescence may arise long after the technology has found a stable market, but it may also occur when it is first introduced. This happens if customers cling to their old approach just long enough to leapfrog the introduced technology and select an even more advanced approach that is introduced later. (Moriarty and Kosnik 1989.)

Day and Schoemaker (2000, 90) also consider standard development a technology-related uncertainty, as well as the supply of materials and the manufacturability of the products. Customers may also wait and see what standard is eventually chosen by the industry if there are several competing ones. The new potential sources of supply have to be located and the supply relationships established before the manufacturing of the product can start. The company that has developed the product has to check that there are no bottlenecks in the manufacturing process, and that it is technically possible to finish it.

The developers and marketers of emerging technologies also face several market-related challenges. Suggestions for dimensions of market uncertainty are given in the literature (Day and Schoemaker 2000; Moriarty and Kosnik 1989; Quelin 2000). The main feature is that the competitive structures are still embryonic, since the markets for emerging technologies are still developing, or do not exist at all. Thus, firstly, a lack of knowledge concerning market behavior forms a major obstacle for the technology suppliers. There is ambiguity about the type and extent of the customer needs that can be satisfied by the technology. Secondly, companies developing new technologies cannot rely on lead-users (von Hippel 1988), or systematically collect information about customer needs to facilitate development: in contrast to the situation in stable and mature industries, it is unclear who will be the most attractive customers or how they will use and value the products (Day and Schoemaker 2000).

Thirdly, the size and the scope of the potential market is still a question mark. In the early stages of the development of an emerging technology it is not clear whether the market will eventually be large enough to warrant the project if it is still in its nascent stage (Day and Schoemaker 2000; Moriarty and Kosnik 1989). Fourthly, according to Moriarty and Kosnik (1989), predicting how fast a high-tech innovation will spread and be adopted is difficult. Fifthly, the distribution channels are not necessarily clearly defined, and sixthly, the regulatory environment is still to be formed (Day and Schoemaker 2000, 5–90; Quelin 2000, 478). Finally, the nascent industry structure also gives rise to many conflicting views and much speculation about

potential rivals and competing technologies. Companies entering the market have to assess to what extent their technology will satisfy the customers better than their competitors' offering. Some technologies will never come close to realizing their potential before they are pushed aside by rival technologies. (Day and Schoemaker 2000, 129–130.) Customers are often cautious in investing in new technologies that may soon become obsolete or whose design may turn out to be inappropriate. Moreover, if they are first-time buyers, they have limited experience of the technology they are dealing with (Cunningham 1995, 329). Figure 5 summarizes the technological and market uncertainties that are likely to occur when emerging technologies are developed and launched.

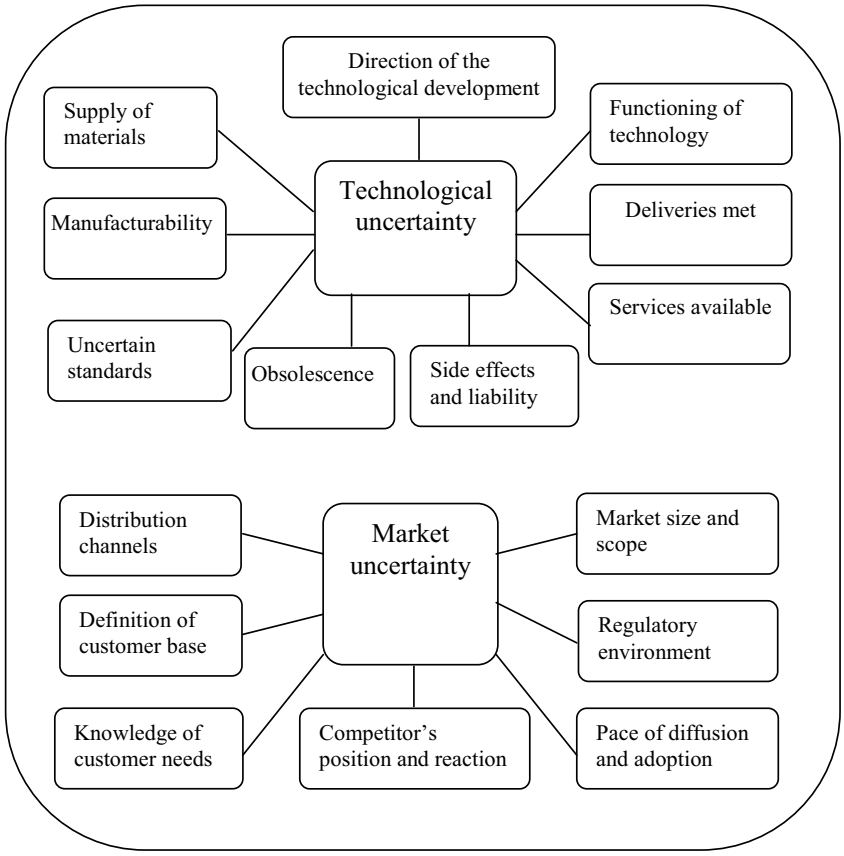

Figure 5 Technological and market uncertainties when emerging technologies are developed and launched

The uncertainties are much lower in stable or established value systems due to their well-defined nature (Möller and Svahn 2003, 206). The technology life cycle reaches its mature phase and products that are built around the dominant

design proliferate (see e.g., Uusitalo's (1995) study about dominant design). When this happens, there is no fundamental uncertainty concerning the customer needs since market studies can be conducted by targeting the existing customer base. The distribution channels are accessible and the other links of the value chain are better organized. Producers start to reduce the number of product experiments and to rationalize the production process. Thus, the emphasis in R&D shifts from product innovation toward process innovation. In addition, innovations are needed for systems integration and interfaces. Since process innovations are inherently time-consuming and expensive, R&D cooperation is established in order to share the cost and the risk among companies. (Lambe and Spekman 1997; Roberts and Liu 2001, 28.)

According to Roberts and Liu (2001, 28), in their mature developmental phase companies have the highest propensity to enter into R&D cooperation, as well as into manufacturing and marketing alliances that counteract the effects of the notoriously cyclical high-tech industries. On the other hand, Lambe and Spekman (1997) argue that during the latter stages of the discontinuous technology life cycle, when the technology and the market requirements become more stable, the level of industry uncertainty decreases, and firms often shift their focus from alliances to internal development and acquisition. In general, it could be suggested that, in stable and established value systems, companies considering cooperation may feel more confident in what they can offer to and what they can demand from their partners if they are planning R&D cooperation. In an emerging value system, on the other hand, companies may be hesitant to engage in R&D cooperation. According to Lambe and Spekman (1997, 103), during the highly uncertain advent of a radical innovation companies are not yet sure how the new technology will affect the industry, and therefore they may not feel compelled to enter into technology alliances. The industry is at the beginning of an evolutionary process and there are difficulties in embedding the emerging technology into its products, and this may cause the hesitation.

Among the new kinds of alliances that companies are likely to form during the fluid phase, in other words the first phase of the technology life cycle, even when the uncertainty is very high, are those aiming at establishing standards (Roberts and Liu 2001, 28). A need to develop common standards evolves simultaneously with the development of new technologies and markets. Standards enable networks, machines and users to communicate with each other, and they work without special modification, thus ensuring the compatibility of the technology products (Blomqvist 2002, 115; Dodgson 1992, 234–235; John et al. 1999, 81). Compatibility also has to cover related services and processes (Ford and Saren 1996, 8), which means that hardware

and software, telecommunications products and services, and different components of an industrial automation system, for example, can be used in conjunction (Parolini 2001, 37–38).

Competitors often cooperate in standard setting since they realize that the adoption of particular technical standards may proceed more smoothly if they are promoted by a number of firms rather than only one (Dodgson 1992, 234–235; Doz et al. 2000, 241; Möller and Svahn 2003; Teece 1995). Standardization can also be used to block competition. For example, a Microsoft operating system with an Intel processor together form the dominant computer-operating system "Wintel". In this kind of situation, when a dominant design has emerged, it is difficult for the rivals to market their products due to incompatibility problems. Users who would choose the competitor's product in spite of the compatibility problem would experience network externalities in relation to the dominating product. For example, the users of certain software applications also require a certain computer-operating system. If a product of a non-dominant design is chosen, there may be certain reduced benefits related to the wide diffusion of the dominant design. (John et al. 1999, 81; Parolini 2001, 37–38.)

2.4.2.2 Convergence and the systemic nature of technology products

It is typical, especially in the ICT sector, for new products to require interdisciplinary work and the integration of technologies that draw on previously discrete areas of knowledge. The phenomenon of convergence occurs when several industries use similar technologies that begin to overlap. This naturally also boosts R&D cooperation. Companies representing the different disciplines need each other's expertise to build complex and systemic products. (Brown and Pattinson 1995, 41; Freeman and Soete 1996, 160; Grabher 1993, 13; Mody 1988, 5; Narula and Hagedoorn 1999, 258.)

Convergence is evident not only in information and communication technologies, but also in office equipment, entertainment and consumer electronics, all of which can be represented in the same product, thereby also increasing interdependency between the sectors and technologies (Ford and Saren 1996, 6; Narula and Hagedoorn 1999, 258). Examples of converged knowledge bases at the product level include telematics products that combine computer and telecommunications, and on the technological level the fusion of microelectronics and software to produce digital products (Duysters and Hagedoorn 1998, 16). Shephard (2000) also points out that service convergence is powered by the underlying technologies that make it possible to build applications that were not possible previously. Convergence also

reaches out toward traditional industries. For example, the automotive industry nowadays is focused not only on mastering mechanical technologies but also on developing new materials technology, telecommunications and semiconductor technology (Narula and Hagedoorn 1999, 258).

Convergence, especially among information and communication vendors, is challenging players by setting new competence requirements: terminal manufacturers have to learn about delivery, content and display, mobile operators must be ready to create information technology, and traditional IT suppliers and integrators must start the process of learning about e-business and the related media and content industries (Blomqvist 2002, 113). In particular, expansion in the use of the Internet has brought a fundamental change not only in communications but also in doing business. Combined with wireless technology, the Internet is believed to enhance the commercial potential of the "information superhighway" by allowing new products and business opportunities to emerge. These opportunities are supported by simultaneous major technological developments in computing and data transmission, such as digitalization of the data, and increased processing power and available bandwidth. Nowadays, high-capacity fiber-optics networks and digital compression carry voice, data and video inexpensively around the world. Setting up business for the Internet may need cooperation between service providers and technology suppliers, however. A good example is e-banking: it is provided only through the interplay of banks, operators and communications technology, as well as between information technology and the digital media. (Blomqvist 2002, 111; Dodgson 1992, 234.)

Cooperation between companies is also required because the current wave of technological innovations requires the integration of a variety of new products and processes as components into broader systems or architectures rather than the application of separate inventions and stand-alone products (Blomqvist 2002, 121; Teece 1998, 61; van Tulder and Junne 1988, 219). Few firms have both the breadth of knowledge in the wide range of technological systems and the resources to innovate in several areas simultaneously. Since different companies often produce the system components, they have to make sure jointly that they can be synchronized. The development towards decomposable systems implies fundamental transformation because improvements in one component, in other words autonomous innovations, can be introduced independently. On the other hand, sometimes improvements in one part affect all the others as well. This kind of systemic innovation is much more complex to deal with since it requires significant readjustment to the other parts if new components are introduced (Teece 1995, 22). Shortcomings in the adjustment and coordination of the different components, which are

often located in different companies, may cause the whole project to fail (Blomqvist 2002, 122).

2.4.3 Cooperation as a company-level decision

On the company level, R&D cooperation may be based partly on voluntary decisions to outsource certain less important R&D activities rather than to conduct them in-house, but it may also be a strategic choice influenced by environmental pressures, and even serve as a pre-merger exploration. According to Prahalad and Hamel (1990), companies could be seen as bundles of competencies rather than separate business units. Competencies, in turn, can be divided into core and enabling competencies. Core competencies refer to integrating the technologies and coordinating the diverse production skills that are essential elements of the company's core products. These products are thus the physical embodiments of one or more of the core competencies, and secure competitive advantage by differentiating the firm from its competitors (Prahalad and Hamel 1990, 85). Enabling competencies, which are referred to elsewhere as necessary technologies, are needed to ensure competitiveness, but they are not in themselves enough to yield competitive advantage (Price 1996, 43–44; Tidd et al. 2001, 235–236).

Although there are conflicting views concerning R&D cooperation in stable and established networks (Lambe and Spekman 1997; Roberts and Liu 2001), it is suggested that companies in stable and established value systems, which are under fewer environmental pressures, are not forced into cooperation, and that core competencies and the underlying technologies can be developed in-house. The necessary technologies supporting the core competencies, on the other hand, can be outsourced or developed in cooperation based on long-term considerations. Cooperative R&D could thus be viewed as a supplement to internal know-how and not as an alternative to it (Dodgson 1992, 235).

The situation becomes more complicated in the context of emerging value systems. It has been suggested that it would be beneficial for companies to conduct in-house research and development if they desire to be the first-movers in the markets, because higher control ensures speedier progress (Tidd et al. 2001). Although in-house development guarantees unambiguous rights to the research results, it also means that the company must possess the required knowledge on which the new product or technology will be built. This is not always the case: companies may have a well-established technology base to suit the current situation but lack the new technology, and this starts a new trajectory (Cunningham 1995, 320; Quelin 2000, 483). Thus, it is not enough for them to cooperate to develop less critical competencies,

they should also focus on those that are or should become their core competencies. It is suggested that heavier environmental pressures influence the development of core competencies in cooperation.

The development of products for emerging markets requires quick reflexes because shrinking development cycles do not leave a choice for companies wishing to speed up their market entry. Environmental pressures thus seem to have a stronger effect on firms engaged in emerging value systems. For them, R&D cooperation is hardly a one-time phenomenon or a last resort to fall back on, but is often part of the corporate strategy, fortifying technological and business success. In the past the emphasis was strongly on vertical integration and on the use of mergers and acquisitions to harness the core business if external resources were needed. Strategic alliances were used to strengthen and outsource only non-core activities. (Cunningham 1995, 346; Dodgson 1992; Duysters, Kok and Vaandrager 1999, 346; Narula and Hagedoorn 1999; Prahalad and Hamel 1990; Ståhle and Laento 2001.)

A typical opportunity for cooperation in emerging value systems is created when a large incumbent technology company[2] is looking for radical technologies in small, innovative companies in order to strengthen its competencies, which often only support incremental innovations (Blomqvist 2002, 88). Since large companies are structured formally and hierarchically, they may become closed to market and environmental changes, and to new sources of technology, which slows down their innovative activities (Teece 1986). On the other hand, small firms tend to be flexible in their organizational structure, and the informal management style of the manager-owner supports the entrepreneurial atmosphere. Strong technological expertise is embodied in specialists working in companies that concentrate on specific R&D and product innovations. In spite of the positive effect of innovativeness and a strong technological orientation, the small size of the firm is problematic because it also implies that the company has a limited amount of resources.

The lack of finances may reduce the use of external resources, and the internal resources are generally too small to drive the change, for example in

[2] Although earlier empirical analyses of the characteristics of firms engaged in R&D cooperation have not produced a clear pattern of variables or factors that determine the propensity to cooperate, it has been suggested that large firms with high market shares and high R&D intensity in general tend to cooperate more (Fritsch and Lukas 2001, 300; Kleinnecht and Reijnen 1992, 349). More support for the argument that large companies are more active in R&D cooperation is provided by Vonortas (1997, 151) and Link and Bauer (1987, 253), who suggest that firm size, measured in sales, indicating its market power, also has a statistically significant positive impact on the propensity to maintain such cooperation, and is the principal determinant that steers involvement in cooperative research. However, it is very likely that the emergence of small technology companies in recent years has changed the picture significantly: R&D cooperation is no longer restricted to large companies, and is also entered into by small firms, essentially in high-technology sectors.

terms of standards. The turbulent environment itself is difficult to manage for a small firm, whose marketing skills often need developing: merely focusing on technology is not enough to ensure successful business. Cooperation with large partners may provide the necessary marketing channels and other critical resources, such as the financing to complete development projects. (Blomqvist 1999; Roberts and Liu 2001.)

Even if a company was to internalize the competencies developed with external partners at a later stage, cooperation could be used as a pre-merger exploration. It may be a far-sighted step to find out as much about each other as possible beforehand in order to reduce the costs of integration and the related inflexibility. Cooperation helps companies to assess compatibility in terms of organizational structures, management styles, the corporate culture and technologies and markets before a full merger goes ahead. This is especially important if the two firms operate in unrelated areas, since this type of merger has a very high failure rate. (Dodgson 1992, 235–236.)

2.5 Creating relational value in strategic R&D networks

The concept of value in business markets has recently attracted a lot of attention among academics and business managers (Anderson, Jain and Chintagunta 1993; Lapierre 2001; Möller and Törrönen 2003; Walter et al. 2003; Wilson and Jantrania 1994; Ulaga 2003). Studies on value have been related mainly to customer value, based on the literature on pricing and customer behavior (de Chernatory et al. 2000). As research on supplier-customer relationships in the business-to-business context started to emerge, so did the discussion on value in the literature on industrial marketing. It is an essential concept in marketing because all the parties involved in the exchange expect to gain value (Ulaga 2003, 678). Business markets can thus be understood only by applying the concept of value (Walter et al. 2003, 366).

Although important, the very concept of value is rather problematic (Wilson and Jantrania 1994, 63). This is reflected in the marketing literature, which provides a wide variety of definitions (Brandenburger and Stuart 1996, 7; de Chernatory et al. 2000, 40; Flint, Woodruff and Fisher Gardial 1997, 170; see also Ravald and Grönroos 1996; Slater 1997; Zeithaml 1988). However, it has been stated that studies on *relational value* are only just emerging, and for this reason the measurement of value creation in relationships is still in its infancy: a sound understanding of the concept is a prerequisite for developing reliable and valid assessment tools (Ulaga 2003, 678).

Given the fundamental role that value plays, it is crucial for firms to understand what kind of value-creation possibilities, perhaps also including

the unexpected, are embedded in R&D cooperation. Previous studies on value creation in customer-supplier relationships provided a valuable starting point for this study. The value-assessment frameworks drawn up by Walter et al. (2001) and Möller and Törrönen (2003) were used as a basis for the framework developed here, since they acknowledge joint product development as a source of value and also discuss the network effects of value creation. However, these frameworks require modification in order to fit the study of R&D networks because the characteristics of the relationships differ from those in the manufacturing context in several respects (Campbell 1997; Werani 2001, 3). Firstly, the timeline in the relationships is different. Unlike customer-supplier relationships in manufacturing, which are based on a long-term orientation, R&D relationships are often of short-term duration and are project-based: once the task has been completed, the relationships may well be dissolved.

Secondly, the frequency of interaction in R&D relationships is not necessarily constant, and it cannot be determined in advance as it can in other customer-supplier relationships in which transactions take place regularly. Moreover, the very nature of exchange: in R&D relationships it does not primarily involve tangible components, the volume of which can be specified, but is more to do with knowledge and know-how, which are embedded in human resources. These aspects point toward some difficulties in applying the frameworks developed for value-creation assessment in relationships, such as calculated volumes and related profits as a source of relational value. The first of the following sub-chapters discusses the value concept and gives a definition of relational value, and the second one establishes a more detailed framework for assessing value creation in relationships and networks in the R&D context.

2.5.1 Defining value

Earlier literature on value creation in business relationships provides several definitions of value (Anderson et al. 1993; de Chernatory et al. 2000; Ulaga 2003, 677; Walter et al. 2001, 366). Although Ulaga (2003, 677) acknowledges that the earlier definitions stress different aspects of the concept, he also identifies four recurring characteristics: 1) value is a subjective concept; 2) it is conceptualized as a trade-off between benefits and sacrifices; 3) the benefits and sacrifices may be multifaceted; and 4) value perceptions are relative to competition. In short, value is generally defined as a trade-off between the benefits (“what you get”) and the sacrifices (“what you give”) in a market exchange.

Werani (2001, 4) labeled the benefits vs. sacrifices a decision theoretic value concept. He argues that the starting point is the proposition that the value of an economic good is never an immanent quality that exists objectively, like a physical attribute, and thus is not independent of the valuing person. On the other hand, it is never the result of a purely subjective assessment given that the relation between the valuing person and the goods to be valued cannot be isolated: it is rather and always the result of a rational calculation made by the valuing person against the background of given goals, alternatives and environmental variables. Therefore, it is a measure of preferability, which means that from a set of alternatives the one that results in the relatively largest ratio of benefits over sacrifices will be preferable. (Werani 2001, 4.)

The following definition is based on the above discussion and on Werani's (2001, 4) suggestion, with slight modifications: *The value of a business relationship is a measure of its preferability in a specific decision situation. It has its origin in interaction between parties that have an exchange relationship, and results from the difference between perceived benefits and sacrifices.*

In the business-to-business context many researchers have chosen to use the concept "value" when they mean the *perceived* trade-off between the multiple benefits and sacrifices gained through the customer-supplier relationships by key decision makers in the partner's organization (Flint et al. 1997; Lapierre 2000; Walter et al. 2001). This study follows the subjective-valuation route, using "perceived" value to refer to value assessment and thus approaching the perspective of the person who is expressing his or her view on possible value. Perceived value thus allows separation between the expected and the realized value. The moment when expectations of the network value are formulated is not the same moment at which the value becomes real in the network. It is also possible that the value expected from the R&D cooperation will never be realized due to the several uncertainties that are related to the development of new technology (see e.g., Day and Schoemaker 2000).

The neutral formulation of value as a measure of preferability also enables both monetary and more broadly non-monetary valuation. Möller and Törrönen (2003, 110) reviewed the existing literature and summarized non-monetary benefits as competitive gains, competencies, market position, social relationships, knowledge, and non-monetary sacrifices such as managerial time, effort, and energy spent. Although this study does not reject the view that value is a trade-off between benefits and sacrifices, it does follow more closely researchers who argue that value comprises only benefits (Morgan and Hunt 1994; Hamel and Prahalad 1994). Concentrating only on the benefits is one way of limiting the scope of the study, as examining the sacrifice

dimension would introduce another wide domain. Moreover, it has to be noted that the assessment of value would be a very complex task given the problems in identifying and measuring both the monetary and non-monetary benefits and sacrifices that parties make in order to complete their task or to maintain the cooperative R&D relationship (Möller and Törrönen 2003, 12).

2.5.2 Relational value conceptualizations

According to Ulaga (2003, 678), the conceptual roots of relational value are to be found in the literature on business and services marketing. The early works concentrated on customer assessment of value and the research was based on the transactional approach, which emphasizes only product-related issues and neglects the relational dimensions of customer-perceived value. This traditional notion of customer assessment, perceived in relation to alternative offerings, was criticized for having too narrow a view, since the value assessment was restricted to the most important product-related variables. By way of response, new studies started to focus on the relational aspects of value creation.

The following literature review is based on Ulaga's (2003) attempt to summarize the conceptualizations of relationship value because it fits the context of this study and provides a basis for examining value in R&D networks. These conceptualizations are illustrated in Table 4. According to Ulaga (2003), the work of Anderson et al. (1993) was one of the earliest attempts to identify the relational dimensions of value. They define value in business markets as "the perceived worth in monetary units of the set of economic, technical, service and social benefits received by a customer firm in exchange for the price paid for a product offering, taking into consideration the alternative suppliers' offerings and prices". The relational dimensions thus include social and service benefits.

Table 4 Conceptualizations of relational value (based on Ulaga 2003, 679)

Authors	Benefit dimensions	Sacrifice dimensions	Comments
Anderson et al. (1993) Anderson and Narus (1995)	Economic benefits, technical benefits, service benefits, social benefits	Price	Theory-based
Wilson and Jantrania (1995)	Economic benefits, strategic benefits, behavioral benefits	None	Theory-based
Ravald and Grönroos (1996)	Episode benefits, relationship benefits	Episode sacrifices, relationship sacrifices	Theory-based
Grönroos (1997)	Core solution, additional benefits	Price, relationship costs	Theory-based
Lapierre (2000)	Product-related benefits, service-related benefits, relationship-related benefits	Price, relationship-related sacrifices	Survey
Walter et al. (2001)	Direct functions: quality, volume safeguard Indirect functions: market, scout, innovation	Direct function, cost reduction	Survey
Möller and Törrönen (2003)	Efficiency function, effectiveness function, network function		Theory-based
Ulaga (2003)	Product quality, service support, delivery, time-to-market, supplier know-how, personal interaction	Price, process costs	Survey

Not long after Anderson et al. (1993) conducted their review, Wilson and Jantrania (1994) published a work that was aimed at widening the traditional view. They described relationships between companies as involving economic, behavioral and strategic elements, arguing that their value was an aggregation of these elements.

The main point in the work of Ravald and Grönroos (1996) is that value consists of a trade-off between benefits and sacrifices in long-term-oriented exchange processes: it is not restricted to the single-episode level, and its assessment should rather take into account both episode and relationship benefits and sacrifices. Their basic assumption is thus that the relationships are long-term and not like projects, which could form one and even the only episode in them as often happens in cooperative R&D relationships (Seppänen 2000). Consequently, in the R&D context, value created during one episode, in R&D relationships that is, during a project directly forms both the episode and the relationship value. Still, since the project relationship may continue through inactive periods until a new project starts (Seppänen 2000), the idea

put forward by Ravald and Grönroos (1996) makes sense. In this kind of situation the actors should take into account the possible value created in the future on account of the relationships, and thus the full value would be the sum of the episodes or the projects.

More recent works published by Walter et al. (2001) and Möller and Törrönen (2003) refer to the joint product development and to the indirect impact of the larger network as a source of relational value. It has been suggested that value can be created directly or indirectly through the activities and resources of the interacting parties. The direct value functions are not dependent on other connected relationships, but the indirect functions do have an oblique effect on the partners due to their connectedness to other relationships (Walter et al. 2003, 367). The fact that companies can innovate together is of value and may increase the worth of their offerings in the focal relationship or in relationships they may have in the future (Gemünden, Schaettgen and Walter 1992). Accordingly, this study adopts a definition of "relational value" that refers to the benefits that are drawn from the relationships and that are directly or indirectly related to the focal R&D project. These indirect and direct value functions are discussed in the following sub-chapters.

2.5.3 The dimensions of relational value

2.5.3.1 Direct functions

Walter et al. (2001, 367–368) suggested that value in a customer-supplier relationship can be assessed through direct and indirect value functions. This means that the first group comprising direct value functions describes value that has an immediate effect on the partners in terms of profit, volume and safeguards. Möller and Törrönen (2003, 111) drawing on Walter et al. (2001) to some extent, argue that the major underlying factor in these functions is efficiency: the parties aim at jointly getting more from the resources invested in the relationships in terms of lowering production and transaction costs (Möller and Törrönen 2003, 111). This way of thinking also applies to cooperative R&D relationships on the general level, but on a deeper level the contents of the value functions have to be modified due to the different nature of the relationships.

The profit function vs. the cost/time function

The profit function, which is the first of the direct functions suggested by Walter et al. (2001, 367), refers to the existence of steady and profitable customer relationships that are a necessary precondition for the survival of any

company. However, the profitability of R&D cooperation cannot always be measured in terms of tangible goods that can be priced, sold in certain quantities and repurchased. This is because the cooperation depends mainly on know-how, which cannot be compared with any standard component the profitability of which in a certain customer-supplier relationship can be calculated. However, some companies in the network may well be making profits because their partner is paying for the development, for example. The other side of the coin is that research and development cooperation may offer an opportunity for *cost savings*, as needless duplication can be avoided and the development-*cycle time be reduced* (Dodgson 1992, 235). These factors can be directly measured. It is therefore suggested here that the profit value function should be labeled the *profit/cost/time function*, thereby including all the elements mentioned above.

The volume function

In an industrial relationship suppliers are interested not only in the profits that they make but also in the quantities they sell. R&D cooperation may lead to the ordering of increasing quantities from the suppliers related to the development project, which in turn could lead to price concessions. Consequently, value is created through the volume function (Walter et al. 2001, 367). However, it is a fact that volume cannot always be measured in terms of tangible products and exact quantities, as in an ordinary supplier-customer relationship: in an R&D relationship it could be measured as the firm's dedication to the focal project. The volume of resources that are required to complete the task can be calculated: how many persons the firm is allocating to the project and how the project affects its other projects, for example. Members of strategic R&D networks should make sure that there is balance in their dedication of resources to the joint project and to their other development projects. Although joint R&D may offer great value-creation opportunities to each company in the network, large-volume joint projects may be detrimental to their other projects and divert them from the path recorded in the business strategy. This may have a negative impact on their future development.

The safeguarding function

Another direct function, *safeguarding* in the manufacturing context, has been presented as a situation in which the supplier establishes certain customer relationships that are held as an insurance against crises or difficulties with other customers (Walter et al. 2001, 367). In an R&D context, safeguarding takes place when firms start joint product development in order to secure the continuation of an existing exchange relationship, since cooperation in R&D may increase commitment among the parties (Walter 2003, 721).

Safeguarding thus relates to relationships that have been established before the joint development started, and the aim is thus to maintain the stability and the status quo.

The party that is the most willing to safeguard the relationship may find the means to reach its aims. These aims may include relationship-specific investments, which can also lead to lock-in effects. This, in turn, makes switching the partner more difficult, since the investments made may lose substantial value unless the relationship continues (Brennan and Turnbull 1999, 482). Partners in strategic R&D networks should therefore be aware of the impact of their commitment to joint product development.

2.5.3.2 Indirect functions

Indirect value functions (Walter et al. 2001), or network functions (Möller and Törrönen 2003), are assumed to have an oblique effect on partners because of their connected relationships, i.e. their wider networks. The impact is not directly measurable and may be realized only far in the future. Walter et al. (2001, 372) argue that although these functions do not directly influence the performance of the company within the relationships or at a particular moment of time, they are nevertheless important for its future development. They are referred to as the access, market and scout functions and are discussed in more detail below.

The access function

Access in the context of R&D relationships implies that cooperation facilitates activities with external parties, which may be other business partners, shareholders or public organizations. Participants are able use their partners' knowledge, expertise or experience to gain access to these parties, which may be directly or indirectly involved in the focal product development project and, in business-to-business markets, include banks, official authorities, chambers and trade associations. Sometimes partners' experience in dealing with such bodies is of considerable help in terms of reducing time- and money-consuming licensing procedures and business negotiations, for example (Walter et al. 2001, 368). When the co-development expands to the existing network of relationships, it may also bring in potential contacts and partners from the universities. If one of the actors is a university start-up, it often has access to graduates or researchers, who are valuable resources in the research work (Blomqvist 2002, 92). This kind of access could be labeled *external access*. If one member is able to bring a new participant into the network it could be called functional access with a positive influence. Dysfunctional access has a negative impact: forming a relationship with a certain actor may

rule out a relationship with another one. (Möller and Törrönen 2003, 109–110.)

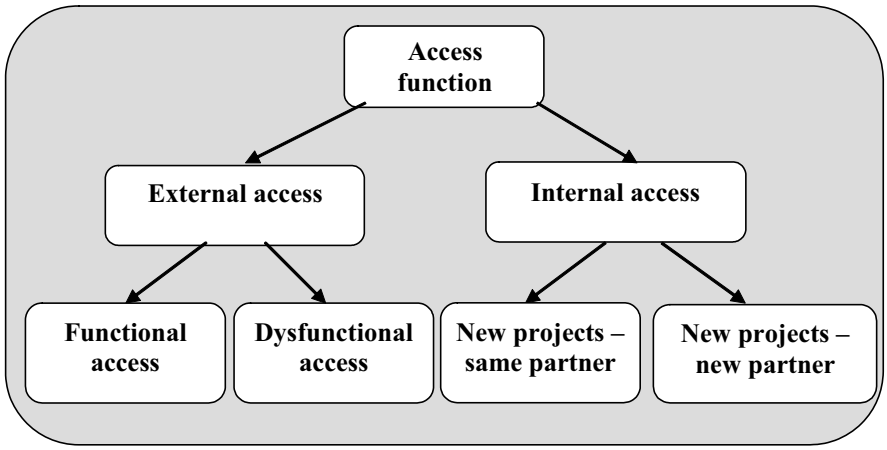

Figure 6 Relational value through the access function

Figure 6 above illustrates the division between external and internal access, which is another important aspect of the access function. It means that firms that are members in a strategic R&D network may find new opportunities to continue cooperation with the same partners in the future in other projects and perhaps in new ways. The other option is that network partners will provide concrete help to each other in finding new projects with other partners in the future. Although this resembles the safeguarding function discussed above, there are also certain differences. A company may plan to safeguard the relationship beforehand, which means that by engaging in the joint development it increases its commitment to the relationship and ensures its continuation. For example, safeguarding may occur in a supplier-customer relationship in which an ordinary supply relationship has usually preceded R&D cooperation (Ali-Yrkkö 2001). It is not typical of R&D relationships between competitors, however: on the contrary, without a strong incentive to start cooperation any kind of contact is usually avoided (Bengtsson and Kock 1999, 414).

The market function

The market function refers to the possibility of accruing new customers or distributors through the reference impact of a particular partner (Walter et al. 2001, 368). Referrals and recommendations are useful when the product that is being developed is aimed at new markets. This is especially important for

small technology companies that do not yet have a reputation in the field. Cooperation with a large firm may help them to find further customers and to establish business relationships with them (Boles, Barksdale and Johnson 1997, 256). The additional cost of getting the next customer is decreased because of the increased credibility. If the partners have jointly developed the product, they can also jointly target several markets simultaneously. (Blomqvist 2002, 93.)

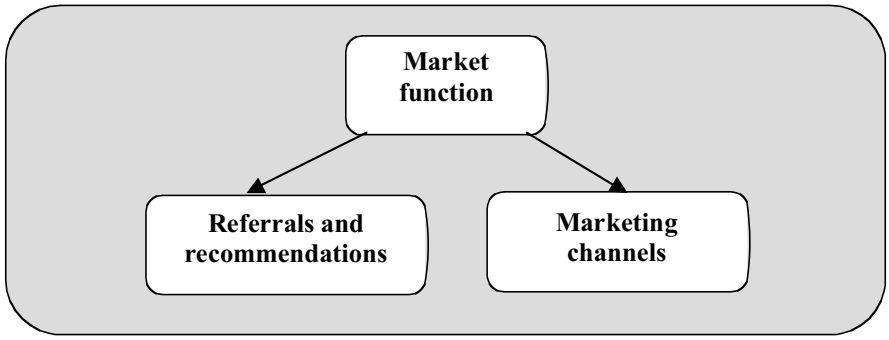

Figure 7 Relational value through the market function

It has been suggested that it is not only the small firm that benefits from the reputation of a large firm. The large company, too, may gain positive visibility from its technological cooperation with a small partner operating in an "exiting and new field" if it does not possess the relevant competence (Blomqvist 2002, 92). Participation in joint product development itself could also be regarded as a merit: it could indicate that the company has competence in a certain technological area, which increases its value as a potential future partner for other interested companies. In addition, one party in the network might allow the other members to market their products through the *existing marketing channels*, which would eliminate the work and the costs involved in establishing new contacts (Blomqvist 2002, 93). This is especially important for a small firm that does not have any previous contacts. One possibility is for small technology companies to sell their product as part of the large company's solution. Since ICT cluster products are often systemic, this naturally passes on the marketing to system integrators or partners that serve as marketing channels (Helander 2004, 50). Figure 7 summarizes the components of the market function.

The scout function

In order to ensure success, companies have to obtain meaningful information related to markets, technologies or the orientation of the science in general from others outside the organization (Gordon, Shoenbachler, Kaminski and Brouchous 1997, 33). Through the scout function in a relationship companies are made aware of what is happening in the environment (Walter et al. 2001, 372). The knowledge obtained may be market or science based.

If the partner in the co-development is a customer, he or she can gather and disperse information about market developments that is relevant to the supplier's business earlier than the supplier would be able to. Manufacturers may also have an interest in influencing supplier decisions with regard to what kind of technologies to invest in, in order to provide the best conditions for future technological cooperation. The supplier could also serve as a scout in these long-term alignment efforts, which become visible in so-called "technology roadmaps", which companies draw up together with their suppliers to identify technological trends for both parties. These technology roadmaps may also provide a basis for the companies to discuss their future investments. (Wynstra et al. 2001, 158–159)

In addition to serving as "knowledge-generating stations", R&D cooperation could also create "listening posts" for monitoring the capabilities of domestic firms, thereby giving a better picture of what is going on in the industry (Florida 1997, 89). Cooperation could be seen in terms of observation posts that fulfill the desire to "have a window on foreign science" (OECD 1992, 225). Knowledge about the direction of the science helps firms to identify and evaluate what they can learn and utilize (Davenport and Miller 2000, 203). Furthermore, by scouting the environment they can acquire metaknowledge, which is described as an appreciation of what they know and what they do not know (Russo and Schoemaker 1992, 8).

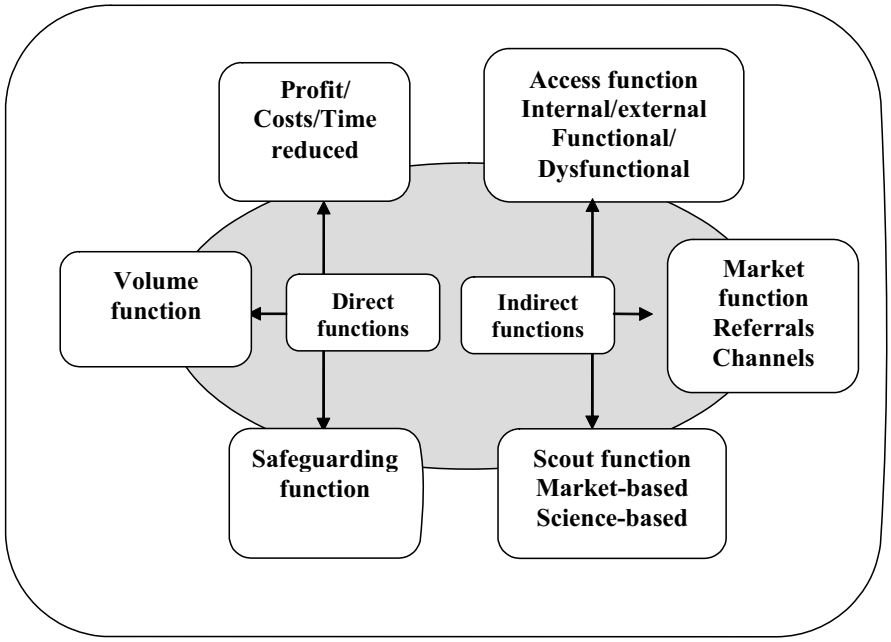

Figure 8 Functions creating relational value in joint product development

Figure 8 summarizes the direct and indirect value functions. The volume, profit, safeguarding, access, market and scout functions appearing in this framework also feature in earlier value frameworks, but their contents have been modified to fit the R&D context better.

2.6 Managing value creation in strategic R&D networks

Although strategic networks in general have a lot of potential for value creation, very often these arrangements fail or do not meet the goals set at the beginning (Barringer and Harrison 2000, 368; Duyesters et al. 1999, 344). There are many studies reporting attempts to capture the management areas that explain why this happens. Differences in goals, strategies and anticipated synergies, variances in expectations about the value that can be created, unfitting partners, cultural differences, lack of trust and opportunistic behavior in the partner are just a few of the factors influencing failure (Dacin et al. 1997; Duyesters et al. 1999, Ireland et al. 2000, 433; Kale, Singh and Perlmutter 2000, 217; Spekman, Lynn, MacAvoy and Forbes 1996).

As the above list indicates, the challenges related to network management are multifaceted. Especially in the beginning the parties initiating cooperation in the network face management issues that have a strategic content and a

long-term impact on their operations. First of all, network mobilization raises concerns about finding competitive partners with the right resources and capabilities. Since the establishment of access to external partners' resources is a lengthy and costly investment process, companies should include in the network only the relationships that are particularly valuable to them (Gemünden, Ritter and Heydebreck 1996, 450; Ritter 1999). Secondly, network visioning requires knowledge about the environment and its actors and resources in order to picture its future and what it will offer (Möller and Svahn 2003, 215).

Thirdly, the created visions could be used as a basis for strategizing, which means intertwining the goals of the network actors and making sure that they do prioritize their network activities over their other activities (Douma et al. 2000, 587). Strategizing in the network can seriously put the members to the test in terms of finding out whether their will to cooperate for the sake of the common goals is strong enough to endure the disputes on the way. Fourthly, guarding the network primarily refers to protecting the results of the cooperation as well as the knowledge resources exchanged, but it also means watching over their fair sharing among the network members. Furthermore, although an R&D network as an entity also involves short-term, operational management issues, this study focuses on the management of strategic issues that appear more at the start of the cooperation. It is suggested that their role is greater in terms of creating value in the network. The four management issues are discussed in the following sub-chapters.

2.6.1 Network mobilization

One of the essential areas of network management is mobilization. It is during this process that the structure of the network is formed for its task, in this study for the development of a technology or product. Network mobilization thus means forming new resource structures that cause changes in industrial activities, which in turn result in the creation of new interdependencies (Lundgren 1992, 160).

There are two ways in which a network can be mobilized. Firstly, it can be engineered, starting with a core company that is willing to establish new relationships in order to further its product development ideas (Doz et al. 2000, 242; Lindell and Björkman 1998, 58; Lundgren 1992, 160; Wynstra et al. 2001, 161). Thus, the core company is also responsible for setting the suitable criteria for the partner selection and carrying out the selection during the mobilization phase.

Secondly, as Lundgren (1992, 160) notes, an alternative to calling previously unfamiliar companies to participate in the network is to set it up among firms that already have a relationship, which could be called emergent mobilization (Doz et al. 2000, 242). In the latter case companies simply integrate new activities into their existing ones, or combine previously unrelated activities, thus causing the network to change accordingly (Lundgren 1992, 160). In reality this may imply that the partners are in an exchange relationship but eventually want to extend their cooperation to cover research and development activities (Ali-Yrkkö 2001).

In this context it is worth noting that the different theoretical approaches imply different perceptions of how networks are managed and how they are mobilized. According to the strategic approach, they are systematically built, managed, and further developed (Jarillo 1993, Parolini 1999). There is an underlying assumption in studies on industrial networks that they are self-organized entities (Tikkanen 1996, 387) and could thus be seen as voluntary, cooperative structures that no *one* actor is able to control or manage (Ford and Håkansson 2002; Håkansson and Snehota 1995).

It could be said that the two ways of mobilizing networks require different conditions, and consequently differing management approaches. It is obvious that starting from scratch with new partners is more demanding than integrating new activities into an existing network. The following sub-chapters further discuss the two suggested forms of network mobilization, and the role of partner selection in this task.

The engineered mobilization of R&D networks

There are various initial conditions determining how networks are mobilized, including changes in the environment that lead to perceived interdependence, the presence and identification of common interests among the potential members, and the intervention of a hub company. In the case of engineered mobilization the effects of the environment and of common interests are not very strong, but the hub company is necessary. (Doz et al. 2000, 242.) Studies on strategic networks in particular often emphasize the role of the central network body, a “hub”, a “triggering entity” or a “core company” in their formation and management. The last-mentioned term is adopted in this study. The core company defines the members of the strategic R&D network beforehand in the mobilization phase, and restricts open access to it: it has to be sure of securing the right skills and other resources (Lindell and Björkman 1998, 59).

The core company is, in fact, the strategic center of the network, and is needed to manage the web of partners as a whole. It often works as an organizer and a powerful integrator of the activities: in addition to setting up the network, it offers strategic guidance in the evolution of the established

relationships and pursues a pro-active role in its smooth operation. (Doz et al. 2000, 242; Jarillo 1988, 32; Lorenzoni and Baden-Fuller 1995; Snow, Miles and Coleman 1992.) Its impact may culminate in certain persons. Snow et al. (1992, 11) specify certain roles that key managers play in strategic networks: they may act as "brokers", creating and assembling resources controlled by outside parties, and, after the initiation phase, they may also assume the roles of "lead operator" and "caretaker", which have a more practical and day-to-day content. The results of previous research suggest that, during the network life cycle, the core company may have multiple roles that change and expand from the outset. In sum, the core company in this study is defined as *an active entity that has an interest in supporting the network formation, acts as an initiator and a partner selector, and shows a tendency to manage but also to control the members in the strategic network.*

The core company is often a single firm, but as Doz et al. (2000, 242) suggest, in terms of network formation it is more appropriate to refer to "triggering entities". These include not only individual firms (Håkansson and Snehota 1995), but also governmental bodies, such as the National Technology Agency (TEKES) in Finland, which subsidize companies to engage in R&D cooperation (Halme et al. 1999, 48). In these cases the research project is not driven by a core company: it is managed by all of the participating actors who represent a certain industry, for example, and who attempt to resolve certain issues that the industry is facing. Issues that require the setting up of such a network include the renewal of its technological base, the creation of norms and standards, and finding solutions to security-related or environmental problems.

The duration of the cooperation is limited in the engineered network. Doz et al. (2000, 252) further suggested that in the case of strategic R&D networks the cooperation is often project-based, and offers no future security. The projects are explorative, aimed at discovering new opportunities to produce innovations or find new markets, or to enhance the firm's capabilities. They are often unique: they cannot be repeated. Seppänen (2000, 97), however, points out that although each project may be unique, any earlier projects the company may have had could be learning bases for successive projects. If the unknown future of the project increases uncertainty among the network members, there is a greater need for the mediation of a strong broker, which also controls the network (Doz et al. 2000, 241–252).

