Management of Innovation Networks –A Case Study of Different Approaches

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Abstract

The literature includes vast amount of research on both innovation and business networks, however the empirical knowledge of their intersection —innovation networks and their management— is still scarce. This empirical study aims at increasing the knowledge of management of innovation networks by mapping characteristics of management approaches of two case companies. These companies operate in the software business and develop their products in inter-organizational networks. Special attention is paid to differences in the management approaches between the case companies. The present empirical article is based on analysis of two case companies representing very different and contrasting approaches to management of innovation networks. The empirical study is conducted among SMEs in the software business. As a result of the analysis, several aspects of management of innovation networks are identified and their nature was explained. These aspects are: a) duration of the network, b) rewards from the network, c) fundamental meaning of the network, d) the nature of the networked organization, e) planning, control, and trust, f) hierarchies, authority, and coordination. These aspects are powerful in mapping and explaining the characteristics of innovation network management.

Introduction

Innovation and business networks essentially belong together. Innovation and technology are often the driving forces behind the formation of business partnerships and networks (Johansson and Mattson, 1992). In networks, an innovation should not be seen as the product of one actor, but as the result of interplay between several actors (Håkansson, 1987). The term "network" refers to a set of nodes and relationships which connect them (Fombrun 1982). Innovation is likely to be individually motivated, opportunistic, customer responsive, tumultuous, nonlinear, and interactive in its development, and, managers can plan overall directions and goals, but surprises are likely to abound (Biemans, 1990). Management of innovation is called controlled chaos (Quinn, 1985), it includes
surprises and unexpected changes, but it can still be controlled to a certain extent. Companies' network competence is important for achieving innovation success in business networks (Ritter and Gemünden, 2003). Network competence involves relationship-specific tasks,

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initiation, exchange, coordination, cross-relational tasks, planning, organizing, staffing, controlling, specialist qualifications, and social qualifications (ibid.).

There is a clear pattern of growth in R&D partnerships in the economy (Haagedoorn, 2002). This is due to increased scientific and technological complexity, higher uncertainty surrounding R&D, increased costs of R&D projects, and shortened innovations cycles that favour collaboration (ibid.). These partnerships, according to Hagedoorn (2002), enable companies to learn from variety of sources and partners in a flexible setting of (temporary) alliances for various company activities across the value chain. The amount of R&D partnerships has increased particularly in high-tech sectors and other sectors where learning and flexibility are important features of the competitive landscape. IT has also facilitated the increase of innovation networks. IT makes possible new products, services, business concepts, organizations, and forms of cooperation. A virtual organization is a network and an example of a new kind of organization facilitated by IT (Mowshowitz 1997; Christie and Levary 1998; Hoogeweegen *et al*. 1999). In some cases, innovative networked cooperation may take place even with competitors. This has been called "coopetition" (Bengtsson and Kock, 2000), and it may be encouraged by public R&D-funding and the desire to share substantial costs and risks in the case of products based on technological breakthroughs (Tidd, 1995). In contrast, the literature also includes findings suggesting that networked cooperation *as such* is no guarantee for successful innovation and products developed in partnerships are no more successful than those developed in-house (Campbell and Cooper's, 1999). Indeed, the management of innovation networks is both important and challenging. However, in general, the knowledge of management methods in inter-organizational networks is still scarce (Ojasalo, 2004). Clearly, there is an evident need to examine this area further.

This empirical study aims at increasing the knowledge of management of innovation networks by mapping characteristics of management approaches of two case companies. These companies operate in the software business and develop their products in inter-organizational networks. Special attention is paid to differences in the management approaches between the case companies. The term "innovation network" refers to a set of actors mobilized by a focal company for R&D activity.

The rest of this article is organized as follows. First, it briefly discusses the nature of innovation management, management of business networks, and innovation networks. Second, it explains the method used in the present empirical study, reports the findings, and discusses them in the light of the literature. Third, it discusses the theoretical and managerial implications. Then, it draws the final conclusions by summarizing the contribution of this

study and by offering directions for further research.

Innovation and Network Management

Innovation Management

In the literature, "innovation" may refer to an outcome of an innovative process or to the innovative process itself (cf. e.g. Drucker, 1985). Yet, some authors have reserved the term "innovation" just for the result of the innovation process, and "innovation management" for the managerial activities that attempt to control the innovation process (Dreijer, 2002).

The term innovation, most importantly, implies newness (Johannessen, Olsen and Lumpkin, 2001). Innovative activity may relate to new products, new services, new methods of production, opening new markets, new sources of supply, and new ways of organizing. Innovation has been characterized as a process of commercialization of a newly developed product or practice (Freeman, 1982; Dickson and Hadjimanolis, 1998). Johne (1999) distinguishes three types of innovations: product innovation, process innovation, and market innovation. Product innovation provides the most obvious means for generating revenues. Process innovation provides the means for safeguarding and improving quality and for saving costs. Market innovation is concerned with improving the mix of target markets and how chosen markets are best served. Its purpose is to identify new or better potential markets; and new or better ways to serve target markets. The role of effective use of market information is emphasized particularly in the case of product and market innovation (Ojasalo, 2003a; Ojasalo and Olkkonen 2005), including the generation, internal dissemination, and the firm's responsiveness to market information (Biemans and Harmsen, 1995).

Innovation is characterized by its uniqueness. Innovation may be highly radical, radical, intermediate, significant incremental or minor incremental (Abetti, 2000). Highly radical innovation is an unique original product or system which will obsolete existing ones. It is based on proprietary technology beyond the state-of-art and major R&D. Radical innovation is a new product or system with original state of-art proprietary technology that will significantly expand the capabilities of existing ones. It requires significant R&D. Intermediate innovation is a new product with proprietary technology, however it may be duplicated by others. It is a mix of standard and special features, and requires average R&D. Significant incremental innovation refers to significant extension of product characteristics with original adaptation of available technology. It is characterized with limited patent protection and minor R&D. Minor incremental innovation refers to incremental improvement over existing products. It is a standardized product and an application of current technology. It has no patent protection and requires no R&D.

Innovation is also characterized by the question: to