It may be that the management of the network is more challenging if it is formed in an engineered way given the nature of R&D projects and the unfamiliarity of the partners with each other. In the light of earlier research it could be argued that the development of new relationships is a time-consuming process. According to Mäkinen (2001, 12), when a new network is

formed it has to go through the following phases: 1) awareness, 2) formation (the identification phase, the negotiating phase, and the launching/establishing phase), and 3) growth before the relationships enter the final phase, 4) stabilization (see also other models of network formation Chaston (1995, 11) and Zheng, Johnsen, Harland and Lamming (1998, 598).

Given the time that is needed to establish relationships and build trust, it is very interesting to examine project-based R&D networks and to see how they manage to build up functioning relationships in a short time. Because of their project-based nature, they should go through the formation phases quickly in order to kick the project off and to be early in the market with the new product. Secondly, it seems to be too much to expect cooperating companies to build up trust quickly in such a sensitive area as research and development, which was for a long-time protected from outsiders (Narula and Hagedoorn 1999). However, it seems that when quick adaptation is absolutely necessary, the parties are ready to behave accordingly. Blomqvist (2002) found that companies are able to create "fast" trust in their R&D projects.

The emergent mobilization of R&D networks

According to Doz et al. (2000, 242), emergent mobilization implies the involvement of parties that have already previously cooperated in the same function, or whose exchange relationship has been established to serve other purposes. In other words, the firms are already familiar, at least to some extent, with each other. The influence of a core company is less important here, or there may be no core company. For the companies mobilizing the network the source of the stimulus is the environmental change, which leads to the interdependencies between the partners and reflects IMP thinking. The network mobilization and formation are on more of a voluntary basis.

Another important and determining issue in emergent network mobilization, according to Doz et al. (2000, 242), is the similarity of interests among the potential partners. Companies operating within the same industry embedded in a similar regional or national culture and of a similar size (Campbell 1997, 389) may find similar interests in developing new products. These interests are obvious to all the actors in the network simultaneously.

Emergent networks of partners who already know each other are easier to manage. If the firms have a strong interest in working toward common goals this could naturally be expected to decrease the opportunistic behavior of the members. Membership could also be determined through self-selection: the network will be open to interested members in the future (Doz et al. 2000, 254). In fact, it is a major advantage in the mobilization phase that selection procedures can be avoided if membership is based on previous cooperation and there is a ready-made "frame" for the new project among the network members: the relationships have existed and they are revived for a new

episode when the new project starts (see e.g., Seppänen 2000). Consequently, cooperation may also be more systematic if the tasks are allocated appropriately according to the known skills and capabilities of the network members. The strategic R&D network could therefore be targeted on exploitative development rather than on uncertain exploration.

Doz et al. (2000, 255) suggest that an emerging network often follows the formation of the engineered network whose actors decide to continue their cooperation. As originally engineered strategic R&D networks make relational investments and improve their relational quality (Lorenzoni and Lipparini 1999, 331), a context may be created in which the emergent process will develop. Thus, engineered, explorative cooperation makes way for a network that will no longer need the influence of the core company. An existing network of exchange relationships may also be a basis for R&D cooperation in cases in which the cooperation did not extend to research and development, but took place in other areas (Håkansson 1987). Thus, *familiarity* among partners seems to play a key role in emerging network formation. It must also be noted that these mobilization alternatives are not necessarily clear-cut, and may overlap.

Partner-interface management

Partner-interface management is about building an infrastructure of partners who can contribute to joint product development in the strategic R&D network. Maximal value-creation potential is the basic guideline and is behind the partner selection. Ståhle and Laento (2001, 94) suggest that "a suitable partner does not necessarily need to be the number one of their field, but it has to be a company that provides strategic advantage for all the companies". Thus, since the choice of partner is an important factor that affects network performance, capabilities and skills should be carefully screened (Duyesters et al. 1999, 350). At the same time, potential partners' capabilities should not be overestimated, which is a typical mistake in the evaluation of fast-growing high-tech firms (de Meyer 1999, 327).

Duyesters et al. (1999, 350) suggest that effective selection should involve evaluation of the potential partner on the basis of its competitive and technological position and track record of successful partnerships, and on the transferability of its resources (e.g., licenses and patents). Access to other networks or clusters should also be taken into consideration, since this could facilitate the activities of the network. If partners are linked to different clusters outside the domain of the focal strategic R&D network project, they will bring their knowledge with them and thus be very powerful actors (Duyesters et al. 1999, 350). The following discussion provides a review of the key capabilities or characteristics of partner candidates that should be emphasized in the selection (see Figure 9). It is suggested that R&D intensity,

prior experience with technology, a cooperative history together with network competence, and size and reputation may later have an impact on the value-creation potential. Why these characteristics are emphasized in partner selection is discussed below.

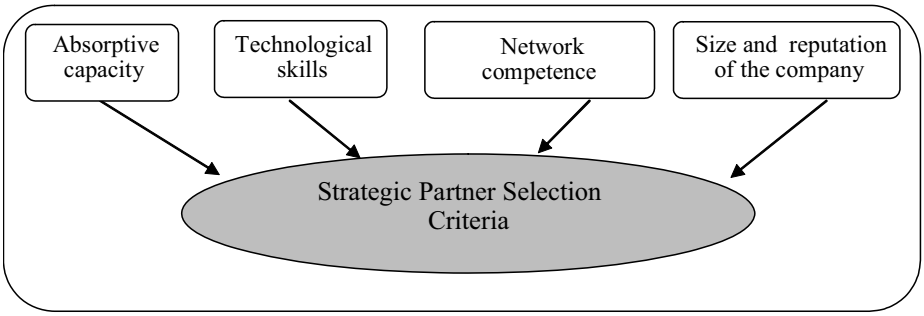

Figure 9 Factors affecting partner selection for a strategic R&D network

The results of earlier research suggest that R&D-intensive firms tend to cooperate more and are more attractive partners than those who do not conduct much research (Fritsch and Lukas 2001, 300). Research intensity requires that companies must have developed their abilities to exploit external knowledge efficiently. In other words, they must have absorptive capacity for evaluating and utilizing knowledge that comes from outside (Cohen and Levinthal 1990, 128). It is suggested that selecting partners with proven absorptive capacity enables the network to achieve efficiency gains if the chosen partners have the skills to quickly analyze the resources offered by the other partners and utilize those that are relevant.

Absorptive capacity in general, and specifically prior experience with the necessary technology, make a company an attractive target for cooperation. Firms could be seen as repositories of knowledge and know-how, whose nature in terms of technological evaluation is determinable to some extent by looking at their past activities. Unlike physical assets, knowledge and know-how could be considered “self-regenerative”, and evolve when one piece creates conditions for the acquisition of subsequent pieces (Glazer 1991). The adding of new knowledge to previous knowledge is a phenomenon known as path dependency (Blomqvist 2002, 136). Thus, with many technologies participation in later developmental stages is conditioned by knowledge accumulation through participation in earlier stages (Dosi 1988). This could be interpreted to mean that a lengthy presence in the specific technological field is often necessary for the development of relevant skills and capabilities.

Conversely, companies with little or no expertise in the technologies have little to offer to partners.

If a company has credit not only in developing technologies but also in cooperating within the R&D function, it indicates to other companies that this might be an interesting partner to cooperate with again. Past innovative activities would also make it a potential preferred partner, since a cooperative history sends a signal about possible accumulated general technical competence (Ahuja 2000, 320; Duyesters et al. 1999, 349). Thus, in general, past experience in R&D cooperation is frequently considered useful and even necessary when the organization is participating in a new R&D cooperation project (Quelin 2000, 485).

Earlier experience in R&D cooperation may also indicate that a partner candidate possesses network-management capability or network competence, which could be defined as an ability to form alliances and networks and to partner in these arrangements (Eisenhardt and Martin 2000, 1107; Gemünden and Ritter 1996; Möller and Svahn 2003, 213; Ritter 1999). Companies with this competence have experience in network formation, governance and administration, and they will be in a better position than those with little experience to structure and manage the relationship in order to exploit the benefits of cooperation (Neill, Pfeiffer and Youngh-Ybarra 2001, 231). Gulati et al. (2003) emphasize that prior experience with the same partner could be of greater benefit than general partnering experience, which means in most cases that it is better to continue cooperation with a partner that is already familiar.

Ritter (1999, 468) argues that a company's degree of network competence has a positive impact on its degree of technology-oriented interactions with other organizations, and in order to develop network competence it must have enough qualified persons to take care of the tasks that are related to network management. The skills that are needed are divided into specialist and social qualifications (Helfert 1998).

According to Ritter (1999, 469), specialist qualifications include technical skills, which are important in terms of understanding the partners, their needs and their requirements. Economic skills are required for the definition of inputs and the setting of prices, whereas skills in legal matters are relevant in the setting up of contracts. Network knowledge is also emphasized as an essential network-management qualification. This knowledge includes information about other companies, their personnel and resources, which is necessary for understanding the development of the network. Social qualifications refer to the extent to which a person is able to exhibit autonomous, prudent, and useful behavior in social settings. They are needed because individuals are interacting with one another within relationships that are built around interpersonal exchanges (social qualifications), but are based

on economic and technological objectives (specialist qualifications). (Ritter 1999, 469.)

Companies may even establish a dedicated strategic network function. Dyer, Kale and Singh (2001) conducted a study showing that firms that systematically created value from alliances had such a function. The tasks of this (alliance) function included coordinating all alliance-related activity within the organization, and in the processes and systems, in order to teach, share and leverage previous network-management experience and know-how throughout the networking companies (Dyer et al. 2001, 38). In view of the earlier discussion about the role of the core company, it could be suggested that the tasks that Dyer et al. (2001, 38) mention could either belong exclusively to the core, or then the participating companies could be jointly responsible for establishing such a function.

The need for networking capabilities is greater if many cooperative relationships exist simultaneously, since it is a more demanding task to handle a variety of them, especially when the interests are sometimes conflicting (Duyesters et al. 1999, 348). It could be concluded that, given other, perhaps more visible capabilities, one partner-selection criterion could be network competence. This would possibly increase the gain from R&D cooperation and make the network management smoother, thus increasing the chances of success.

The size of the company may have an unexpected impact on cooperation. De Meyer (1999, 327) argues that large companies do not always prioritize development projects with their small counterparts, or dedicate sufficient resources to them. Therefore, the size of the preferred partner should be assessed in the light of this priority perspective. It has been suggested (Campbell 1997, 389) that it is preferable to cooperate with companies that are of the same size. The name and reputation of the organization should also be assessed (Ireland et al. 2000, 439), although de Meyer (1999, 27) argues that it may not necessarily be enough that a company has a good reputation if its real capabilities are not sufficiently developed: it may not be as good a partner as expected.

2.6.2 Visioning the network

Companies may have various views about the environment in which they are operating. Some realize the importance of systematically collecting material about the development of their industry in order to get a realistic view about its direction, while others may put their trust in their instincts or assumptions rather than in figures. When a strategic R&D network is established, its

members have to deal together with the same future-oriented challenges as each company has done separately. Visioning requires developing as clear a view as possible about the network and its offering, and about the opportunities, limitations and threats.

The established network operates in a macro network, cooperating and competing with other value-creating networks. As part of the visioning process, the members of the established network should analyze these networks or value systems, and their key actors and competition logic, or in other words they have to monitor the environment constantly and to recognize the signals that are essential for its operations (Möller and Halinen 1999, 417; Möller and Svahn 2003, 209). Möller and Svahn (2003, 209) further argue that visioning goes beyond traditional environmental scanning since the latter assumes relatively transparent markets, actors and processes, which cannot always be found in technology-intensive markets. Not necessarily all of the companies in the network are able to analyze the value systems and their offerings, but a visionary, often core company, is able perform this task. The visionary, often a large corporation, may also be strong enough to influence the beliefs, goals and behavior of other key actors in the focal strategic R&D networks, or even in the larger "macro" networks, which have been engaged in network orchestration. It has to have strong communication and persuasion skills, credibility that is achieved through understanding the field, and a strong business position. (Möller and Svahn 2003, 215.)

According to Khanna (1998), determining the scope of cooperation is one of the most critical and comprehensive activities. Cooperation partners have to make decisions regarding product categories, brands, and geographical boundaries with an eye on the future markets and technologies that are related to the joint development (Khanna 1998). Developing a view about the offering and its positioning in relation to existing or new markets is also related to visioning. Wynstra et al. (2001, 161) specified the management activities that are needed for this task. They suggest that companies in the network have to be familiar with the options that are available in the market when the decision is made to use different technologies. Partners therefore have to search for and provide information about them. It may be necessary to appoint somebody to look for this information and to monitor the changes that are taking place in the field. (Wynstra et al. 2001, 161.)

Tidd et al. (2001, 245) suggest that information about technologies is also available through dialogue with actors that are external to the network, such as universities, research and technology institutions, other users and producers, and trade associations. It may also be profitable to scan journals, visit exhibitions and attend conferences. Indeed, these could be useful sources can be used also in market and technology forecasting, the purpose of which is to

gain understanding about the likely dynamics of new markets and future technological developments. Forecasting must also cover related fields and trends, which may affect the development. (Tidd et al. 2001, 244–245.) According to Wynstra et al. (2001, 161) the information obtained facilitates evaluation of product designs and promotes standardization and simplification of the product that is being developed.

2.6.3 Strategizing in the network

According to the definition, cooperation in a strategic R&D network has a clear purpose: the members have committed themselves to participating in its R&D activities. This does not simply mean that all the network actors have similar goals that they bring with them: their goals may be conflicting, which further complicates their management (Möller and Svahn 2003, 209). Further, although the network members are dependent on each other through their resource ties (Gadde, Huemer and Håkansson 2003; Håkansson and Snehota 1997, 153), their commitment to performing network-related activities may vary. It is therefore essential to find a strategic fit in terms of goals, to assess the extent of the network's significance to each partner, and to ensure that the partners are equally dependent on achieving their objectives (Douma et al. 2000, 587). This is called strategizing in this study, which does not necessarily mean that the network has a common strategy. In the context of project-based, short-term networks it is adequate to refer to common goals or objectives. The term strategy has traditionally applied to a single firm, but the relational aspect of the resource-based view recognizes that critical resources span firm boundaries (Dyer and Singh 1998). For this reason, strategy formulation could be shifting toward networks, although at this point there is a need to assess how the strategy of the individual firm relates to the ambitions and activities of these relevant others (Gadde et al. 2003, 361).

According to Douma et al. (2000, 587), the network goals should be shaped so as to meet all partner needs and expectations. However, finding complete balance and satisfaction among the members may be only an ideal situation, and it is more probable that in reality they have to come to a compromise with the other parties. The goals of the network may not be clear in every small detail at first, but at least they should be specified on a larger scale and available to every network member. According to Hoffman and Schlosser (2001, 363), agreement on clear and realistic goals in the initial phase of cooperation is a basis for professional project management.

Relationships characterized by mutual commitment, interdependencies and trust (Ford et al. 1998, 107; Håkansson and Snehota 1997, 152), at least to

some extent, preclude opportunistic behavior, and a focus on pursuing victory over others turns to a willingness to make it together with the business partners (Ford et al. 1998, 107; Hoffman and Schlosser 2001, 362). Actor mutuality is a measure of how much a company is prepared to neglect its own individual goals or intentions in order to increase the positive outcomes of others and, through this, to ultimately increase its own wellbeing (Ford, Håkansson and Johanson 1997, 61). Mutuality, which rests on a belief in the importance of the collective goals or common interests of more than one company, may restrain partners from entering to the network in order to deliberately achieve "private" benefits (Duyesters et al. 1999, 345; Khanna, Gulati and Nitin 1998, 195). Khanna et al. (1998, 195) defined private benefits as something that a firm can learn unilaterally by picking up skills from its partner and applying them to its own operations in areas unrelated to the network activities. Common benefits, on the other hand, accrue collectively to all network participants (Khanna et al. 1998, 195).

One or more companies in the network, often a core company, may have the motivation to control the network activities and to manage the relationships so that their own objectives are achieved (Gadde et al. 2003, 358; Håkansson and Ford 2002, 137). This may happen if the goals of the network are not equally important to each member. The task of the core company is thus to find the means to commit the partners in such a way that they prioritize the network goals over their other activities. According to Håkansson and Ford (2002, 137), this ambition to control is one of the key forces in the network, but the paradox is that the more a company achieves this ambition, the less effective and innovative the network will be: it runs the risk of becoming a hierarchy and the flexibility disappears (Gadde et al. 2003, 358). The conscious desire of the core company or other controlling actor to influence the operations of the network actors should not exclude systematically listening to the ideas of the other actors and being influenced in return.

2.6.4 Guarding the network

There is a risk that, in the long run, the network will have a negative influence on the value creation of one or several of its members, particularly if the necessary safeguarding precautions are not taken. Guarding the network means, on the one hand, guarding each member's competitive position, which may be threatened as a result of cooperation if the companies are competitors, or if as a result of the cooperation they become competitors. On the other hand, it also means avoiding unwanted spillovers, in other words unwanted information leaks to other network members and outside. Guarding is not

necessarily equally important to all members: the intellectual capital they possess, and which comprises the knowledge, skills and intangible assets that businesses can convert into usable resources in order to generate competitive advantage (cf. Kitching and Blackburn 2003, 16; see Teece 2000), are not always unfamiliar to their partners.

If the network members are competitors, they are, in fact, making each other more competitive through cooperation, and therefore have to consider the symmetry of the resource exchange. Perks and Easton (2000, 334) suggest that partners involved in resource exchange should make sure that they are able to receive what is offered. If symmetry is not achieved, one possible effect is an increase in the competitive advantage of a competitor while the other party remains in the same position. According to Perks and Easton (2000, 334) there are no problems if the companies do not compete in the same markets or segments, or in the same way. Cooperation between rivals sometimes strengthens them against third-party competitors, or even against similar competing networks. If cooperating parties in strategic R&D networks are really competitors, they could develop mechanisms to counteract the dangers of losing their competitiveness. They could set limits on the competition, such as geographical boundaries. As the cooperation progresses they may seek methods and techniques to differentiate themselves in the marketplace, such as different brand propositions and alternative distribution channels, or they may target different market segments. Alternatively, they may pursue new emerging product sectors in which their partner is absent. (Perks and Easton 2000, 334.)

Guarding the network from spillovers is, again, specifically a matter of horizontal cooperation: this refers to relationships between competitors, since they may enter the cooperative agreements in order to learn about their rivals' competencies (Tether 2002, 952). However, Teece (1992, 11–12) also suggests that cooperation between competitors could, to some degree, serve as a means for firms to overcome spillover problems, as the transfer of knowledge may take place through direct linkages that could be efficiently monitored. Leaking knowledge and know-how is also a concern in vertical relationships. There is always a chance of direct or indirect competence leakage to competitors outside the network following efficient knowledge or competence transfer between cooperating companies (Nooteboom 1999, 50). If the other members of the network or outsiders are able to access and internalize the competence, it is no longer rare, inimitable or valuable. According to the resource-based view of the firm, these are essential attributes that provide competitive advantage (Barney 1991; Grant 1996). Leaking competence could thus cause the loss of a strong power position in the strategic network (Möller and Svahn 2003, 207).

In order to systematically protect their intellectual property and to establish an intellectual property right (IPR) strategy, firms should identify exactly what their intellectual property is (Hurmelinna, Peltola, Tuimala and Virolainen 2002, 41; Matthews, Pickering and Kirkland 2003, 37). According to Matthews et al. (2003, 37), the key activities in managing the intellectual property within a single firm in addition to protecting the property assets is to organize the operations so that the staff is aware of what they include. Exploiting them efficiently and being aware of their potential value is also important (Matthews et al. 2003, 37). Alvarez and Barney (2001, 141) suggest that large firms in particular are able to learn about the technologies used by small, entrepreneurial firms more quickly than the small firms are able to imitate the organizational resources of the large ones. This happens because small firms often have to explain their technologies in detail, thus revealing how it works and how it can be commercialized, whereas they cannot learn so quickly about the capabilities of large companies, which may be very complex and cannot be taken to laboratories to be studied. (Alvarez and Barney (2001, 141.) This calls for the development of suitable control mechanisms that can regulate, if possible, the learning processes in cooperative ventures so that all participants will benefit equally.

The attribution of the results of network cooperation should be clearly agreed upon between the partners (Hurmelinna et al. 2002, 39; Ståhle and Laento 2001, 95). A large amount of new, commercially exploitable data, knowledge and material is typically produced in cooperative projects between companies. The results could be attributed at a later stage to the company that financed the cooperation, or to the party that produced them, or they could be commonly owned. Allocating the rights according to what was invested is possible, but it is also problematic given the nature of investments, which may vary from the financial to the intangible, and it may be impossible to align them. The contracts covering R&D cooperation between companies may not be sufficiently detailed, or they may cause more conflicts if they are deficient or open to various interpretations. Reaching clear agreement on ways of doing things and on utilizing the results before starting collaborative operations very often prevents later conflicts. (Hurmelinna et al. 2002, 41–42.)

Juridical control is sometimes required in protecting the results of R&D cooperation in the form of copyright or patent law, for example. Other means of protection include contracts and practical action. What is problematic in R&D cooperation is that information and knowledge cannot be judicially owned, and pure ideas are difficult to protect through the legislation on intellectual property rights. Non-disclosure agreements, passwords and non-competition agreements are sometimes used in efforts at their concealment, however. (Kitching and Blackburn 2003, 17; Tarkela 1998.)

2.7 A summary of the theoretical framework

The aim in this section is to integrate the key ideas and concepts covered in the theoretical discussion into the theoretical framework of the study. R&D networks are viewed as strategic networks, which implies that they have certain characteristics. The relationships in question are intentionally established between industrial actors. They combine their competencies in order to fulfill the purpose of the network and to create value. The network aim is to enhance the competitive position of one or more of the actors, and there may also be other long-term effects.

The focus in this study is on the nature of R&D networks as intentional value-creating systems in terms of three key domains of interest. The first concerns the circumstances that make companies seek value creation in strategic R&D networks, the second the kind of value that is created, and the third covers the key management issues that support it. It is suggested that networks operate in various circumstances: they represent either stable/established or emergent value systems depending on the technological change taking place in the environment of which they are part. In the former the change is incremental and in the latter it is radical. The value-system framework is used as a base in comparing the case networks. It is suggested that, firstly, the differing circumstances may have a different effect on the decision of companies to mobilize value-creation networks, and secondly, that the management of the network may also differ.

There are certain industry-, market- and technology-level factors that trigger R&D cooperation. The role these circumstantial factors play in each case network when it is mobilized for value creation is assessed in the study. The degrees of technological and market uncertainty vary between the value systems, and it has been suggested that the higher the uncertainty, the greater the need for cooperation. Convergence and systemic products characterize information and communication technologies, and all this increases the interdependence between ICT companies and companies representing other sectors, thereby creating a need for cooperation. The development of the ICT cluster has also created a myriad of cooperative arrangements between large and small companies, as they need each other's specialized competencies. The study examines the triggering effect that these factors have in mobilizing the network, and also assesses how significant the influence of the circumstances is at the company level when the decision to engage in R&D cooperation is made.

When actors form networks they expect to draw varying benefits through these arrangements. In this study, the concept of "value" refers to those benefits. It is possible to examine the value that is created in the network by

means of a value framework comprising direct and indirect value functions. It is suggested that direct value is created when cooperation helps the firms to increase their volumes, generate profits, reduce development time and bring cost savings to the network members. It is also created when the joint development is a means to safeguard the relationships in the future.

Indirect value is created through the access, market and scout functions. The access function creates value when the network provides access to valuable resources, including other business relationships and new business opportunities, often with the same partners. The network also creates value if it opens up new marketing channels and provides some parties with referrals from the joint project, which refer to the market function. Companies in networks are sometimes able to utilize the scout function if their partner's knowledge about the related markets and technologies offers them something valuable. These value functions and other key concepts applied in the study are summarized in Figure 10 below.

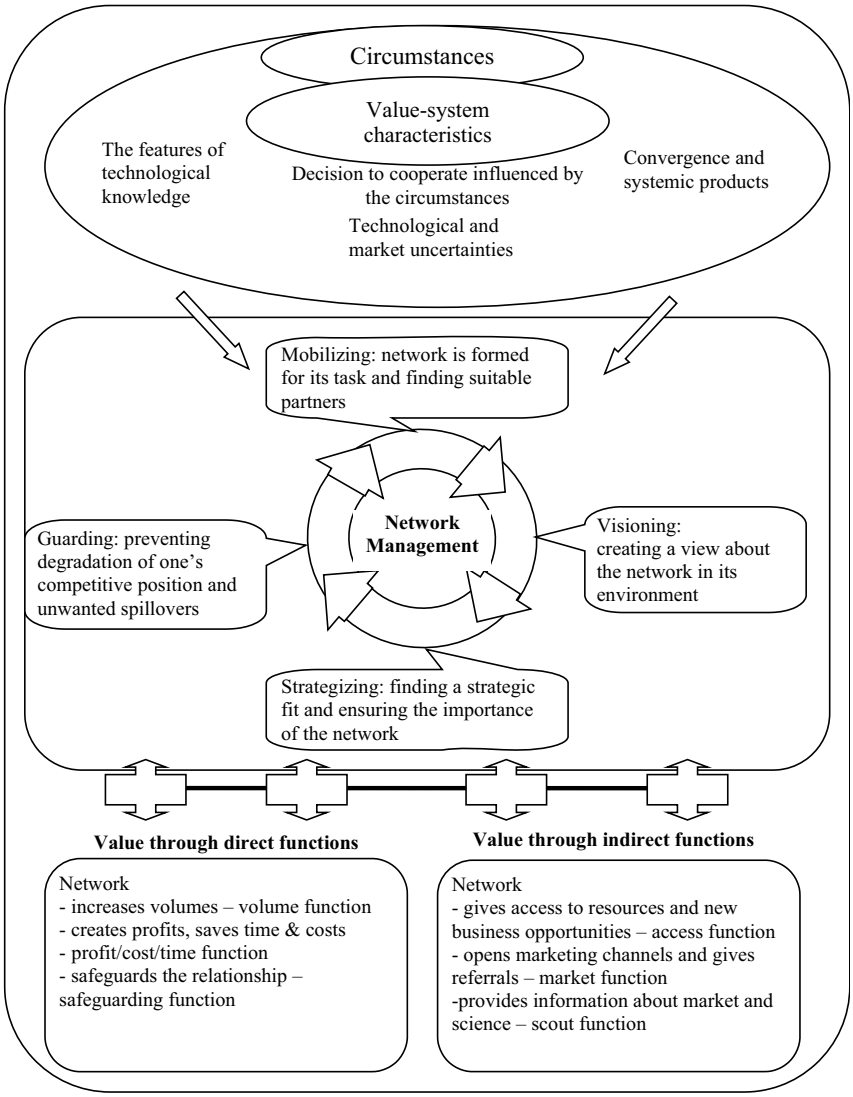

Figure 10 A value-creation framework for strategic R&D networks

In order to draw the value from the relationships, the network has to be effectively managed. The key management issues that support value creation are mobilizing, visioning, strategizing and guarding. The mobilization of the network is driven by its purpose, and the members are selected accordingly. Visioning means that the members picture the network and its position in its environment, and identify its opportunities, strengths, threats and weaknesses. Strategizing is needed in order to find a strategic fit between the goals of the network members, and to ensure the importance of the network among them. The purpose of network guarding is to prevent the weakening of the actors'

competitive positions and to act against unwanted spillovers. These network-management issues are presented as a cycle in the figure since at least some of them are relevant throughout the existence of the network. Moreover, they cannot necessarily be divided into clearly separated actions, and are rather intertwined.

3 METHODOLOGICAL CONSIDERATIONS

3.1 The qualitative approach

For a long time the scientific approach in the social sciences was rather unambiguous. The positivistic mainstream dominated the field, which stressed the idea that there was an objective truth existing in the world and that it could be revealed by using methods focusing on measuring relationships between variables systematically and statistically. A basis for an alternative paradigm was created with the realization that the social world was seldom as straightforward as the positivistic paradigm would suggest. This represented the objectivist approach to science, since it concerns human actors exhibiting complex behavior in a naturalistic setting. Consequently, the subjectivist approach, emphasizing the description and interpretation of the subject matter rather than definite truth and objectivity, started gaining strength. The ontological assumptions, in other words how the reality is perceived, epistemological assumptions about the nature of knowledge, and assumptions about human nature are different in the two approaches, and consequently, the methodological choices also differ. Quantitative methods are used in studies emphasizing objectivity, and qualitative methods in those emphasizing subjectivity. (Burrell and Morgan 1979; Cassell and Symon 1995, 2; Morgan and Smirchich 1980, 497.) The qualitative approach was chosen for this study in order to fulfill the purpose, which is to describe the nature of R&D networks as value-creating systems.

Ontologically, the objectivist approach represents realism, according to which reality is a concrete structure, and the world is external to human beings and exists independently of them. The subjectivist approach to reality adopts nominalism, which relaxes the ontological assumption that the world can be frozen into structural immobility. Human beings are viewed as constructors of the real world in giving labels, names and concepts to things in the social world. Epistemologically, causal relationships and regularities are in focus in the objectivist approach. On the other hand, the anti-positivist assumption stresses the idea that the social world of actors is not separated from their subjective experience, and that the world can therefore be understood only through the actors involved in the events under study. (Burrell and Morgan

1979, 4–5; Morgan and Smirchich 1980, 497.) The third array of assumptions concerns the nature of human beings, who are strongly present in network studies as well as in organizational studies in general, both as research subjects and as respondents. The objectivist approach adopts a deterministic perspective: it reduces the role of human beings, making them subject to a deterministic set of forces; they are not free to act according to their own will as if they were under laws that influenced their behavior. In contrast, the subjectivist approach applies voluntarism: human beings are perceived as capable of possessing complete autonomy and of making freewill-based decisions. (Burrell and Morgan 1979, 5; Grönfors 1982, 28.)

Furthermore, the objectivist approach adopts nomothetic methodology. As the term suggests (nomothetic implies 'based on law'), the aim is to find general laws and regularities that could serve as a basis for future predictions, and quantitative methods, mainly surveys and laboratory experiments, provide a set of tools that are suitable for this purpose. Researchers taking the subjectivist approach use qualitative methods in conducting ideographic (the term ideographic implies 'based on particular individuals') studies that focus on describing and explaining certain individual events or phenomena. As far as organizational research is concerned, ideographic studies are particularly suitable for capturing the mechanisms that have produced the phenomenon under study. (Lincoln and Guba 2000, 33; Niiniluoto 1980, 26; Tsoukas 1989, 556.) The features of the two approaches to science and their ideal types are summarized in Figure 11.

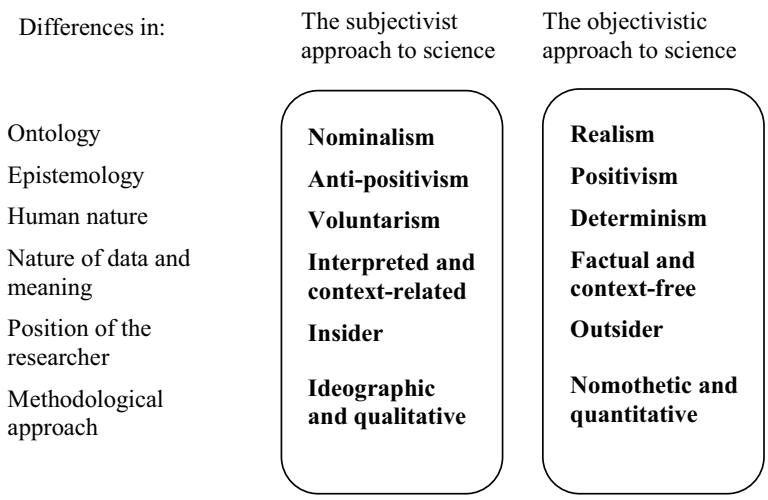

Figure 11 Two approaches to science and their differences in terms of basic assumptions (based on Burrell and Morgan 1979, 3; Viitanen 1998, 98)

The ideographic and qualitative approach emphasizes "inquiry from the inside": the researcher creates a relationship with the research subjects and acts in intense interaction with them. Researchers taking the objectivist approach, on the other hand, always remain outsiders in relation to the subject under study.

3.2 The art of the case study

Case studies have become increasingly popular as a strategy in research, and as a way of teaching and providing tools for consultancy (Gummesson 1991, 76; Remenyi, Williams, Money and Swartz 1998, 163). Organizational studies in particular, which include research on relationships and networks, exploit the strengths of the qualitative approach and the case strategy when they seek answers to the "what", "why" and "how" questions that are typical of the field (Halinen and Törnroos 2005; Hartley 1995, 209; Yin 1989, 13). The definitions of the case study in general, and in network research in particular, reveal some of these strengths. Yin (1989, 23) defines a case study as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used". According to Halinen and Törnroos (2005, 1286), case strategy in network

research is “an intensive study of one or a small number of business networks, where multiple sources of evidence are used to develop a holistic description of the network, and where the network refers to a set of companies (and potentially other organizations) connected to each other for the purpose of doing business.” The strengths of the case-study strategy are summarized in Figure 12, and are further discussed below.

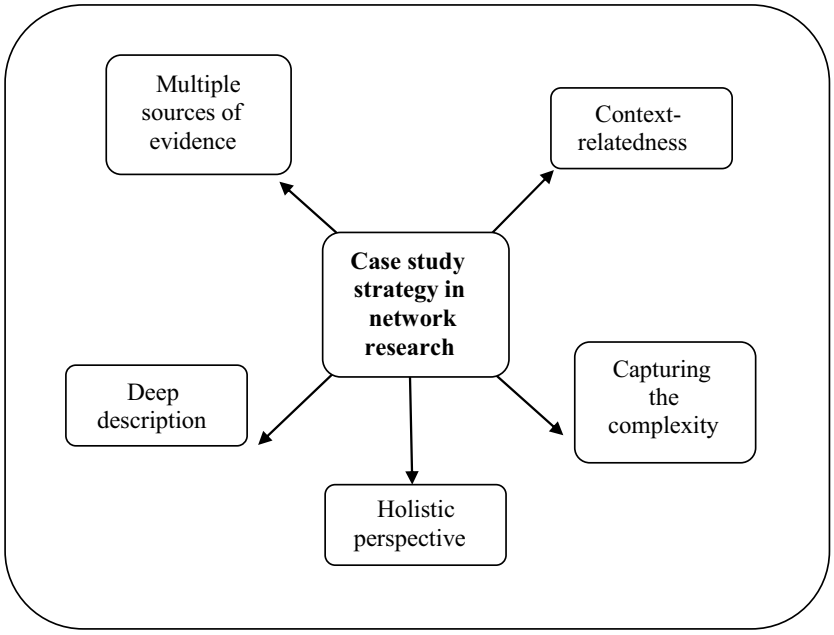

Figure 12 The strengths of the case study in network research

As in social research in general, the phenomenon and its context are often interrelated and difficult to separate in network studies. Hartley (1995, 209), in fact, suggests that the phenomenon might often be interesting precisely because of this context-relatedness. It is essential in network research to realize that the organizational actors are embedded in many interpersonal relationships and larger social structures that could be described as dyad-network or micronet-macronet relations. There are also suggestions concerning the different types of embeddedness that apply when business networks are looked at in context: technological, spatial, temporal, social, political and market-based. (Halinen and Törnroos 1998, 192–194.) Business-management situations in general are aggregates of complex organizational behavior (Remenyi et al. 1998, 166), and business networks tend to be specifically complex structures. It is not straightforward to define them or to set boundaries, for example, which in any case tends to complicate the

research process (Halinen and Törnroos 2005, 1286). However, the case strategy is also often capable of capturing these complexities.

By definition, the case study makes it possible to obtain a holistic picture about the subject matter. Valdelin (1974, 47) clarifies what this holistic view means in practice (cf. Gummesson 1991, 76): "The detailed observations entailed in the case study method enable us to study many different aspects, examine them in relation to each other, view the process within its total environment and also utilize the researcher's capacity for "Verstehen". Clearly, the case-study strategy enables us to widen our perspective on the phenomenon under study, to take on new emerging perspectives, and to study them in relation to each other.

Case studies are particularly suitable for producing deep descriptions of phenomena. Moreover, as Yin (1989) argues, in general they well serve exploratory and explanatory purposes. Exploratory studies concentrate on understanding a little-understood phenomenon, and on identifying and discovering important variables, whereas explanatory research elucidates the forces that cause the phenomenon in question (Marshall and Rossman 1994, 41). However, according to Gummesson (1991, 75–76), these aims are hard to see in isolation, and are rather interwoven: description as such is driven by the chosen paradigm, by the theoretical elements, and by the pre-understanding of the researcher, and it often includes explanatory and exploratory elements. Accordingly, the boundaries between the different aims are considered somewhat artificial here, and it is argued that elements of all three can be included in any one study. It was obvious at the start of this study that the aim was to explore the phenomenon and describe it so that it would be more deeply understood.

The case strategy is fully open to the process of triangulation, in other words the integration of multiple data sources and the open-ended processing of a full variety of evidence, including documents, interviews and observations. The basic assumption behind triangulation is that the weaknesses in each single data-collection method/source are compensated by the counterbalancing strengths of another one. (Hartley 1995, 212; Jick 1979; Pauwels and Matthyssens 2004, 129; Yin 1989, 20.) In network research the perspectives of multiple actors often complement each other in terms of capturing a multi-faceted view of the network and its functioning in the area under study.

This study was targeted on identifying and describing the chosen structural theoretical elements in the data. The data was collected retrospectively after the development project had ended, or when it was about to end, in order to gain some idea about the nature of the value that had been pursued in the networks, of the circumstances that were driving the actors to set them up, and

of how they were managed. However, networks (particularly those consisting of long-term relationships) are inherently dynamic as research units, and subject to change (Easton 1995, 419), which meant that some process elements also emerged in the case descriptions.

3.3 The role of the theoretical framework in the study

Conducting a case study is seldom a linear project with clear conceptualized phases that advance according to deductive logic, with data collection that follows strict frameworks and models that derive from the previous literature, or to genuine induction without any reference to the earlier theories. In reality, the researcher has to go constantly back and forth from one type of research activity to another, and between empirical observations and theory. (Dubois and Gadde 2002, 555–556.) This kind of reasoning logic, abduction, which is applied in this study, seems to capture more productively how researchers taking a qualitative approach think and work. It also allows a more central role for empirical research in the generation of ideas, and more dynamic interaction between data and theory (Alvesson and Sköldberg 1994, 42; Coffey and Atkinson 1996, 156; Dubois and Gadde 2002, 555; Ezzy 2002, 14). Abduction theory was introduced by Charles Peirce (1965) in an attempt to complement inductive and deductive logic, and to provide a way for new ideas to be conceptualized. Pierce (1965, 624) suggested that abduction occurred when a curious circumstance had been observed and could be explained to be a case of a certain general rule. The phenomenon could be explained by relating it to broader concepts that may be derived from the focal discipline and its theories and frameworks (Coffey and Atkinson 1996, 156). This requires the reviewing of earlier literature, at least to some degree, in order to provide the necessary pre-understanding (Alvesson and Sköldberg 1994, 42). It is problematic to argue that the ideas produced by the empirical observations are new if they cannot be reflected in the earlier literature, and if it cannot be shown why they are new. Moreover, the researcher adopting “pure” inductive logic would only be able to describe the observations, and would not be able to take a step further, to grasp the linkages between them. (Grönfors 1982, 36.)

Unrefined or even unknown research questions could also cause delay in the literature review, and the theories needed in the study may well be crystallized only during the research process: not all of the relevant literature may be known of beforehand (Dubois and Gadde 2002, 559). In this, qualitative inquiry, especially case strategy and abductive reasoning, show their strength: they are uniquely suited to uncovering new and unexpected avenues in the research and in the characteristics of the phenomenon under

study. Their flexibility grants the researcher the freedom to change direction during the process if more insightful and probing research questions appear. (Dubois and Gadde 2002; Grönfors 1982, 35; Marshall and Rossman 1994, 26.) It is thus obvious that abductive reasoning allows new theories to be developed. However, Ezzy (2002, 15) highlights the fact that these theories must then be subjected to an ongoing cycle of deductive examination and inductive confirmation through further research and data collection. Figure 13 illustrates the differences between deductive, inductive and abductive logic.

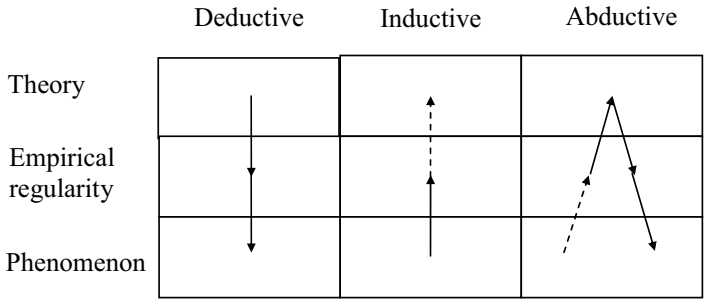

Figure 13 Distinctions between deductive, inductive and abductive logic (modified from Alvesson and Sköldberg 1994)

Deductive logic approaches the research subject through the theory, while inductive inquiry, at its purest manifested in grounded theory (Glaser and Strauss 1967), starts from the phenomenon and advances through empirical regularity towards theory creation. Abduction systematically combines these phases and there is repeated interaction between existing ideas, former findings and observations, new observations, and new ideas. (Coffey and Atkinson 1996, 156; Dubois and Gadde 2002; Kelle 1995.)

Abductive logic was followed in this study given its fit to the chosen research strategy. It was essential for the researcher first to review the existing literature on relationships and networks, strategy, and technology management, although a slight limitation was that the literature on value creation in R&D cooperation was not very extensive. The next phase involved modeling the key concepts that arose from the review into an initial framework. When the fieldwork started, the existence of the theoretical framework guided the empirical work, but it did not set too tight limits; sometimes new themes emerged during the data collection that were considered meaningful enough to be studied further, provided that their relevance could be established. These new themes, in turn, led to the

sharpening of the theoretical perspective and a search for new literature when it became necessary. The sharpened focus was then applied to the second round of data collection. In this way, the study was conducted based on interaction between theory and empirical material.

3.4 Defining the case: the unit of analysis

Individuals and their roles, episodes, events and processes are examples of possible choices for what can be studied as a "case". As is generally the case in business-management research, in which one case is often formed by one or more organizations and the events that take place within them or that surround them (Miles and Huberman 1994, 97), so it is in this study: the basic unit of analysis is a network formed around a product-development project. Business relationships in projects are usually based on contracts. The network consists of more than two actors, who have established exchange relationships in order to cooperate with each other. Defining the unit of analysis, in other words setting the network boundaries, is a complex question in network research. Cooperative arrangements between firms, described as "business networks", are often not legal entities, but are governed by some kind of agreement, be it formal or informal (Halinen and Törnroos 2005). Consequently, there may not necessarily be an unambiguous view about the structure of the network: its boundaries are often vague and the identification of the relevant actors is not clear-cut. Sometimes the grounds for defining the case are dependent on the researcher's reasoning and common sense.

In this study, too, it was not fully transparent at the beginning which actors would eventually be studied. The picture of the network and the actors was clarified when access was granted to one company, and in the first interview the names of the companies that had had a significant role in the case started to emerge. However, the researcher had pre-knowledge that the organizations that were approached were involved in the type of development project that fitted the research purpose. Setting the network boundaries thus followed the suggestions in the existing literature, according to which the actors take precedence over the researched phenomenon in the selection of organizations (Halinen and Törnroos 2005; Johansson and Mattsson 1988, 472). The networks that were studied were naturally more extensive than the relationships and actors that were included. The purpose of the case selection was to find collaborative R&D networks, including relationships that were considered strategic to the key actor or actors. The first interviews enhanced understanding about who the key actors were who saw cooperation as a strategic issue, and who therefore were able to provide the necessary data for

the study. This meant that it was only the views of these key actors that were relevant in this study, and the views of actors in what might have been ordinary customer-supplier relationships, and which did not fit into this "strategic" category, were sidelined. Furthermore, it was not technically possible to interview all the actors in the networks. Delimitation is necessary in order to decrease the researcher's workload, which would be extensive if a great number of actors were interviewed.

3.5 Case selection – multiple case design

This study follows a multiple case design. Although one single case could provide solid evidence about the research phenomenon, there are certain advantages in having multiple cases. It could create more theory-driven variance and divergence in the data, for example. To some degree, too, it could add confidence to the findings, although the idea that multiple case studies allow more replication, and eventually result in a more externally valid outcome, is misleading, at least to some extent. The number of cases is by no means a quality criterion in case-study research, since no statistical significance is pursued. Instead, the use of many cases potentially increases the opportunities for analyzing the results. Looking at a range of similar and contrasting cases facilitates understanding of a single-case finding when it is supported through the specification of how and where, and if possible why, it holds as it does. (Dubois and Gadde 2002; Eisenhardt 1989, 541; Miles and Huberman 1994, 29; Pauwels and Matthyssens 2004, 129.)

Unlike the random sampling that is usual in surveys conducted to locate informants, the case selection should be purposive (Miles and Huberman 1994, 28). According to Pauwels and Matthyssens (2004, 129), it is essential for the case sampling to have a theoretical basis. Miles and Huberman (1994, 28) suggest in their synopsis of sampling strategies, which was based on Kuzel (1992) and Patton (1990), that theory-based sampling aims at finding examples of a theoretical construct, and thereby elaborates on and examines it. Still, it is possible that the samples, in this study the cases, are not wholly pre-specified but evolve once the fieldwork begins (Miles and Huberman 1994, 27).

The four cases investigated in this study are located in the ICT cluster, including supporting and related industries (see Paija 2001, 15). This particular cluster was chosen because research and development cooperation within it has become rather common in recent years (Hagedoorn 2002), and for this reason it is continuously providing new, interesting examples as the technological development moves forward. At first the specific interest of the

researcher was to study R&D cooperation only among high-technology firms, of which there are many in the ICT cluster. However, it soon became obvious that cooperative arrangements also often involve firms representing more traditional industries, such as banking and the media, that are related to ICT firms as users of their applications. This shows that the ICT cluster has varying sub-contexts, and that the nature of the actors involved in cooperation also varies.

Given the wide spectrum of relationships and networks within this cluster, there was a danger that the picture of the phenomenon would be too scattered if the cases were selected without any sampling frame, guided by the research questions and the conceptual framework, be it specified or emergent (Miles and Huberman 1994, 29–30). A specific design was therefore followed in all of the cases. This limited the scope of the study and gave logical boundaries for cross-case comparison.

When access was gained to the cases it became obvious that they formed logical pairs, which could be reasonably coupled according to the purpose of the development work and the context of the R&D networks. The first two represent the development of financial applications and the other two are focused on the development of video streaming and video compression. The first two companies were developing a solution to replace or to introduce incremental improvements to previous solutions. As far as the users were concerned, this would not bring remarkable changes. The companies in the network and their value systems could be characterized mainly as stable and established, although the offerings of companies with emerging value systems are used, too. On the other hand, the cases comprising the second pair of networks were targeting their digital video solutions on markets that had not yet been developed, or were in the process of formation, representing the emerging value system. Thus, the technologies were new not only to the markets but also to the firms. Given these observations it seemed logical to use the value-system continuum to classify the networks, and it formed a starting point for comparing them.

Other features of the networks and their members also varied within the pairs, but they were not used as primary selection criteria. For example, the size of the companies was not pre-determined, and no account was taken of whether the companies or the cooperative relationships were new or established, or whether the actors were in horizontal or vertical relationships. These features only give some background data about the networks, and the case comparison was based on the differences in the value systems. In order to give a short overview of the case networks, the basic structural features are summarized below in Table 5 and Table 6.

Table 5 The constellations of the two networks developing financial applications

Description	**Case A (Finland) The development of the e-banking solution**	**Case B (Israel) The development of the financial information system**
Value system	➢ Stable/established	➢ Stable/established
Horizontal/vertical	➢ Horizontal/ vertical	➢ Vertical
SME/large firm size	➢ Large	➢ Mixed
Established/new companies	➢ Both established and new	➢ Established
Established/new relationships	➢ Both established and new	➢ Both established and new

Table 6 The constellation of the two networks developing video compression and video streaming

Description	**Case C (Israel) The development of the video-streaming technology**	**Case D (Israel) The development of the video-compression technology (8)**
Value system	➢ Emerging	➢ Emerging
Horizontal/vertical	➢ Horizontal/ vertical	➢ Horizontal/ vertical
SME/large firm size	➢ Mixed	➢ Mixed
Established/new companies	➢ Established	➢ New
Established/new relationships	➢ New	➢ New

The firms involved in the cases varied in size, and they were in both vertical and horizontal relationships with each other. The "direction" of the relationships is mentioned here in order to describe the positions of the network actors in the supply chain in relation to each other. After the joint projects in cases A and C had finished, the relationships between some of the actors turned more visibly horizontal, thus assuming more competitive features. The majority of the companies studied were established, some several decades ago, but some were newly established and others had existed for some 10–15 years. Consequently, some relationships in the networks had a long history behind them, while others were newly formed with previously unknown partners.

3.6 Data collection

The data collection from the multiple sources started in August 2002 and continued until July 2005. In total, 25 interviews, listed in Appendix 2, were

conducted during this time, and they provided the main means of collecting evidence. In addition, company documentation, namely brochures and annual reports, were retrieved mainly through the Internet, and expert interviews with persons not involved in the cases were also conducted in order to support the data collection in the cases concerning technological issues. Furthermore, material giving background information on the development of solutions and technologies was sought: increasing the researcher's understanding of the technology was especially important in the cases that involved the development of video solutions for emerging markets.

All the contacts with the case companies were created through the researcher's personal acquaintances, who either worked in the companies or had contacts with them and were able to introduce the right people to be interviewed. Most of the interviewees were reached easily, especially in Finland. Although initial access to the company and the case had been granted, in some cases the busy schedule of the managers caused delays in reaching them to set up the interviews. Since this study aimed at obtaining a holistic perspective about the functioning of the network, as many parties as possible were interviewed in each one. The interviews in Finland were conducted in Finnish, and all the others abroad in English, with a few exceptions in Israel when the language used was Hebrew. Table 7 shows how many interviews were conducted for each case in each network, the position of the interviewee in the company, and where it was located.

Table 7 The interviewed persons in each case network

Case network	**Companies in which the interviews were conducted**	**Interviewee's position**	**Country of origin**
A) The development of the e-banking solution (4 interviews in total)	Alef – bank	Business CIO of eBanking	Nordic countries
	Bet – technology provider	Systems Engineer Manager	Denmark
	Gimel – IT-service provider	-Vice President of Financial Solution Businaess -Development Manager -Technology Manager	Finland/ Denmark
B) The development of the financial information system (7 interviews)	Pey – software developer	-CEO	Israel
	Purchasing organization 1	-Controller (2x)	Israel

	Purchasing organization 2	-Economist	Israel
	Purchasing organization 3	-Controller	Israel
	Kaph – consultant	-Senior project manager (2x)	Israel
C) The development of the video-streaming technology (6 interviews)	Dalet – supplier/co-developer	-Project manager (3x) -Product manager	Israel
	Tet – customer	-2 product managers -R&D engineer	US/Israel
D) The development of the video-compression technology (8 interviews)	Lamed – start-up	-CEO (4x) -Chief Technical Officer (2x) -Business development manager	Israel
	Fenno – potential customer	-Senior Technology Officer	Finland

The names of the companies were disguised behind pseudonyms to protect their anonymity. The pseudonyms for the main actors were taken mainly from Hebrew. There was no need to disguise the purchasing organizations since they did not need to be afraid that the information provided by the study would in any way harm them due to their non-competitive position. All of the three essential parties in the networks were interviewed in cases A and B, and two were interviewed in cases C and D. The interviewees were mainly directly involved in cooperation, and included high-level managing directors, technical officers, and project and product managers. In the small companies Lamed and Pey, the interviewees were the CEOs. On two occasions, in cases A and C, two people participated in the interview at the same time.

The organizations that belonged to the cases were located mainly in the Nordic countries and in Israel. The role of the Finnish companies is emphasized in case A, however, since they had a leading position in the project. The case B companies were purely Israeli, although the consultant Kaph belongs to a worldwide IT group. In case C the partner of Dalet was American, but it had a research facility in Israel. The supply network of the company was also dispersed in European countries, and had a location in Turkey. In case D the start-up Lamed initiated cooperation with several companies in Israel and abroad, mainly in the US, but a key person in a Finnish company, Fenno, was eventually interviewed, given the comfortable distance and granted access.

The theme areas of the questions were given to the interviewees beforehand. With few exceptions, the exact questions (Appendix 2) were not sent to them in advance as they suggested that it was not necessary. The interviews lasted between one and two hours each, and they were tape-recorded and transcribed later. One of them was conducted on the telephone, due to the geographical distance: the case A interviewee concerned was located in Denmark. The interviews were conducted mainly in the firms that had been involved in the cooperation, but in some cases they were carried out in the interviewee's home or in a public place, a café or restaurant, even at a swimming pool.

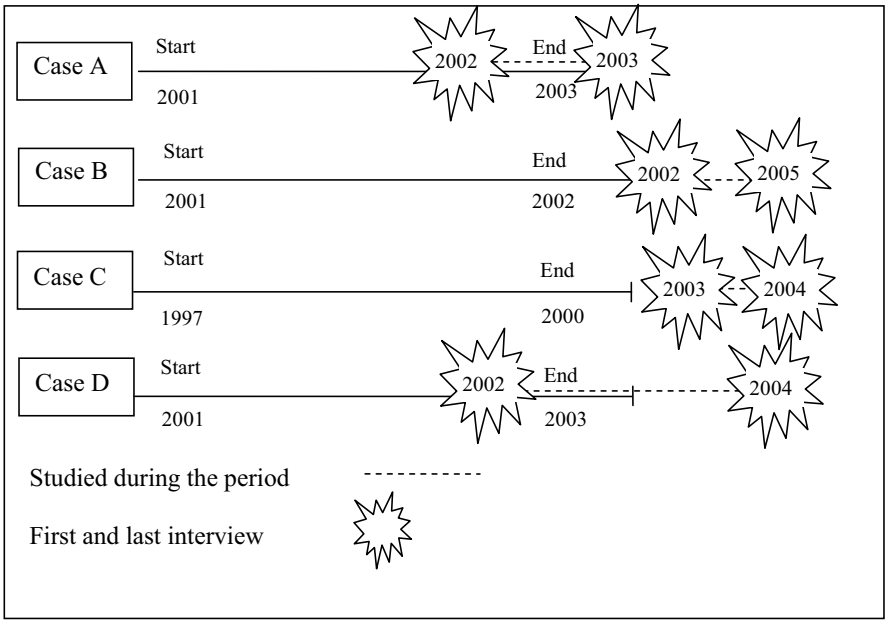

Figure 14 The timeline of the existence of the case networks and when they were studied

The timeline of the networks and when they were studied are illustrated in Figure 14 above. Network A was studied in real time, albeit when it was coming to the end of its existence. Case B was also approached in real time, but the interviews continued after the project had finished. Case C was studied retrospectively as cooperation between the parties had ended and the network had been dissolved. Case D was studied partially in real time, but the data collection also took place retrospectively. The interviews in each case network were conducted during a period that lasted about a year and a half, except in case B in which the last follow-up meeting, which marked the end of the case, took place two-and-a-half years after the first interview. The case descriptions,

and in some cases even the interview transcripts, were sent or personally taken to at least one of the network organizations to be checked.

3.7 Analysis of the qualitative data

Although many other aspects of qualitative research have been thoroughly discussed in the literature, there is no simple recipe for the analysis of qualitative data, which is considered the most difficult part of the research process (Eisenhardt 1989, 539). In general, analysis is mainly a search for meanings and a matter of interpreting the views and acts of the participants in order to arrive at a constructed entity. It is, in fact, intertwined with the data collection: consciously and unconsciously the researcher starts to work on drawing out the essential information hidden in the text (Alasuutari 1994, 35; Ezzy 2002, 80; Marshall and Rossman 1994, 13; Lee 1998, 89). Miles and Huberman (1994, 10) offer some general principles and guidelines for the analysis of qualitative data, which they suggest consists of three concurrent flows of activity: data reduction, data display and conclusion drawing.

Data reduction, or meaning condensation (Lee 1998, 89), refers to the process of selecting, focusing, simplifying and transforming the data appearing in field notes or transcriptions. In other words, during this process the researcher needs to be able to organize, manage and retrieve the most meaningful bits of the data (Coffey and Atkinson 1996, 26). Data analysis and interpretation are at least partially theory-bound, and the most important themes or concepts are articulated during the reduction process (Coffey and Atkinson 1996, 27; Lee 1998, 89). Coding facilitates the systematic grasping of what has been observed and recorded in the theme analysis, and is thus a decisive link between the original raw data, in other words the textual material, and the researcher's theoretical concepts. (Ezzy 2002, 86; Seidel and Kelle 1995, 52.) In this study the first phase of the data reduction involved reading thoroughly through the interview transcripts, the length of which varied between 10 and 25 pages. Secondly, the data was organized, to some extent, according to themes based on the theoretical concepts in the framework, but open coding was also applied: new topics were searched for in an explorative manner (Ezzy 2002, 87). These themes are presented in Appendix 3.

The notes that were produced as a result of the coding process served as a basis for constructing the case write-ups. This phase was about displaying the data, showing it in a more accessible and compact form (although no matrices or graphs were used as such) (Eisenhardt 1989, 540; Miles and Huberman 1994, 11). It seemed sensible to record the events in the case write-ups

chronologically, at least to some extent. This chronological account helped in terms of clarity, but it did not aim at tracking changes within the case as such. The citations of the interviewees were used in the case write-ups to support the researcher's understanding of the events. Writing the case descriptions also increased the researcher's familiarity with each case. The descriptions also fulfilled the overall goal of the case and provided an initial way of generating insights, since a certain analytical path was followed when they were constructed. The events in the networks and the context were presented so as to enable the use of the presented data in further analysis in conjunction with the theoretical concepts.

The theoretical concepts were more strongly present later when the case descriptions were used as a basis for interpretation, firstly in the within-case analysis that directly followed the case descriptions, and secondly in the cross-case analysis, which was the last part of the study. The theoretical concepts were used explicitly in the within-case analysis to locate the matching patterns in the empirical findings. However, the patterns sometimes emerged from the data: studies following abductive logic allow for analytical flexibility, although they may not be as overtly inductive as grounded theory (Glaser and Strauss 1967) would suggest. According to Eisenhardt (1989, 540), within-case analysis can be coupled with cross-case analysis. The fact that the networks studied formed two case pairs was useful in this phase since it was possible to look for similarities and differences between them in the selected dimensions (Eisenhardt 1989, 540). This helped to draw out the wider implications of the study, while giving a strong sense of the circumstances of each case pair. An essential differentiating factor was, in fact, the circumstances of the pairs. The two types of value system in which the networks were embedded were the stable/established and the emerging systems. The decision to look for the differences in value creation between these two value systems was based on the suggestion put forward in earlier research that the management of networks in different value systems is dissimilar (Möller and Svahn 2003, 205). Thus, the theory-based management issues were compared between the case pairs. The same notion concerning differences in the value system could also be applied to value creation in and through the networks, and this was also done in this study. In Huberman and Miles's (1994, 11) terminology, the within- and cross-case analysis represented the conclusion drawing: regularities and patterns and explanations were searched for and emerged.

3.8 Research quality in case studies

The qualitative research approach and the case strategy are frequently criticized for producing weakly generalizable results and lacking rigorous procedures in comparison to quantitative studies (Dubois and Gadde 2002; Hartley 1995, 208). The issues of reliability and validity are sometimes controversial, even among qualitative researchers themselves: some of them dismiss or ignore them as irrelevant remnants of outdated positivist philosophies of science (Kvale 1996). However, many qualitative researchers address the issues related to research-quality evaluation by defending its relevance as a part of scientific procedure, and establish different evaluation standards (Lee 1998; Lincoln and Guba 1985; Marshall and Rossman 1994; Maxwell 1996; Yin 1994). The set of standards provided by Yin (1994, 32–38) is commonly applied in the establishment of the quality of any study in the social sciences, which means that their constructs of validity, internal validity, external validity and reliability are also relevant for the case study. Lincoln and Guba (1985) proposed other standards, such as credibility, transferability, dependability and confirmability, to replace the traditional ones, but they are used in this study only to complement Yin's (1989, 1994) suggestions since they do not seem to be that revolutionary or different from previous standards.

The first research criterion, construct validity, concerns the interpretation of observations and whether the researcher is calling what is measured by the right name, which means establishing a linkage between theoretical and operational definitions of concepts (Kirk and Miller 1986, 20; Silverman 1993, 149–166; Yin 1989, 41). The tactics that Yin (1994) suggests here to support construct validity are, firstly, to examine as many sources of data as possible for the study, secondly, to establish a clear "chain of evidence" so that the reader can follow the researcher's logic, and thirdly, to have the case-study report checked afterwards by the key informants in order to ensure its honesty, truthfulness and clarity. These tactics were used in this research in order to attain the first standard. Expert interviews concerning technological issues were conducted prior to the other interviews in order to ensure that the researcher fully understood the context of the research and would be able to talk with the interviewees about issues that were relevant to the study. Naturally, in all the phases of the fieldwork existing literature on interorganizational relationships, networks and technology management guided what was asked in the interviews. Given this preunderstanding, the researcher was better equipped to maintain an established chain of evidence from the preliminary theory through the case descriptions to the final case analyses. Furthermore, the key informants checked the cases afterwards. Part of the process of sharpening the concepts was writing conference papers about

the main themes of the study (Jokela 2003, Jokela 2004a and Jokela 2004b), and the constructive feedback given during the presentations gave some valuable insights.

The second standard, internal validity as a measure of quality, could be considered secondary in this study in relation to the other criteria, since it is mainly applicable to studies that are intended to assess the conditions of causality between independent and dependent variables (Yin 1989, 40–41). External validity, on the other hand, requires more careful assessment. In general, questions concerning the external validity of the qualitative approach and the case strategy evoke divided opinions. Existing quantitative methods seem to provide more tools for generalization, whereas case studies have been argued to provide an inadequate basis for this task. In order to demonstrate generalizability in a particular case, Yin (1994) calls for replication. Thus, although the sample in case studies is not even meant to be large, and that even a single case may have authority in its own right (see Stake 1995 on the intrinsic case study), confidence in the findings may be increased by using multiple case studies (Hartley 1995, 226). As far as organizational studies are concerned, the issue of generalizability also has to be assessed in the light of the research questions. According to Hartley (1995, 225), organizations tend to be heterogeneous in their characteristics, which raises the question of typicality: what is the average situation in them? Hartley (1995, 225) also argues that it is often necessary to clarify the organizational processes in context in order to distinguish the general from the particular. Detailed knowledge about organizations and the processes underlying the behavior and its context can help in terms of specifying the conditions under which the behavior might be expected to occur. In other words, case studies may be very useful when generalization is about theoretical propositions and not about populations. In Yin's (1994) application this is called analytic generalizability, and thus refers to the extent an existing theory serves as a template for evaluating the results of a case study. If two or more cases show similar results, the underlying theory is corroborated, with the second case proving evidence of external validity. In this study, the two case pairs were used to some extent as points of mutual reflection, and the resulting inferences could be compared within the pairs.

This in itself revealed certain similarities between the cases and their contexts, thereby giving support to Lincoln and Guba's (1985, 2000) concept of transferability: that they characterize as a direct function of the similarity of two contexts, also called fittingness. They suggested that if the sending context A is sufficiently similar to the receiving context B, then the working hypothesis from the sending context may also be applicable in the latter context (Lincoln and Guba 2000, 40). These above-mentioned observations

naturally strengthened the robustness of the case studies at hand, and increased the likelihood that the same processes investigated under similar conditions would lead to similar findings.

Some interviewees became more open when it was explained that the study would be public only after a couple of years. Although studying real-time cases may provide fresh insights into contemporary phenomena, informants may be more accessible if a retrospective approach is adopted. In this study the cases examined had just ended or were about to end, with the exception of one that had ended a few years earlier. This time-line seemed to be ideal: the informants still remembered the events well, but the urgency to conceal the information from their partners was no longer paramount. It was also beneficial for the researcher that there were many interviewees per case, dispersed in the different organizations. The narratives of the different informants thus complemented each other, and some of them were more willing to talk about conflicting issues than others. The use of other research material about the issues in question also reduced the chance that what the interviewees had said could not be relied on. The other material consisted of the annual reports of the companies, the information they published on their Web pages, other Web pages that published related articles and news, and magazines and other publications on Finnish and Israeli economic life.

4 CASE DESCRIPTIONS AND ANALYSES OF THE STRATEGIC R&D NETWORKS

This chapter starts with a brief general review of the ICT cluster and the position of the case network members in it. The Israeli ICT cluster and software industry are also briefly introduced. The four empirical cases are then described and analyzed. The first two concern the development of an e-banking solution and a financial information system, and the other two focus on video streaming and video compression. The analysis of each case directly follows the case description. Chapter 5 comprises the cross-case analysis, with a comparative discussion of the empirical findings in the light of the theoretical framework. At this point the cases are examined in pairs and not individually.

4.1 The industrial context of the cases

4.1.1 The ICT cluster

The development of the information and communication technology cluster (ICT) turned Finland into one of the leading countries in mobile communications, in Internet use, and in digital data transfer. It is not only the business sectors that have been influenced: the changes have touched the whole society. Due to the rapid growth of the cluster in the 1990's, it has a significant role in Finland's economy. In fact, the information and communication industries have become one of its three main economic benefactors, and along with the forest and metal industries contribute considerably to employment and exporting (Kansantalous ja elinkeinoelämä, 2006). Developments in the same industries have been similar in Israel (Israel's Software Industry 2002; Israel's Telecommunications Industry 2002). The development of the Israeli ICT cluster is further discussed in Appendix 4.

Industries that have information and communication technology as a common denominator may well be termed a cluster. According to Porter (1998), a cluster is formed by key industries and related industries, and by other actors that have an essential role in the competition within it. This

already indicates its fragmented nature, which is very visible in Paija's illustration (2001)**:** the ICT cluster is shown to include supporting industries and associated services in addition to key and related industries.

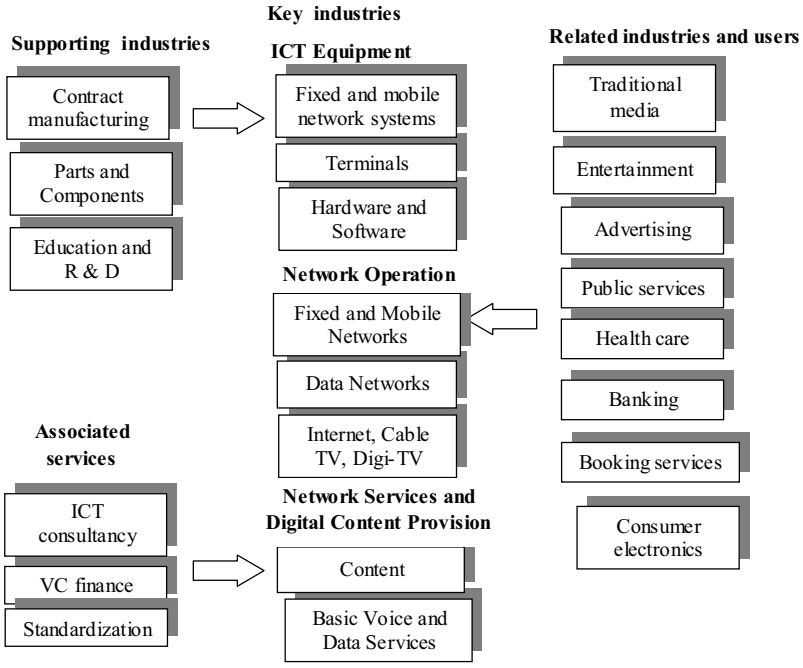

Figure 15 The ICT cluster (Paija 2001, 15; Paija 2000, 5)

Earlier, only telecommunications networks and equipment manufacturers were considered key industries (Sallinen 2004, 122). Now, as shown in Paija's typology, network operations and services and digital content provision are also included. Related industries include traditional media, entertainment and other services, such as banking and health care, while supporting industries include contract manufacturing and components, as well as education and R&D. ICT consultancy, venture-capital financing and standardization are seen as associated services.

Another classification divides the cluster into larger industrial segments, including the electronics and electrical industries, software, telecommunications services, and content provision (Oesch, Varesmaa, Nummenpää and Vuorimaa 2003, 3). Emphasis in the classification is also laid on the users, individuals and organizations, which are represented in the cluster as users and appliers of ICT. This classification is presented in Figure 16.

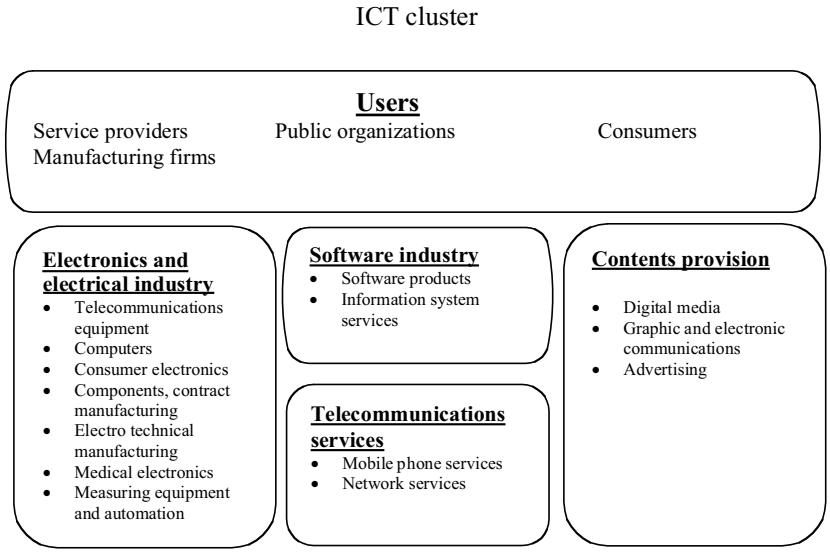

Figure 16 The ICT cluster (Oesch et al. 2003, 3)

However, according to Helander (2004, 40), none of the classification schemes should be regarded as absolute due to the dynamic nature of the cluster. The classification may shed light on its current state, but the boundaries between the different industries will become vague in the future (Helander 2004, 40).

4.1.2 The software industry in focus

Since cooperation in the networks investigated in this study evolves around software development, the software industry is discussed in more detail here, although other actors from other industries, from ICT equipment and network operations, are also involved. Software and hardware products and services together form the IT market, as illustrated in Figure 17 below. A loose definition of the software industry covers all the activities that include software development, which may take place in firms dedicated to software development or in firms in industries that develop software for their own purposes. Firms that are dedicated to software development may focus on software products, embedded software, which refers to software that is a part of larger products, system solutions that are sold on, or the provision of software services, including running projects and consulting. (Hoch, Roeding, Purkert, Lindner and Müller 2000.)

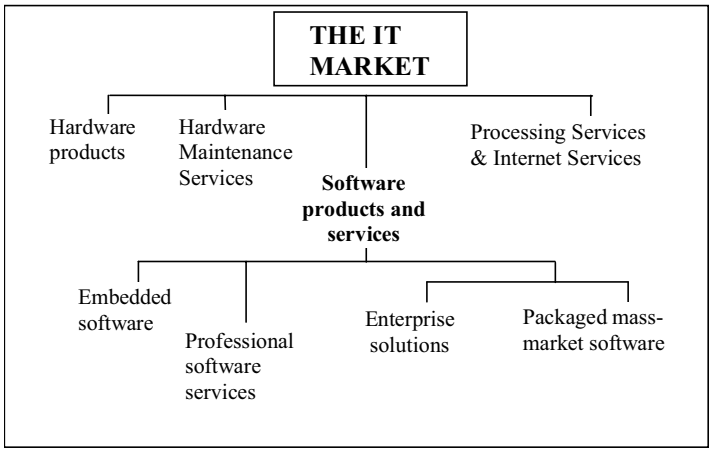

Figure 17 The software industry as a part of the IT market (Hoch et al. 2000)

The software industry has integrated into other industries, thereby creating new business. Consequently, the boundaries between it and other industries have become blurred: in Finland, for example, electronics, automation and telecommunications are dependent on the offerings of the software industry. The banking, insurance, finance and commercial sectors, and the communications industry, have invested substantially in information technology, which has expanded the demand for software products and services in these sectors. In Israel the requirements of the military industry, and of the closely related electronics industry, have boosted the development of the software industry. This has led to certain large enterprises developing software in their own software-engineering units, which could be compared with the small- and medium-sized companies that represent the real software industry. (Tyrväinen et al. 2004, 1–3.)

Low entry barriers are typical of the industry since knowledge as an asset is more important than investments in equipment or in facilities, and this speeds up innovation (Hoch et al. 2000). However, there is a difference between the software-product business and professional software services. According to Hoch et al. (2000), the former includes the development of packaged mass-market software, which refers to a standard product that is sold as such or with minor modifications to customers, and enterprise solutions that could be considered products but which always need customization and substantial time and effort to get them running. One more category in software products and services is embedded software, which refers to software that drives machines other than computers, such as cars, telephones, security systems, audio equipment, printers, and scanners (Lee 2002). Professional services, sometimes also referred to as consulting, are needed when organizational users

want to develop customized software for their businesses and do not have resources of their own (Hoch et al. 2000).

It is typical of the software product business that the products are less customized, and that firms aim at great volumes: product development requires remarkable investments and even years of work before the sales of the software bring any revenues (Kontio 2002, 1). However, marginal costs are almost non-existent: once the software, the standard product, has been developed, it can be multiplied at almost no cost (Hoch et al. 2000). It is essential for the software product companies to establish alliances and distribution channels in order to reach large markets. Exchange is rather simple and short-term, as no relationship development is required between the software supplier and the customer. The markets may be worldwide and competition is open. (Tähtinen 2001.)

Developing customized software has many characteristics that have nothing in common with the software product business. One key competence of the professional service provider is in making the services known to the potential customers, in other words project marketing, and another is running the projects, or project management. The service provider develops unique software for the customer on a platform that is acquired from the software product, and it will also provide training and maintenance. For the customers, these projects are often very important, since they represent an essential part of their business and business development. From the supplier point of view, a project is usually only one among many, but nevertheless, one customer has more significance than in the software product business, given the nature of the exchange between the service provider and the customer: interaction is dense, reciprocal, often long-term, and multi-faceted. (Tähtinen 2001.)

Professional service providers operate mainly in domestic markets. Large companies may have business units that are specialized according to the industries that the customers represent (Tähtinen 2001). Business dynamics in professional services and in the software product business are similar: the entry barriers are low, there is a constant threat of new entrants, and the pace of innovation is high. However, there is not necessarily a race for market leadership. There may be a great number of companies offering comparable services, and small local professional service providers may be very successful if they develop competences relevant to certain industries or specific customers, and are thus able to create long-term relationships (Hoch et al. 2000; Tyrväinen et al. 2004, 15). Therefore, customers have a variety of options when they are selecting the supplier, and in a competitive market the total value that the supplier promises to offer may make the difference. From the supplier's point of view, it is essential not only to concentrate on sales and

service delivery, but also to realize how the customer can be served to the fullest extent.

The cases of this study consist of actors mainly representing the software industry and its customers. The network actors in case A included a bank that was a customer of an IT house that served as a supplier of application software and a systems integrator, and of an infrastructure software supplier. The network in case B consisted of a group of organizations that, as in case A, were customers of an IT service provider and of a consultant who helped the end-user organization to choose from among the different suppliers providing software tools for the project. The development projects in cases C and D focused on embedded software that would be a system component. In case C the system was a solution for cable TV operators, and in case D the initially planned product was a security system, but there were other applications as well. The actors in case C were a broadcasting-system developer, its partner, which was developing a digital video, and a company providing quality certification for the product. Those involved in case D were a developer of a video-compression algorithm and the various partner candidates from the security and telecommunications fields.

4.2 The R&D network in the development of an e-banking solution – Case A

This case describes how a Nordic bank, Alef, a Finnish IT house, Gimel, and an international software supplier, Bet, developed an Internet banking solution in cooperation during 2001–2002. As a result of the project the bank received a new-generation product and the IT house received the rights to it. The project reflects the changes that have taken place in the banking sector: e-banking is believed to bring competitive advantage in the intensifying battle for customers.

The following case description is based on four interviews that were conducted in all three network organizations. Journal articles about e-banking provided further information, and the websites of the organizations and other related material, such as interviews given for other publications, added important insights.

The case description proceeds as follows. The bank is described first, and then the circumstances of e-banking are explained. After that, the rationale behind the bank's decision to develop an e-banking solution is reviewed, and its partners, the Gimel IT house and the Bet software supplier, are introduced. The latter part of the case describes the cooperation between the parties.

4.2.1 A description of Alef

The Alef bank is the largest financial services group in the Baltic region, with approximately EUR 262 billion in total assets and 9.7 million personal customers, one million corporate customers and 500 large corporate customers. The group has created a world-leading Internet banking and e-commerce operation with 3.4 million customers, and handles a total of nine million transactions on a monthly basis. In addition to its banking business, it also has a significant position in the Nordic insurance markets, and the distribution network is the most comprehensive in the region: there are 1,240 bank branch offices reaching to the Baltic countries and Poland, and it leads the way in telephone banking and Internet services.

The Alef financial services group was formed in 2000 following several cross-border mergers between the four Nordic countries, Finland, Sweden, Norway and Denmark. Since December 2001 all operations have been conducted under the same brand name in all of these countries, and together the different countries created a basis for the current business model. The Finnish bank, which was involved in the formation of Alef, took shape through several mergers during the 1990's, and the roots of the oldest part of it reach back to the 1860's. The Alef financial corporation has activities in 10 countries, but this case concentrated on the Nordic level since the units involved in this particular product development project were located in the four previously mentioned countries: Finland, Sweden, Norway and Denmark.

Large banking and financial services companies such as Alef are operating in a challenging international environment in which they face the need to deploy new applications that deliver value-added services to customers more quickly than ever. This implies that banks have to consider to what degree they should and could transfer services from the branch office to the Internet to be delivered electronically. Even the slowdown in the economy has not made the banks stop their investments in Internet systems. Alef has been pioneering this development: today it operates the largest Web bank in the Nordic countries, measured by the numbers mentioned above. This has also been noticed in the field, since their e-based financial services have received several awards for quality.

Alef's move toward Internet banking was thus no longer experimental, but was rather a strategic path it had chosen to follow a long time previously. For example, the history of electronic banking (also referred to later as e-banking) in Finland can be traced back to the "Duo" telephone-banking service, which was introduced in the Finnish market in 1982 by the bank that was one of Alef Finland's predecessors. The service was developed further, and two years later it became possible to access electronic banking services via one's personal

computer. In 1986, when the service already had 7,000 users, it also turned profitable for the bank. More services were added during the following years, and the variety of different interfaces increased: online share trading was introduced in 1988, and mobile-phone banking in 1992. Banking via the Internet has been possible since 1996, via television with an Internet adapter since 1998, and via WAP phones since October 1999.

4.2.2 The increase in e-banking in the changing banking world

In recent years the number of e-banking users has increased worldwide, and Finland in particular has been a pioneer in the field (Pankkivuosi 2002, 14). The banking sector was among the first in the service industry to face an urgent need to rationalize its activities when information technologies broke through (Manninen 2000, 261). According to the results of research conducted by the European Commission in 2003, electronic banking services are used more widely in Finland than anywhere else in the European Union (Pankkivuosi 2003, 15), and according to Karjaluoto (2002, 27), Finland is one of the leading countries in the field of banking technology in general, and in Internet banking in particular. From the technological point of view, providing banking services through the Internet has become easier. Whereas at the dawn of the Internet banking era everything had to be done in-house, now the new programming languages and technology packages serve the banks with ready-made components. Although the components have to be tailored and fine-tuned to meet the specific needs of the service providers, this is still a lighter option than developing the system from scratch.

There is a difference between Finland and the rest of the EU in the position of the branches. Whereas in the EU a significant proportion of payments are still processed in paper form in the branches, Finnish payment-transaction services make more use of technology and telecommunications: it is estimated that 94% of transactions are electronic, and that 67% of invoices are paid through the Internet. Banks and their customers have made 2.5 million agreements concerning electronic banking. (Pankkivuosi 2003, 13.)

The technological infrastructure in Scandinavia and Finland is very good. The number of computers has increased remarkably since the mid-nineties (Virtanen 2001). As a consequence of this increase in the sale of computers, the Internet is also widely used: according to the Finnish Bankers' Association, 68% of Finns use it and more than 50% of those interviewed for the research are also users of e-banking (Pankkivuosi 2003, 13). Another indication of this technology-oriented culture is the fact that the mobile-phone subscription rate in Finland is also one of the highest in the world. Electronic

banking channels other than the Internet and the mobile phone include television and the traditional telephone.

The rationale behind the offering of e-banking

By using the Internet as a delivery channel banks save costs and increase their customer base in a very easy way, just to mention two reasons why e-banking can increase profitability. Its advantages are discussed below (Jayawardhena and Foley 2000, 22).

- Cost savings. These can be achieved since physical channels are more expensive to maintain. The savings come about through the combined effects of reductions in and better utilization of the work force, the need for less equipment, the more economic usage of space, and operational savings.
- Increased customer base. The use of multiple distribution channels increases effective market coverage by enabling different products to be targeted at different demographic segments in banking, increasing the efficiency, enhancing the bank's reputation, delivering better customer services, and increasing customer satisfaction. Furthermore, those who use the Internet are usually well educated, which suggests that they are also high-net-worth customers.
- Mass customization. Internet delivery has the capacity to customize information to suit the needs and the likes of each user.
- Marketing and communication. Banks can advertise on the Internet without facing incremental charges for prolonged exposure given that the costs are limited to initial development and maintenance. Customer data can be collected with minimum effort.
- Innovation. A multitude of banking products can be developed and delivered through the Internet.
- The development of non-core business. The changes in the regulatory framework have enabled many banks to expand their services into non-traditional banking areas, such as insurance and stock brokerage.

The recent developments also have their negative sides. The market shares of the traditional banks have been threatened by the neutralization of many of the competitive advantages related to branch networks and the high costs of developing and maintaining new technologies (Nehmzow 1997). When the branch network is cut down, customers may feel forced to use electronic delivery channels, not being able to turn to employees in the physical branch (Karjaluoto 2002, 31). Security issues are of high priority in the provision of

Internet banking services, and it has been considered an obstacle moderating their expansion. Before customers decide to shift to e-banking or e-commerce in general, they need to make sure that confidentiality and security are taken care of. (Adam 1999, 123) The development of suitable technologies has nevertheless provided solutions to these problems, and the Internet could now be considered a secure form of banking (Nehmzow 1997).

The external and internal drivers of electronic banking

According to Jayawardhena and Foley (2000, 20), technology in general and the Internet in particular have been a driving force behind the changes in the banking industry. They also listed other external drivers that have had an impact on the growth of e-banking: the changing economic, political and social environments. Coinciding with the developments in technology, various industries in many Western countries have been deregulated as a result of political and ideological changes, and this has also opened up new opportunities in banking. The social and demographic trends are reflected in the products that can be offered by the banks to the aging population. (Jayawardhena and Foley 2000, 20.)

Customer power and new entrants have an impact on the banking field from inside (Jayawardhena and Foley 2000, 20). Although perhaps the most important advantage of e-banking is that the bank can delegate tasks to the customer, it is also in danger of losing that customer more easily. From the customers' point of view, Internet banking could mean the freedom to shift from bank to bank more easily because all the information concerning the services is freely available on the Internet. On the other hand, according to Robinson (2000, 106), online banking can strengthen the relationship between the service provider and the customer because it brings the services directly into the customer's home or office, and this can contribute to customer loyalty. Extra value is also provided to customers by offering a variety of financial and other services such as insurances, shopping and news through the e-banking site (Robinson 2000, 106).

New entrants consider the sector more attractive with considerable potential. The cost of entry is low, returns seem very promising and the risk seems manageable. Technology has facilitated the entry of the new banks (Jayawardhena and Foley 2000, 20; Erjanti (2001, 9). Furthermore, Erjanti (2001, 9), basing her remarks on Vesala's (2000) study, stated that competition would intensify in any case following the growing use of the Internet. Technological development could also decrease the importance of quality drivers that are not dependent on the physical distribution network. Technology has affected the competition in deposits and savings. As far as loans are concerned, the branch still has more significance, but these products are also becoming available on the Internet. (Erjanti 2001, 9.)

4.2.3 The intentions of Alef bank and the IT supplier Gimel

The cross-border mergers of the bank created a need to replace the existing systems with a new and uniform solution, which would be shared by the four Nordic countries. Due to its profitability, the Internet banking business was of strategic importance for the bank: it was a source of profit, it saved costs, and it was an easy way of getting customers in. It had also become easier to develop banking solutions and the variety of interfaces had become wider.

Given this background it was clear that the business value of the new solution was great. In practice it meant reducing the variety of technologies used by different countries as an innovative technology was taken for the new solution. The project also led to the standardization of the products offered to customers in the Nordic countries. A goal in this development project was a banking service that could be customized by the customers, which would enable them to define a virtual home in which they could combine their finances with their hobbies, their social contacts and their way of life. Due to the size of the project the related costs and risks were also considerable. The bank realized that in order to maintain the reputation it had built up in the area of Internet banking, the only option was to complete the project successfully. It therefore needed to select its partners with care.

A technology supplier was needed for the project in any case. Alef had to weigh up whether or not to cooperate with some other party that would run the project, instead of the bank itself, since the technology supplier that was selected was not involved in running projects. The bank's desire was to share the costs of the project with another party and in exchange to give the rights to the end result. The novelty of the technology also played an important role in this decision-making. If Alef had decided to run the project in-house, it would have had to train specialists to deal with the new technology. The most suitable people were involved in other development projects, however, which meant that at the same time the bank would have had to cut or reorganize its existing project portfolio in order to produce the required human resources. This was reasoned to be too hard in the current situation. Furthermore, the bank wanted to guarantee the quality of the future solution, since failure in this project or in its outcome was not an option. Training the in-house specialists would not necessarily have been enough. This is how the CIO of eBusiness in the bank crystallized their motivation:

> "We did not want to cut down on our other development programs too drastically, we would have had to reorganize, structure our project portfolio in order to have the people that we needed, and we calculated that it would be such a violent procedure if we came down on those other projects with such a strong hand, and it might be that the end result would have been that we would still not have this new technology

> [related capabilities]… we should have given training in the new technology to a great number of people, and when you put inexperienced people to work the results are generally worse than when you use experienced people. [CIO of eBusiness, Alef]

For several years the development of an Internet banking solution had been on the agenda of Gimel, a supplier of high-value-added IT services. In spite of this high priority, the company had not started the development of such a solution of its own. In the course of time there had also been discussions with Alef Finland about the option to cooperate in this area, but it was only at this time that the tone of the discussions became more serious.

The two companies were already familiar to each other since the relationship between Alef Finland and Gimel could be traced back to the end of the 1960s. At that time Gimel was established as a computer center for a few large companies, and the predecessor bank of Alef was one of them. The company had grown remarkably since the 1960's: now it had €1.1 billion annual sales, and 12,000 employees in 21 countries, in Europe, China and the U.S. Although the multinational giants form a strong entry barrier to the international IT-service market, Gimel tried to overcome this with a strategy of proceeding step by step to Europe, and firstly strengthening its position in the Nordic countries.

Throughout the 1990's its growth was spurred on by several acquisitions, mergers and strategic partnerships, which were aimed at developing and strengthening the core business and focusing on the areas in which the company could achieve superior expertise: banking, the forest industry and the public sector. An important merger took place in 1999 when Gimel merged with a Swedish corporation. In its chosen segments it has adopted a long-term approach in its operations, and it aims at maintaining its established customer relationships by being a strategic IT partner to these customers.

As personal computers became more popular in the 1980's, Gimel expanded its services and products from central computer services and programs to targeted information-systems development in the chosen industries. In today's digital economy it specializes in consulting, and in building and hosting its customers' core business systems. The services of the group are based on a combination of deep industry-specific expertise and the latest information technology. As the demand for high-value-added IT services has remained stable, even the lack of willingness to make new investment has not affected its profitability: its returns exceeded those of all of its Finnish competitors, other IT service providers and software engineering companies, in 2002.

Gimel increased its competence in the financial sector when it established a joint venture, Samech, with the predecessor of Alef Finland in 1995. This unit,

which has 300 employees maintaining the information systems of the bank, belongs to the Gimel financial group, but it is jointly owned with Alef. The establishment of Samech took place in the period when the importance of outsourcing information systems increased remarkably due to the Internet revolution, as did the challenges and the opportunities related to this development. The relationship between Gimel and the predecessor of Alef almost 30 years before this, although the bank had gone through many changes in terms of ownership and organization following the banking crisis in Finland in the late 1980's and early 1990's.

As far as Gimel was concerned, it was very important to maintain the long-term customer relationship with Alef Finland since its competence in the financial sector was largely based on it. Moreover the original bank and its successors had been large customers of Gimel since the very beginning. Alef Finland, in turn, had a trusted partner that knew their environment and was able to be generally responsible for the development and production of its information system. The previous e-banking solution had been developed by Alef Finland and Gimel in cooperation, which was how the key persons, the CIO of eBusiness and the "visionary", or "Mr. E-banking" on the bank's side were familiar to Gimel. There had been no joint operations in e-banking in the other Nordic countries, although there had been other types of projects in Sweden. Alef in Denmark and Norway were unfamiliar to Gimel, although the paths in Norway were connected through the acquisition by Gimel of an IT house that had previously served Alef there.

4.2.4 Forming an R&D network

Gimel and Alef had previously discussed potential cooperation in e-banking, but it was only at the end of the year 2000 that things took a more serious turn. Although it was, in fact, Alef that was looking for competent partners for this development project, it was Gimel that suggested joining forces for the development of the solution. The executives from the remaining Alef countries joined the negotiations later, and the project to develop a new-generation Internet bank started early in 2001.

Partner selection and the partnership between Alef and Gimel

Alef had many other suitable candidates to share the risks and costs, and to provide the lacking expertise in the project. Many world-class IT houses expressed interest in cooperation during the assessment phase, and they regularly came to the bank to discuss how they could help the financial services group to realize its plans. Gimel was one of these, and it approached

Alef with a proposal concerning cooperation in the development of the e-banking solution.

The selection of Gimel was thus not self-evident when Alef first started looking for partners. Since it turned out to be the most feasible option in the end, the other options were put aside, and a small group of people carried out a feasibility study concerning the participation of Gimel in the project. They checked whether the goals matched on both sides, and considered the costs and the responsibilities of the parties concerned. Alef considered it important to promote the idea of partnership in this product development project.

> "We were assessing very carefully why we chose Gimel here…There are always economic issues present, which were quite beneficial for us. Money is always…I would say that I didn't want to have a buyer – customer relationship but I wanted a partnership and partnership in my opinion means that each partner is contributing". [CIO of eBusiness, Alef]

Alef wanted to make an effort to build a solution with characteristics that would create value for its existing customers and attract potential new ones. For this reason the partners selected for the development task had to fulfill certain additional criteria. The new solution was based entirely on new, uniform technology. Its real new-business value to the corporate customers was in the innovative services, such as allowing them to see the total picture of their current financial situation. On the private-customer side there were changes related to the personalization of the services: there was a focus on look&feel issues, which were also aimed at making the bank more effective in its customer-relationship management.

The bank wanted its partner company to operate on a scale that would enable it to enter into serious dialog, and to listen carefully to suggestions concerning its development needs. Gimel fitted this description, but this would not necessarily have been the case with companies that were much larger. There was also another issue that made closer cooperation with larger companies more difficult: their development resources would have been shared with hundreds of other customers. This would have been tricky for the bank, which was insisting on prioritizing the e-banking project due to its urgency in the current situation. This is how the CIO of eBusiness described the situation:

> "In this case we wanted a partner who would consider us an extremely important customer, with a positive and flexible attitude towards our development needs so that we would also have an impact on the development." [CIO of eBusiness, Alef]

The characteristics of the product

The supplier-customer relationship between Alef and Gimel included an element that differentiated it from the usual arm's-length relationship and made it more strategic in content. It also differentiated the Duo project from the previous projects undertaken by Alef and Gimel, which were carried out within the framework of a joint venture, or of an ordinary customer-supplier relationship. By sharing the costs of the development of the new-generation Internet banking solution, Gimel was also earning the rights to the product. This naturally increased its interest in joining in the development. The partnering form was new to the company: it had not previously had co-development projects with its customers but had just developed solutions for them. It was rather seldom that it was able to utilize some elements of these solutions in other development projects.

> "And surely this is the first of its kind from our point of view, first pilot, which is done this way for the customer, it has created these kinds of dance steps, and probably the next ones will be done with a different customer and again we are one experience richer…" [Chief Technology Officer, Gimel]

Gimel would have been willing to carry out such co-development projects earlier, but its customers were not interested. The obstacle was that the customers were not willing to share something that was strategically important with a partner that might later have the rights to use it as a product and to sell it to customers that might include their competitors. Participation in the project naturally also carried a risk. The investments were substantial and the company had no guarantee that the product would attract new customers. The IT house was afraid that the product would be too advanced or too complicated for the market outside the Nordic area. The large investments Gimel could make were necessary, which was the basic reason why Alef had wanted the IT house to participate. Still, the deal was also beneficial to Gimel, which was hesitant to invest alone in a solution that would combine in-depth financial business understanding and modern component technology. It was also strange that Finland's exceptional e-banking competence had not been exported. The end result of the project would possibly make up this deficiency.

The new product was called the Financial Portal. Its essential feature was that it integrated financial information on private and corporate customers and their transactions into a personalized e-banking service. The portal was based on Alef's visionary's idea that e-banking has to start with simple, user-friendly, scalable services with one password in all channels and all services included in the same portal: this would facilitate economies of scope and repetition. Thus far, e-banking solutions had been tailored to the banks

according to their needs. This new solution was a “semi-finished product”, which would require less development effort from the customer in starting to use Internet banking.

Finding a balance between competitive demands and customer needs

Participation in the project had a remarkable reference value for Gimel. Alef’s previous efforts had been rewarded three times as a leading Internet-banking solution. This new-generation solution was an even more sophisticated version and it was favorable for Gimel to use this reference once it started marketing the product. It had to take into consideration in its marketing the fact that certain geographical areas had to be excluded for competitive reasons. It was mainly targeting banks in Central Europe, where the market for Internet banking was still developing. Later, with good references from there, it intended to start selling further afield as well. There were also other competition-related issues it had to take into consideration in its marketing: it had to assess how much it could talk about Alef’s launch schedule, and to find out what details about the product could be presented in the brochures they were preparing.

In addition to acquiring its own e-banking product, Gimel expected the joint project to serve as a bridge in establishing closer links to banks in other Nordic countries. This might possibly bring other projects in the future with the same customers in new areas.

4.2.5 The choice of the technology supplier, Bet

Alef carried out a tough evaluation process in order to find a competent technology supplier for the development project. As a result of its year-long evaluation, which included building a prototype e-business platform, it selected Bet software from the products of four other vendors. Bet is a leading global applications infrastructure software company. It was established in 1995 and had grown most rapidly in the world during its eight years of existence: in 2001 it was ranked the number-one software company and the quickest to reach a turnover of one billion dollars. It belongs to the top ten of companies in terms of market value. Bet has 3,500 employees, and its headquarters are located in San Jose, CA, although it has offices in 31 countries. It has more than 14,000 customers worldwide, including the majority of the Fortune Global 500, which is an annual list of America’s largest corporations.

Bet develops and sells platforms for companies wishing to transform their business into e-business: these companies build mobile and e-business

applications and services on Bet's platform. Its products include a variety of tools for the development of customized electronic services, business-to-business marketplaces, and customer relationship management (CRM), and for connecting the e-business applications to the operational systems of the customers. Its products have been adopted in a variety of industries, including telecommunications and pharmaceuticals, in government institutions and the financial sector, including commercial and investment banking and securities trading. The changes taking place within the financial sector, such as the willingness of the banks to invest in e-banking, have spurred on Bet's growth: with its platform it is assisting the financial institutions to accomplish their business and achieve their technological goals, to build up their business processes around the customer, and to increase their operational efficiency in the rapid delivery of products and services at lower cost.

The selection criteria

During the selection process it became clear to Alef that Bet had superior technology, and naturally that was one of the factors that made it a preferable partner in the project. Bet's products were more mature than the products of its competitors, and its technological competence also included supplying professional services such as consulting, training and software maintenance. Its experience and understanding of customer requirements in large, mission-critical environments also weighed in its favor when the bank was evaluating the different supply options. It was also important in the merger situation that Bet's software at the heart of Alef's e-banking architecture would enable the quick integration of Internet and back-office applications.

Although Bet had sold its software to many banks, in the banking area in general this was the biggest project it had had so far, and it was perhaps the largest in the world in the area. It had carried out other similar-sized projects with companies in the telecommunications and transportation sectors, including airlines. Alef was also looking for software for other purposes in the bank and not only for the e-banking project, which was nevertheless the largest one. This also increased the significance of making the right choice of partner.

In order to leverage the selection of Bet and to make sure that it was making the right decision, Alef asked for solid customer references. The bank talked to some of Bet's existing customers in order to find out how it had succeeded in running a similar size of platform, since scalability and performance were considered the most risky areas in the systems engineering. This helped to convince Alef about Bet's ability to supply the advanced banking architecture, the "strategic platform", for its next-generation Internet banking solution. It was a solution that would be used by more than 20,000 employees and millions of customers. Although Bet's platform was important in terms of

guaranteeing the quality of the result, the skills of the programmers played a crucial role at a later stage.

The significance of the technology supplier

The role of Bet was also significant because as far as Alef was concerned, the large investment in strategic software implied commitment to a long-term relationship with the technology supplier. Bet's technology platform would serve as a basis for further development for roughly 20 years. In addition to incurring the costs of the software, the bank also had to invest in developing software-related skills. It was also important to the bank for the technology supplier to support an open standard, since it preferred not to commit itself to brands that would not allow it to use products or services other than those certified by the brand owners. On the contrary, the open standard would guarantee the bank freedom in choosing its suppliers in the future, when the solution would be further developed. This was a challenge to Bet, which seriously wanted to keep the customer satisfied: it invested in the development of the relationship during the project, and held customer-supplier meetings on a regular basis.

In general, the Bet management had to be conscious about the impact of the deal on their operations during the development project and in the future. Alef was naturally an important customer due to the large size of the project, which carried remarkable reference value as it could make Bet the supplier of the world's leading e-banking services provider. This reference could also be used in sectors other than the financial sector, which gave it even more significance.

> "To say that we have Alef as a reference is of course very important for us. And it's also important for us that they are happy about the relationship with us, otherwise there would be rumors in the market that we were not doing well and that would hurt us very much." [SE Manager, Bet]

Gimel did not participate in the selection process of the technology supplier at all, but its perception was that it did not matter so much which of the two remaining candidates it was.

> "It would not have been so significant for us which of the two (main competing suppliers) they had chosen, they are quite similar". [Chief Technology Officer, Gimel]

Bet Finland had cooperated with Gimel in previous projects, but the interaction had been mainly with the Finnish unit, whereas the Danish unit carried the main responsibility in the new project. Still, the relationship with Gimel was valuable to Bet because of the direct reference it could give. As Bet's partner it could recommend the software for its customers' projects over

the products of a competitor if they had good experience of it and the relationship between the two companies was good. Bet was therefore making an effort to develop and maintain the relationship with Gimel.

> "There is a partner manager in Finland who meets regularly with Gimel as such to ensure that we have a continuously involving partnership. Bet is very, very reliant on partners as such, as well as we are of course reliant on customers, but in many cases our solutions are actually sold through partners and not necessarily by Bet directly. Somebody asked Gimel, "Could you build this financial portal?" and they said, "OK, what can it run on? Well it can run on Bet and on x, but we have good experiences with Bet…" "…OK, so we'll choose Bet then." [SE Manager, Bet]

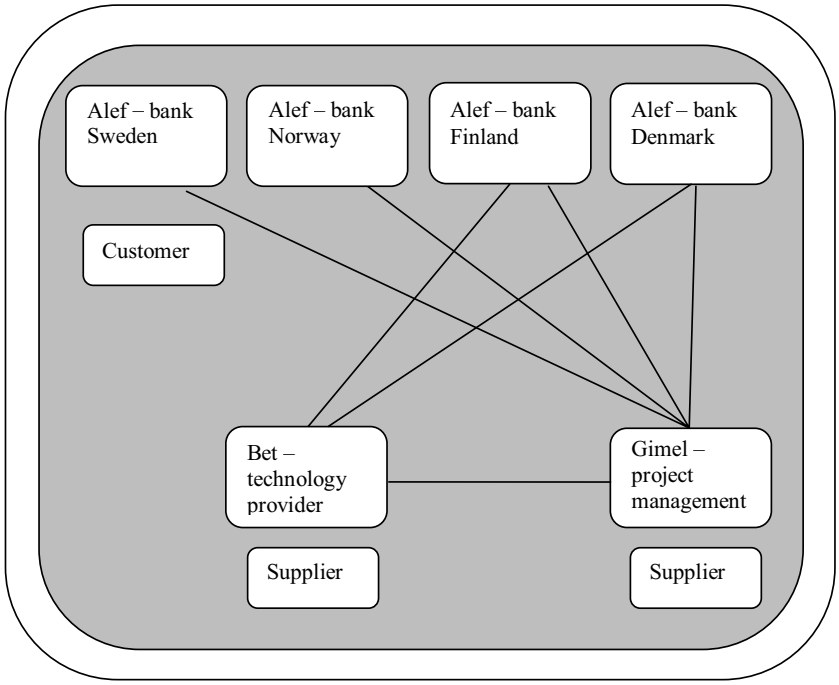

Figure 18 The R&D network of Alef, Bet and Gimel

Figure 18 above illustrates the network that consisted of Alef, a customer dispersed in four countries, Gimel, which ran the project, and Bet, which provided the technology.

4.2.6 Motivation as a facilitator

The project partners had defined roles. Alef determined "what" should be done, Gimel "how" it should be done, and the technology of Bet, together with the expertise it provided, was the enabling element. It was not possible to say at the outset exactly what the end result would look like, and it was the resources, the budget and the schedule that largely determined what could be done. The bank wanted to launch the solution, and Gimel to start marketing the product, during the year 2002.

The parties were highly motivated throughout the project, which facilitated the merging of the slightly different goals of the network partners. As a customer, Alef was at the developmental "core", which implied that the implementation had to take place primarily in line with its needs and requirements. Since Alef and Gimel had agreed on developing the solution for both parties, Gimel had to find a balance between Alef's requirements and its own development needs.

> "Yes we have twisted arms quite a lot in terms of whether we do exactly what Alef wants or whether we think in a more general way, like I don't know how much Alef realizes that at the same time we are doing a product for ourselves." [Vice President Financial Solutions, Gimel]

On the one hand, Gimel had to look after its own interests to a certain extent in its relationship with the bank in order to get a product that would not be too "Alef-specific". On the other hand, however, it wanted things to flow smoothly with the people working on the banking side so that they would not be "jealous" when it started to utilize the solution for its own purposes. At the same time, Gimel was reliant on Alef's vision of the future product and its logic. This balancing between two slightly different goals was also experienced by Bet, who was a supplier to both companies.

> "Did you understand that Alef has certain goals and Gimel has slightly different goals? We are actually a vendor delivering to both of them and we have to ensure that both of them are successful. That's our main objective. And that is always you could say, a different balance, because Gimel was building a product that they were hoping to sell to their customers. Gimel wanted to use this product for a specific purpose and we had an interest because if Gimel is going to sell to the customers and if the customers are going to use our platform, which is very good for us. On the other hand we have to make sure that Alef is going to be successful, Alef is one of our largest customers, we don't want to lose them. That's a very political situation in a way that can be handled only by having a close relationship and by having an open discussion on some of these things." [SE Manager, Bet]

There were other challenges in addition to the differing goals of the network members, such as the size of the project and the geographical disconnectedness of the parties. Good motivation was emphasized as a key factor in resolving every possible situation.

4.2.7 The dispersed network as a challenge

The development work was more complicated because the network also included the internal networks of the parties. One partial project, private customer services, was mainly carried out by Alef Finland, and another one, corporate services, was managed by the bank's Danish unit. Gimel's internal network extended to Sweden and Denmark, and to some extent also to Norway. Bet's key person had an office in Denmark. This dispersion required extensive traveling from the key persons, which was naturally very time consuming.

The large size of the project complicated the communication. The problem was not the lack of trust, but rather how to arrange things on a practical level. Afterwards it was felt that more attention should have been paid to planning where to keep shared documentation, for example. Sometimes it was not clear who should be informed about certain issues. The network language was English, which gave no country superiority over the others. It was noticeable that the communication skills of the parties improved greatly toward the end in terms of the speed and quality of the written documentation, for example.

It was also obvious at the beginning that not all of the participants on the banking side were knowledgeable about the project and its significance and consequences. They therefore wondered what it was about and how it would influence the current development and maintenance of e-banking solution. Some resistance was observed in the bank's Danish unit, which had previously had a different technology supplier in the e-banking area and thus did not welcome the new situation so warmly. However, the development of a uniform solution for every country was the first very large shared project for the parties on the bank's side, which may explain the rigidity, and for Gimel, too, participation in the network brought some new aspects to the project management. The large number of participants also caused other problems. Instead of one key person on the customer's side, there were several. Gimel observed that it was sometimes difficult in the integrator's role to find answers to the questions that came up during the process. The team on the other side was not always able to give one "authentic" answer, which made Gimel feel that it had to navigate through the situations. The dispersion of the parties also

manifested itself when the banking services were defined, and in this phase the participation of Gimel was more than welcome.

The role of each company in the network was briefly defined in the introduction. The most active participants in the implementation phase were Alef and Gimel. Bet had supplied the technology, but it was not involved in running the project, which was thus Gimel's responsibility.

> "We are a little bit different as a company, we do not merely provide the technology but we also have some top-level knowledge, expertise that we can provide, consulting. But we do not run the projects. And that's why we need the partners, like Gimel for example, that we make a deal with. So, we were in a funny situation. Alef was a very large customer of ours and Gimel was our partner, which was going to run the project and we were just to provide some top-level knowledge about our products in order to make sure that Gimel and Alef got the most out of it." [SE Manager, Bet]

Alef was mainly responsible for the business modeling; it defined the banking-services logic on the Nordic level and made sure that the look-and-feel aspects of the interfaces were created according to the standards of the bank. In the subsequent IT review Gimel gave its opinion about the suggestions that had been made by the bank in the initial business review. Sometimes this led to changes since it was not possible to realize all the ideas.

The bank's business people found it challenging to reach agreement on some of the solution details, such as on how a certain service should appear on the screen, since the previous versions of the Internet banking solutions had been relatively different in the four Alef countries. Although the above-mentioned example might seem a minor issue, it must be remembered that there were a large number of similar instances.

Finding a unified direction thus required compromises from the parties. Gimel took on the role of mediator as it could provide an outsider view for the banks concerning the features of the solution. It felt that its opinion was more acceptable than that of someone coming from one of the Nordic countries because it was neutral and did not try to dismiss the other banks' practices. Gimel characterized its integrator and mediator function in the following way:

> "Yes, really my opinion is that in this project we have also been their integrator consultant, who has tried to make the melting pot function. I don't believe that with this kind of schedule they could have mutually agreed on doing these things. It must be difficult when you start with Finnish, Swedish…" [Vice President, Financial Solutions, Gimel]

Furthermore, it was also preferable for the different countries to apply Gimel's project-management practices than the practices of Alef Finland, for example. The participants were playing against time: the project was supposed

to be completed in a year and a half, which was a relatively short time in which to achieve mutual understanding in varying practices. In total, cooperation between the parties functioned well:

> "Yes, this cooperation as a whole has functioned well, there have not been confrontations in which someone consciously tried to make things difficult, in my opinion no." [Chief Technology Officer, Gimel]

Time was very valuable in many ways in this project. Normally, the technical base would have been developed to a mature stage before starting with the banking applications, but in this case they had to be developed simultaneously because of the time constraints.

> "Clearly this could not have been sold to business people if you said now it will be a year before you see any banking services and then after a year and three months you might see some. They want to see something all the time." [Chief Technology Officer, Gimel]

The technology that was used was not very mature, and there were development needs that Bet had to take care of. Otherwise, Bet's view was that it could have been involved earlier in the project, providing knowledge and expertise, since the bank did not know the technology as well as it could have done. Deeper involvement could have had a positive impact in terms of the duration of the development, shortening it. When the project started the company had been operating in the market for only few years and it lacked confidence and experience in expressing its views. There had not been many projects as big as this one, and it was therefore a learning experience for Bet, which could benefit its future customers.

> "In Finland we have actually been in the market most of the time, but in the other countries, Denmark for example, where I'm sitting, we've only been in the market for three years, or actually almost four years. So it was an early project for us as well. So, we're also in a learning organization that is actually trying to find its feet, and this also meant that maybe we didn't do everything in the best way in the first project and we've decided to learn from it as well." [SE Manager, Bet]

4.2.8 Reaching the goals of the network

As planned, the project was carried out jointly up to a certain point, and then the paths of Alef and Gimel separated. The schedule proved to be very tight toward the end of the joint part, but it was essential for Gimel to keep to what had been agreed:

> "It was very tight, at the beginning of the summer it was really tight. At that time we canceled vacations, and worked long hours and weekends ... and we were able…again we proved to be trustworthy. It was also a matter of honor for us." [Vice President, Financial Solutions, Gimel]

Alef had its new e-banking solution, which is used today by 3.5 million private and corporate users carrying out 150 million transactions annually. The bank has also announced that it is committed to the continuous development of new services. Figure 19 depicts the development project and the separation of the partners' paths.

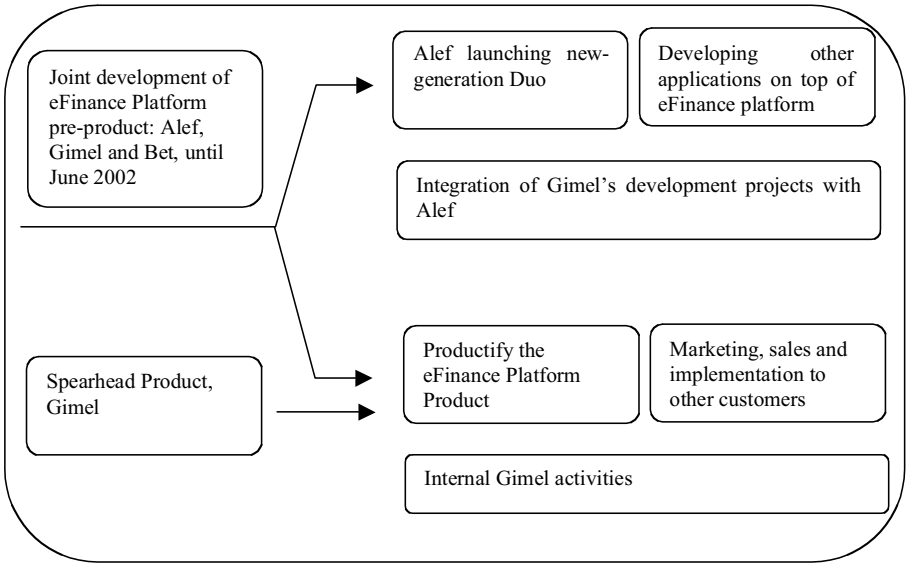

Figure 19 The joint project and the separation of the paths

Gimel went on developing the solution for its own purposes in its Financial Solutions unit with the goal to sell it to other banks outside of the Nordic countries.

4.3 Case analysis

The case networks chosen for this study were meant to represent strategic R&D networks. The definition given in Chapter 2 emphasizes that strategic networks are intentional arrangements between industrial actors, and that they have a certain purpose in terms of strengthening their competitive positions. The members combine their competencies in the pursuit of value creation.

Network membership usually has other effects, many of which could be long-term, such as commitment to the product that has been developed and also to the relationships. The nature of the e-banking case as a strategic R&D network is illustrated in Figure 20 below.

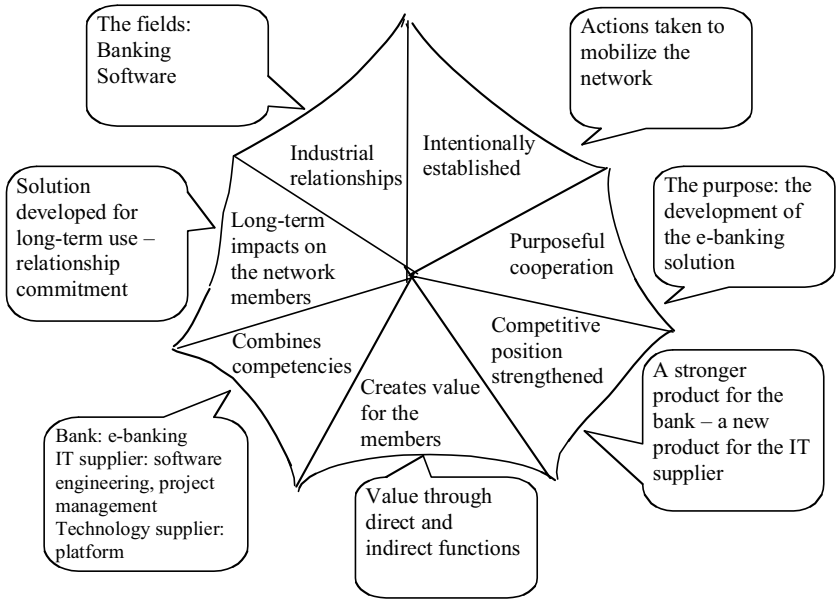

Figure 20 The nature of the e-banking case as a strategic R&D network

The industries represented were banking and software. The organizations established the network intentionally with the purpose of developing their e-banking solution. The new, improved solution was aimed at strengthening the bank's position in the Nordic market and opening a new door for the IT supplier. All of the three main actors brought their key competencies to the project. Value was created through various direct and indirect functions in the network, as described in the following sections.

4.3.1 The circumstances for value-creating cooperation in the network

This sub-chapter assesses the impact of the environment and describes the *circumstances* that were in the background when the development work for the e-banking solution started and the network was formed. The *industry- and market-level circumstances* seemed to have a major impact on the decision to start the development in cooperation, although the *technological-* and *company-level circumstances* were also influential.

On the industry and market levels the parties had recognized the opportunities for e-banking since they were naturally familiar with the developments that had taken place in previous years, Alef as a provider of the services, Gimel as Alef's former partner, and Bet as a provider of technology platforms. The first steps in e-banking were taken in the 1980's. At that time the banks in the regulated environment in Finland were doing well, and large investments were made in information technology in the financial sector. Offering services through electronic channels became part of the development. This created a basis for the further "electronic revolution": the number of e-banking users in the Nordic countries grew throughout the 1990s, and there are millions of users today. On the market level the circumstances have been favorable for banks to move their services to the electronic channels in the Nordic countries, since the users have been willing to start using the technological innovations. Moreover, it is not only the younger generation that has adopted the use of Internet and e-banking services: there are users in all age groups.

These developments have required strong visionaries who have been able to predict which trends would be strengthened and which would disappear. As far as Alef is concerned, this strength has manifested itself in the courage not to respond to the moves of competitors if the payback from the investment is not considered sufficient. However, moving services from the physical branches to electronic terminals is now more serious business: self-serving customers have become a source of competitive advantage for the banks, which have to be more cost-efficient in the hardened competitive situation in the unregulated environment.

The availability of the new technologies enabled the reform, a new e-banking solution. On the technological level, the implication was that, as far as the bank was concerned, the newness of the technology was creating a need for cooperation and for utilizing its partner's skills. On the company level, it had decided long ago to outsource its IT activities. The environmental pressures thus played a smaller role in the focal project. Another important internal factor was the post-merger situation: there was a need to unify the e-banking solution in the four Nordic countries.

4.3.2 Value created in the network

Value perceived by Alef

The Alef bank, as a mobilizing force in the network, had a clear view at the beginning about the value it would bring. The main value domains were cost/time function, competence function, product-performance and access

functions. The starting point for the cooperation with Gimel was the sharing of costs and risks with the IT house, which had invested in the project in order to have an e-banking product to sell at the end. From Alef's point of view, notable value was created through the competence function since the bank could utilize Gimel's human resources in general and its project-management capabilities in particular. Thus, its primary goal was not to learn for the future, but rather to gain access to its partners' skills and thereby complement its own competence without going through the acquisition process. The well-developed project-management capabilities of Gimel guaranteed efficient implementation; in general, carrying out strategic information technology projects is heavy and slow. Moreover, it would have been difficult for the bank to take the required manpower away from its other projects and tasks. The competence and cost/time functions were also connected, since the capabilities of Gimel and its outsider role contributed to the advancement of the project and the bank was able to benefit from the reduced development time: it would otherwise have been slower to draw together the differing views of the bank's internal network members.

A visible value function was also product-performance function. The new banking solution, which was based on Bet technology, was meant to provide the corporate customers in particular with new-business value, and innovative features to the other customers. The goal of the bank was to continue providing superior-performance e-banking services, which would attract increasing numbers of new users. The aim behind the careful partner selection was to make sure that this goal would be accomplished.

The fact that Gimel was largely responsible for the project management implied that it should also take care of the problems with the Bet technology platform during the development process. This meant that the bank could be released from responsibility to some extent, and would therefore derive value from the internal access, as Gimel was in charge of fixing things with Bet. All the value perceived by the bank, including cost and time reduction, competence and access functions, are illustrated in Figure 21, which also summarizes Gimel's and Bet's perceived value from the network.

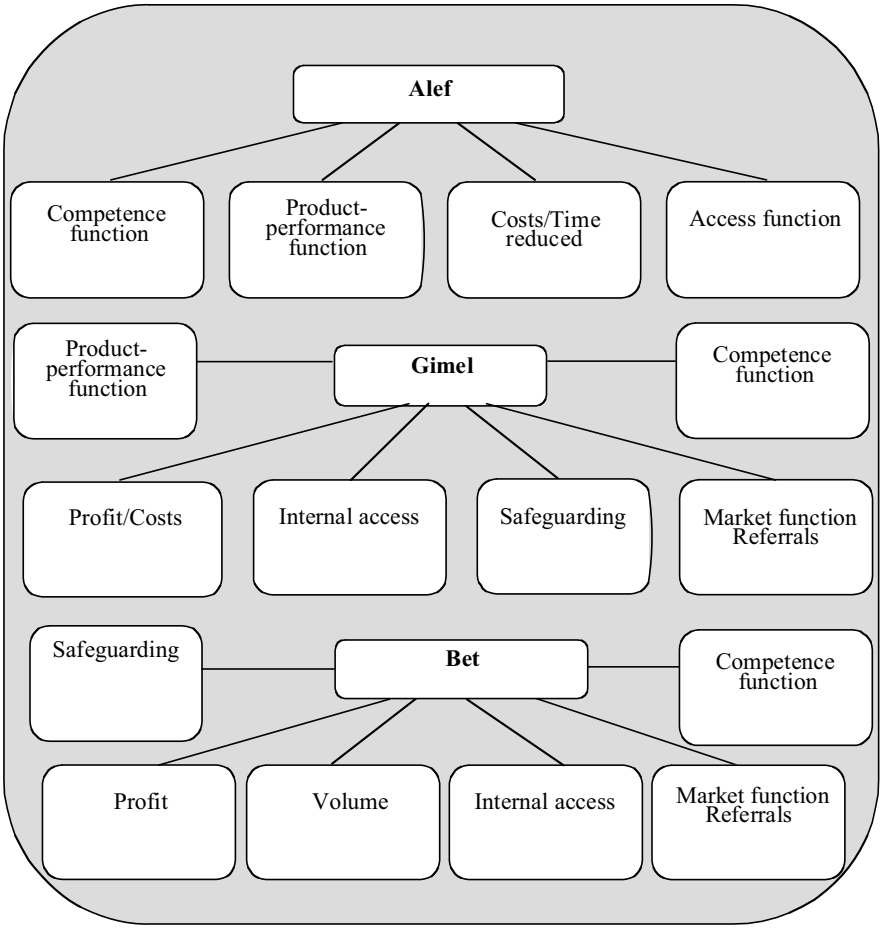

Figure 21 The value captured in the network of relationships in the development of the e-banking solution

Value perceived by Gimel

Like the bank, Gimel was able to benefit directly from the joint carrying of the risks and costs associated with the development. Other direct value functions it perceived included competence, product performance and safeguarding. Indirect value was created by the market and access functions. The competence function was particularly important for Gimel: through cooperation the company was able to take a closer look at Alef's banking competence, which increased its knowledge of the banking business and strengthened its own banking competence.

Although the IT house had been involved in the development and maintenance of the information systems for this particular bank and others, banking competence was only one of its expertise areas, which included IT

systems development for the forest industry and the public sector. This project with the bank could also be seen as an investment in competitiveness in forging potential relationships with customers coming from the financial sector. The joint project also temporarily increased the volume of exchange in the relationship between Gimel and Bet, and this deepened Gimel's knowledge of Bet's products. It could be said that it also strengthened the competence of Gimel.

The solid banking competence also contributed to the product performance, guaranteeing its high quality and competitiveness in the market. In addition, the market value function was also significant for Gimel: Alef's good reputation in e-banking, and its widely acknowledged sophisticated solutions, would also facilitate the marketing of the product.

The project could also be considered a means of safeguarding the future relationship between Gimel and Alef. Although the paths of the companies separated at a certain point, as planned, the idea was to use Gimel's services on a smaller scale in order to add new services to the solution at later stages. Gimel also pursued internal access within the project: in getting to know banks in different countries it was seeking opportunities to serve the same customer in the future in new projects. This approach is usual in the consulting business.

Value perceived by Bet

The third partner in the strategic network, Bet, gained value directly in terms of profits, volume, safeguarding the relationship, and strengthening its competence. The indirect value was expected to come from the marketing function, in referrals and easier access to new customers. Since the deal that Bet had made with the bank was large in terms of volume, Alef jumped up into Bet's group of very important customers. Like Gimel, Bet announced that Alef had been its partner and had used its platform in the development, which would strengthen the company's reputation and give it solid references for potential customers. The highlight here was the size of the project: the e-banking solution would have millions of users among bank customers, and thousands of internal users.

The deal also meant that the relationship between Alef and Bet was safeguarded for a long time: the agreement covered several years, even two decades as far as the technology was concerned. Bet's membership in the network also gave it internal access to new projects through Gimel. It realized very soon that when Gimel started projects with new customers, and if they had a positive experience of working with Bet and its products, it would be easy for them to recommend Bet to the new customers. This therefore encouraged Bet to make an effort to maintain and develop their business relationship.

As a member of the strategic R&D network Bet was also able to learn important lessons about project management and to strengthen its competence in this area. The experience gained from this project in particular would make it easier for the company to give advice to large customers with similar projects. Later on, the improved operations could benefit other customers, as Bet felt that it would be able to provide them with a quick result and a rapid return on investment.

In sum, all the parties in this network were able to draw direct as well as indirect value through the relationships. The analysis of the value function also shows the interconnectedness between the functions. For example, the possibility to access partner competence may well reduce development time, and learned competencies may also contribute to improved product performance.

4.3.3 Managing value creation in the network

Network mobilization and partner-interface management

The establishment of the strategic R&D network was a step forward on the strategic path that both the bank and the IT house had chosen. These two parties were pursuing a product idea as a result of cooperation. The role of the technology provider was more "mechanical": it did not play much of a part in the development activities, but provided technical support when needed. Alef held the key position in network management. It could be regarded as a *core company* (Doz et al. 2000, 242; Jarillo 1988, 32; Lorenzoni and Baden-Fuller 1995) since it steered the network by giving the strategic direction and expressing the needs to be fulfilled. However, the findings of the case study revealed the bi-polarity of the network: there were two core companies. Alef was responsible for mobilizing and visioning, which are more strategic tasks, and could thus be called the *strategic core*. The IT house, Gimel, could be labeled the *operational core*. Its tasks reached beyond those introduced in the theoretical frame: it acted as an integrator and interpreter of needs, filtering out the realizable ideas and separating them from the impossible ones. Thus, *integration and interpretation* could be added to the list of key management issues, and they are further discussed at the end of this sub-chapter.

This network formation had features of both *engineered and emerging mobilization* (Doz et al. 2000). The parties were familiar with each other to some extent, which indicates an emerging structure. Nevertheless, the engineered aspects of the mobilization were more obvious in that the influence of the strategic core was notable and it had to find new suitable partners for its project.

The selection criteria that Alef emphasized in its partner-interface management were *superior technology* and *technological skills*, which are naturally among the most important (Duyesters et al. 1999, 350; Hoffman and Schlosser 2001, 362). This large-scale project was technically risky: Alef had to make the selection very carefully in order to find competent partners and minimize the risk of failure. Of all the alternatives, the IT house Gimel and the technology supplier Bet turned out to be the most attractive. Alef already had a *common history* with Gimel, which had developed its previous e-banking solution. Thus, their *relative familiarity*, which refers to how well companies know each other relative to their knowledge of other partners (Campbell 197, 392), was high. They had also had a joint venture, which must have given Gimel deep sector-specific knowledge. Much emphasis was placed on the fact that Gimel was the most *cost-beneficial option,* and *shared the risk* with Alef. It was not only its *financial contribution*, but also the *size* of Gimel (Duyesters et al. 1999, 350) that appealed to Alef.

The selection of Bet was based on *technological superiority*: its products were more mature than those of its competitors. Alef was also aware of the experiences of Bet's other customers, which refers on the one hand to its *cooperative history* and on the other hand to its general *reputation* (Duyesters et al. 1999, 350; De Meyer 1999, 27; Quelin 2000, 485). The bank was also aware of the fact that its commitment to the technology supplier would be long-term, which further highlighted the importance of competent selection. It made no difference to Gimel who the technology supplier was.

Visioning the network

The bank and the IT house *combined their visions* of the e-banking opportunities. The bank had been using electronic channels for several years, and as a forerunner of e-banking it was sure about the positive impact of the new solution on its post-merger competitive position: according to its vision there was still potential for growth in the number of on-line customers. By adding new features it could consolidate its number-one position among e-banking service providers. Gimel was also aware of the direction of the trends in the area, and it had visions about its position in this development. Cooperation with the bank in this project enabled it to realize its vision of a future e-banking product.

Although Gimel and Alef were sharing the rights to the product solution, they were both using it for their own purposes. This implied that their plans were made independently, and that there was no need for joint marketing, or for making combined efforts to recognize the threats.

Strategizing in the network

The most important strategizing issue among the network members was to find a *balance between the goals* of Alef and Gimel. On the general level the goal was the same, a new e-banking solution, but in reality both parties were going to use it for their own purposes. The initial feasibility study carried out to assess the compatibility of the objectives of Alef and Gimel nevertheless found them to be *similar enough*, and it was thus reasonable to start cooperation (Duyesters et al. 1999, 350; Hoffman and Schlosser 2001, 363).

From the bank's point of view, another significant strategizing issue involved ensuring that all the parties, especially the IT house, would realize the importance of the network's activities and therefore, *prioritize the project* (Douma et al. 2000, 587). In addition to the *common goals* that were mentioned previously, there were other mechanisms that were used in this task. In the first place, the bank had selected a partner with a *fitting size*. The partner was not to be too large, which could result in a loss of focus on the bank's project, or too small with insufficient resources. Moreover, by selling the *rights of the product* in exchange for sharing the costs, Alef was also able to improve Gimel's commitment. This commitment was tested later, when the joint project was approaching its end. The schedules had been set at the beginning, in the fall of 2000, and in the spring and summer of 2002 it became clear that things had to move more quickly if the project was to keep on schedule. Gimel made every possible effort to do this, and it succeeded.

The strategic planning of the network, including the assessment of each company's role, was not clear-cut at first. Bet, as the technology supplier, felt afterwards that it could have been more involved in the project by offering its technological knowledge and thereby facilitating its implementation. However, as a newly established company it was not confident enough to market its resources to the bank as the project progressed. This might have meant higher initial costs for the customer, but the increased knowledge about the product could also have reduced them later. This gives reason to suggest that extra care should be taken in evaluating each partner's potential once again after selection has taken place.

In sum, it could be concluded that, in order to conduct constructive dialogue concerning the goals and objectives of the network and to create a strategy for achieving them, the parties should be willing to open up their corporate boundaries. This applies particularly to the strategic core of the network. It is suggested that, at best, the partners could be encouraged to be pro-active problem solvers and initiators during the development process, which would further benefit each party.

Guarding the network

It was Gimel's special task to *guard the network* externally to ensure that there would be no *spillovers, or unwanted knowledge leaks to outsiders*. Firstly, it had to consider carefully what public statements it could make about the product and the schedule if it wanted to use Alef as a reference in its marketing efforts. Secondly, since many of Alef Finland's competitors were also Gimel's customers, indirect contact was possible through the competence-based units if the same person was used in the projects with different banks. However, absolute confidentiality in the business relationships was secured. Internally, due to the slightly different development goals of Alef and Gimel, Bet was initially reluctant to reveal information freely, but later on, when the goals of each party had become clear, it was able to be more open in the meetings.

In addition to safeguarding against knowledge spillovers, there was also a need to *protect competitiveness*. The bank made moves to safeguard its competitive position. It was in Alef's interest to make sure that it would not be disadvantaged because Gimel was getting an e-banking product to sell to other banks, and certain limitations were therefore imposed. Gimel, in turn, had to work hard throughout the project in order to secure its interests. Although it was clear that the product would be available to both Alef and Gimel, the latter had to achieve a balance between Alef's and its own requirements. However, Alef's interests were the main starting point in the development work.

Interpretation and integration in the network

The mergers of the banks in the Nordic countries brought their operations under the same umbrella. However, the dispersion was still apparent, and finding a consensus among the different views of the banks representing different countries sometimes required extra effort. Each bank had had its way of doing things, and the logic behind the e-banking solutions was also different. This situation created a challenge for Gimel, whose demanding task was to *interpret and integrate the needs and wants into a functioning solution*.

It was thus more than necessary to have an "outsider" addressing the difficult and controversial issues that arose. This "*diagnostics*" role is often assigned to consulting firms, which try to articulate the innovation needs of the customers as accurately as possible (Bessant and Rush 1995, 102). Other interpretation needs arose from the dialogue between those planning the business in the bank and those who were responsible for the realization of the ideas on the IT house's side, since there were also gaps between the ideas of the business people and what was technically feasible.

All the companies had very good motivation in the project, which made it possible to overcome the challenges that arose. All parties considered the

project a learning experience. For Gimel, it was the first of a kind, since it was carried out in a special way with the customer. Bet gained more confidence to deal with large customers. As far as the bank was concerned, cooperation implied finding consensus among the parties in the different Nordic countries. There were improvements on the practical level: documents were written in better language and more quickly, and the intraorganizational and interorganizational communication also improved.

4.4 The role of an R&D network in the improvement of a financial information system – Case B

The main actors in this case were five purchasing organizations specialized in buying raw materials and other goods for their kibbutzcustomers. At the same time they served as a financial institution for the same customers. One of them, Mishkey haKibbutzim, was not involved in the development work, but the other four hired an *information-technology consultant Kaph* to advise them on a project, the goal of which was to renew the system that carried all the necessary information about their customers' transactions.

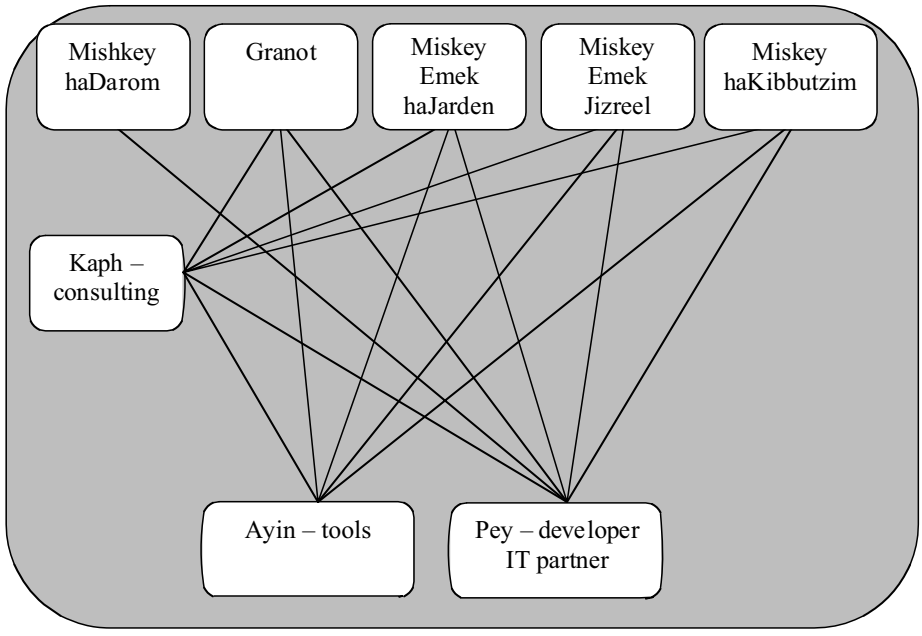

Figure 22 The members of the network

Figure 22 above illustrates the network that was formed to improve the legacy systems of the purchasing organizations. The development work was carried out by the organizations' long-term *IT partner Pey*, which had been responsible for the maintenance of the system for several years. The IT company had to search outside for suitable tools for the project, and thus it forged a link with the fourth party *Ayin*, *the provider of the new technology*.

The case description is based mainly on six interviews that were conducted in five organizations, namely Pey, Kaph, Emek haJarden, Granot and Miskey haKibbutzim. In this case the circumstances play a minor role. It is true that the impetus to develop came from the environment, as the members of the network saw that the opportunities provided by the new technology would facilitate their business activities, but the impact did not reach much beyond that. The emphasis is rather on assessing the value the partners gained and the management issues.

During the project the customers, the purchasing organizations, had serious disagreements concerning its extent. Only the fact that they shared a common goal and could all benefit from it kept it going. The goals of the project were more or less met according to expectations, but in the end some customers started to doubt the sense of it and the motivation that had driven the developer, the IT company, to choose this renewal alternative, since it did not seem to be the optimal solution. Only 18 months after the project was completed the same organizations started to look for new developers of a system to replace the earlier work partially or completely.

4.4.1 The background and the existing relationships

The group of customers in the R&D network consisted of four purchasing organizations of the kibbutzim. Israel is well known for these agricultural co-operative communities, which nowadays own and operate factories, hotels and restaurants. There are 270 of them, and each one belongs to a certain area with a local administration, which includes a purchasing organization responsible for the collective purchasing of the kibbutzim and moshavim, another type of co-operative. The purchasing organizations are specialized in buying raw materials, selling agricultural products, providing finance and representing the settlements in their relationships with external institutions. Given the scale of the kibbutz industries and agriculture, the purchasing volumes are substantial. The kibbutzim and moshavim benefit from this arrangement by enjoying economies of scale as the lowest possible prices are negotiated by the purchasing organizations. Furthermore, when the kibbutzim need to give guarantees to the suppliers that they are purchasing goods for the use of the

kibbutz, the purchasing organizations provide them, taking a percentage of the value as compensation. There is also a larger purchasing organization, which serves customers from all over the country and is specialized in certain commodities, such as motor vehicles or tours abroad. This organization has institutional customers as well as the kibbutzim.

Six of the ten purchasing organizations ran their activities under a legacy[3] system that was developed by the information technology department of Harei Yehuda, one of the regional administrative organizations. Although the system had been developed in the mid-1980s, it was maintained and used by the purchasing organizations until the new century and beyond. From time to time they had discussed replacing, or at least changing it, since the technology was getting old and costly to maintain. In spite of its age, however, it was still valuable because it continued to provide the purchasing organizations with core information about their customers. Thus, given its importance to their operations, they could not easily have stopped using it.

Since 1996, the maintenance and small-scale development of the system had been the responsibility of a small IT company, Pey, which was located in Tel Aviv and had 20 employees. The founder-CEO of Pey had worked for the Kibbutz Movement Headquarters for many years as a manager in the computer and information division, and had become familiar with the purchasing organizations and their operations during that period. The purchasing organizations also knew some of the other personnel, programmers and technicians, who had started to work in Pey and who had previously worked for the Kibbutz Movement Headquarters as well. The organizations became Pey's customers when Pey employed a programmer who had been involved in the early development of the legacy in Harei Yehuda. Since he had the deepest knowledge about the legacy system, the purchasing organizations had to follow him to Pey.

In spring 2001 four of the six purchasing organizations using the legacy started to think in more detail about how to replace or renew the system. These included Mishkey Emek haJarden, Granot, Mishkey Emek Yezreel and a larger organization, Mishkey haKibbutzim. Later on, when the project had already started, one more, Mishkey haDarom, showed an interest and joined the others. The talks also naturally involved the IT company Pey, and also an IT consultant, Kaph, who was hired by the purchasing organizations to be the project advisor.

[3] Legacy systems are often designed and implemented by means of methods and programming languages that are no longer in use. They are frequently large, complex, and difficult to modify, yet replacing them often means reengineering the organization's business processes on a large scale.

4.4.2 Purchasing organizations need technological consultation

The consultant had been hired because the purchasing organizations felt that it needed external help in evaluating the options that their IT service provider was going to present. The users of the system were mostly economists and accountants, whose knowledge about technology was narrow. They believed that someone from the outside was needed in the project in order to fill their knowledge gaps. The organizations had bought services from the Kaph IT consultancy some years earlier when fear of the millennium bug was at its highest. The same company, more specifically its general manager, was used this time, too. It was an Israeli branch of a worldwide IT company whose wide customer base included other financial institutions and telecommunications companies.

> He [the general manager] was in all our meetings, we talked some things that we want to turn out like this or like that, he was part of our thinking group, so he would tell us if it is logical or not can do it or not, if he recommend it or not. So together we advanced a lot in the process. [The head of finance at Granot]

The consultant was necessary to make sure that the project did not produce unwanted results and that the organizations would "not fantasize about something that could not be achieved". Although there were several parties sharing the expenses, the organizations naturally had limited budgets and the consultant was also able to evaluate what could be done within that framework. The organizations also counted upon his ability to translate their needs into an understandable form and communicate them to the developer, Pey, since they felt that they would not necessarily be able to do this themselves.

> Each one has to do, what he is good at. We're not computer persons, most of us, are economists, or accountants and to talk with computer person, it is a little bit different language, so if I don't speak this language properly, I have to have some sort of mediator that will translate what I mean, to the possibilities that the computer man will understand. And basically that's what you call outsourcing. Do what you do best and outsource the rest. So you don't deal with computers just with users. So if I want to buy something or to develop something, I must bring the third party to the company, because otherwise I might reach places that I don't want to be there. You take the specialist to do it. [The head of finance at Granot]

The down side of using the consultant included the high cost involved and the persistent uncertainty about the end result. One of the representatives of the purchasing organizations expressed his opinion on using consultants in

general, and said that when the project ends up well the consultant is credited with the success, but when it fails to meet the goals he can always say, “You didn’t do what I told you to do”.

4.4.3 The options for developing the legacy system

When the purchasing organizations started talking about changing the legacy system they were also considering companies other than Pey to carry out the development work. The renewal system was strongly connected with the main programmer at Pey, who was familiar with it, and he had to be involved in the development team in some way, even if someone else were to do the work. Some other options were checked out by the purchasing organizations, but they ended up continuing their cooperation with Pey, partly because of the dependence on the programmer.

Some years earlier these organizations had suggested to Pey that one option for replacing the old legacy system would perhaps be to buy off-the-shelf software and modify it for their use. The programmer had rejected this, saying that there would be too many changes and that it would become too complicated for the purchasing organizations. The idea was thus abandoned.

Now that the customers were seriously looking for renewal, one of Pey’s options was to offer to develop a new system. It would have taken a long time for a small company to develop such a solution, and meanwhile the technology would have moved on: it may well have been “old” by the time the project was finished. According to Pey’s calculations, this option would have required considerably more hours of development work, and consequently the costs would have risen to what might be described as “enormous”: it was therefore not considered a cost-efficient solution.

The third option was to renew the system with new technological tools, which would provide a quicker and less costly solution. There were several companies on the market that had developed these kinds of tools in response to the growing need to access the legacy systems in current Internet-centric applications and Web services. These new modernization techniques had made it possible to re-use the legacy system, and also to use the new applications with minimum changes to the source. Choosing the transformation route would help to retain and extend the value of the legacy investment. It would cut the development time by half from 5,000 to 2,500 hours, which would mean remarkable cost savings for the customers. This option required finding a suitable technology provider to supply the tools, which Pey did not possess.

It was also in the interests of Pey to cooperate with the purchasing organizations with the second option: it needed to make an effort to provide a

satisfactory service at a fair price in order to ensure the continuation of its relationship with the purchasing organizations, which were its most important customers. Since these organizations were not that familiar with the technologies, Pey could recommend solutions that they would accept since significant trust had developed over the years, especially in the key programmer.

4.4.4 Reaching the common goal in the network

After the spring of 2001, the four organizations started meeting regularly, every other week, to discuss the project. Since they were geographically dispersed, coordinating the meeting places and finding times that would suit everybody was not an easy task. The head of finance at Granot, one of the purchasing organizations, took a leading role in these arrangements at first.

It was not crystal clear in the beginning what the parties wanted from the renewed system. Opinions varied greatly: some representatives of the purchasing organizations wanted to change many things in the legacy and others tried hard to avoid any changes in the new interface. Some parties were also more willing to invest more in the project in order to get a multifunctional system, whereas others merely supported a basic version, which would be less expensive. Moreover, the fact that the new technology would provide new application possibilities was not completely understood by everybody. All this made it difficult for the parties to reach an agreement on the possible end result of the project.

The representative of Mishkey haKibbutzim, the largest purchasing organization, was attending the meetings in order to find out whether it would be feasible for his organization to take part in the project as well. Although the organization decided not to get involved, its representative continued coming to the meetings. His listening role turned into more active participation, as he was called to mediate between the fighting organizations and to cool down the heated situation that had developed between members who did not like each other.

> In the meetings that we are talking about where does it go, as an organization considering whether to get into it or not, the main problem was the personal problems. Not about the software. Someone is going to use it this way, someone is going to use it this way. The problem is that one wanted to make things this way and one in another way. That is the main problem, the people, not the problem of computer… [The head controller of MK]

The disagreements between the organizations were so serious at one point that an outsider might well have thought that they would never be able to cooperate so as to produce a good end result. However, in the end the common goal – renewal of the old legacy system and the benefits related to it – tipped the balance and gave a strong incentive to overcome the conflicts.

> There were so many fights and disagreements, with all of them. But as you know, people when they think that the goal is O.K. they find the way to eliminate the differences and came out of something that could be much better. [The head controller of Mishkey Emek haYarden]

The head controller of Mishkey haKibbutzim also had doubts about the project goal, and in his opinion it was nothing but face-lifting: the planned new interface would only give the impression to the organizational management that something had been done, although the logic of the system would remain more or less the same. In the end, his organization decided not to take the step to join the project. The whole kibbutz ideology was in a transformation process, and this also caused uncertainty concerning the future steadiness of the purchasing organizations' operations.

At this point the other purchasing organizations felt that they wanted to keep abreast of technological developments. The renewed solution was aimed at helping the controllers in their work: the new interface would enable them to retrieve reports from the Internet easily, and would give them more options in managing their customers' financial data. This was important, since the customers handled thousands of transactions annually. Not only would the purchasing organizations be able to use the system internally, the kibbutzim and moshavim would also be able to retrieve data through the Internet: thus far they had used an inconvenient and slow modem line to enter the system. These parties were heard in the planning phase: the purchasing organizations asked each kibbutzim in its region, – 25–30 organizations each – what kind of reports they would like to retrieve. The answers were bundled up and the applicable suggestions were selected for the development.

Kibbutzim and moshavim were not the only external parties who were able to use the new solution, however, and it was also open to the suppliers who were selling their products through the purchasing organizations to the kibbutzim. Earlier, they had had to call and ask for faxes to be sent in order to find out when the bills would be paid, but the new solution made it possible to them to find this out independently through the new interface.

4.4.5 Establishing a relationship with the technology provider

Once the purchasing organizations had given their support to Pey's suggestion to renew the system, the main programmer started locating suitable technology providers. By this time several meetings had been held over almost a year in order to form the basic lines of the project.

The programmer found several candidates on the Internet, while the purchasing organizations also searched for a technology provider. In the end there were two Israeli companies competing, Pey and one of the customers of the purchasing organizations. There were practical reasons for giving preference to a local company in this project. One important factor was the location, and another was the Hebrew language: the way it is written from right to left might have caused problems to a non-Israeli company.

After inviting the candidates over to Pey and questioning them, the programmer decided that a company called Ayin, an innovative provider of business-to-business integration software solutions for the e-commerce market, would be a suitable candidate, since it provided a more focused solution than the other one. Ayin has over 1,000 customers and has strategic alliances with Oracle, Compaq and other global partners. It is also a publicly traded company with worldwide locations. Its focus on supplying technology solutions for integrating disparate data sources, legacy and mainframe applications enabling real-time access to the enterprise implied that its strengths were exactly in the area that the project required. The CEO of Pey also knew someone who was working in the company, but this was not the decisive factor in the partner selection.

> …I make the test, I try who they are, who is the back that stands behind them. This is a company that doesn't vanish tomorrow morning…I look what is the back of them, the real company behind those people in Israel and just who is the people here in Israel that we can work with. Then I check, if the technique..works". [the former CEO of MOP]

The Kaph consultancy also participated in the selection process. It was already familiar with Ayin, which had also provided tools for its IT-banking products. The consultant decided what kind of investigation would be appropriate and Pey carried it out. During the project the purchasing organizations would only be negotiating the price with Ayin, and the work would be done in cooperation between Pey and Ayin. The programmer from Pey was in touch with four or five people in the company and he felt that their way of working was professional and the service good: each time he needed support, he received it. Nevertheless, one of the purchasing organizations' representatives later criticized the way the technology provider had been selected. He said that Pey had already been working with Ayin's tools for half

a year before there was any signed agreement on prices. The procedure was justified on the grounds of the trust that the organizations had in the developer, Pey, and in its knowledge about the needs of the customers.

4.4.6 Carrying out the project

The development of the technical application took almost a year, from March 2002 until February 2003. Pey was well aware of the resources that were needed to carry out the project, and the hours were calculated and the reports sent on a monthly basis to the customers, which could then keep track of how it was proceeding. The efficient tools that were provided by Ayin enabled the project to proceed according to schedule, which was rather unusual since software development usually exceeds the calculated time. Pey also reported on what had been done in the subsequent meetings. The presentation only covered the concept of the new system, and thus the organizations were not able to access it though the Internet to try it out and give their opinions about it. This was referred to later on by one of the organizations as problematic, because its representative would have wanted a proper demonstration that would have given some indication of the end result. This was a very large project, and the first of its kind, which explained why it was not clear what should be included in the requirements.

The representative from Emek haYarden also felt that there were little things that Pey could have corrected during the development process if the users had been aware of them. When the system was finalized and came "on air" in February 2003, this person prepared a long list of suggestions for corrections, but Pey did not deal with all of them because, in their view, they were not included in the original plan. This did not satisfy the complainant, who felt that all the issues that he pointed out were minor things and would not have taken long to correct.

> The problems in day one they did not correct them. And every time we looked at it, it makes me furious. I paid something, I paid the full price, I want to get full project, not 99%, a 100%. [The controller of Mishkey Emek haYarden]

The customers were no longer arguing among themselves about the contents of the new system that much, but they still asked for changes during the project. Pey was not disturbed by the disagreements, and took them as part of the reality. It also realized the significance of the fact that the representatives of the purchasing organizations came from an accounting environment, an inherent feature of which is often that nothing should be changed and that consistency with previous practice should be maintained.

The new technologies that Ayin introduced required an investment of time for learning the complicated technologies during the first months. This was very slow and took a lot of time at first, but then it speeded up. The consulting company was able to facilitate the learning by providing an expert in the programming language to help Pey in the development work.

4.4.7 The end of the relationship with Pey

Following the completion of the project, the relationships between the purchasing organizations and the developer and its long-term IT partner, Pey, were dissolved in the spring of 2003. The reason for this radical change was a chain of events that, firstly, caused the CEO of Pey to leave his position in the company. Although the situation was otherwise unfortunate, it gave the programmer and the key person involved in the project the opportunity to look for another job. He was offered a position by the Kaph consulting company, with which he had become more familiar through the intensive joint development work.

When he accepted the offer and left the company alongside the CEO, Pey lost its most important customers, the purchasing organizations, which had to follow the programmer to the new place. Pey agreed not to divulge any information about the customers after the relationships had been cut off. The loss of the programmer to the other company meant that Pey also lost a skillful employee, who had acquired new knowledge from his involvement in the project with the purchasing organizations. Pey was very aware of this and tried unsuccessfully to persuade him to stay in the company. As a result, it had to change the focus of its business, to give up software development and focus on networks. The fact that the maintenance of the legacy was moved to Kaph put an end to the consulting services that the organizations were buying, since they did not want the same party to be responsible for both maintenance and consulting.

4.4.8 Planning for a new project

Some of the purchasing organizations were so satisfied with the result of the project that they would have wanted to continue immediately with a new one in which the system could be developed further. The organizations had been able to provide easy access to outside parties, the suppliers and the kibbutzim, but now they started planning something that would serve them only internally. In the summer of 2004, only 18 months after the previous large

project had finished, the four organizations sent out a request for proposals to several software companies to find out what kind of follow-up options they would propose. One of these was the development of a totally new system for the use of the purchasing organizations. It was considered attractive because it aimed at reducing dependence on the programmer. The programmer nevertheless thought that the organizations had got what they wanted, and he was also confident that, even if several companies responded to the request for proposals, in the end the organizations would stay with him because he knew their needs the best. This happened, but the main reason was the price: the purchasing organizations backed down since the costs of the new project would have been very high.

4.5 Case analysis

The nature of this case of financial information system development as a strategic R&D network is illustrated in Figure 23. Again, the network was intentionally established for the purpose of improving the financial information system, although some of the relationships had been established earlier and not for this particular project. The network members represented purchasing organizations for kibbutzim and various areas in the software industry, and they brought their various competencies with them, including software engineering, tools and consulting. The customers in particular, the purchasing organizations, experienced long-term effects as a result of the network activities.

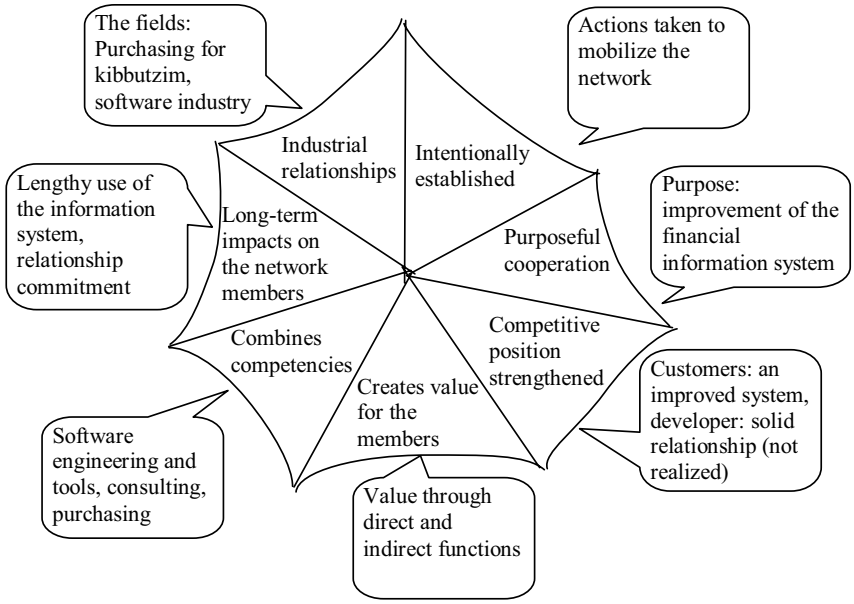

Figure 23 The case of financial information system development as a strategic R&D network

The improved information system would be used for several years, thus implying commitment to the relationship with the developer.

4.5.1 The circumstances for value-creating cooperation in the network

The aim of this sub-chapter is to assess the impact of the circumstances on the cooperation. The case findings indicate that the *industry and market circumstances* were not a substantial factor affecting the parties' decision to start cooperation, and that the *technological and company-level* issues had more influence.

Since the outcome of the project was not a new, marketable product or technology, but an information system for internal, and also to some external, use, it is argued that the *industry- and market-level circumstances were not heavily determining factors* triggering the development. For this reason, they carried less weight than in any other case in this study. In comparison with the other cases, especially those focused on video compression and video streaming technology, this type of development was more convenient and simple for the parties in the network. In this case, too, there was no "market" in the sense that the purchasing organizations needed to make the effort to carry out a market study, and later on to sell the solution. The only "market" that they had to be concerned about was the possible wishes of the customers

and suppliers that would use the renewed information system, but would not buy it. The opinions of the former group were considered, but those of the latter group were not.

The limited number of users of the legacy, in comparison with the e-banking solution with thousands of users, decreased the pressure that would normally relate to project success. What is more, the schedule was not a critical factor. Again, there was no market that would have expected to see the renewed solution on a predetermined day. Although it was important for the customers to follow the schedule that had been planned and not to pay extra for exceeding it, it would not have been catastrophic if more hours had been needed.

The development and the *trends on the industry and market levels* influenced the decision of the purchasing organizations to start the project. They had followed developments and had observed that many interfaces were Internet-based. This inspired them and gave them the feeling that the renewal of the legacy and the use of newer tools would also positively affect the image they had in the eyes of their stakeholders. These stakeholders had not directly demanded the new tools. *On the technological level* the triggering impulse for the network formation was the dispersion of the knowledge that was needed in the development. The developer, Pey, needed to acquire the new tools from Ayin, and the consultant, Kaph, was able to support the purchasing organizations' decisions with its technological expertise. On the *company level*, it was necessary for the purchasing organizations to form the network for the project. These organizations, like many other users and buyers of information technology, have outsourced systems development and maintenance to IT specialists.

4.5.2 Value created in the network

Perceived by the purchasing organizations

For the customers the cooperation *created value* according to what had been planned. From the purchasing organizations' point of view, the main direct value functions were *cost/time reduction, product performance and competence function,* and of the indirect value functions *scouting* was significant. *Time reduction* was achieved because the developer, Pey, was already familiar with the system. If the development work had been given to a new company, it would have taken at least several months for it to become familiar with the program that the purchasing organizations were using. The cooperation also meant that the *costs were carried jointly* by the purchasing

organizations, which thus divided the total sum of 200,000 dollars into four parts.

The *competence* of the partners created value for the purchasing organizations, which did not have the necessary capabilities for building the information system in-house. The renewed solution provided a new and improved way for their customers to keep up-to-date with their transactions and for them to look for information in the database. Thus, value was created through the *product-performance function*. The project also served a *scout function* since the purchasing organizations were able to see what kind of solutions the new technology could provide for them, and therefore to consider further development of the system. They were also able to utilize the *access* that the developer arranged to the technology provider, Ayin. The value of this diminished due to the fact that they were also making an effort to find their own option at the same time. The developer, Pey, was taking care of the relationship with the technology provider on all matters except price, which was negotiated by the customers. The following Figure 24 summarizes the kind of value the members of the strategic network received from the joint project.

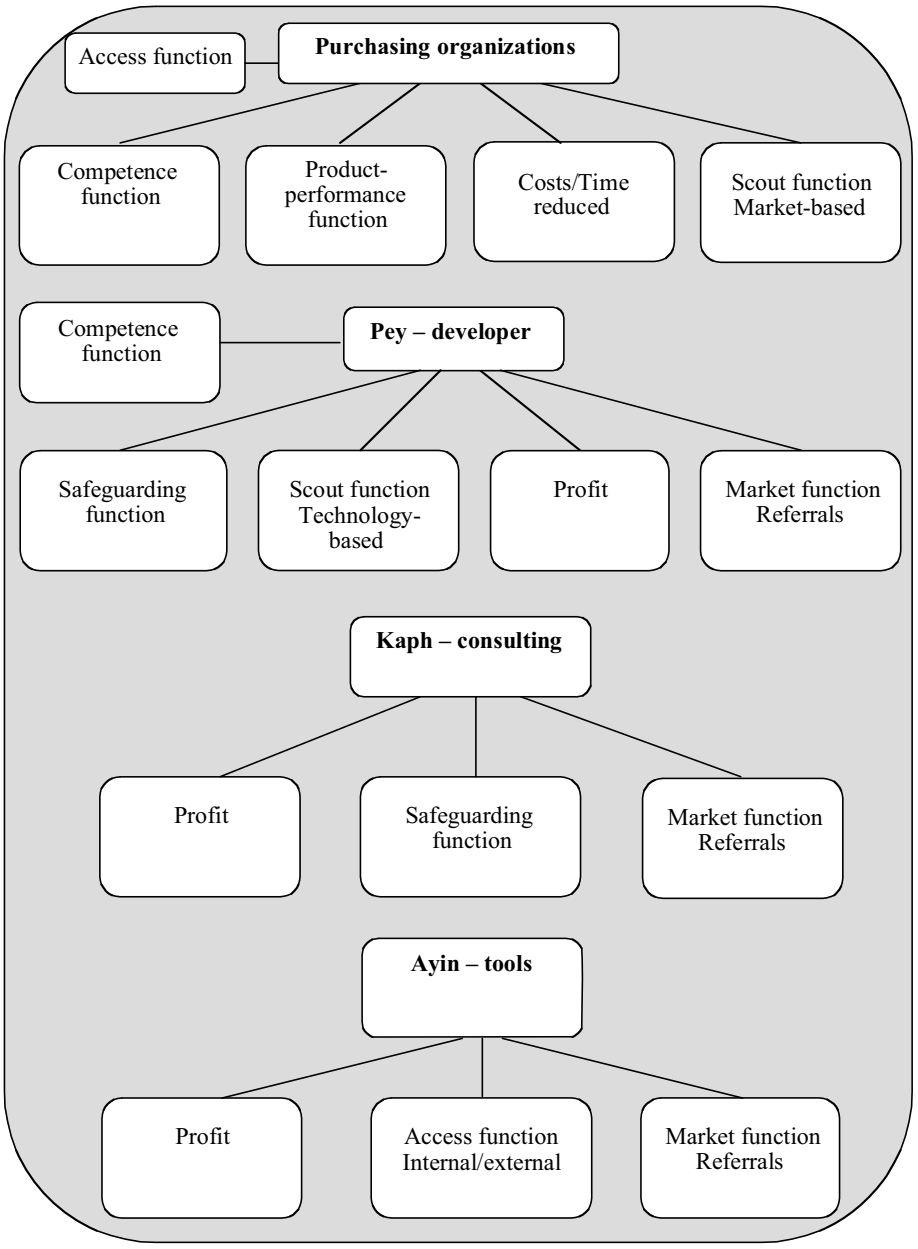

Figure 24 The value captured in the network of relationships

Value perceived by the developer, Pey

From Pey's point of view the value that was created included both direct and indirect benefits. Directly it was expecting to benefit in terms of making *profits and safeguarding* its relationship with the purchasing organizations.

The indirect benefits included obtaining *referrals and becoming familiar with new technologies,* which partly became its internalized *competence*, but also served a *scouting function*.

Safeguarding the relationship with the customers played the main role for the developer at the beginning of the project. The company wanted to grab a tight hold of their main customers in order to continue the relationship with them in the future, and tried to make sure that they would generate revenues from the maintenance of the renewed system. Without the unexpected events that took place after the project had finished the company could have succeeded in the safeguarding. When the situation drastically changed, it could no longer expect value to be realized in the future since the customers had migrated to the Kaph consulting company to be sure of getting the same services that Pey had offered in previous years.

Pey was able to derive more direct value in the form of *competence*. Although learning the new technology provided by Ayin took time at first, in general it opened a window in terms of obtaining new capabilities to strengthen the competence of the company: after the project the programmer was also able to work as a consultant, for example. The total benefit gained diminished for Pey because the project-related learning was a relationship-specific investment. Thus, most of the new knowledge was useless in its other customer relationships. Even if the programmer had stayed, there would have been no guarantee that the learning gained from this project, which was related to new technologies, could have been applied in other projects due to its uncommon nature. The programmer was more likely to be able to use his skills in the new company because of the larger size and therefore the wider variety of projects. The customers, the purchasing organizations, were also able to benefit from the move since, as the larger company, Kaph was able to take care of their needs in a more efficient manner than Pey was able to do in its time.

Indirectly, the developer was able to derive benefits from the project with regard to its other relationships with potential customers: the customer group was able to provide remarkable *referrals*. Again, the problem related to the previous value function, safeguarding, was the same: this project was the last one that Pey undertook for the same customers, and it could no longer use the referrals to the same extent as if the purchasing organizations had stayed with it.

Value perceived by the consultant, Kaph, and the technology provider, Ayin

At first the consultant expected to receive direct value from the network. However, in addition to the *profit* it made from the project, it was able to get closer to the purchasing organizations. In the end, it succeeded in

safeguarding the relationships with the customers, which was originally Pey's plan. As a result of the project the company became familiar with the key person in Pey, and managed to persuade him to move to work with them. They were probably aware of how dependent the customers were on this person, and that they would also have to move with him to get his service. This was a big loss for Pey, which was many times smaller than Kaph and had to restructure its business after the main customers left. Even if Kaph had not started giving service to the purchasing organizations, it would have obtained indirect value through *referrals* from the project.

The value Ayin gained from the project was similar to that gained by Kaph. The technology provider made *profits*, and the company was also able to use the *referrals it* received. The fact that the key person in Pey had learned about the tools was also of significance: when this person started working for the consulting company he also faced situations in which he needed the products of the technology provider. Because of his familiarity with them, he could happily recommend the Ayin products with which he was familiar. In this way, the technology provider strengthened the likelihood of *internal access* in the future, given that there might be new projects with Kaph's other customers.

4.5.3 Managing value creation in the network

The mobilization of the strategic network

The formation of the network mainly followed an *emerging path*: at first the partners, especially the purchasing organizations that formed a network within a network, found a common interest, which was the *mobilization* trigger. For this reason, they could be regarded as the core of the network. However, they did not exclusively select the other members, and neither did they determine the tasks of the other actors: it was the developer, Pey, and the consultant, Kaph, that participated in these activities. It is relevant to point out Pey's role as an *integrator* in the network. It was supposed to integrate the signals that came from every party: the customers were expressing their needs, and the consultant was acting as mediator by modifying those needs into a more understandable form.

The purchasing organizations were already in a business relationship with both Pey and Kaph. The former relationship had been going on for five years, and the latter for three years, before this project started, which indicated they were relatively well familiar with each other. The only new member in the network was the technology provider, Ayin. This company was not the only option in this case, but its *superior technology* and its *easy location* just 15

kilometers' distance from the developer's facilities, made it the preferred choice. The existing members of the network selected Ayin in cooperation. The consultant observed the selection process, which was carried out by Pey, thus attending to the customers' interests and providing expertise to Pey in the process. The customers had considered changing developer too, but because of their dependency on the programmer, the relationship with Pey continued.

Visioning the network

In this case, the *visioning* was different than in the other networks, again because the outcome of the project was not a marketable product but a renewed information system. Thus, the parties did not need to vision the opportunities and the threats against the other competing networks, for example. It was sufficient that the purchasing organizations had a vision concerning the outcome of the development, an improved information system, and its usefulness for their suppliers and customers.

Strategizing in the network

As in the Nordic e-banking case, the needs of the customers, the purchasing organizations, were in the background when the *goals* of the network were formed. The difficulty in goal formation did not relate to the differences between the purchasing organizations, the developer, Pey, and the other network members, but was rather due to the internal disagreements between the customers, the purchasing organizations. They had started the project based on a common interest, but their conflicting views on the final appearance of the solution strained the relationships from the beginning.

If one party had taken a stronger leader role from the beginning, had met individually with each of the organizations and created a frame to be followed according to their suggestions, it might have prevented the major collisions between the network members. Their attitudes could be partly interpreted as being culturally bound: "two Israelis, three opinions" is a common saying. Nevertheless, all of the members considered the common goal to be so important that it spurred them on to reach understanding.

At first it seemed that the usefulness of the project in the long run had not necessarily been assessed thoroughly by the purchasing organizations, since soon after it had ended they started looking for a new solution. This could be interpreted to mean that the goal to improve the information system was correct, but the way the improvement was brought about could have been different. However, due to the high costs of a new project aimed at replacing the improved system, and the uncertain future of the purchasing organizations, the idea was abandoned in 2005.

The purchasing organizations had no need to use any special incentives to make their partners prioritize the development project. The developer

perceived the purchasing organizations as such an important group of customers that the project was automatically *prioritized*. It also made sure that the schedule did not exceed the planned time, and that the renewed system was more or less equivalent to the features that were wanted.

Guarding the network

A typical problem with development projects within a network concerns *spillovers*, which have to be avoided. This was not of major importance in this case, since the aim of the project was not to develop a marketable product. However, there was some sort of "spillover": the consultant, Kaph, was able to persuade the programmer with Pey to move there. This might be typical of joint projects to a larger extent: the person in the partner firms get to know each other well because they are working intensively together. One of the companies might thus be in a position to closely evaluate the skills of these persons and their suitability to the company, and to make them an irresistible offer. The company that lost the employee also lost intellectual capital, and more concretely, the customers who followed the programmer. It is understandable that the most attractive employees are the most skillful ones, or those who have some unique and therefore valuable capabilities in the eyes of other employers.

The competitive position of the purchasing organizations was not threatened as a result of the project, and no guarding was needed in this area. They did have to guard their interests when the technologies and suppliers were selected, however, and for this they hired the consultant because they did not have sufficient technological knowledge in-house.

4.6 An R&D network in the development of a video streaming solution – Case C

The goal of the network, which was established by Tet, a California based company specialized in providing solutions for the broadcasting industry, and Dalet, an Israeli company pioneering in the field of digital video solutions, was to build a system to accommodate the emerging markets for digital products for cable and satellite applications at the end of the 1990's, starting in 1996 and continuing until 2000. The companies involved in the project were sharing their expertise in the development of the system – Tet in order to reduce the time-to-market and thus to establish its position in the emerging markets with its new-generation products, and Dalet to ease the financial difficulties they were facing at that time.

This case description is based on six interviews conducted in two companies in the network, Tet and Dalet. Additional material was found on

the company websites and in articles that shed light on the development of the broadcasting industry. The latter sources gave valuable information concerning the context of the companies, and were thus used to answer the first research question concerning the circumstances of cooperation.

This case study concentrated mainly on the core relationship between Tet and Dalet, and on the network of relationships that Dalet had with its component suppliers and with a company providing certification about the sound quality of the product. Dalet was in a vertical relationship with Tet, a supplier of the component used in the development of the broadcasting system, but at the same time it was in a partner relationship since it was developing something specifically for Tet, tailored according to its needs. Tet also had other partner-suppliers who provided important parts of the system. These partners had their own supply relationships, which were also indirectly involved in the development, but these were not included this study: the description is thus concentrated on the core relationships with Dalet and its supply network. Figure 25 illustrates the R&D network of the actors. The case network is encircled with a dotted line.

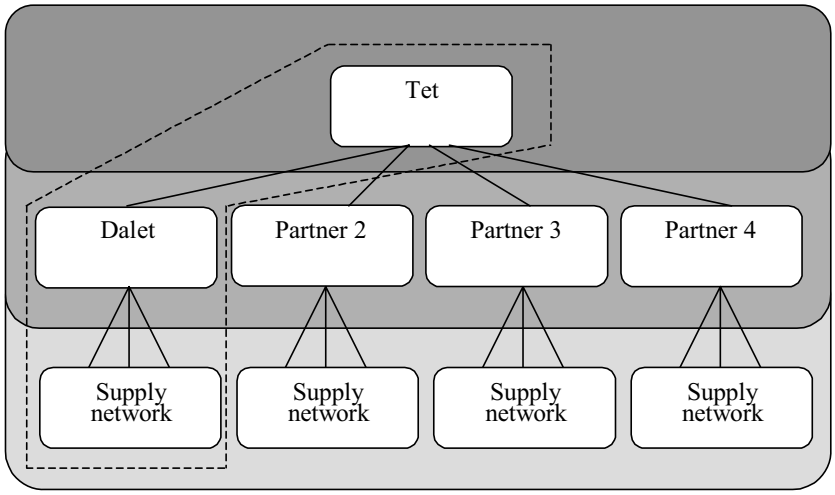

Figure 25 The R&D network in the development of a broadcasting system

This case description proceeds in the following manner. The key companies in the development, Tet and Dalet, are introduced first, and then the circumstances that provoked the decision to cooperate are discussed. This discussion includes a description of the broadcasting markets. Thirdly, the focus turns to Dalet's supplier network and its role in the joint development.

The final section of the case study describes the end of the joint project between the parties.

4.6.1 Descriptions of Tet and Dalet

The initiator in the cooperation was Tet, an American company founded by an Israeli in 1988. Tet designs, manufactures and sells digital video systems and fiber-optic systems that enable network operators to provide a range of interactive and advanced digital services, such as digital video, video-on-demand (VOD), high-definition television (HDTV), high-speed Internet access, and telephony. Most of the company's current sales are to cable-television and satellite operators, and a smaller proportion to telephone companies that offer video services. It has distinguished itself by introducing innovative products ranging from the world's first broadcast-grade real-time video encoding platform to the cable industry's platform of choice for video-on-demand transport and distribution. The company is headquartered in Sunnyvale, California, with R&D, sales and system-integration centers worldwide, including Israel. Its customer base is also globally dispersed. It went public in 1995 and it has 560 employees.

Dalet is an Israeli company, a pioneer and market leader in broadband media gateways and MPEG-1 and MPEG-2 encoding and streaming platforms. Propelled by sophisticated technology and market expertise, its products are at the core of professional digital video solutions for high-end content creation applications worldwide. These products are helping to push the boundaries of digital video networking and streaming over IP networks by enabling applications such as video streaming in the enterprise and in TV entertainment. The company was founded in 1990 and has been listed on NASDAQ since 1999. It has 160 employees, located in company offices worldwide, in North America, Europe, Japan and China.

Dalet's products are marketed in over 40 countries through a combination of direct sales, independent distributors, authorized resellers, system integrators and OEM partners. The company is involved in the activities of the sub-committee of the ISO Moving Picture Experts Group (MPEG) initiative for MPEG-4 standardization, which aims at standardization and interoperability.

4.6.2 The broadcasting markets

A brief description of broadcasting industry is included in this case study. This will further understanding of the context of the case companies, and link them to something more familiar: merely describing the technological fields in which they are operating would not give a clear picture of their eventual target markets, the value chain in the broadcasting sphere. There are also some words on the digital revolution, which is transforming the industry, and on the opportunities that it has created for the case companies.

The structure of television broadcasting is fairly complex. The reason for this is that the different players in the field are performing overlapping tasks: some broadcasting companies, such as AOL Time Warner, are highly vertically integrated, and incorporate program production and physical distribution. In other cases these tasks are performed in separated companies: for example Disney Inc. is concentrated more on program production.

The categorization given in Cook, Naresh and Swann (2001, 357–358) is helpful in terms of examining the structure and the actors in the broadcasting industry. Firstly, the category of *television broadcasters* is made up essentially of firms engaged in television broadcasting by means of over-the-air, satellite or cable technologies. *Program producers* are essentially makers of television programs, but also include firms specializing in the production of commercials. The *artist* category comprises casting agencies, agents, individual artists trading under a company name, and theatres. *Providers of production services* provide studio facilities, specialists in on- and off-line editing, sound-recording services, animation, subtitling and special effects. One of the categories includes equipment suppliers: *manufacturers, distributors and hirers of the specialist equipment* that is required for program production and post-production. In order to distribute the programs, the broadcasters (if not vertically integrated like governmental broadcasters) need *distributors*. Whether these service providers distribute over-the-air, via satellite or through cable technologies, they in turn need suppliers of broadcasting systems: *manufacturers and installers of broadcasting hardware.* These suppliers manufacture satellites, aerials and transmitters, and also manufacture and install cable systems. (Cook et al. 2001, 357–358.) The companies in the case network belong to this group, and they developed a system especially for cable operators.

The broadcasting system in Finland was government owned and regulated for a long time: Yleisradio Oy took care of the production, broadcasting and distribution of programs. In countries in which the government has been in a minor role, like the U.S., the commercial system has allowed cable, and later

on satellite, operators to flourish and to transmit the contents of commercial channels. (Wiio 2003, 115–117.)

Cable TV is not a new invention as such, but its popularity has increased steadily since the 1980's especially in the U.S. The number of cable customers was about 40 million households in the U.S. in the 1980's, reaching 73 million households in 1994 and ending up with 96 million in 2003. Technically, the television signal is received at the cable-head end from a satellite downlink and is delivered to homes through coaxial-cable networks (Cave 1997, 586). The conventional method of broadcasting has been *over-the-air* transmission, which has predominantly restricted people in most countries to few channels, between two and five, and these have been mainly governmental due to the restricted spectrum. In comparison to this, the advantage of cable TV is its ability to provide multiple, even 50, analogue channels to subscribers. In many developing countries, China for example, fast-growing cities have found cable TV a relatively inexpensive way of taking television to a lot of customers. (Cairngross 2001, 64–65.)

Satellite transmission started challenging cable TV in the 1990's. The big novelty at that time was that it could be delivered straight to the customer, who would buy a small receiving dish (called "direct broadcasting by satellite" (DBS) in America, and "direct-to home" in Europe). The advantage to the satellite broadcasters is the low start-up cost in comparison to cable. Whereas satellite distribution architecture requires one earth station, which uplinks the signal to the satellite, cable operators first have to build networks, which are similar to telephone networks. (Cairngross 2001, 64; Cave 1997, 586.)

The digital revolution as a challenge to the broadcasting industry

Almost every TV watcher has at some point engaged in a discussion about digital TV. TV production technology is already to a great extent digital, and the distribution and receiving of television transmission has also started to adopt digital technology (Wiio 2003, 125). Some researchers describe the shift from analogue to digital as the first big change in the way the signal is delivered since color was launched (Cairngross 2001, 64), and others claim that it is the most significant innovation since the advent of television (Chalaby and Segell 1999, 352). Both these opinions reflect the significance of the shift that is taking place in broadcasting, and which will eventually touch every TV watcher who has to buy set-top boxes or new televisions, and broadcasters and operators who have to up-grade their transmission systems.

From the technological perspective, digitization brings information handling to a new level of *ease and efficiency*. It underlies all the coming changes in the communications infrastructure, including television. It allows the transformation of diverse original materials, such as sound and still and moving images, all of which are presented in a numerical format, to be

transformed into a universal, compact and transportable data stream. This data stream can be delivered via the Internet as well as by traditional broadcasting technology. (Grünwald 2001, 720; see also Blair 1999, van Tassel on digital TV technologies.)

The advantage of the shift from analogue to digital transmission in TV broadcasting is the increased *capacity* of the distribution platforms. Compression technologies enable many more digitally encoded channels to be squeezed into the same space that is required for a single analogue channel (Cairngross 2001, 65; Grünwald 2001, 720). The industry ponders the possibilities of being able to offer 500 channels with digital compression. This will change the television landscape from the regulatory perspective, too, and the increased capacity will bring new niche broadcasters to share the market with the existing players. Broadcasters will also enjoy the lower costs now that compression is bringing down the high cost of bandwidth, given that the electromagnetic spectrum is a scarce and valuable good. (Grünwald 2001, 720.)

With digitization consumers will enjoy *better-quality programs*: digital technology features CD-quality sound and clearer images, and enables the wide-screen format. Digital delivery broadens the use of television, integrating features from both the broadcasting and the Internet world. This has given reason to speculate about the extent of the convergence of television and networked computing equipment. Some experts suggest that the difference between television and personal computers will ultimately vanish, and that markets will converge towards the development of an integrated PC/TV, whereas according to other opinions, these two will continue to be distinctive pieces of equipment in spite of their overlapping functions. (Chalaby and Segell 1999, 355.)

Converged or not, the current effect of digitization is to increase television interactivity, and the provision of similar services to those provided by the Internet: consumers are able to get live and on-demand television programming, but they can also become actively involved in the TV broadcast via devices that enable richer interaction. Moreover, in the future television will be used for sending e-mail. It is therefore turning into a personal communication device (Grünwald 2001, 719–720; Shrimpton and Balfanz 2004, 137; Wiio 2003, 125.)

In spite of the great visions that the forerunners of digital TV have expressed, great uncertainties prevail concerning the behavior of consumers and their reactions to the forthcoming digital services (European Audiovisual Conference 1998, 2). This is naturally making the service providers and equipment manufacturers uncertain of where market preferences will lie, and only time will tell what the market will eventually look like. The following

section discusses some aspects of the uncertainty related to digitization. These aspects include technological, regulatory and competitive factors, which also relate to the situation that triggered the companies in the case network to start cooperation.

The digital revolution and the sharp competition underlying the need for new broadcasting systems

Although the broadcasting industry may hold great promise for the players in the field, it is still in the formation phase and is characterized by regulatory uncertainties, technological complexities, and sharp competition. The existing regulations may not fit the changing market structures, or they may be different between different countries, which can hamper the activities of internationally operating broadcasters (European Commission 1997, 22). Moreover, unadapted regulatory structures can cause confusion: in Great Britain, for example, there are 14 regulatory bodies that lay claim to jurisdiction over media and communications. Convergence makes gaps and overlaps in regulatory coverage even more apparent. (Chalaby and Segel 1999, 357.)

The expansion of the broadcasting field and the multiplicity of competitive strategies among its old and new players make it a complex industry, thereby increasing the uncertainty. A further significant source of uncertainty is the pace of technological progress. The evolution of digital technologies is extremely rapid: experiments in the field take place continuously, thus technological progress is on-going. The players are continuously looking for the breakthrough that would give them a competitive edge over their rivals. For this reason, the leading companies are also actively involved in research, because they cannot afford to be left behind. Although new technologies generate new markets, they also eliminate the existing ones. The corporate players, broadcasters and operators, are therefore in constant fear of entering a technological dead-end, since the pace of the progress makes prediction very difficult and companies cannot be certain that the technologies they are now investing in will not be obsolete in a couple of years. An ability to choose the right technologies for the future is critical. (Chalaby and Segel 1999, 358–359.)

An additional factor that increases technological uncertainty is the fact that digital services incorporate several technologies, i.e. different transmission systems. As these technologies become interrelated and interdependent, it is increasingly difficult for players, on both the production and the regulatory side, to maintain their grasp of what exactly is going on and of how to respond to the trends that analysts in the field suggest are inevitable. The players, broadcasters as well as equipment manufacturers, are aware that their position in tomorrow’s broadcasting will depend on the routes they take and the

alliances they make today. For example, as the systems started becoming more complex, equipment vendors developing solutions for operators in the United States began to form strategic alliances with companies that possessed suitable complementary technologies. In addition, the future of broadcasting itself is unpredictable because of the unknown nature of consumer behavior. (Chalaby and Segel 1999, 358–359; Cairncross 2001, 65.)

To conclude, it is very obvious that the impact of digitization has been complex, creating new opportunities but challenging the players in the broadcasting industry. The uncertainty for broadcasters and operators lies in the regulatory environment and the development of new technologies. Although the change to digital has opened up new opportunities for new and existing players in the broadcasting industry to improve and change their business operations, it has also sharpened the competition between the players. Equipment manufacturers and installers in particular have been able to reap the benefits of the situation, as new systems are required for broadcasters and consumers. This also led to the cooperation between Tet and Dalet.

4.6.3 Emerging markets behind the need for cooperation

Since its establishment Tet's operations had been fairly successful, but in 1996 the company announced that it would change its strategy. It intended to go beyond its primary purpose of being a supplier of fiber components and to become more involved in digital communications, reflecting the development that was taking place in the market due to the new emerging technologies. This move was considered a long-term commitment, since the company was moving away from its core competence area to some extent. Until that point its strength had been in the optical analogue domain, but the new direction required new capabilities aimed at developing solutions for a new, rapidly evolving market.

Following the shift in strategy, more resources were allocated to the development of digital systems, approximately one third of the R&D budget, which in 1996 was 15% of the revenues. As part of this new focus the company decided to expand its digital-research facility in Haifa, Israel, which was established in 1994. Some time afterwards the facilities were moved to Cesarea, closer to Tel Aviv.

Dalet was broadening its product line, infrastructure and expertise, since it recognized the opportunities in marketing the new products. The main customer domain had been cable-television operators, but other segments were now brought to their notice: other network operators delivering bandwidth intensive services, video, voice and data over wireless networks through the

deployment of new networks and the upgrading of existing systems. Companies in the cable-TV market started to upgrade their products with rapidly evolving new solutions. Tet also believed that most of the major service operators would upgrade their networks during the next several years, and would incorporate digital systems for the delivery of high-speed, data-intensive services. The whole broadcasting industry was facing changes. This development also started to challenge the content and distribution of players, since it implied that, given the available TiVo technology, personal video recorders and video-on-demand services, consumers would be increasingly in control of what they watched, and of when and how they watched it.

4.6.4 Tet and Dalet start cooperation

Tet was targeting the broadcasting market with an embedded solution that would enable the broadcasting of TV over IP or cable. Following its change of strategy, it did not have all the expertise required for developing the solution. Putting its efforts into in-house development would have consumed time and resources, and the company lacked both. If it had chosen to develop its expertise in-house, it would have required years and would also have incurred higher costs. Saving in time-to-market was crucial, since the markets for digital solutions were rapidly evolving and the company wanted to be able to establish its share. Tet was not interested in acquiring a video company. Instead, given the situation, it suggested to Dalet in 1996 that they should form a cooperative venture, since it knew that Dalet had a lot of capabilities in developing digital video solutions.

> "…the situation in the market was that.. the marketing reached the decision that it's gonna be cheaper and faster to do with somebody else's components cards." [Product manager of Tet]

It was not only Dalet's superior competence at that time in developing digital video, but also its location in Israel, close to Tet's R&D facilities, that made it a preferred choice for cooperation. The product manager of the project described the choice in the following way:

> "They are also an Israeli company and it was easy to work with us, because their R&D was located here in Israel. Although they are a huge company in the U.S., they are originally from Israel. There are two or three Israelis that opened the company in the U.S…their CEO is Israeli." [Product manager of Dalet]

Dalet was a smaller company than Tet, belonging to the SME category, and it had not had a cooperative project of this size: all its previous projects had

been small-scale. It had very good technical resources, and skilled R&D people, but it lacked the marketing channels for its products. By partnering Tet it was able to access these channels through the customer. The marketing manager of Tet characterized the rationale behind the cooperation in the following way:

> "They had the technology, but they didn't have the distribution channel to sell it, so they were using Tet to sell the product. We had the distribution channel, but we did not have the technology, so it was a synergy." [Marketing manager of Tet]

As far as Dalet was concerned, cooperation with Tet was the first of its kind in the broadcasting market. It had previously worked with companies that were suppliers to the original equipment manufactures (OEM), such as Tet, and which were finally selling to customers in the broadcasting markets. It had gained knowledge about the broadcasting field from these previous relationships, but it did not have direct experience of the market. Partnering was therefore considered a better solution than attempting to penetrate the market alone, due to the high entry barriers and the fierce competition in the field.

> "IBM did few projects, we had relations with Time Warner…we had relations here and there, but not in the cable market. Broadcasting is a very wide market. So, we had some relations, but more with the system integrators, that were selling to the broadcast markets by using our boards. But we had no own experience in the cable market." [Product manager of Dalet]

Working with Tet provided a clear advantage for Dalet: the company had expertise in building the products, and in selling and supporting them in the cable markets, whereas Dalet was able to build only a very small part of the product.

4.6.5 Competitive aspects of the relationship

Although the two companies were not direct competitors with their current product, in theory there were competitive elements present when the relationship started. This caused a lot of discussion on Dalet's side.

> "We had discussions and debates, whether to go with it or not, because we can find ourselves as competitors…"[Product manager of Dalet]

The company realized that in the future Tet might be able to develop its own solution with the knowledge that Dalet possessed, but that would be

transferred to Tet as a consequence of the cooperation. This spillover aspect was already present at the beginning, when Dalet was still considering entering into the joint development project.

> "But we could see… it was one of the risks that we took, we decided to go, we had revenue problems…we know that if they don't buy it from us, they will buy it from another. So we have taken the risk.. we knew that there was a risk, but they could really easily buy it from a third vendor and not from us, so we didn't have problem doing that but eventually it turned out that they did it." [Product manager of Dalet]

The financial difficulties that the company was struggling with in those days were weighing more heavily, however: it was still a small company and was not listed on NASDAQ in those days. In this situation the project with Tet would provide relief: the company calculated that it would gain millions of dollars per year in revenue. In order to overcome the threat of competition, the companies had to work hard to create a deal that would cover every possible pitfall. Dalet wanted to protect its IP from leaking to Tet, but Tet was also worried that Dalet might be able to compete with them with regard to the technologies they would learn in the course of the cooperation.

> "There was a very rigid contract, where we weren't supposed to compete with them with technologies that we had learnt from them." [Product manager of Dalet]

Under the contract Dalet agreed not to compete with Tet in the cable markets for four years, and Tet faced restrictions concerning the market in which Dalet was operating. There was also agreement that Dalet would not approach their competitors and build applications for them. One practical problem that arose concerned the division of work between the two companies. Eventually, two engineers came to work at Dalet's facilities, but later on this was considered a mistake on Dalet's side since these people were in continuous interaction with its own personnel. Tet's engineers were thus able to listen freely to Dalet's ideas during their working day. In hindsight, it would have been preferable if a separate R&D facility had been established for the purposes of the joint project. However, in Tet's opinion, the technological competence of Dalet was useful only for this particular project and would have no value later in its other projects – especially because the company acquired another video expert a few years after the cooperation had started.

> [Did you learn something in cooperation with Dalet that you could use the knowledge later on in something?]
> "I think everything was just done, because we acquired a company that had a superior technology, which is the best in the market today. So, all the technology is left behind." [Product manager of Tet]

The fast technological change was also one of the reasons, why Tet thought that the knowledge accumulated through the project would not benefit it later on.

> "In any case, in every 18 months the compression technology changes, so.. even as we stopped using their encoders, we're using different encoders in any case every two years." [Product manager of Tet]

On Tet's side, there were also different opinions concerning the knowledge gains. Although the technology as such would not benefit the company later, the knowledge it acquired about the development process of digital video was enriching. From Dalet's perspective the project was complicated and risky, not only because of the competitive elements within it but also for other reasons. The decision to start to cooperate with Tet was strategic in terms of its other products. It was investing a lot of resources in this project: its best employees, five engineers, were working on building the solution for Tet.

Dalet had to consider whether dedication to the joint project would hurt their other business in the long run due to the cut in resources that came as a consequence. This was of major significance in the field in which they were operating, since the technology was under constant development and the company should not be left behind. The eventual impact on Dalet's own operations was that it had to close down one of its product lines.

4.6.6 The formation of the supply-network relationships

The goal of the project was to build an embedded system for the broadcast market. Dalet was assigned to build an encoder board to be incorporated into the new platform Tet was developing. The board, which was developed by Dalet for Tet, required hundreds of components. Dalet had already established some supply relationships for its earlier products, but the new cooperation required new ones. The number of existing supply relationships was around 20–25, and five new suppliers of the new technologies were needed to meet the requirements of the development. There were also learning requirements on Dalet's side, although the majority of technologies had been used in its previous projects.

> "We had to implement new technologies in Dalet. P. is one example, but there are others. But the majority are old…let's say 80% of the product that we used to sell to Tet was based on current technologies, that we had…we were not very familiar with the networking components, which had to be learnt as well, so I would say that five components, five new technologies that we had to adopt in order to work with them, but the

> majority was really fairly easy. We really took our product, did some tailor-made for Tet, changed it a little-bit… [Product manager of Dalet]

Tet and Dalet worked together to some extent in order to locate the right suppliers for the project. Tet was also able to take advantage of Dalet's experience in video technologies in this selection phase. Since Tet was not familiar with the field, and did not have relationships itself, it could assign Dalet to carry out the supplier selection and to initiate the relationships from the beginning, while Tet gave its recommendations concerning the supplier selection.

> "Yes of course, for us it was much easier than to leave Tet to do it themselves. So saved them a lot of time and money by us approaching these suppliers, because they were not familiar with…they were far away from video, audio networking…so for us to evaluate it, it was much easier to evaluate it, it was much easier than for them." [Product manager of Dalet]

By using Dalet to take care of the supplier relationships Tet was able to save costs and time. The selection of a supplier took three to six months at the beginning of their development work. There were several options for each component, but there were only one or two left at the final phase. Although Dalet was rather experienced in the selection process, the nature of the components set its requirements.

> "It's especially, when you are talking about a very unique component, you need to have contracts in place, you know, with a lot of constraints, to secure your supply chain and everything, it is not easy." [Product manager of Dalet]

In addition to using Dalet to establish new supply relationships, by agreeing on development cooperation Tet was able to access its *existing* supply relationships as well. These relationships had been developed over the years of the company's existence, and the project with Tet increased the interaction. Although Dalet had had to close one product line, this did not have an impact on its current supply-relationships.

Because of the fast technological development on the supplier side, the contracts with the suppliers had to be designed so as to keep Dalet informed every few months of the steps they were taking. Thus, with the major suppliers it provided a way of monitoring the development. Dalet and its suppliers agreed that it would be notified six months in advance of every new product release on the supplier side. The fact that there were hundreds of components made the monitoring a complicated task. Keeping up with the pace of advancement also required continuous interaction with the suppliers.

> "The suppliers for the PCI market actually progress very very fast, every three months, four months you have a new revision, so everything is very very quick. So, O.K., you sign a contract and from there you have to progress with a new development of components, so it's very difficult, because you have let's say, hundreds of component products on a board, so you have a lot of changes." [Product manager of Dalet]

The reputation of the large customer, Tet, was used in some cases to pressure the suppliers to decrease their prices and give better service.

> "When I spoke to the supplier I was using *Tet* to decrease prices and everything. I put a lot of pressure on the supplier as far as prices, service, etc. are concerned and it is very easy. Whenever you come to a supplier and you are telling stories – it is very difficult for you know how to come up with a good story but when you come with *Tet* and say "Guys this is a board we developed for *Tet*", the story becomes better. All the time you have to tell stories as it is a very competitive market, you need to decrease prices. Many times I have to give a forecast, which I personally don't believe in, but that's the business it happens all the time. You say that you will buy 50,000 components a year and actually it tends to be 30,000, because you are over-exaggerating a little bit. But whenever you come up with *Tet* and say "it is not for me it's for *Tet*" of course it makes some leverage." [Product manager of Dalet]

The fact that Dalet was a supplier for Tet had some positive effect on other customer relationships, strengthening its credibility. Dalet itself, however, was "marching in the shadows", since Tet did not publicly mention who its development partners were and thus it could not attract extra attention from outside through its customer. There were differences in the supply relationships that the company had. Some of Dalet's suppliers were characterized as "major suppliers", implying that their component was more significant in financial terms and thus had more development behind it. "Alge" was one of these "major" suppliers.

Alge

Dalet had established a supply relationship with Alge in 1995, three years before the relationship with Tet started. Alge is the world's largest information-technology company, as well as its largest business and technology services provider (services include business transformation consulting, systems integration and strategic outsourcing), with more than 300,000 employees worldwide. The company also offers hardware, software, fundamental research, financing and components that are used to build larger systems, in other words a full range of computing solutions.

The fact that Dalet already had a well-functioning supply relationship with Alge facilitated Tet's work, since it did not need to use its resources to approach the company. It was relatively easy for Dalet to take a board that was based on Alge's component and to use it in the joint project. Dalet was also

able to reap other benefits in this particular supply relationship after starting the relationship with Tet. Buying Alge's components for the project also helped Dalet with its other purchases. Because of the project the quantities, and consequently the purchases in dollar amounts, increased remarkably, reaching over a million dollars a year. Dalet already had a good relationship with Alge, but the increasing amount of purchasing elevated it into the position of VIP customer, thereby further improving the relationship.

Poly

Another company that Tet was able to access through its cooperation with Dalet was called Poly. Poly develops audio signal processing systems, manufactures the professional equipment to implement these technologies in the motion-picture, broadcasting, and music-recording industries, and licenses the technologies for the consumer-electronics industry. The firm continuously seeks genuine, long-term improvements in sound quality and its primary commitment is to provide the best possible audio for any entertainment environment, including music, movies, television and multimedia. The firm is based in San Francisco. Its European headquarters are in England, and it also has offices in Hong Kong, Shanghai, Beijing and Tokyo. It is privately owned, with 550 employees worldwide. Poly technologies are used by sound professionals everywhere: the logo is recognized in tens of thousands of cinemas every day, and it is familiar to home listeners via DVDs, digital broadcast TV, digital cable, direct satellite transmissions, video and computer games.

Due to the fact that in the broadcasting market the quality of the product plays an important role, certification increases credibility. Dalet had certified the boards they had built prior to entering into cooperation with Tet. Although the boards that Dalet would be developing for Tet were not included in the original certification plans, the decision to do so was taken after it had been taken into common use in the cable markets.

Dalet had applied for a Poly license for the certification of its own boards. The company provides a Trademark and Standardization Agreement (TSA) to companies that wish to use the Poly trademark to indicate that their recorded audio content is encoded with Poly technologies. The certification procedure is lengthy, taking up to one year, because quality testing of the products that are to be certified is required. Furthermore, firms must make an initial payment of $50,000 in order to apply for the license.

> "Yeah, you need to pay in the beginning 50,000 dollars in order to apply for a license. So actually we had it, so it saved the 50,000 dollars. We told Poly that it is actually the same design, so there's no need for other certification, so actually we saved a lot of time from them. So.. It was quite good for both sides." [Product manager of Dalet]

Since Dalet used the same board design with Tet, no new certification was needed, and it was only a question of contacting Poly and notifying them. This established relationship between Dalet and Poly was therefore beneficial to Tet, not only because they saved the fee and the time, but also because Dalet had knowledge about the certification process and the experience of going through it with Poly.

4.6.7 The end of the relationship between Tet and Dalet

Although the exact duration of the joint development was not determined in advance, Dalet expected at the start of the relationship that the cooperation would continue for at least three to five years, but it was not clear on either side for how long it would eventually last. When the product manager of the joint project on Dalet's side saw that there was a U.S. video-technology company, their competitor, for sale at a fair price, there was speculation about Tet's moves in this matter. When Tet gave a sales forecast concerning Dalet's product that dropped close to zero, it indicated that the end of the relationship was at hand. The fact that Tet had decided to acquire this competitor was, of course, shocking for Dalet. However, the competitor was able to provide video technologies and thus to extend Tet's technological range. The acquisition was the result of an evaluation of the best companies in the field.

> "And then, it was time that we wanted to realize, which is the best company in the field. And then, we decided to go to buy X…so Tet bought X, and then we moved towards better solutions from Tet's point of view, Tet concept of the digital headends" [Product manager of Tet]

> "Of course they (Dalet) didn't like it, but of course they understand the reality that we have a better solution for encoding right now, which is in-house…"[Marketing manager of Tet]

Tet's need for Dalet in its development was thus brought to an end by vertical integration, the acquisition of company X. This company was able to provide better video encoding than Dalet, and the better quality required by Tet that ruled its partner selection. The acquisition opened doors for Tet to focus better on the satellite markets, in which it saw a lot of potential.

> …Three years ago they decided to acquire a video company like Dalet something bigger which is called X. So they acquired X and actually they are more capable than us. So they actually don't need us anymore" [Product manager of Dalet]

Tet thus stopped promoting Dalet's encoders in 2000. The relationship was not cut "over-night", however, because Tet still continued supporting the products it had sold: it continued for another year. However, it was natural that Tet felt that Dalet had lost interest in supporting the products. Earlier when there were problems, Dalet had responded quickly in order to solve them immediately, within a week or two. Now that the business relationship had come to an end, Dalet no longer wanted to invest its human resources in the project, which now had no future. The product manager thus brought it to an end, leaving one engineer to answer questions concerning the maintenance of the product.

4.7 Case analysis

The network was established for the purpose of developing a video streaming solution for cable operators among actors specialized in both software and hardware, and component manufacturers coming from supporting industries. The aim was to create value for the members and to strengthen the competitive position of the participating firms. The competence that the supplier of digital video technology brought to the network was crucial for the customer. The long-term effects of network membership touched this supplier in particular, since the partner customer limited its customer base and its commitment to the customer's objectives determined the direction of its business. The nature of the digital video system development case as a strategic R&D network is illustrated below in Figure 26.

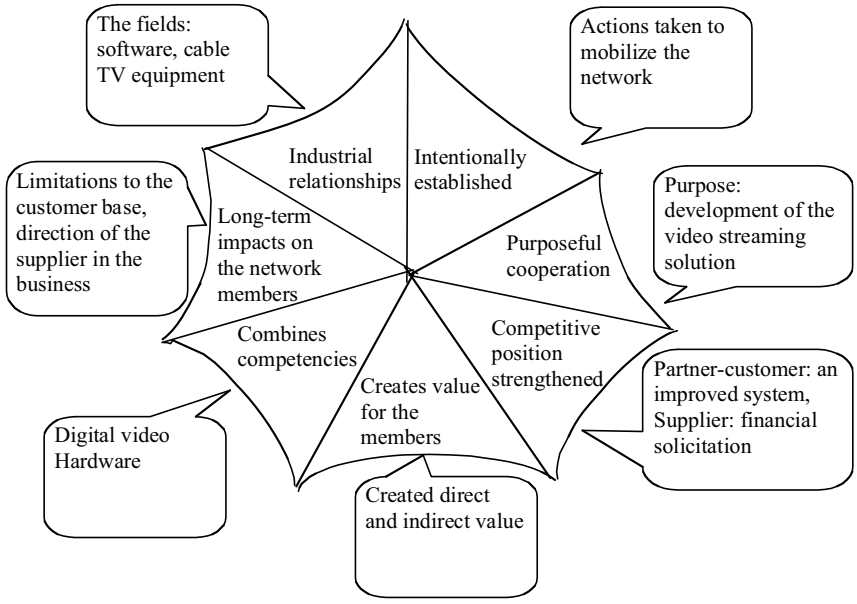

Figure 26 The nature of the digital video system development case as a strategic R&D network

4.7.1 The circumstances for value-creating cooperation in the network

The major need to establish the focal strategic R&D network reflected the reality of the broadcasting industry, in which the players were eager to acquire new systems in order to strengthen their position, thus indicating substantial potential. Therefore, the major need to cooperate came about through *industry- and market-level circumstances*, but the *technological level* was also influential due to the prevailing uncertainties. Cooperation was a self-evident option on the *company level* due to the environmental pressures.

Digitization and the general technological developments in the broadcasting industry since the 1990's created a demand for new systems among cable, satellite and telephone service providers. The worldwide equipment market was developing solutions to fulfill the increased demand. This situation also influenced Tet's and Dalet's businesses, which were providing broadcasting and video streaming solutions, and the choices they were making in their research and development. Tet had followed the market developments and was aware that the cable operators were waking up to the fact that they needed to up-grade their equipment and to provide a better service to their customers in order to achieve competitive advantage. They were not only competing with

other cable companies, which had been steadily growing in number in the United States, they were also fighting the growing threat from the satellite operators. As a result, the competition between the cable and satellite operators became more intense in the 1990's, and changed in dimension.

Direct broadcast satellite (DBS) operators had been the first to offer several hundred channels of high-quality digital video. Consequently, the number of DBS subscribers increased significantly. The cable operators suddenly realized that they would have to upgrade their analogue networks in order to offer comparable and additional services, including digital video services, as well as "two-way" services such as video-on-demand, high-speed data and voice services. At the same time, they started their expansion into a field that had been traditionally the realm of telephone companies. This created opportunities for Tet and the network as a whole, since the situation, so-called "Triple Play" referring to sending voice, video and data services over a single network, meant increasing equipment supply. In practice, "Triple Play" enabled cable operators to use their network and to attract high-speed broadband customers for data services. They were thus moving into the territory of telephone companies, which so far had been providers of Internet connections. Telephone companies started responding to the competitive threat of cable by forming partnerships with satellite broadcasters, for example.[4]

It is clear that, for the cable operators, the timing of acquiring the equipment was crucial. This, in turn, also triggered the formation of the case network, since on the company level Tet could not wait to have digital video developed in-house if it wanted to offer a quick solution. The competence that it was acquiring was not its core competence at that time, although it was later on. On the technological level, cooperation implied that Tet could form a channel for intensive knowledge transfer.

4.7.2 Value created in the network

Value perceived by Dalet

The companies that were involved in the network and engaged in the joint activities derived value from the joint development mostly according to the

4 The alliances with telephone companies have been important to satellite broadcasters due to the differences in technologies between cable and satellite. With digital cable the return path, which enables the interactivity, is included in the delivery infrastructure, whereas with satellite delivery the return path is through the telephone network. (Cave 1997, 586.)

expectations they had had in the beginning. From Dalet's point of view, the most important direct value was created by the *profit* they made and their strengthened *competence* in digital video. The *market function* created indirect value in terms of the channel its partner Tet provided, and the *scout function* helped Dalet to learn about the market.

Although the outcome of the joint project was not successful in the end from Tet's point of view, at least Dalet was able to reap the financial benefit that it had pursued by becoming involved in the project with Tet. The purpose of its engagement, to improve the financial situation of the company, had been fulfilled in terms of the *profit* the company made out of the project. Unlike Tet, Dalet was not in a hurry to get onto the market because it was not selling a whole system to the end customer: saving time or costs as a result of the joint development was of no significance. *Cost savings* were achieved in a different way. Because of the joint project Dalet increased its purchasing volumes, which enabled it to negotiate lower component prices with its various suppliers. The reputation of the customer helped in this. Since Tet was a large and a well-known company, Dalet was able to use this in pressuring the suppliers to give lower prices. The price reduction also benefited Dalet's own projects to some extent.

On the one hand, Dalet's *core competence* was strengthened, and on the other hand it slightly deteriorated as a result of the project. The strengthening was in the fact that the cooperation included areas that were previously unknown. Furthermore, the people in the company became more professional in their work because they were able to imitate Tet, which was a much larger American company. This learning experience concerning the routines of the other organization is also included in the competence function. The deterioration derived from the fact that the company had tied up its best resources and was thus not able to start new development projects. It also had to discontinue one product line as a result of lacking resources.

The most important indirect value function was *access to the marketing channel* through cooperation with Tet. At some point Dalet had thought about developing a similar system to the one Tet was offering. It lacked the necessary marketing experience, however: even if it had a system to offer, this would have been a serious deficiency since the broadcasting markets were very hard to penetrate. Tet's channels were thus a valuable resource. Another type of market value function, references from the project, did not have remarkable significance for Dalet. One problem with this kind of cooperation with the OEM is that the customer, the OEM, does not reveal the identity of its partners. In this case too, Dalet was not able to enhance its reputation in the market and thus attract more customers, although it was able to refer to its relationship with Tet when it was trying to get new customers.

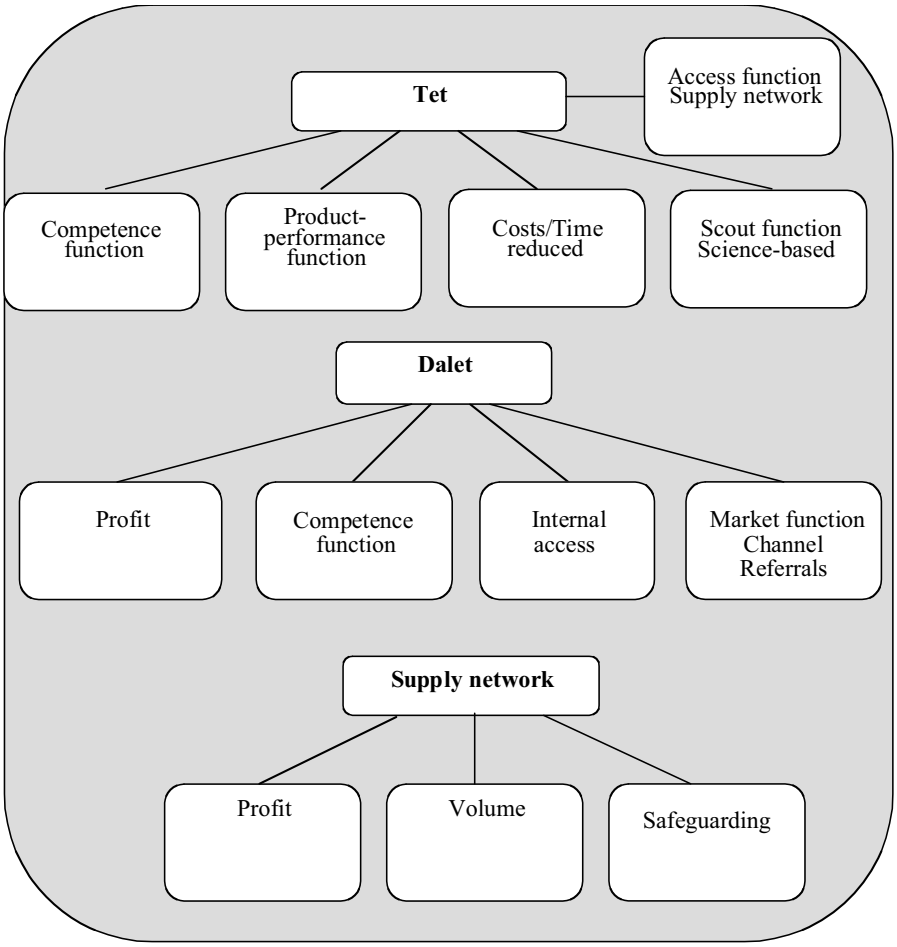

Figure 27 The value captured in the network of relationships in the development of the solution for the broadcasting markets

Value perceived by Tet

For Tet, the cooperation created value *directly* by *saving time and reducing costs*, providing the necessary *competence* and offering a *high-performance product*. Indirectly, it derived value from the *access* and *scout functions*. Time saving was a critical value driver, since Tet was looking for quick access to the market. It lacked competence in digital video, and Dalet could provide it. In the course of time, this became such a strategic issue that Tet realized that it should be added to its core competencies. Internalization happened later through the acquisition of a company with superior knowledge in the field. As

it turned out, it could be concluded that the co-development with Dalet prepared Tet for the internalization of competence in digital video.

Tet learned a lot about working with video standards and about the development process. As its representative said, it would have been difficult to absorb this knowledge only from books and other material. In this way the network, and especially the cooperation with Dalet, served a *scouting function*: it opened a window onto science and provided a way in which to apply the knowledge in a commercialized product.

At the time Dalet possessed sufficient competence to develop a *high-performance product*. Although the rumors about failing installations had a negative impact on Tet's reputation, the partners did not suffer because they maintained their anonymity. The access provided by Dalet to its supply network was also a great time saver. Another benefit in this was that Dalet was then responsible for these relationships: by choosing a model in which the video solution was developed by an external partner, in this case Dalet, the supplier was selecting the "turnkey" option. Dalet, like Tet's other three partners in the network, was thus responsible for the functioning of the suppliers' products. Dalet's access to Poly also brought Tet cost benefits, and without Dalet the licensing procedure would have been lengthy – now the same license covered Tet's system. Tet was able to use Dalet's resources, knowledge and time in building up new supply relationships, although *access to suppliers* cannot be considered as critical a source of value as the engineering knowledge, or competence, provided by Dalet or the other partners. It made things easier for Tet, but it was not a critical factor in the development, as competence in digital video was.

Value perceived by the other partners

The other parties involved in the network consisted of Tet's other development partners and their supply networks. The direct value experienced by the other partners was apparently somewhat similar to that experienced by Dalet: *profit and strengthened competence*. On a smaller scale it could also be said that there was some *safeguarding*. These considerations are based on statements made by the representatives of Dalet and Tet, since no access was granted to the companies concerned. *The profit function* created value for the suppliers through the increased volumes. Alge also elevated Dalet to the category of VIP customer, which is an indication of the perceived importance of the relationship between the two companies.

The fact that Dalet was a leader in the digital video field and required high-quality products probably also affected the suppliers' need to learn about its requirements. It is likely that this increased their awareness about the relevant issues, and strengthened their competence. The business relationships were supported by the more frequent interaction with Dalet that occurred before and

during the project. Although the suppliers, at least the largest of them, had a great number of customers, it could be said that, especially given the position of Dalet in the market, the relationship was still worth safeguarding for the future. As Figure 27 shows, both companies, Tet and Dalet, gained value through several functions in the network, whereas the supply network mainly enjoyed profits and increased volumes. From Tet's point of view, the competence that it was able to internalize was more crucial than any other function. Dalet benefited mostly financially, but Tet also provided a marketing channel and market knowledge.

4.7.3 Managing value creation in the network

Network mobilization and partner-interface management

The case network was *mobilized by Tet*, which had experienced the need to find a company to develop the digital video in the solution to be sold to cable operators. The company had monitored the environment, and consequently the sharp signals about the technological change triggered the network formation, which had more features of the *engineered path*. Tet approached Dalet, whose superior *technological capabilities* comprised the key selection criterion, and its *geographical proximity* to Tet's location in Israel was also beneficial.

Since Tet was acting as an initiator in the network formation, it could be considered the core partner in the development. It also made the strategic decisions concerning the operations of the network – which was natural given the fact that the company was paying and would be solely responsible for marketing the product. However, when new companies, suppliers, joined the network, Tet harnessed Dalet to carry out the selection to some extent, and to use its expertise to evaluate the candidates, although Tet gave the recommendations. Since some of those who were accepted were Dalet's old suppliers, and thus their technologies were already familiar, establishing the supply relationships for the new project was not considered time-consuming or complicated.

It could be concluded that the assembly of the network was not fully anticipated at the start of the cooperation, but the fact that Tet and Dalet were engaged in the development for several years created a need to bring in new network members in the course of time. For example, the provider of the sound-quality license, Poly, joined it later on when the parties wanted to improve the product quality.

Visioning and strategizing in the network

On the whole, the parties did not discuss the opportunities and the threats to any great extent. The future of the network was not clear either, and the parties did not determine beforehand for how long their cooperation would last. One reason for this was technological advancement, which forced the customer, Tet, to monitor the environment and to search for improved solutions. In spite of being aware that the network may not remain forever static, Dalet was surprised at the acquisition of another video company, and this eventually caused the dissolution of the relationships. It had thought that Tet might well have been interested in the company in question, but it had hoped that their development cooperation would continue.

The goals of the partners were somewhat similar, although Dalet had to make compromises in its own business during the strategizing phase. There were some potentially negative effects of this, including the fact that not all of its current products could be supported since it was not possible to quickly recruit and teach new people to work on them. In spite of these somewhat negative considerations, Dalet decided to start cooperating with Tet since the financial gain was considered more important. This also reassured Tet that Dalet valued the joint development and would also be committed to promoting Tet's interests.

This case shows that strategizing and visioning in the network have their limitations for companies operating in an extremely volatile environment. The characteristics of the industry are influential: if companies, at least on the theoretical level as in this case, were able to develop similar solutions, even if this took a long time, they might be unwilling to share their ideas and plans concerning the future. The thought that a partner today is a competitor tomorrow makes them cautious about what they reveal. Still, it was generally acknowledged by the interviewees that even if the firms were competing in one area, they could cooperate in another. In this case, although it was dissolved, the relationship between Tet and Dalet started to show signs of recovery: at the time of the interviews they were planning a new joint project.

Guarding the network

Tet *guarded* the network by ensuring that the knowledge that was transferred and created would be protected from outsiders under the terms of a contract that the parties had made. It was in Tet's interest to secure its competitive position, and therefore Dalet was not allowed to establish business relationships with Tet's competitors for several years.

Avoiding within-network spillovers was not efficient. The case showed that companies in networks should try to find a balance between efficient knowledge transfer that supports the development and knowledge leakage, i.e. negative spillover. When Tet's engineers were located in Dalet's facilities

because of the joint development activities, they were able to listen to Dalet's employees' discussions about new ideas, and this could have revealed something valuable to Tet. This would have been prevented if a separate facility had been established for the joint development work. This case provides a typical example of a situation in which a large firm can access the knowledge base of a smaller firm through R&D cooperation, and in this way internalize valuable competences (Alvarez and Barney 2001). Dalet, in turn, also tried to imitate Tet's product afterwards, using the knowledge it had gained, which indicates that it, too, was able to absorb knowledge through the joint development process. Although Tet had other development partners, they passed no information about them on to Dalet.

4.8 The formation of an R&D network for the development of video compression technology – Case D

Lamed was a start-up, which was formed in January 2001 in Tel Aviv, Israel following the merger of two firms. This case description is based on 10 interviews that were conducted with the key managers and one interview with a manager representing a potential development partner in Finland. Further material concerning the technology and the business of the potential partners was found on the Internet.

The focus of this case is on the network management, and especially on the mobilization phase. The circumstances are reviewed, too, and to a certain extent the study identifies the potential value the network relationship would have brought to its members. The mobilization activities are described from the point of view of an Israeli start-up, Lamed, which approached several companies. Although Lamed might have entered into a partnership with just one company, a network would have been formed if other companies that were closely related to the partner had joined the development project, or if Lamed had formed several cooperative relationships simultaneously.

4.8.1 The beginning of Lamed

The first firm in the merger was established one year previously to develop hardware for video compression and the other in the year 2000 to develop a video compression algorithm, the software for the same solution. The key persons from the two companies knew each other from university, where they had been studying together few years earlier: the business development

manager of the new company came from the hardware side and the CEO and chief technology officer from the software side.

The new company was based in Tel Aviv and the number of employees after the merger was 20. The purpose of the merger was to facilitate the provision of a full solution, which would include the hardware and the software for transmitting video over the networks. The company on the software side had more employees and a stable organization, which made the merger attractive to the hardware company. Afterwards the hardware makers continued with that side and the other team went on with the software. The company's core competences were related to digital signal processing, mathematical algorithms and network infrastructure.

After the merger Lamed started searching for partners for the development. It contacted a large number of companies in Israel and abroad that might have needed the new technology to complement their offerings and that perhaps would have provided help for Lamed in its worsening financial situation. In spite of the numerous contacts, of which some went further than others, after two years the company had not succeeded in forming a development network and gradually its operations were wound down. This case description covers the background of the development and the attempts of the start-up to find a suitable strategy. The contacts the company made are described in the order in which the events took place.

4.8.2 Background

The mission of Lamed was to develop a compression algorithm and the hardware for transmitting video over networks. Although competition was harder on the hardware side, the idea the developers had was to provide a higher-performance product in comparison with other offerings. The software was something that could be described as breakthrough, however. The founder of the second start-up had been working in Motorola, where he became familiar with the new MPEG-4 standard, and also became convinced that it would be advantageous to develop technology based on this, and that it would be part of the future media picture.

The MPEG-4 standard is based on the work of the information-technology committee of the International Standardization Organization (ISO). This committee, which was established in 1987, includes the Moving Picture Experts Group (MPEG), which conducts research on coding video and voice. It has developed several MPEG standards for this purpose. Released in 1992, the first MPEG-1 standard was targeted on the sending of VHS-type video over local networks and on CDs. An improved version, suitable for high-

definition TV, was introduced in 1994. The MPEG-4 standard, on which Lamed also based its solution, was finished in 1998. It was developed especially for the encoding and decoding of digital multimedia, including the moving picture and its transmission over networks, and it was revolutionizing high-quality and interactive digital media over all types of networks.

In addition to defining standards and decoders for video and voice streams, MPEG also defines the multiplexing of several video and voice streams into one byte stream, and methods of testing the synchronization with the standard. However, it does not define encoder algorithms. This allows individual firms to develop them further and to match them with the interfaces used, which was also Lamed's purpose.

At the time Lamed was established, sending live video through IP networks, including cellular phones and wireless handsets in general, personal computers and set-top boxes for digital television transmission, was becoming more popular. Still, it was a challenging task due to the high information content. Anyone who receives pictures attached to e-mails is familiar with the phenomenon: opening the picture may take several minutes if the data-transfer channel is very slow. As the same applies to sending video over networks, the material sent has to be compressed, in other words its size is minimized in order to reduce the transmission time. Uncompressed video would demand excessive space and would be practically impossible to send over networks. When compressed it is reduced in size by over 90%. The compressing process is called *encoding:* the video signal coming from the source is encoded and "packaged", and coded into the MPEG stream. The MPEG stream is changed back to a moving picture in the decoding process. Encoding methods are based on the fact that successive frames in a moving picture are similar to each other. The data size can be reduced if only what is different is sent. Data-transmission capacity is also saved if changes that are not detectable by the human eye are ignored.

Investors were convinced that this would be an excellent opportunity. The new technology would be good, nobody had it, and in the field of video applications it would have the potential to open up new opportunities if the universality of television and the interactivity of the Internet were to be combined and the new solution would also send video at low bandwidths over the networks.

> "Still, but for Lamed I can really say we really had something that no other company did not even want to start developing." [former Business Development Manager with Lamed]

What differentiated Lamed's solution from previous ones, and which made it "a next-generation solution", was object discrimination. The algorithm

would analyze digital video streams, extract the objects from the background in real time, and send them separately in a "selective transmission". The object discrimination would thus potentially save a lot of bandwidth, which meant that good-quality real-time transmissions would be available to Internet subscribers at home, for example.

4.8.3 Many ways to go with the technology

Although Lamed had the skills and the capabilities to develop the algorithm for the video solution, it lacked a solid vision of the final application and of the product with the technology in it. The options were multifaceted. For example, the solution would allow people to follow sports events, learn from a distance, watch music shows and view sites. It could also be used for medicinal and security purposes. Choosing the focus of the business was a challenging task for the start-up.

When Lamed was tackling this issue of finding a focus for its future business, it turned to a consulting company for assistance with its business plan. Building the business plan together with this consulting company required intensive cooperation between the parties, but the end result was not very satisfactory. The consultant was not able to provide comprehensive answers to Lamed's questions about the best business direction to aim for. One of Lamed's first ideas was to shoot football games from many directions and transmit them over the Internet. Other ideas supported concentration on security markets.

In spite of the lacking focus, after the merger things in Lamed proceeded at a high speed. The initial vision was that the company would come up with the full solution, including the software and hardware, alone. The number of employees was increased with this in mind, and the investors were urging the firm into rapid development. Money was burned at a high rate.

> "So we went too fast in developing the full solution. And we did not think to focus on what we can do and how we can do part of the product and to come to a full solution together with another company. We thought of how we can make the whole solution and so we got hardware people, we got software people, we got algorithm people, we got Internet people to build the application and so on. We grew very, very fast and it cost a lot of money and we burned the money very fast. And I think this was the real problem and I started to get a little bit unsatisfied with this worry, but the atmosphere was and the investors told us, that we need to go fast, fast, fast, so the atmosphere was, that this is the way." [former CTO of Lamed]

However, it was soon noticed that the growth, which had been almost too rapid, had become difficult to manage. The CTO started to become worried, but the opinions of the investors, who wanted quick growth, carried more weight.

4.8.4 The MPEG-4 convention – a step towards new business relationships

A few months after the merger, in April 2001, Lamed participated in an MPEG-4 convention that was held in Las Vegas. The company initially decided to keep a low profile with its development and not to show anyone what they were doing. However, before the convention the CTO convinced the board that they should tell others about their development since it would open up enormous opportunities for MPEG-4. The position of the standard had worsened after Mega came up with its own video technology standard for Media Player, and the company had deviated from MPEG-4. The aim of Mega was to force the market to use their standard. The CTO of Lamed, however, saw an opportunity to defend the position of MPEG-4 with the development work that they had done. He therefore contacted the chairman of the MPEG-4 organization before the convention to tell him about their work.

At the convention the conflict with Mega culminated in an open confrontation onstage. The Mega representative was a participant even though the company was no longer with the standard. He aimed in his presentation at convincing people that Mega had a better technology, and that it was only because of this that they were no longer with MPEG-4. The CTO of Lamed had a different view about this and he interrupted the presentation.

> "…they want to do it from the commercial point of view, not from technology and MPEG-4 has a lot of technology, but they don't want to make a deal… So the situation, the atmosphere got more and more tense. Then, when he finished his talks, he opened for questions, so I came to the stage and said: "Why are you saying that MPEG-4 is not a technological breakthrough, when I can show you here that we have something that is a breakthrough in MPEG-4 and it has better results than you have on *Mega* Media Player and it is still MPEG-4." [former CTO of Lamed]

This interruption aroused the curiosity of the other participants and made them want to know more about Lamed's technology. The chairman of the organization, who had been contacted earlier, also took notice of Lamed, and later introduced the company to the other participants as a developer of a breakthrough technology. He also gave the contact details of many large companies, which included Cisco, Scientific Atlanta and Philips, and of the

people who where in key positions in them, and allowed the CTO to use his name as a reference.

4.8.5 Attempts to enter into cooperation with various companies

In addition to forging foreign contacts, which were mainly American, Lamed started to make an effort to find development partners in Israel, where video compression and streaming was an emerging field among the high-tech applications that had started to blossom a few years earlier. There were several reasons why high technology was an emerging field in this small country. The wave of new immigrants from the former Soviet Union brought an abundant reserve of technically skillful employees to Israel, which already had strong technological knowledge due to its advanced military industries. The people in these industries who were being fired at the end of the 1980's used their accumulated experience in the military to start new companies on the civil side.

The CEO of Lamed was responsible for the contacts on the Israeli side, whereas the CTO and the business development manager were talking to the foreign companies. The total number of contacts was 20, and some went further than others. Lamed immediately started to use those it had made at the Las Vegas convention because it was racing against time: due to the fast growth of the development team the burn rate of money was high. It had to actively look for partners that would either pay for the development costs or who would assure the investors of the continuing financing of the venture.

Lamed's main contacts are shown in Figure 28. The Israeli companies that were contacted starting from spring 2001 are listed on the left-hand side of the line, and those in the United States and Europe on the right-hand side. The convention in Las Vegas was the real starting point for Lamed to reach out to companies abroad, and this intensive phase lasted until August 2001. After that Lamed tried to make more Israeli contacts, and also found some abroad. Some of them went further, but even they did not bring the desired results. These attempts to form a relationship are discussed in more detail below in order to illustrate the complicated process of establishing an R&D network for technology development.

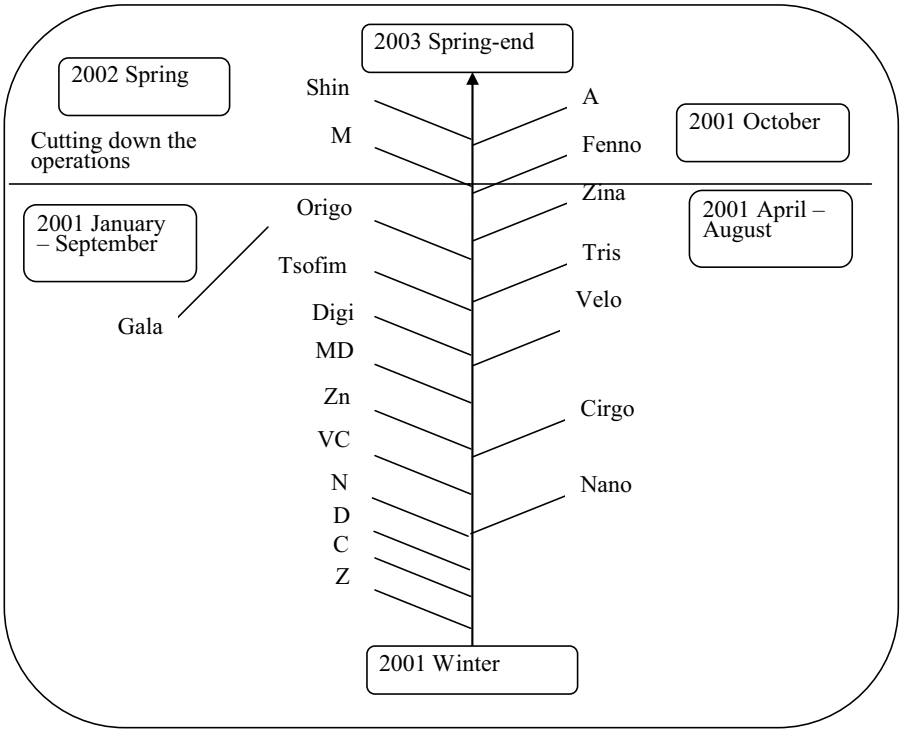

Figure 28 Lamed's main contacts during 2001–2003

Figure 28 reveals that the most active period with the Israeli contacts started in January 2001 and lasted for nine months until September 2001. The line in the upper part of the figure illustrates the turning point of the company in August–September 2001. After this point the contacts on the Israeli side were few in number. The main foreign contacts were made between April–July 2001, but there was also action afterwards in October 2001, when Lamed's representatives visited a Finnish company, Fenno. This visit did not offer the company any new opportunities either.

Nano

The first meetings were held during the Las Vegas convention, as the representatives of the companies were available there and had just seen Lamed's presentation. One of the interested parties was Nano, which is one of the largest electronics companies in the world. It is a producer of consumer electronics and security systems, and also presents itself as a leader in the field of digital technologies, including the video compression that Lamed was offering. Nano's technical and business representatives wanted to know more about Lamed's technology, and the business side was even more enthusiastic about it. The people the CTO was talking to asked specific questions

concerning possible difficulties that might emerge with the technology, and this gave him reason to believe that the company might be developing something similar to what they already had. The meetings ended with promises from Nano's side to keep in touch, but after about a month they indicated that they did not want to maintain the contact.

After the convention Lamed started utilizing the other contacts. The firms in the United States were approached in conference calls, initiated by one Lamed person based in New York, and the CTO in Tel Aviv. After this, the companies in the States started to show interest and wanted to see what Lamed really had, and how they could use the technology and put it into their own applications. The Israeli companies in the same field had also become interested after receiving proof of the concept in spring 2001. Lamed had made a CD showing that they really had the technology and that it was working. In spite of the interest of both large and small companies in Israel and abroad, this small firm found it very difficult to know in which direction to go to and with whom. It had the willingness to make a commitment to a certain application and a partner, but it lacked the knowledge about which one to choose.

> "And we thought, "We can do this one and we can do this one", but we didn't get to do what we wanted to do – to focus on one application. We started to do all kinds of things but we did not focus." [former CTO of Lamed]

Tris and Origo

At the convention in Las Vegas the CTO had obtained a contact for Tris, an American company that creates networking solutions for the Internet and provides hardware, software and service: it has 35,000 employees worldwide. This company was already a customer of the Israeli medium-sized company Origo, which was also operating in video streaming and was chosen by Tris because of its good-quality product. Lamed's algorithm raised interest because it was felt that if that technology were combined with Origo's offering it would provide Tris with an even better product.

However, since the company was already receiving a total solution from Origo, it could not immediately switch to Lamed. Lamed started to think about how they could provide a similar full solution with the hardware like Origo, or how they could perhaps cooperate and jointly provide a product for Tris. There were about five meetings between Lamed and Origo, and as a result Lamed started to plan cooperation with another Israeli company that was a partner of Origo. This company did not have knowledge of video compression since it was specialized in hardware. The negotiations failed, however. Origo made an offer for the technology and the team that had developed it, but this

was not acceptable to Lamed due to the conditions imposed that would have radically changed the position of the previous investors.

Digi

Digi was another Israeli company that was interested in the algorithm and it came close to a deal with Lamed. It wanted to have the algorithm on its DSP, or digital signal processor, which is a "chip" used in high-end TVs, stereos, TV cameras, answering machines and digital cell phones, for example. This would have given Lamed access to the many customers that would use the Digi DSP. The problem was, however, Lamed's lack of stability and its uncertain financial situation.

> "They were interested to do it, but they needed more time. The fact that we didn't have enough money did not let them…also make them not want to do it, because we are not stable..we were not stable… and it was a problem and I am sure that they felt it. And they stopped with us." [former business-development manager of Lamed]

Zina

The company faced a live-or-die-situation in July–August 2001. It was acknowledged that selling it was one option because it was not approaching the point at which it could sell its product. There were plans to go to another convention to Los Angeles in August. The booth had cost $30,000, but there was no money to prepare any material or to bring anyone from Israel to America except the CTO, who left with a piece of paper and his computer to give the lecture he had been asked to deliver. Again in the convention people showed interest in the technology when they realized what Lamed had. Even the BBC wanted an interview about this small company and the exciting situation of Mega pushing out MPEG-4 with a view to taking over the standard.

The convention resulted in some new contacts. One of these was Zina, a company that markets personal computers and communicating solutions worldwide. The Vice President warmly welcomed the CTO of Lamed, and expressed amazement at the progress of the company. He invited him to Zina for a meeting with the technical people. Postponing his return to Israel, the CTO flew from Los Angeles to San Jose to visit Zina. However, he faced a brick wall when he talked to the technology people. He felt that they had a problem accepting someone else's ideas about future technological developments. The manager who was supposed to come to the meeting, and who was the key player, suddenly found something more important to do and he just quickly passed by the room.

> "When I started to talk to the technical guys they got to a position that….even before I met them and showed them what I have, they had a bad attitude towards me. If they wouldn't have been obliged to meet me they would not have done it." [former CTO of Lamed]

The next day the CTO had a quick meeting with the original contact, the Vice President, and it was during that meeting that he learned why he had not been well received in the company. Thus far Zina had had its own proprietary technology for showing media clips, but since the MPEG-4 started showing signs of being a good future technology, the business people started pressuring the technical side to start looking for ways to utilize it. This was not popular with the technical people, who wanted to rely on their existing solution, and when the Lamed CTO came to present what his company had developed they punished him by ignoring his presentation. The meeting ended with assurances by the VP from Zina's side to do something about the problem. This would require time, however, which was running out for Lamed.

Tsofim

While the CTO was trying to work things out with Zina, another Israeli company was contacted since the investors were not prepared to wait for many months to see what would happen. A company that was focusing on end-to-end system solutions for the delivery of digital TV and data over broadband networks was interested in hiring the team and paying for that. The deal was almost closed, but Lamed asked for a few more weeks to think about it. Finally, in September 2001, they decided to accept the offer, but Tsofim had made other arrangements and was no longer interested in a deal with Lamed.

Lamed's difficulties culminated in July 2001, six months after the merger. The expected investment of $700,000 was not forthcoming in the end, and although this was not unexpected, it forced some of the people to leave the company. The hardware side ceased operations, and few people were left to continue with the algorithm. Meanwhile, a new investor was found and the company was able to continue. Finally, Lamed ended up deciding to target the security markets, since there seemed to be a need for low-cost cameras and digital solutions. Although there were a lot of options in traffic and ATM control cameras for example, Lamed decided to concentrate on low-end home security, but before that it considered the option of sending video through cellular phones. In October 2001, it contacted Fenno in Finland.

Fenno

After its change in operations, Lamed was still looking for new development partners. One possibility was Fenno, a leading Finnish mobile-phone manufacturer, and a meeting with its representatives took place in October 2001. Fenno's response was that it was not possible to use technology that still

needed further development. Lamed then started to look into cooperation with another Israeli company that was developing cameras, and which also had contacts with Fenno.

Fenno's representative was interviewed for this case study two-and-a-half years after the meeting, but he could recall nothing about it except the name Lamed. However, he did have something relevant to say about how start-ups come to present their offerings. He emphasized that for cooperation to begin a start-up had to offer resources that suited the purpose of the large company. In other words, the technology offered had to fulfill certain criteria. Primarily, if Fenno already had similar technology, the new offering had to show better performance, or its price had to be more competitive. In other words, the strategic positioning had to take place in terms of cost leadership or differentiation, and if this were not the case there would be no reason to accept the technology. It may be very sophisticated in itself, but its potential user-benefits may not be obvious. This applies in situations in which the start-up is providing technology that is too advanced, and which contains a component of uncertainty.

The technology was not yet developed into a readily usable form. The start-up may have conducted the basic research, but it did not have a product. This would stop any progress in the interaction since technology in the research phase was not interesting to Nokia. In this case, the start-up was directed towards the company's research unit, but another possibility would be to sell its portfolio of intellectual property rights. The manager's view, too, was that in the case of a systemic product, it would be preferable for the start-up to provide the whole system.

It was suggested that, in order to be able to target the needs of the large firm, the start-up should have pro-actively tried to form a holistic picture of its business as a whole, the volumes that are sold, and the size and the nature of the market. Knowledge is also required about the environment and the possible future directions of the industry. The start-up itself should have a clear view about what its own business logic will be in order to provide concrete suggestions to the large firm. Weaknesses have previously been observed in this area, mainly explained by the technology orientation of the start-up.

Entering a large organization can be challenging for start-ups because it may be difficult, if not impossible, to know how the decision-making structures are organized. They would need to find the right person with the decision-making power in the potential partner company, who would be able to take their initiative forward. The technology people in the recipient firm may consider the technology introduced by the start-up very interesting, but it may not be their primary aim to move ahead with it. People's busy schedules

may also bring any attempt to cooperate to an end, especially if the technology is not on the agenda for that particular year.

The impression that the representative of the start-up gives in the first meeting could have an impact on how willing the company is to set up another meeting, although it will not affect the possible end result of the partnership formation. Representatives are considered trustworthy, and there is a belief that the contents of their presentations of their technology give a true picture of what the start-up really has. Its references have significance in the beginning, strengthening the impression of a trustworthy partner. Getting the first deal done is crucial: if the start-up already has deals with other companies that may be competitors of Fenno, there is a greater chance that Fenno will be more interested in finding out whether the technology is something they should have, too.

4.8.6 Looking for a partner for the hardware

In fall 2001 the firm gave up its hardware development following the re-organization. Since the hardware was an essential part of the solution, however, and because a new investor would enable operations to continue on the software side, Lamed considered different options for acquiring the hardware, or the board on which the algorithm would run.

The most feasible option per item would have been in-house development, but this was discarded because Lamed had already invested 1.5 million dollars in the development of the algorithm. The second option was to find a partner and to cooperate in a way that would benefit both parties. This assumed a more concrete form at the beginning of 2002, when Lamed was contacted by Shin, a small Israeli company that was looking for a compression algorithm for its board. Shin was producing solutions for digital surveillance over IP networks, and it was about the same size as Lamed with its 15 employees at the time. The Shin solution had been used in applications at airports and railways, in city surveillance, on military campuses and highways, in energy and infrastructure facilities, and so forth.

The two companies started negotiating about cooperation and during the next few months Lamed had five meetings with several persons from Shin – the CEO, the chairman of the board, the VP of R&D, the board engineer and the salesperson. The discussions with the engineers convinced Lamed that the component, the board, was suitable, and that the company could meet the requirements it had set. Shin also wanted to check Lamed's algorithm for the same things.

> The motivation to work with Shin was that of course we can buy let's say the board… If we develop the boards ourselves then the boards will cost us 200, only the cost of materials and the integration and it's about 200 dollars. But it is better to buy them at about 500 dollars or even 700 from Shin, because they first did the development, which is a lot of investment to develop that board. And for Shin the motivation to work with us…means better compression. [CEO and founder of Lamed]

What was beneficial to Shin in this deal was that the quality of its product would be improved on account of the algorithm that had been developed by Lamed, and that it would get better compression. It benefited Lamed that Shin had already invested in developing the board, and Shin that Lamed had done the same thing with algorithm development. The deal with Shin was such that as soon as the board supplier found customers, it would pay royalties to Lamed for the algorithm. If the Lamed solution was sold later on with the Shin board on it, the company would get the price of the board and a certain percentage of the price at which it was sold. The difficult issues encountered in the negotiations concerned the pricing of the board and the software (algorithm), and how to deal with the intellectual property rights. Marketing was also discussed, and uncertainty prevailed concerning the future customers. The aim was to finish the project by the end of the year 2003.

Although Shin supplied Lamed, the two were, in fact, competitors. This project would clarify this competitor status, since as a result Shin would have an improved, more competitive product in the market that Lamed was targeting. In normal circumstances there would have been minimal cooperation, but because times had become really hard in Israeli high-tech markets it was necessary.

> "Of course each side knew in the bottom of their heart that we are competitors and we should kill each other, we put that aside, we said, we are not competitors, we are doing boards and we are doing algorithm. We found the way to join to… I tell you what. If the situation in the market was not the same like now, when it is harder to sell and harder to get investment, we will never talk. Absolutely, we were completely competitors. But sometimes, when it's hard times it makes people both soft. Just companies like people. And they find the way to join together to help each other. And actually we really found the way to help each other. " [CEO and founder of Lamed]

Lamed knew that, given its small size, Shin would not have the financial or human-resource capacity to build its own compression algorithm then or in the near future, and that it would be a long time before they would compete on the algorithm side. Shin had similar thoughts about Lamed, and this alleviated the competitive aspect of the cooperation. The trust that was built up gave Lamed the confidence to be open with the competitor about what it was doing. This would not have been possible with a larger company, which could have had

too close a look at the core competence of the smaller company and, with its resources, would soon have been able to come up with its own solution. In this case the benefit that the companies derived was bigger than the risk of giving information to a competitor. Lamed felt that, in this situation, it was thus much easier to initiate cooperation with small companies, which were more certain about what they could do from the beginning and there was more flexibility in the business relationships.

Contrary to expectations, the negotiations with Shin also failed, since the small company was not willing to pay what Lamed asked for. This was discussed in what was to be the last meeting between the companies, at which point the story of Lamed was more or less written. At the same time as the negotiations with Shin had been going on, Lamed had also approached a party engaged in military research and development in its search for financing the development of the algorithm for military use. However, there was no longer any money for this kind of project and all hope of continuing operations at Lamed was abandoned during the spring of 2003.

4.9 Case analysis

The fourth case network was different from the other three because the actor taking the mobilizing action did not succeed in establishing relationships with companies representing software and hardware developers. Thus, the purpose, which remained unclear even to the initiator, was not fulfilled either.

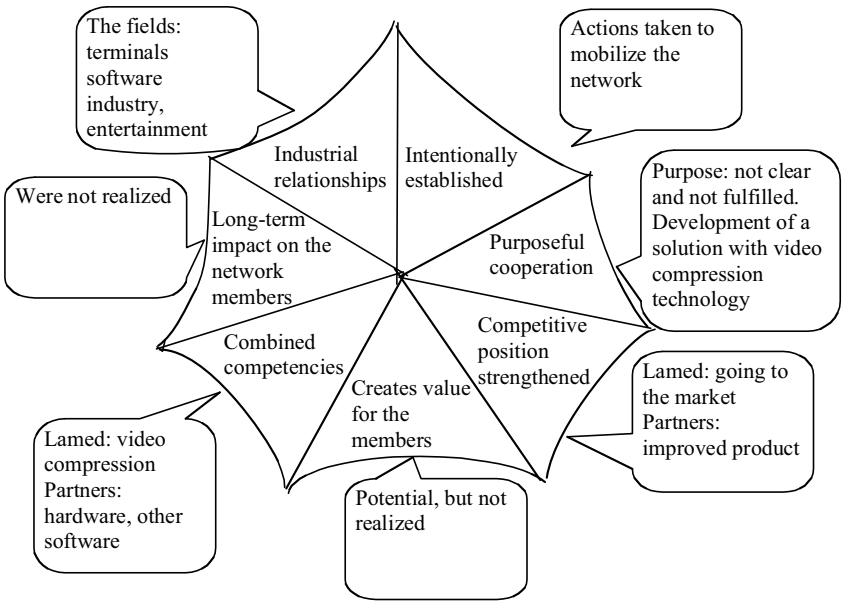

Figure 29 The nature of the video compression development case as an R&D network

It is clear from Figure 29 above that the network had the potential to create value for the actors involved. It could also have strengthened their relative competitive positions – or in the case of the start-up have even established it, but this did not happen due to the problems that occurred in the network formation. These problems are further discussed in the following case analysis.

4.9.1 The circumstances for value-creating cooperation in the network

On the *technological, industry and market levels the circumstances* were strongly influential in this case. The technology that Lamed was developing was innovative and its development required lots of funds. Cooperation would have provided the means not only to finance the development but also to transfer the knowledge. The innovative nature of the technology was also an obstacle in the network-mobilization phase. Lamed experienced that the potential partners were not sure how it could be utilized in reality, and although there were all the features of a breakthrough, this did not mean that the market was ready for it. On the market level, uncertainty was increased due to the fact that Lamed still did not have a product. The technology people

could identify the potential problems related to the technologies, and the business people were not able to evaluate the opportunities at that point.

On the *industry and market levels the circumstances,* and the uncertainties surrounding them, were in the background when Lamed was planning the network formation. Partnering with companies that could use its technology would open up a marketing channel. The uncertainties in the environment were also a significant hampering factor. When Lamed was founded times were not the best for high-technology companies due to the crash of the dotcoms that had taken place just a little earlier. Enthusiasm, investment and speculation had risen and fallen in line with the stock prices on the Nasdaq during the first Internet wave. This negatively influenced the atmosphere, and it was not only the small companies that were in trouble: the collapse of hi-tech industries in Israel and worldwide also brought hard times to the larger companies.

Lamed found that the large companies were suddenly uncertain about starting new relationships and entering into alliances due to the drastic downturn in the market. They were not able to forecast which projects or products would survive the fall, and their response was to put every new venture on hold. The level on which the decisions were made was raised: everything had to be approved by the top management. The aim of the companies was only "to keep their heads above water". On the *company level* cooperation became a strategic choice for Lamed when it had to give up the development of the hardware. The company felt under pressure to finalize the development in a short time, which made it rush to look for partners that could provide the financial resources.

4.9.2 The potential value from the relationships

The potential value Lamed would have wanted to derive from the network was both direct and indirect, *cost/time* being the most important of the direct functions, although the *market function* would also have created significant value. Its partners would have enjoyed *good product performance and strengthened competence*, both of which are direct value functions.

Lamed could have provided its potential partners with an innovative technology, but it lacked the money to finish the development. Given the difficult situation they were facing themselves, they were not able to provide the required financial help either. *Time saving* could have provided value for the members in the potential network, as duplication could have been avoided if the development efforts of several companies had been combined. This was especially obvious in the attempts to cooperate with Shin. The innovative

technology could have been perceived as a window to the developments in the field, which refers to the scout function.

There appeared to be remarkable value potential embedded in the *market function*. As Lamed's compression technology would have been incorporated into another company's offering, the start-up would not have needed to worry about marketing the product as such, as it would have had to do if it had offered its own full solution. Thus it could have saved its own marketing effort if it had been able to negotiate a deal with one or several companies in the first place. In general, cooperation with large companies could have taught Lamed something about the market, and value could have been created through the scout function. References obtained from cooperation with large companies would have opened new doors for Lamed and its future business, depending on the type of deal negotiated with the first partner: close cooperation with one large company might have excluded selling to others.

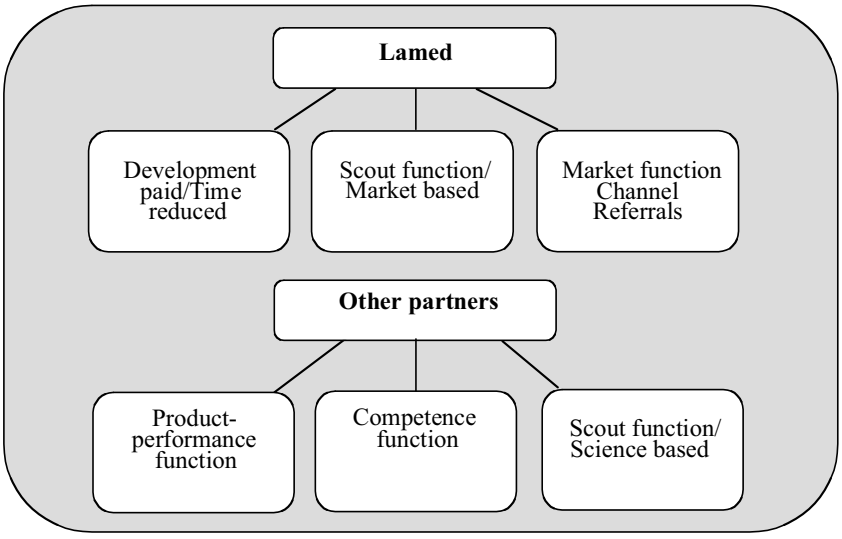

Figure 30 The potential value from the network for Lamed and its potential partners

The potential value that Lamed and the other companies envisaged is summarized in Figure 30 above. In comparison with the other case networks, it is noticeable that the value functions are fewer in this case. To some extent, this was a direct consequence of the fact that the network was never fully realized. Due to its relatively recent establishment, Lamed did not have previous business relationships, and safeguarding was thus not a relevant value function. Internal access to new projects with new customers was also off limits since Lamed had nothing else to offer except its video compression

technology. It was technology that interested the likely partners with its potential to improve the quality of their products, but because of the half-finished development work, the venture carried too many uncertainties. These potential development partners might also have been able to internalize the competence of Lamed.

4.9.3 Managing value creation in the network

Mobilizing the network

The *mobilization* of an R&D network, in other words finding fitting partners and forming the network structure, seems to be an especially challenging task for a start-up company. It has to be formed in an *engineered way* due to the lack of a previous business history and relationships. This would require a strong core company with a strong vision about the future direction, and the necessary resources to carry out the partner selection. In this case, these conditions were not fulfilled, and in spite of the many potential partners approached and meetings held, from Lamed's point of view the mobilization did not lead to any successful results. The company was new in the market, which implied that it did not have any references that could have encouraged the potential partners to take a closer look at its offering.

The times had changed and the companies were not willing to commit themselves to potential opportunities: they wanted to have something concrete. Therefore, although they were impressed with the technology, the answer many of them gave to Lamed's inquiries about cooperation was a recommendation to turn to them later, when there was something more solid than just a demonstration to be seen.

It is a time-consuming process for companies to enter into a contract and to develop relationships. One of the possible reasons why Lamed's cooperation attempts failed was that progress in the negotiations was expected in too short a time. Reserving time for waiting patiently for things to develop with the other companies was not easy, partly because of the pressure being exerted by the investors. On the one hand, they clearly saw the potential and were convinced that it could succeed. They were also very pleased when contacts were made with large U.S. companies. On the other hand, however, the investors were afraid that it would be a long time before Lamed had something to sell and before they would get a return on their investment. They therefore started putting on the pressure in order to have something very quickly. The money started to run out after the Las Vegas conference, and getting more depended on the contacts with other companies. This put Lamed in a very difficult situation, since it was not possible to focus under pressure, or to

respond to the demands of the investors. The potential partners probably felt this pressure, too.

Another problem was that it was probably not always the right people that were contacted, especially in the large organizations: it is more likely in small companies that the contact persons are the ones that have the decision-making power. Furthermore, as a small and newly established company, Lamed did not have the capabilities or the resources to handle business relationships with potential cooperation partners. One solution to this problem would have been to take someone from the outside to help in establishing the relationships.

Visioning the network

Visioning the network, mapping the future of the technology, and finding the business opportunities was also tricky for the start-up. Firstly, it used outside help in creating a business plan and turned to a consulting company. The complexity of the information and communications technology sector makes it a very challenging playground and no one person can master everything within it. This was probably one reason why Lamed found that the consultant could not give direct advice on focusing its business and building its strategy. The lack of focus was reflected later in each of the contacts in that it was not possible to create a clear picture of what the network would be like in the end, or of what the goals would be. Later on, this also had an impact on its attempts to enter into cooperation, since its potential partners could not help a start-up that was lacking a vision.

These partners did not want to divulge their long-term product-development plans to Lamed. For this reason, they gave no clear indication of what they would like to do with the company and the technology it would give access to, and only wanted to hear Lamed's opinions. This caused confusion, since Lamed itself did not have a clear view of what it should offer.

The theoretical framework of this study does not directly cover the factors that lead to failure at the network-formation stage, although it does offer some suggestions concerning partner selection. Given the results of this last case, however, it is possible to specify certain factors related to network management and the circumstances that contributed to Lamed's failure in this respect. The problems it faced demonstrate the importance of the management function and the related circumstances in forming R&D networks. The findings, which are summarized in Figure 31, could thus be highly relevant to firms similar to Lamed, which further justifies the inclusion of these factors in this study. Firstly, Figure 31 includes factors that relate only to Lamed, such as the lack of a clear strategy and of knowledge about the potential partner. It also includes partner-related factors such as the uncertainty about the right persons reached and the lack of time to concentrate on assessing Lamed's offering. The bad atmosphere in the market, as well as technology-related

aspects, affected both sides. As far as Lamed was concerned, the major factors that prevented the network formation were its lack of a clear strategy and the problems it had to envisage due to its limited knowledge about its potential partners.

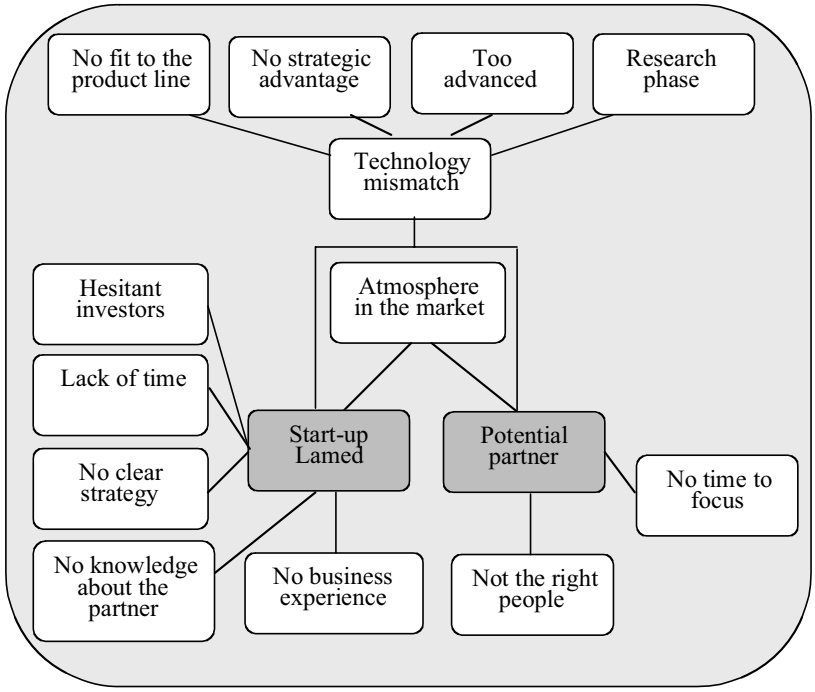

Figure 31 The factors affecting the failure to form a strategic network

Strategizing in the network

Since the network was never formed, there was no strategizing, and one can only draw inferences about possible goals. Again, the basis for strategizing would have been Lamed's clear goals and its plans for achieving them. The company did not have a clear strategy in terms of what it could offer to other companies in the negotiations, however, nor did it have the time to find out how compatible the profile of the potential partners was in terms of its possible future direction. Thus, understanding the partners' strategy would have facilitated the making of offers and the achievement of concrete results.

It is not necessarily easy to find out the views of other companies concerning their future and thus to draw clear conclusions about their strategy. However, continuous screening of the environment and following the trends in the field should be enough to give at least some indication of the future directions of potential partner firms. Lamed should have put more effort into

determining the real needs of each company and its customers. If it had had a better understanding of their position it would have had a more solid basis on which to make suggestions concerning the cooperation.

The unstable financial situation of the company was a hindrance for many potential partners. Following the end of the economic boom investors had become more cautious about supporting new ventures. In this case their decision to continue financing Lamed's research and development depended primarily on its performance with its potential partners. When attempts to mobilize the network failed, it had to find partners to pay for the development if it was to continue its operations. When these attempts failed the company faced a dead end.

5 CROSS-CASE COMPARISON

The aim of this study was to describe the nature of R&D networks as intentional value-creating systems, and to accomplish this aim by means of a case study. The four cases investigated formed two case pairs, which are now compared in order to find the similarities and differences. In multiple case study research theoretical inferences can be drawn through analytical generalization (Pauwels and Matthyssens 2004, 124). The results of the comparisons will reveal patterns of value creation and management that are linked to each of the networks, and will justify the assumption that similar patterns could be found in other networks. For ease of comparison the cases are grouped according to the contents of the cooperation, and to the technology-, company-, industry- and market-level circumstances that surrounded the development.

The first case pair had goals related to the development of an e-banking and financial information system, and the second concentrated on developing embedded software for digital video solutions. The circumstances in the former could be characterized as something between those of stable and established value systems, although elements of emerging value systems also emerged. The circumstances of the second pair had more features of the emerging value system as a whole (Möller and Svahn 2003, 207). The following sub-chapters describe the differences in circumstances between the two pairs. Following a general review based on Möller and Svahn's (2003, 207) model of different value systems, certain issues are addressed. The kind of circumstances that trigger actors to seek value through network cooperation are described, and then the type of value created through the network is discussed in detail. Thirdly, the focus turns to how value is managed in networks and, more specifically, how the value system determines the network-management requirements.

5.1 Circumstances for the R&D networks

The value-system construct of Möller and Svahn (2003) consists of stable, established and emergent systems. The model was condensed in this study so as to comprise only two opposing value systems, as it is suggested that the first two, stable and established, are similar enough to be discussed in

combination. Characteristic of both is the slow pace of technological change. The actors and their offerings are basically known. The networks consist of various business actors jointly pursuing improvements in their business processes rather than focusing on new products, although incremental and local improvements may also take place. (Möller and Svahn 2003, 206.) Both systems could be said to correspond with the transitional and mature phases of the product life cycle. It is during these phases that incremental and business-process improvements take place, and technological and market uncertainty are reduced (Abernathy and Utterback 1978; Roberts and Liu 2001, 28). According to Möller and Svahn (2003, 205), this reduced uncertainty makes the value system more manageable.

Emerging value systems face radical changes as new activities are created to complement and replace the old ones. Accordingly, new actors appear to compete with the existing and known actors, who have to learn to envision the future of the changing arena. Uncertainty is very high because offerings and markets cannot be unambiguously defined, and this further complicates the network management. (Day and Shoemaker 2000; Moriarty and Kosnik 1989; Möller and Svahn 2003, 207.)

The following sub-chapters discuss in detail how the characteristics of the value systems appeared in each case network. The evidence drawn from the case studies shows that the suggested framework and the related circumstances did grasp the differences between the networks. New actors with new offerings face more uncertainty than companies that have been in the market for years, or even decades, with known offerings.

The networks do not represent only one value system, however, since sometimes the mixture of companies represents both ends of the continuum. However, a starting point in this study was the newness of the technology for the actors concerned, and its impact on the development and on the network members. This implies that similar technology might already be on the market, but not necessarily targeted at the same customers that the focal network is targeting. Moreover, although the project may be large and the improvements radical as far as the developers are concerned, as in the e-banking case A, it may not radically change anything for the end-users since the functionality of the product remains the same. On the other hand, with a radical innovation, the way the end customer experiences value in the end product may also radically change in a positive way, such as if there is a substantial improvement in quality, or if it is a product or service that did not exist before.

5.1.1 Stable and established value systems

The circumstances in which the e-banking solution and the financial information system were developed represented stable and established value systems (Möller and Svahn 2003, 206), and this gives reason to deal with both cases as one entity. Of the two industries concerned, banking was stable and IT services established: their services and products were known and the actors had been on the market for decades. The technology providers in both cases were more representative of the emerging value system given the nature of their new technology products (Möller and Svahn 2003, 206). However, the stable and established value system characteristics dominated, since the actors displaying them had more significant roles in the development projects. As far as the users of the e-banking and financial information systems were concerned, the changes that took place were incremental as the solutions with new features replaced the old ones. Thus, another indication of stability was that the market already existed and the users did not need to adapt very much to the change that the new solution brought about: they just continued as before.

The actors operating in this stable and established value system were known not only through their market offerings and established positions, they were also familiar with each other because of their earlier business relationships. The technology suppliers, representing the emerging value system, joined the network as new members. However, in spite of the familiarity between the customers, the bank and the purchasing organizations, and the IT suppliers, cooperation on this scale was new for them: the focal project was very large. In the e-banking case it was carried out according to a new model since the IT house was not only running the development project, it also shared the outcome with the customer.

On the *industry-market level* the triggering factor for the mobilization of network A was that the Internet had become a popular delivery channel for e-banking services (Karjaluoto 2002, 27; Pankkivuosi 2002). The number of Internet users willing to accept the new way of delivering banking services had increased steadily. The large investments in information systems that the banks had made earlier had facilitated the development of e-banking, as had the appearance of an innovative technology platform on the *technological level*. At the same time, the newness called for the acquisition of expertise from outside as far as the bank was concerned. *On the company level* the decision to cooperate was related to the bank's chosen path to outsource IT activities rather than to strong environmental pressures. Moreover, the internal events on the Nordic level made the project necessary: following the merger the banks in all four countries needed a unified solution.

The triggering factor on the *industry and market levels* in case B was the observation by the purchasing organizations that the Internet had become an important tool. Their aim in moving their services to the Internet was to increase the operational efficiency of the financial information system among the internal users (Maurino, Pernici and Schreiber 2003, 79). By following the observed trend they projected a more sophisticated image about their operations to their external users and provided easy access to the information services: enabling the stakeholders to see their financial status on-line was one example.

An influential factor on the *technology level* was the dispersion of the knowledge among different organizations. Bringing this knowledge together required network formation. On the *company level* the triggering factor was similar to that in the e-banking case in that the purchasing organizations had decided a long time previously to outsource their information-system development and maintenance to a partner: it was not from the industry or market level that the pressure to start this particular project came.

5.1.2 Emerging value systems

The circumstances of the second case pair could be likened to the emerging value system, although to some degree the actors concerned were in transition from an established towards an emerging system. In other words, on the *technological and industry-market levels* the main circumstantial triggering factor in cases C and D was a jump to new-generation technology. In the broadcasting industry the digitization of the systems created new markets for the cable operators. In practice, in case C this implied that the actor had to be prepared to move from analogue technology to the new-generation digital video technology during the discontinuous technology life-cycle phase, which was added by Utterback to the original three-phase model developed by Abernathy and Utterback (1978) (cf. Roberts and Liu 2001, 26).

On the *technology level* it was the systemic nature of the products that influenced the mobilization of the network; the different parts of the system could be developed separately by different actors (van Tulder and Junne 1988), and the high costs of the development (Dodgson 1992) motivated the firms to cooperate. In case D, cooperation was an efficient way of transferring knowledge that, as is typical with high technology, was tacit and therefore required face-to-face interaction.

On the company level the strategic decision to cooperate was directly influenced by environmental pressures: cooperation was necessary if competitiveness was to be achieved and maintained. The resources that the

companies in these networks had to acquire from outside were valuable, rare, inimitable and non-substitutable, which reflects the resource-based view (Dyer and Singh 1998; Eisenhardt and Martin 2000). Thus, it could be concluded that cooperation is more of a necessity than a voluntary choice in emerging value systems, which clearly distinguishes these circumstances from those of companies operating in stable and established value systems.

5.2 Creating value in the strategic R&D network

This study revealed some interesting points about value creation in strategic R&D networks. The assessment was based on earlier models of value creation in supplier-customer relationships (Möller and Törrönen 2003; Walter et al. 2001). These models guided the analysis, but the R&D context necessitated two kinds of modification. Firstly, some changes were required in the value-function definitions that were taken from the old models: the direct value functions of profit/costs/time and volume, and the safeguarding function, and the indirect functions related to access, the market and scouting. This was illustrated earlier in Figure 6 (Möller and Törrönen 2003; Walter et al. 2001). Secondly, based on the empirical findings, two new value functions, competence and product performance, which emphasized the nature of the exchange in R&D cooperation, were added to the previous set.

Moreover, the value created was assessed from the perspective of multiple actors and not on the dyadic level, as in existing studies (Möller and Törrönen 2003; Lapierre 2000; Ravald and Grönroos 1996, Walter et al. 2001). The abductive logic that was followed allowed the flexibility to adapt the above-mentioned models to this study based on the initial empirical findings and their interpretation in the chosen context.

The existing literature distinguishes between direct and indirect value functions. The direct functions include *profit/cost/time, volume and safeguarding* in the original model, and the indirect functions include *access, market and scouting*. The *profit/cost/time function* refers in this study to profits made, costs saved and time reduced as a result of cooperation. The increased volumes following the start of cooperation may lead to concessions in prices in the related supply relationships, which represents the *volume function*. Value is created through safeguarding if companies start to cooperate with a view to continuing the relationship in the future. The indirect value functions were also modified slightly. *The access function* is divided into external and internal access. External access creates value in that network members can use their partners' contacts to bring in new members or to facilitate the development work with these contacts, while membership in a

strategic R&D network can create value at a later stage by providing access to new projects involving the same or different members. *The market function* creates value through marketing channels and the references that can be obtained if the cooperation partners are prestigious. *Scout function* provides information about markets and technologies through cooperation.

The findings of the study support the addition of two new direct value functions*, competence and product performance*, to the existing models. Firstly, the literature on alliances and networks emphasizes the role of these cooperative arrangements in gathering new knowledge for firms, that then use that knowledge, in combination with other resources, to benefit beyond the scope of the cooperation (Alvarez and Barney 2001; Madhok and Tallman 1998, 329; Wu and Cavushgil 2005). Thus, cooperation may support the *internalization* of the partner's competence. A company may start cooperation and enter the network with a strong learning intention (Wu and Cavushgil 2005), which implies that learning and knowledge sharing are key motivators in alliance or network formation (Das and Teng 2000; Powell et al. 1996). One danger with R&D cooperation in particular is that some firms may try to derive private benefits and exploit their partners' resources, especially technological knowledge, without the consent of the original owner. This may result in a shift in bargaining power and the rapid dissolution of the relationship (Inkpen and Beamish 1997; Wu and Cavushgil 2005).

In spite of the risk of exposing too much information it has been suggested that firms with experience are in a better position when cooperative know-how is being developed (Simonin 1997; Wu and Cavushgil 2005). The unwanted internalization of competences that comprise embedded and tacit knowledge can be also held at bay in short-term projects because it requires the development of close and long-term relationships (Tidd et al. 2001, 233–234), and it is sometimes enough to access and acquire the necessary competence (Tidd et al. 2001, 232). If companies are only interested in access, the network relationships may be of the arm's-length type. Learning intention is lower, and it is more efficient to transfer migratory and explicit knowledge in short term-projects. It is then more likely that companies are only strengthening or complementing their existing competence with their partners' skills and technologies, and not absorbing them.

Support was found for adding the competence function in all four cases, which means accessing and making use of the resources of the network partners in order to carry out the project. Basing his arguments on those of Håkansson and Snehota (1995), and relating them to his competence-evolution framework, Seppänen (2000, 46) strongly suggests that corporate resources should not be viewed as given entities, and that it is only the use of the entity that determines whether they are resources or not. It is also noted that the

resources are both results and conditions in the R&D world (Seppänen 2000, 46). This means that firms start R&D cooperation because they want to utilize the competence, which can also be created and developed concurrently within the relationship (Seppänen 2000, 192). This study revealed a difference in how the competences were treated after they had been accessed: the skills and technologies were simply *acquired* (Tidd et al. 2001, 235) and used in the focal project, or they were *internalized* through the learning that took place in the network relationships (Madhok and Tallman 1998; Wu and Cavushgil 2005).

The literature on value creation in interorganizational relationships and the findings of the four case studies also support the addition of a product-performance function into the value model. Several researchers suggest that when transaction-specific and firm-specific resources are bundled, it can lead to cooperation-specific, common benefits. The synergy that follows the bundling promotes a level of accomplishment that the partners are unable to attain without the cooperation (Khanna 1998, Madhok and Tallman 1998; 329). In the context of this study, this refers to the outcome of the cooperation, and it could be interpreted to mean that the cooperation has a positive impact on product performance. Performance in this context relates to some quality of the end product or to the quality of the development process. Thus, the *product performance function* emphasizes the value that is drawn from cooperation in situations in which the partners join forces to provide a product that performs well. This may have an impact on the added value related to the product experienced by the end customer: quality and customization; service; flexibility, reliability and technical competence in the relationship; the image of the supplier; and trust (Lapierre 2000, 125). The definitions of the value functions are reviewed in Table 8.

Table 8 The value functions of the study

Value function	Definition in this study	Based on:
Profit/costs/time	Profits made through cooperation Costs saved through sharing Time reduced through cooperation	Walter et al. (2001), definition modified
Volume	Increased volumes as a result of cooperation – concessions in prices in the supply relationships	Walter et al. (2001)
Safeguarding	R&D cooperation aims at maintaining the existing relationship	Walter et al. (2001), definition modified
Competence	Skills and technologies acquired and internalized through the network	New function
Product performance	A superior product as a result of cooperation	New function
Access	External: access to suppliers etc. through the network Internal: expectation of continuing cooperation in the future	Walter et al. (2001), Möller and Törrönen (2003), definition modified
Market	Cooperation provides a channel and references	Walter et al. (2001), Möller and Törrönen (2003)
Scout	Cooperation provides information about markets and technologies	Walter et al. (2001), Möller and Törrönen (2003)

5.2.1 Value creation in networks operating in different value systems

Value creation in R&D networks operating in stable and established and in emerging value systems seemed to differ to some extent. One basic difference was that in the former the actors could apparently better foresee which functions would create the value. The reason for this lies in the nature of the value system: it is well defined and the value activities and actors are basically known (Möller and Svahn 2003, 207). According to the IMP view of value creation, relationships have value because exchange between the different actors becomes predictable and reassuring as the actors learn how they each organize their business operations (Lindegreen and Wynstra 2005, 739). Thus,

the clearer value perception in the case pair that developed the e-banking and financial-information systems was a result of the increasing familiarity between actors in long-term relationships with each other, who knew what each one was able to offer. Familiarity does not exclude the possibility of discovering new value-creation opportunities, however.

Value perceptions are more vague at the beginning of or prior to cooperation in the emerging system. Again, this may be connected to the undefined nature of the value system and the unknown value activities and actors, and to the related technology and market uncertainties (Day and Shoemaker 2000; Moriarty and Kosnik 1989; Möller and Svahn 2003, 207). Companies that plan cooperation in emerging value systems are not necessarily familiar with each other, which is natural if they are newly established technology companies. They are therefore not fully aware of each other's resources, or of developments in the industry and the markets, and this makes value perception more complicated when the network is mobilized. On the other hand, value-creation opportunities may arise during the period of cooperation, as the network members perceive new ways in which they could be of use and what they could ask from others. For example, the help the supplier in case C gave in establishing new supply relationships was not completely planned for in the mobilization phase.

It was obvious that direct benefits, i.e. competencies accessed, profits made, costs shared or saved, and development time reduced, and the quality of the products developed in the network, were emphasized in both value systems. However, there were some differences in the *criticality* of some value functions, and in how the functions were *manifested*.

The findings suggest that access to the network members' competence was fundamental in each of the cases, and it was expected to create value in them all for certain members. It was only in case D, in which the small company failed to assure its potential partners that its competence was worthy, that value was not created through the competence function in the end. Naturally, saving costs and time, and acquiring a good-quality product, were closely related to the competence function.

Access to the partner's competence in case C with its emerging value system was fundamental for the customer, who thus did not need to develop the required competence in-house: it only had to combine its own and its partner's competences in order develop a competitive digital video solution for the emerging markets. Later on, cooperation led to the internalization of the competence of the smaller partner, which is a typical risk in cooperation between small and large firms in emerging value systems (Alvarez and Barney 2001).

In the stable and established value systems the competence of the partners created value for the network members through acquisition rather than internalization (Tidd et al. 2001, 235). Internalization may take place to a certain extent if the parties are cooperating closely and useful knowledge is available or has been created (Madhok and Tallman 1998), but learning was not the rationale behind the network mobilization (Das and Teng 2000) for the actors in these highly specialized and customized IT-development projects. Partner competence is critical for value creation in stable and established value systems, but for different reasons than for the companies in emerging value systems. In the latter the competence is critical in establishing a position in the emerging market, while in the former external competence replaces or complements in-house competence and supports the existing business.

The cost/time/profit function created value in a similar way in the different value systems. Costs and time were saved from the point of view of the customer in case C, with its value system. Duplication of development effort was minimized as the small technology company already had a video streaming solution. Consequently, this led to a shorter time-to-market with the digital video solution. The cooperation also carried profit implications for the small company: the incentive to start it was financial. In the cases with stable and established value systems the source of the cost savings was the cost sharing, which in the e-banking case involved the bank and the IT house. With the development of the financial-information system it was the group of customers, the purchasing organizations, which shared the costs. In both cases it was about avoiding duplication. The banks in the Nordic countries could share the e-banking system and there was no need for each country to develop its own solution. Sharing the development costs with the bank enabled the IT house to have a product, too. The purchasing organizations also avoided duplication, since instead of running five separate development projects they only needed one.

In all of the cases, the resources of the network members created value through the product-performance function. In the cases with a stable value system the skillful employees could ensure the smooth progress of the projects and the quality of the outcome. As suggested by Tyrväinen et al. (2004, 16), recruiting and managing highly skilled personnel who could guarantee the quality of the development is a key success factor for firms developing customized software. In case C with its emerging value system the video streaming solution provided by the smaller technology company helped the customer to bring a high-quality system onto the market, although given sufficient time and costs the customer could have produced a similar outcome in-house. Further, the innovativeness of the video compression technology in

case D could have improved the quality of the products of the potential partners if cooperation had started.

Safeguarding as a value-creating function with the aim of securing existing relationships in the future was only related to stable and established value system networks, since the relationships in the emerging value systems were newly established and the aim of R&D cooperation was not to strengthen the existing ties. The relationships between customers and suppliers were established in the former, and the suppliers as more dependent parties wanted to safeguard them and to be certain that they would continue. This was crucial because of the fierce competition in the services they were providing (Hoch et al. 2000). For the same reason, the case suppliers had higher value expectations concerning the indirect value functions.

In the e-banking case in particular, the IT house was hoping for internal access, which means that it expected the current project to be a key to new projects with the same partners, or at least with the same customer. Again in case C, internal access was realized from the point of view of the partner-supplier because the satisfied customer was willing to continue the development for some years. Here, external access, which refers to the contacts that network members may have with external parties that could join the development or facilitate it, created value for the customer. The customer was able to broaden its supply base easily due to the existing relationships of its development partner. For the same reason, these relationships also provided the customer with an easy and a less costly way out of a lengthy certification procedure involving the provider of the noise-reduction system. The access to the supply network certainly brought extra value to the supplier, but the competence function was naturally considered more important.

The suppliers in cases A and B expected value through the market function in the form of references. Firstly, the reputation of a prestigious partner was expected to facilitate the marketing of the e-banking product that had been developed in network A. Due to the good reputation of the bank in the field of e-banking this could be considered a relatively important value function. Secondly, the solid reputation of the customer group as such in case B was seen to strengthen the image of the developer.

The smaller technology companies with emerging value systems expected the cooperation to give them indirect value through the market function by opening up a marketing channel. The other dimension of the market function, references from the customer in case C, could not create value for the supplier in its other business relationships because the customer did not divulge who the supplier of the subsystems in the systemic product was (Teece 1998). Instead, the supplier was able to use the solid reputation of the customer-partner to influence the pricing decisions of its own suppliers.

On the evidence of the case studies, it seems that the role of the scout function, in other words providing information about markets, technologies and related knowledge, is more closely related to the functioning of networks that are developing technologies for emerging markets. This is in line with the results of earlier research, which also suggest that small and newly established companies have the motivation to cooperate with large companies in order to obtain market information (Blomqvist 1999, Roberts and Liu 2001). However, the reverse is the case with science-based knowledge: It is usually the small technology company that delivers details about its technology and how it functions to the large company (Alvarez and Barney 2001, 141). It is suggested that, if internalized by the partner, this knowledge will become part of its competence.

5.2.2 Time and value creation

Given the case findings, it is possible to draw some conclusions about the link between value creation in the R&D network and time. Although change is considered to be an essential feature of networks, the approach was retrospective in this study because the development project had ended or was about to end. The idea was to get an idea of the nature of the value that had been pursued, of the circumstances that drove the actors to set up the networks, and of how they were managed.

Only the empirical work revealed that, in spite of the short-term duration of such networks, some change takes place in the value perceptions of the actors. Other studies suggest that value is a dynamic and interactive phenomenon that changes over time, particularly in *long-term relationships* (Forsström 2005, Möller and Törrönen 2002; Ravald and Grönroos 1996; Walter et al. 2001). Some observations about the impact of time could be made in this study too, concerning the relationships that were short-term and that were established in the R&D context. The case networks were mainly mobilized for projects, although some of the relationships in them had been established earlier. The value – time relation was crucial in the form of the time frame in which the value was expected: some of it was clearly future-related and it had certain characteristics. Furthermore, some change in value perceptions occurred even during the project.

In the chosen cases, the majority of the firms in the networks expected to benefit from the cooperation during the focal project, but also later, for an undetermined period of time. The value expected during the project could be measured more exactly than the value that was expected in the future. The companies knew exactly which competencies they could access, how much

they would be paid, and how the project would increase their volumes. The value to be obtained through future cooperation could not be very well defined, and was more often indirect than direct – although indirect value functions in the end naturally also aim at creating direct value. Statements such as, “We might have the opportunity to continue cooperation with them in the future”, “This project may open the door to new projects for us once that we know the customer well”, “Their reputation may help us to sell the product” and, “The partner may recommend our products to new customers” reflect the nature of the value that might be realized in the future. The impact and realization of these indirect functions was not known at the point of time at which the network was mobilized, or even when it ceased operations.

A change in value perceptions over time was also observed in some cases. In other words, there was a gap between what was expected and what became the reality, in both a positive and a negative sense. For instance, one customer in case B was dissatisfied with the product performance, and felt that it was not what the partner had promised. The opposite happened in case C: the satisfied customer-partner was willing to continue its cooperation for several years. Relational value, referring to the sum of the value functions, is thus cumulative and becomes visible in the course of time, both during the project and after it.

It was not possible to run follow-up interviews covering all the expectations that the partners had concerning the value that would be created indirectly in the future, for example through the access function in the form of new projects. There was also a measurement problem related to some of the functions: referrals and recommendations may be helpful with new customers, but they may not be the only decisive factor when customers are making their decisions about suppliers: partner resources have to be excellent, for example, and the cultural fit between the companies is often a prerequisite for successful cooperation (Hoffman and Schlosser 2001, 361).

Inherent in some of the projects was a longer time span, and value from the original project could be expected to extend beyond its duration. In software development projects at least some of the partners are often bound to each other for several years. The customer often needs maintenance and technical support as long as the application is used, although the project may have been terminated. This implies that, from the developer’s point of view, the relationships are safeguarded for several years, thereby bringing value in the form of profits if the customer is satisfied with the hardware and the software, as well as with the responsiveness, flexibility and reliability of the IT supplier’s employees and the relationship itself (Lapierre 2000, 133).

5.3 Managing the network

The key concepts of network management that were presented in the theoretical framework were mobilizing, visioning, strategizing and guarding. The empirical findings of the study support the inclusion of a fifth management issue, integration and interpretation. The findings concerning the A and B case networks suggest that the new management function was related to the activities of the IT suppliers.

Integrators receive incoming flows of knowledge and other resources that they incorporate into the process of accomplishing the network outcome. The integrators in the case networks also had a "diagnostics role", which is typical of consultants (Bessant and Rush 1995). In addition to integrating resources, they had to understand what their customers' real needs were, find solutions, and give technological advice. The IT suppliers as interpreters had to mediate the conflicting views in the internal customer networks on the one hand, and the views of the business and the technical people in the networks on the other. This new management issue was considered particularly important in facilitating the functioning of the networks in the A and B cases because the customer was not only a single organization, but also a group.

The integrator of the network could also be characterized as its *functional or operational core*. This person was responsible not only for the operational management, but also for its strategic management, including searching for new members. This broadens the theoretical perspective, since earlier studies give the impression that there is only one core company in the network, and that this has sole responsibility for its management (Doz et al. 2000, 242; Jarillo 1998, 32; Lorenzoni and Baden-Fuller 1995; Snow et al. 1992).

5.3.1 Network mobilization

The mobilization phase is when the structure of the network is formed to suit its task (Lundgren 1992, 160). The mobilization may be *emergent* or *engineered* (Doz et al. 2000). In the first case, the partners know each other and common interests trigger the network formation, whereas the role of the *core company* is stronger in the second case: it activates the network by identifying suitable partners. Visioning the network means observing the environment and assessing the future opportunities and threats (Möller and Svahn 2003, 209). The aim of strategizing is to find a strategic fit between the goals of the network members and to make sure that they all perceive the importance of the network activities and prioritize them in a similar way (Douma et al. 2001, 587). Guarding the network means securing the

competitive positions of the members so that they are not threatened because of the cooperation (Perks and Easton 2000), and preventing unwanted spillovers in and from it.

Differences in network management between the case pairs representing stable/established and emerging value systems were obvious. In the former case the parties knew in much more detail what kind of partners they were seeking, what they would expect from them, and what the outcome would be. The network was mobilized after the members had become aware of their common interests (Doz et al. 2000). The constellation was decided at the beginning of the project and it did not change during it. The parties knew each other and the competencies that were offered to some extent.

The mobilization in the emerging value system was more engineered (Doz et al. 2000). The partners did not know each other and the projects aimed at producing innovations, the future of which was not known. This was more complicated, and the newness of the technology was an additional factor that increased the uncertainty in establishing the relationships. If a network is mobilized in an engineered way, there is a need for a strong core company to steer it from the beginning. This role was assumed by the customer, at least to a certain extent, in case C, but the lack of a core company probably contributed to the failure of the network mobilization in case D. The start-up with its vague visions was not able to convince the larger companies to start cooperation. In this emerging value system the network constellation was not fully known at the beginning, and new members joined during the development process. The key differences in network mobilization are illustrated in Table 9 below.

Table 9 Differences in network mobilization

The value system	**Stable/established**	**Emerging**
Network constellation	Decided at the beginning	Formed during the cooperation period
Network formation coordinated by	Similar interests	Core company
Partners knew each other	Yes	No

According to the results of this study, in three of the cases, A, B and C, the impulse for the network mobilization came from one strong actor or group of actors that was the strategic core in the network and that had a vision about its outcome. These visions were fulfilled, or at least it was less painful to see them realized, with the resources of the network in both case pairs.

One of the strategic management tasks was the search for partners. In this the companies concerned emphasized the synergies that would be created with the partners' resources (Hoffman and Schlosser 2001, 361), the opportunity to share the risks related to the development (Dodgson 1992), and familiarity and trust (Campbell 1997). In some cases the small geographical distance was also advantageous.

Three patterns were recognized in the performance of the partner-selection task. Firstly, in the e-banking case A, there was one strong actor, the strategic core, who took action to find the partners to serve the need of the network, and decided who would eventually participate in the development. This could be labeled a *"sole search"*. In the second case B, the customers used external help to evaluate the partner options selected in cooperation with the existing IT partner, which could be called "*mediated search"*. Thirdly, the network was mobilized so that one actor, again the visionary and the strategic core, gave the task of finding the partners to another actor whom he had already selected. The difference between these two search types was that in the latter case of "*supplier-aided search*" there was no hired mediator. Fourthly, when the start-up was trying to mobilize the network it tried to get itself selected, but it had no influence over the decisions of the partners it was approaching. This kind of situation is best characterized as a "*random search"*. These four paths are illustrated in Figure 32.

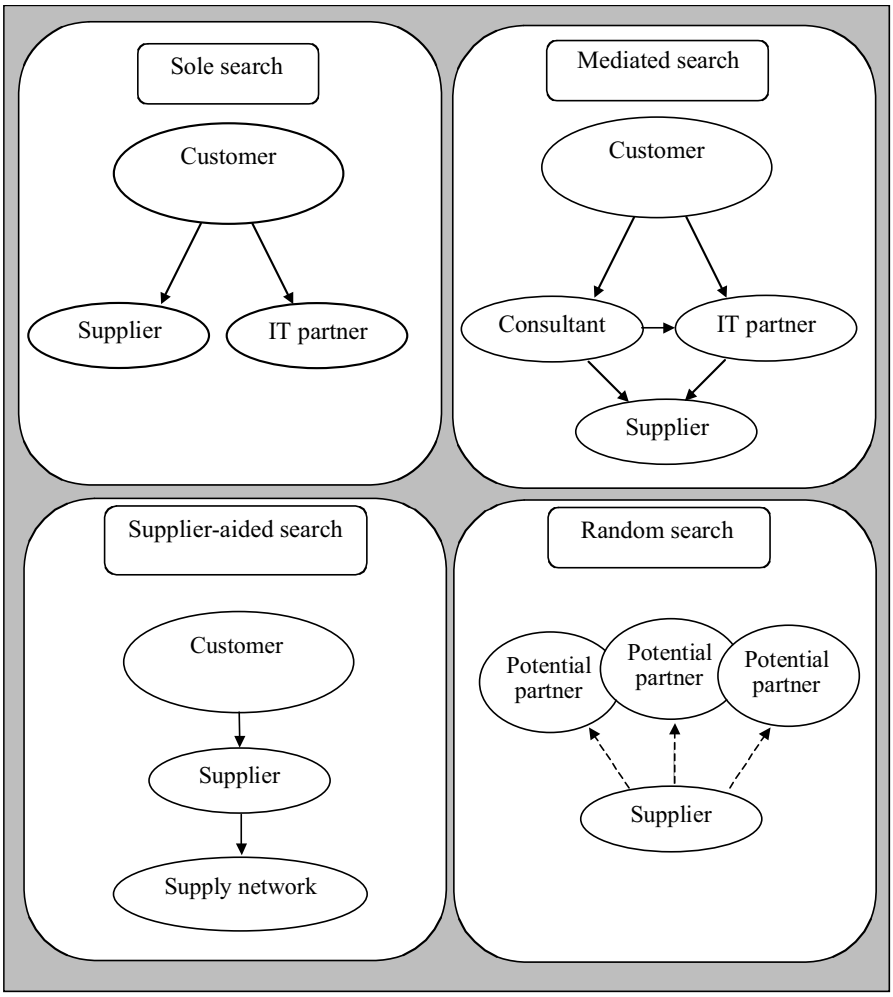

Figure 32 Strategies for partner search

The last two types, supplier-aided search and random search, reflect the uncertainties of emerging value systems: the structure of the network was not fully known at the beginning, and new actors joined during the development process if needed. The sole search and mediated search that took place in the stable/established value systems were steered by the customers, who knew precisely who they wanted in the network.

On the operational level the management of strategic R&D networks seemed to equate to some degree with project management. Setting the schedules and allocating the tasks among the members, and monitoring the performance, are naturally more complicated than for in-house projects. These tasks were divided between the strategic and operational cores. The real challenges are in the strategic management. Unlike the in-house project for

which a team can be called together, a development project carried out in cooperation requires joint network mobilization, visioning and strategizing, all three of which are intertwined areas of network management.

5.3.2 Visioning the network

When the network is envisioned, the companies assess the future possibilities, the limitations and the threats (Möller and Svahn 2003, 209). In fact, this requires one or several companies to have a vision about the product or technology and its position in the future market, since the opportunities and threats will affect the constellation of the network when it is mobilized, and its future.

Certain differences in visioning emerged between the stable/established and emerging value systems, and visions about the network and its outcome varied correspondingly from clear to blurred. In the A and B cases, when the strategic networks were set up to replace or renew the existing solution, the vision about the network was quite clear on a general level, although there were some internal disagreements concerning the details of slowing down the network activities. The strategic cores new exactly what resources they needed to fulfill their visions, and found them by themselves or with the help of other companies that could provide them. Since the goal of the network was well defined in the cases with stable value systems, it was possible to foresee how long it would exist.

The companies with emerging value systems had a more blurred view about the technology in terms of where it would finally be applied and whom it would serve. The developers of the video compression technology were not able to concentrate on one vision, which disturbed the partner hunt. Moreover, they did not know exactly what resources they could request from their potential partners. The uncertain environment and lacking knowledge about the market complicated the picture in case C. The opportunity was there, but the competitors' behavior and the success of the new technology was difficult to forecast. Table 10 below summarizes the differences between the two contexts.

Table 10 Differences in visioning in two value systems

The value system	Stable/established	Emerging
Vision about the position of the product or technology in the market	Clear	Blurred/partly unclear
Resources required	Fully known	Partly known
Duration of cooperation	Defined	Undefined
New opportunities that would possibly arise	No	Yes

The probability of new opportunities arising during the course of the cooperation may be increased if the product or technology developed in the network is successful. However, it seems that this is like playing roulette: in a good case there is an opportunity to double the bet that was first placed when the customer showed a willingness to continue the development with the partner and its supply network for several years, or in a bad case to lose everything if the cooperation ends due to competitor intervention.

5.3.3 Strategizing in the network

The clearness of the network vision was also reflected to some degree when the partners were strategizing, in other words finding a strategic fit. Strategizing implies drawing up the network goals so as to meet each member's expectations as far as possible. Another aim is to make sure that the partners recognize the value of the network and will therefore prioritize its activities (Douma et al. 2000, 587). The clearer the vision, the easier it is to shape the goals of the network accordingly

The companies with stable/established value systems had no great difficulties in planning the development *goal* on a large scale, although there were some conflicting interests in case A, mainly because the product would be used or marketed by both the customer and the IT partner. Small details troubled the internal networks of the customers in cases A and B because the needs and wants of this customer group in their internal networks sometimes did not match. The companies with emerging value system that had a clear strategy on the company level, in this study those in case C, did not find the goal setting complicated as such. However, as far as the smaller technology company was concerned, it would have a negative impact, such as the closing of one product line, because the resources had to be allocated differently due to the cooperation. Case D indicated unambiguously that the lack of an individual-level strategy and a vision about the future of the technology were hindrances in the goal formation when the potential partners met to negotiate

about possible cooperation. To add to the strategy-related insufficiencies, the technology of the start-up still needed further development, which was not good from the point of view of the potential partners.

Another aspect of strategizing was ensuring the priority of the network activities among the members (Douma et al. 2000, 587). The cases investigated in this study indicate that being part of the network may not be necessarily equally important for each partner, but that it matters the most to the member who perceives the product or technology under development as very important for its business. In this study the members faced with taking care of the prioritizing were the customers, and at the same time the strategic cores that had initiated the network.

Several ways of ensuring priority were recognized among the four case networks. Firstly, the strategic core in case A set certain criteria for partner selection. The customer was looking for a partner of about the same size (Campbell 1997, 394), so that the project on the IT house's side would not be buried under other projects. Secondly, familiarity and common trust-selection criteria (Blomqvist 2002; Campbell 1997, 394; Hoffman and Schlosser 357–381) between the bank and the IT partner was a positive influence: the IT house was willing to do all it could to meet the requirements. Thirdly, the fact that the outcome of the project would be shared increased the IT house's commitment to it. The partners were familiar in the second case as well, and it was self-evident to the small IT partner that the customers and their project were important since, fourthly, they were its largest group of customers. Fifthly, in case C money was the incentive. The small technology company was willing to tie up its best resources in the project, even if this was detrimental to its other projects. In sum, in order to ensure the network's importance to its members, it is beneficial to start cooperation with companies that are of a similar size, that are already familiar and in a trusting relationship, and that consider the project very important. Offering a big enough financial incentive could also ensure the priority of the network among its members.

5.3.4 Guarding the network

In the theoretical part of this study the term guarding implied, firstly, making sure that the cooperation does not endanger one's competitive position (Burton 1995; Möller and Svahn 2003, 207), and secondly, avoiding spillovers to external parties (Nooteboom 1999), and also to some degree unwanted spillovers inside the network. There was an observable split in understanding the importance of this management element in the two contexts, stable/established and emerging value systems. The firms in the former took a

solid stand on internal guarding: they made an effort to prevent any harmful information leakages. In case A the contract was drawn up so as to ensure that the shared rights to the product would not negatively affect the bank's competitive position. This was not an issue in case B in any case because there would be no competitors given the restriction to internal and stakeholder use.

The smaller and less experienced companies in the emerging value system faced challenges in guarding the network internally. According to Nooteboom (1999, 50), there is always a risk that efficient knowledge and competence transfers will lead to competence leaks to competitors, and Möller and Svahn (2003, 207) argue that this may result in losing the current power position in the network. These two things are exactly what took place in case C, when competence leakage became a stumbling block for the less experienced smaller technology company. The large customer was able to absorb part of the competence of the smaller company following the intensive cooperation, and with this knowledge to acquire a company that could provide the same kind of, but better, competence than the previous partner. In this case C, however, the large company, was well aware of the dangers of cooperation, and also wanted to use the contract to secure its competitive position: the supplier was not able to sell to its competitors.

5.4 The nature of the strategic cooperation for the firms in the R&D networks

The case networks that were studied matched the definition of a strategic network. The R&D networks concerned were intentionally formed, purposeful arrangements aimed at bringing together the dispersed knowledge resources of the industrial actors for the development of innovations (Gadde et al. 2003; Håkansson 1987; Jarillo 1988; Parolini 1999; Powell et al. 1996). The labor was divided so as to allow the network members to specialize in the value-creation activity that was supported by their own distinctive competence. Although it was set up only for the project, and the relationships were dissolved, at least to some extent, afterwards, the network and its outcome had long-term effects on the companies and their business in the cases in which the development task was completed successfully.

Cooperation was strategic for the firms involved because of the resources provided by the members. These resources were, at least to some extent, unique and inimitable, and according to the resource-based view these characteristics can form a basis for competitive advantage (Dyer and Singh 1998; Grant 1996). The impact of the network on the competitive position of the firms that gained a product as a result of the cooperation was obvious in

cases A and C, and the same would also have applied to case D, if only the formation had succeeded. However, the criticality of the resources that were needed from outside varied between these two cases. The bank might have been able to develop the e-banking solution with its own resources in the longer term, and this would not necessarily have damaged its business since its customers were already using e-banking services. However, in the case of C the company that wanted to develop the video solution for the cable operators had to hurry to meet their needs and there was no time for in-house development. Case C thus illustrates the strategic importance of cooperation in emerging value systems in which markets are still developing.

In case B, in which the organizations aimed at improving their financial information systems, the aim of the cooperation was not to affect the competitive position of the purchasing organizations, but rather to support their business and facilitate transactions with their stakeholders. The cooperation was strategic for the purchasing organizations because they would not have been able to develop the solution internally. It was the intention to strengthen the competitive position of the developer, however.

6 SUMMARY AND CONCLUSIONS

6.1 Summary of the study

The development and growth of the ICT cluster over the years has increased inter-company cooperation in research and development. The companies involved expect to complement their competencies and to derive multiple benefits from the cooperative arrangements. However, managing the cooperation is challenging, in particular when there are more than two parties involved. The R&D network phenomenon has been discussed in the recent literature to some extent, but its special intentional nature called for more in-depth investigation. The key domains covered in the study, value creation and network management, were considered relevant research topics because there is room in the literature on industrial marketing for more discussion on value creation, particularly in the R&D context, and network management in the same context is also a less researched area.

The aim of this study was to describe the nature of R&D networks as intentional value-creating systems in which more than two actors cooperate in order to develop new products and technologies. They were termed strategic R&D networks in order to emphasize their distinct nature. Industrial actors intentionally establish such networks in order to accomplish a product-development project. They also aim at creating value and strengthening their competitive position by combining their competencies, and there may be other long-term impacts as well.

It was suggested that the differing circumstances in which the networks operate have an influence on the firms' need to mobilize them for the purpose of value creation and on the way they are to be managed. The networks studied represented either stable/established or emergent value systems depending on the technological change and the newness of the activities related to the system. The value system model also provided a basis for comparison. Each network was individually analyzed in order to answer the following research questions:

1) What are the circumstances that make companies seek value creation in strategic R&D networks?

2) What kind of value is created for the members in strategic R&D networks?
3) What are the key management issues supporting value creation in strategic R&D networks?

The methodology chosen for the study was the qualitative case study with multiple cases. The perspectives of multiple actors were combined in each case as several organizations were approached, and in some cases even several informants per organization were interviewed. It could be considered necessary to take a multi-actor perspective in studying networks because, as the results of the study show, it enriches the quality of the data and gives a more holistic view than a single informant could give. Collecting the views of more than one actor was beneficial to the study since it revealed some differences and similarities in the way in which each party related to the activities of the network and the new product development project at hand. The views of the multiple actors were thus complementary in constructing the descriptions of the network and the phenomenon, and even their conflicting statements provided productive ideas for the research. If only one actor had been interviewed, the results would have been much less fertile.

Four case networks were selected for the study: two of them, A and B, represented a stable value system and the other two, C and D, represented an emerging system. The companies comprising the first case pair, A and B, were involved in developing software for the financial sector. The purpose of the network in case A was the development of an e-banking system, and in case B it was the improvement of its financial information system. The actors in the second case pair aimed at developing embedded software. The case C network developed digital video and that in case D was engaged in the development of a video compression algorithm. In terms of location, A was a Nordic case, involving all four Nordic countries, whereas cases B, C and D were mainly based in Israel, and involved companies or potential partners from Europe and the U.S.

The cases were analyzed in the light of an initial theoretical framework. Since abductive logic was applied in the study, this framework was complemented along with the empirical data collection and analysis. The nature of each R&D network was addressed by analyzing the circumstances, value functions and management issues in each case separately. Later on, the cases were compared as case pairs. The comparison was based on a value-system classification, which revealed certain differences between the case networks that were caused by the different circumstances. The following sub-chapters discuss the theoretical conclusions, provide managerial implications and suggest avenues for future research.

6.2 Theoretical conclusions

Investigation of the circumstances that cause firms to seek value in networks reveals that establishing them for development projects is rarely triggered by one decisive factor, and that the path to cooperation in the R&D network is rather a combination of several events and their culmination on the industry, market and technology levels. The factors that influence firms' decisions to form the network may be wider trends that penetrate the whole society, such as the use of the Internet, or it may be the jump to a new-generation technology in a certain, more narrow market.

It was observed that convergence brings ambiguity to the development of new products. On the one hand, it definitely brings new business opportunities, as already existing industries and technologies are combined, but on the other hand it leads firms to struggle with an intensifying need to manage more technologies and competencies, and consequently to turn to partners that have a deeper knowledge about them. This study showed that the systemic nature of the products offers opportunities for small technology companies to cooperate with large technology companies, as the development can be broken down into separate entities. The narrow, deep competence of the small companies complements the broader range of competencies in the large ones.

Assessment of the need for R&D cooperation and network formation as an internal company decision reveals differences between the value systems that the case networks represented. The changes are more predictable in stable/ established system, and R&D networks are viewed as complementing rather than totally replacing the internal resources. In emerging value system the urgency and the criticality of the need for resources that have to be located outside of a single firm increases, and the network formation becomes more of a necessity than merely an option. R&D networks are in continuous interaction with the environment, taking signals from it and at the same time sending signals back and influencing it.

The literature on industrial relationships dealing with value creation provided a starting point for the discussion on value in the R&D context. Previous models of value creation in supplier-customer relationships include the direct value functions of profit/cost/time, volume, and safeguarding, and the indirect value access, market and scouting functions. In principle, these models formed a good starting point for investigating value creation in R&D networks. However, the initial framework was complemented with the results of the study to make it fit the R&D context even better: the functions of competence and product performance were added as they were considered important in R&D cooperation. These represent direct value functions, and also touch on the essential reasons why companies are willing to start the

cooperation, that is, to share competencies in order to achieve superior outcomes, products and technologies.

The difference between stable/established and emerging circumstances in the value system was that in the former the companies could foresee better what kind of value could be created in the network, and in the latter new ways of creating value were discovered along the way. To some extent this happened because in the course of time the partners got to know each other and the skills and resources they could offer. The firms in stable/established networks had a clearer picture of value-creation possibilities with familiar partners. In all of the networks studied some emphasis was laid on indirect value, and particularly on value functions that were to be realized in the future. These benefits were more difficult to define, however, and their materialization could not be verified beforehand or even during the focal development project.

In accordance with the existing literature, the key management issues that were distinguished in the management of R&D networks concerned mobilizing, visioning, strategizing and guarding. These different areas of network management do not necessarily appear in the above-mentioned order. They are rather intertwined and may recur in cycles during the existence of the network. Mobilizing the network refers to carrying out the necessary activities for its formation and finding suitable partners. Visioning happens when the actors create a picture of the network in its environment. Strategizing is needed in order to find a strategic fit between the goals of the members, and to ensure that the network is equally important to each actor. Preventing situations in which the competitive position of the firm is endangered and knowledge unintentionally leaked is the goal of network guarding.

The empirical investigation gave evidence that interpretation and integration should be added to the key network-management issues, again reflecting the special nature of R&D networks. The competences brought in require concrete actions to be combined in the development of the final outcome. Integration also refers to the ability to mediate in disputes, which contributes to the faster advancement of the development project. Interpretation is needed in finding out the exact needs and wants of the partners and in determining which of them are feasible, which helps the network members who do not have enough technical knowledge of their own. Integration and interpretation are not necessarily the responsibility of the same network member, and the tasks may be split several ways. One member may be the operational core of the network, which involves managing the operational tasks and participating in its strategic management, together with the strategic core.

In the cases investigated in this study the impulse for the mobilization of the network came from the core company, which was mainly responsible for the strategic tasks. This strategic core was nevertheless willing to split the tasks with the operational core, whose main responsibility was integrating the resources. Mobilizing a network for effecting a minor change in the product or for developing existing business was much less complicated than mobilizing one for promoting radical change in the technology and creating new business. Familiarity between the actors facilitates the mobilization, and the other activities later on, if the relationships are already established.

The full constellation of the network was not clear at the beginning. In some cases new members joined during later phases according to the needs that emerged. Four ways of searching for partners were identified: sole search, conducted by one key actor; mediated search, in which external help was used by a group of key actors in order to find a suitable partner candidate; supplier-aided search, when the customer gave the task to his partner-supplier; and random search, when the searching party tried to convince its potential partners that it was worth partnering.

The importance of strong visioning is emphasized in the emerging value system. Companies with a stable and established system have already existed for a relatively long time and their stability and knowledge of the environment is much wider than in companies with emerging systems that are struggling with technological and market uncertainties. The study showed that weak and diverse visions did not hold, and as a result attempts to enter into cooperation collapsed.

The idea of strategizing is to make the goals of the actors fit and to make sure that the network and its goals are important to each one. It is obvious that goals are not formed without compromises. A strong and more influential actor in the network can argue for the significance of its objectives in the development project. The study showed that compromising does not necessarily relate to the relationships between different organizations, and it may also be intraorganizational if there are separate units within one of them. If the network is not equally important to each member, a concerned actor for whom the network and its outcome is critical may use financial incentives to enhance its position. Choosing partners that are willing to prioritize the activities of the network in the first place also helps to overcome concerns about its significance.

Guarding one’s competitive position and avoiding spillovers may be related in particular to small technology companies that are in danger of losing valuable knowledge to their larger counterparts as a consequence of their cooperation. This kind of setting again reflects the need of small companies to strengthen their business management and to devise means of protection from

unwanted knowledge leakages in cooperation. A long-term, trusting relationship between companies with stable/established value systems is a safeguard as such, since it promotes loyalty to the partner and minimizes the risk of misconduct. A further safety factor lies in the fact that it does not necessarily bring to light the knowledge or competencies in which the partners would be interested. Companies with emerging value systems are in a more risky position in this matter, since the value of the knowledge they possess may vary among the network members. This means that some members could opportunistically take advantage of other members' knowledge if they considered it valuable.

6.3 Managerial implications

In spite of the delimited scope of the cases that were examined in the study, it is possible to draw attention to several lessons learned through them that could benefit practitioners planning to engage in cooperative relationships and networks in R&D. One of the most efficient ways of learning is by doing, which is sometimes also merciless, however. The failure that was experienced by the small start-up when it tried to build its network taught it a lot about the practice of mobilizing networks, and if only there had been a second chance, things could have been different. Although the lack of business skills and strong concentration on technology in small technology companies has been well recognized in earlier research, it seems that the development of business skills can never be emphasized too much. Promising technology cannot alone secure a prosperous future for the company if the business development is neglected. Dealing with large, world-class companies requires experience, which should be outsourced by the small technology company if it does not exist in-house. The development of networks and the relationships within them requires a lot of time, endurance and consistency.

Assiduous preparation for network mobilization is required because engaging in a relationship and in a network is always an investment. Although the network might exist only for the limited period of a development project, its outcome will often extend far beyond that. Partner selection may thus have a far-reaching impact. Companies are not free to act according to their own aims, or to react to circumstances as they arise, and they must take into consideration the structure of the relationships. In order to avoid the feeling that the network is constraining at a later stage, technologies and skills must be thoroughly checked at the selection stage. From the point of view of the core company, it is also far-sighted to think about the means of committing the

partners to the network and its goals. In other words, it is about making sure that the partners are able to prioritize the project.

There was also some indication that continuous partner evaluation might be beneficial at least for some members of the network. The resources held by members may not be fully utilized by the others if their existence is not recognized. Making most of the relationships may require opening up the boundaries of the companies even more than was planned. Furthermore, the company that was the main architect and designer of the network, the core, should realize that learning to listen actively to the partners may pay off if new skills and capabilities are discovered as a consequence. Another thing to avoid is an overload of egocentricity. Companies should rather focus on expressing what they could do for each other if they notice the potential to offer more.

Participation in joint development is a strategic issue for most companies. All possible consequences of this commitment should be evaluated during the decision-making process: how the cooperation will influence internal operations and what its influence will be on immediate and more distant counterparts. In terms of the internal operations the focus should be on the benefit and sacrifice ratio, and on the far-reaching impacts on the future business of the company. Engagement in the network activities should support the chosen business strategy and not shake it. Given the findings of the study, it is suggested that it is useful to have as comprehensive a picture as possible about the potential of the network in terms of value creation at the decision-making stage. It is worth noting that not all opportunities for value creation may be obvious at first, but they may become clearer during the process of cooperation. It must also be taken into account that value creation may not take place as expected, and may show variance in both positive and negative directions.

The nature of research and development projects requires getting it right the first-time, since there are no practice rounds. This generally complicates the management of the project within the network. The development of an IT system, for example, may not have a precedent, and the customers in particular may have difficulties in defining what they want. These difficulties are not network-related, but occur simply because of a lack of knowledge. The case studies illustrated how an obstacle like this could be overcome. External consultant help was used to express the needs of customers in an understandable form. Companies in similar situations that wish to develop financial solutions could actively make use of consultant skills. In cases in which several customers form an internal network within a strategic R&D network, the role of an external party may be significant in mediating the conflicting views, which may otherwise slow down the activities. The other

option is to decide unambiguously who will be the leader in the network with the final say in decisions that concern everybody.

6.4 Research limitations and avenues for future study

The choice of a network approach in the study made it possible to capture the phenomenon, product development among several actors, as it appears in the reality. However, it also gave rise to certain limitations. Studying networks is fundamentally complicated. It is not trouble-free to define the boundaries of the network for example, and thus to know which actors should be included and interviewed. Even if access were granted easily to any firms with anything to contribute to the study, for practical reasons, such as the lack of time and other resources, including all the possible actors would be difficult to manage. There were some challenges connected with access, partly because of the sensitivity of the research topic, and partly simply to do with the busy schedule of the interviewees. Consequently, the more firms that are included, the more demanding it is from the researcher's point of view.

If the networks were accessed from the inside, implying that the researcher would be part of the organization and even participate in the activities of the network, it would eliminate the access problem, at least in that one case. This might increase the construct validity, because spending a long time in the organization may reassure the researcher that the theoretical constructs used are the right ones. However, this might bias data in favor of one organization in that it would become more familiar in the course of time, thus endangering the researcher's neutral position. A further limitation in that case is that the researcher would not necessarily be able to keep track of many cases at the same time from the inside, which would then eliminate the possibility of case comparison.

The number of cases dealt with in this study, four, was found to be appropriate for analytical generalization. The fact that two case pairs emerged already provided a basis for comparison within the pairs and between them. The findings suggest that the constructs used might possibly be applicable to other R&D networks, but this should be further investigated in future research.

This study succeeded in painting a picture of two kinds of networking contexts in the information and communications cluster. Since this cluster is characterized by a multiplicity of actors representing different value systems and cooperating in various matters, one possible future research avenue would be to apply the theoretical perspective of this study to other empirical contexts within the same cluster. The comparative setting could include actors from the public sector and IT-service providers representing stable and established

value systems. The findings of this study suggest that the role of IT-service providers as interpreters of customer needs would deserve more attention. Investments in information technology are usually quite large, and it would therefore be crucial for decision makers to understand what they really need. One problem is that if the decision makers do not have sufficient knowledge about the technology in the user organizations, the investments may not match the needs. It would be interesting to explore if there really exists a gap between what is wanted in those organizations and what they get from the IT-service providers, and if there is, further research could also seek solutions to the problem.

Several new research ideas arose from the empirical part of the study. One of these concerned the role of time in value creation. It was observed that the value perceptions of the network members changed in the course of time, for example. With a longitudinal study it would be possible to follow up how well the initial value perceptions corresponded to the reality after the cooperation had ended. This would mainly concern the indirect value functions that are very much future-oriented, such as the access function – the access of the actors to new projects with their previous partners.

Another possible research avenue would be in assessing the impact of the decision to cooperate in both internal and external terms. This refers to sacrifices that firms may need to make, and to other possible impacts that are not necessarily negative. This study emphasized the benefit aspects, but the sacrifice dimension was apparent in case C, in which the resources tied up in the cooperation were taken from those allocated to internal development, and this had a negative impact later on the company's regular business. Assessment of the effects of membership in a strategic R&D network on other networks to which the focal actor belongs could also provide interesting perspectives.

Finally, the fourth and last case examined in this study described the difficulties a small company had to convince potential partners about the importance of the technology it was providing. On the evidence of this case, some suggestions concerning unsuccessful network mobilization were presented in the analysis. Future research could investigate a larger number of similar companies, and consider to what extent the difficulties faced by the start-up in case D might apply to them.

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Appendix 1. The list of case-study interviews

Case A:

Vice President of financial solution business, Gimel, 5.8.2002, Espoo

Development manager, Gimel, 5.8.2002, Espoo

Business CIO of eBanking, Alef, 7.8.2002, Espoo

Technology manager, Gimel, 26.8.2002, Espoo

Systems-engineering manager, Bet, 19.11.2003, Denmark (telephone interview)

Case B:

CEO, Pey, 21.1.2003, Tel Aviv

Senior project manager, Kaph (formerly Pey), 11.12.2003, Petach Tikva

Accountant, Mishkey haKibbutzim, 29.6.2004, Tel Aviv

Economist, 18.7.2004, Herzilya

Controller, 20.7.2004, Tiberias

Senior project manager, Kaph (formerly Pey), 29.7.2004, Petach Tikva

Case C:

Project Manager, Dalet, 1.6.2003, Herzilya

Project Manager, Dalet, 17.6.2004, Herzilya

Project Manager, Dalet, 9.7.2004, Herzilya

2 Product managers, Tet, 5.7.2004, Pardes Channa

Product manager Dalet (formerly Tet), 18.7.2004, Herzilya

Engineer, Tet, 22.7.2004, Ramat Aviv, Tel Aviv

Case D:

CEO, founder, Lamed, 16.12.2002, Tel Aviv

CEO, founder, Lamed, 23.12.2002, Tel Aviv

CEO, founder, Lamed, 6.1.2003, Tel Aviv

CEO, founder, Lamed, 23.7.2003, Ra'anana

Business development manager, Lamed, 28.11.2003, Tel Aviv-Yafo

Chief technology officer, Lamed, 4.11.2003, Herzilya

Senior Technology Manager, Fenno, 19.2.2004, Tampere

Chief technology officer, Lamed, 12.5.2004, Herzilya

Appendix 2. Interview questions

The form of the questions and their order varied in the different interviews.

General background questions:

- What was the project about?
- Who were involved in it?
- When did it start and when did it end?
- For how long has your company been in business?
- What is the size of your company?
- What was your role in the development?

A) VALUE CREATION – BENEFITS FROM THE RELATIONSHIPS AND THE NETWORK

What was the relationship between your resources and your partners' resources in this project?

- How significant was it using the partners in this project?
- How would you describe the match between the project's needs and what was offered?
- What kind of financial gains were expected as a result?
- How were the costs shared in the network?
- What was the impact of the network on the development time?
- Could you internalize something new as a result of the project, and if so, what?
- Could you utilize what you have learnt in other projects?
- What kind of impact did the cooperation have on the product quality?
- What was the role of the network in providing you with new marketing channels?

Significance of cooperation in the focal project:

- How important to you are your partners as customers/suppliers?
- How were you able to utilize the referrals that you gained as a result of the cooperation (access to new suppliers, customers)?
- What was the significance of your reputation to other members of the network?
- What were you able to learn about the markets from your partners?
- What kind of impact did this project have on your future relationship with your partners if they were previously familiar to you?
- Will your cooperation continue after this project, and if so, will it be similar or different?
- Will you be locked into the relationships with your partners for a long time?

B) NETWORK MANAGEMENT

Setting up the network:

- How did the project start and who initiated it?
- How did the cooperation progress after the initiation?
- Who were the parties in the development and how active was their participation?
- Who was the leading network member taking the strongest position on important issues?
- What was the history of the relationships between you and your partners?
- Why were you an attractive partner for the other partners?
- Did the size of the partners have any impact on the network and if so, what kind of impact?

Planning the future and shaping the goals of the network:

- How were the visions you had about the future brought together?
- How similar were the goals when you started the cooperation?

- How challenging was it to make them fit among several partners?
- How important were the network activities to you, and how do think the others perceived them?
- Did this project have any effects on your other projects?
- How openly were you able to share information concerning your activities during the project?
- Was there any fear that unwanted information leakages would take place?
- Did this lead to any activities?

PROJECT CIRCUMSTANCES

- What kind of an impact did your industries have on the cooperation?
- What were the challenges related to the different industries that you and your partners were representing? (banking/information technologies)
- What has been the impact of the general technological development on the project? (Available technologies etc.), and why was this project not carried out earlier?
- How did you recognize the need for this type of solution in the market?
- Have there been similar products or solutions before?
- What are the innovative features of the developed solution?

Appendix 3. Themes guiding the coding of the interviews

Main theme	Sub-theme	Contents
Circumstances – the network environment, its features and developmental trends	1) Technology characteristics	1) The features of technology and its impact on cooperation
	2) Industry and market characteristics	2) Events and developments in the industry and the market that create a need to rethink the solution, and their impact on cooperation
	3) Cooperation as a company-level decision	3) Environmental pressures shaping the need and the decision to cooperate
Value creation – the relational benefits in and through the network of relationships	1) Profit/cost/time function	1) Financial gain from cooperation, cost-sharing in the network, the impact of the cooperation on the development time
	2) Volume function	2) The impact of the cooperation on the volumes purchased, and the consequences
	3) Safeguarding function	3) Cooperation is important for the continuation of the relationships between the network members
	4) Access function	4a) Possibilities to continue cooperation with the same or with a different partner after the focal project has finished
		4b) The network members providing access to external parties that will join it or help in the project
	5) Market function	5a) The network provides a marketing channel
	6) Scout function	5b) The network members can benefit from the reputation of other members
	7) Competence function	6) The network provides relevant information about markets and technologies
		7a) Companies can utilize the network to access and acquire competences
	8) Product-performance function	7b) The network can be used to internalize the competencies of the partners
		8) The capabilities and skills of the partners contribute to the superior quality of the product or technology

Management – the activities taken by the network members to lead the network in the desired direction	1) Mobilization 2) Visioning 3) Strategizing 4) Guarding	1) Activities in initiating the network, searching for partners, setting up the network; the influence of one stronger actor 2) Planning the future of the network and its offering 3a) Goals and their compatibility among the network members, and the consequences of incompatibility, 3b) The perceived importance of the network activities to its members 4a) The impact of the network on the competitive position of the members 4b) Securing knowledge transfer between the firms in the network, and the success of the transfer

Appendix 4. An introduction to the Israeli ICT cluster and software industry.[5]

The ICT cluster has been booming in Israel for the last fifteen years. There are some 2,000 high-technology companies in the country, aimed mainly at the U.S., European and Asian markets since the domestic market is rather small and the surrounding areas are not key target markets. The number of start-ups is the second highest in the world, after the U.S. High technology accounts for two thirds of Israeli industrial output, and for 80% of its industrial exports. The country currently has the highest number of companies listed in Wall Street after the U.S. and Canada. A large venture-capital industry emerged during the 1990's, and many of the leading American investment houses and venture-capital funds have established a presence in Israel in order to support Israeli high-tech firms, even though the unstable political situation has caused uncertainty and a slow-down in investment.

The success of the high-technology firms derives from the highly educated work force, investments in R&D, a supportive government policy and the entrepreneurial atmosphere. The government has a range of programs to support technology, from incubators to aid start-up companies, cooperative programs to foster basic R&D, and research subsidiaries for established companies. Thousands of skilled personnel were forced to leave the defense industry at the end of the 1980s. Many of them formed start-up companies, which later became successful high-tech firms. Moreover, advanced technologies that were originally developed and utilized for military purposes are now being used for developing commercial products for civilian use. The influence of the army culture on firms that have been established on the civilian side has been not entirely positive, indifference concerning product quality, the inability to make the firm grow and poor customer service being some of the adverse effects

The arrival of one million Russian immigrants at the beginning of the 1990's also contributed to the development of the high-technology industries.

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[5] The presentation on Israel is based on the following sources:
Ahavat Israel – Israeli High-tech. <http://www.ahavat-israel.com/ahavat/eretz/hightech.asp>, retrieved 26.1.2004.
Israel High-tech and Investment Report. <http://www.ishitech.co.il/quote.html>, retrieved 26.1.2004.
Statistical Abstract of Israel 2002. Central Bureau of Statistics. <http://www.cbs.gov.il/shnaton53/shnatone53.htm#19>, retrieved 26.1.2004
The Embassy of Finland – Business, Israel Overview. <http://www.finemb.org.il/business-main.htm>, retrieved 26.1.2004.
Tyrväinen et al. 2004, 67.
Vedin 2000

Many of the new immigrants brought excellent basic scientific skills with them. In recent years the percentage of engineers in Israel has been the world's highest, with 135 engineers per 10,000 persons (the equivalent ratio in the U.S. is 85/10,000). In the last two decades Israeli developments have contributed significantly to the following information-technology and telecommunications industries: wireless communications, advanced data communications, voice mail and related voice-manipulation technologies, DSP – digital signal processing technologies and products, encryption and data security, and Internet technologies and products. Moreover, some of the world's largest companies, including IBM, Compaq, HP, and Motorola, have adopted the country to serve as a major center for software design and development. Dozens of Fortune 500 companies are counted among the clients of Israeli software houses.

The Israeli software industry has developed to some extent in line with the military needs of the country, as electronics and telecommunications development also requires software. Israeli firms are very innovative in their operations, but the same problem characterizes the technology firms there as in many other places in the world: marketing skills are not as developed as technological skills.

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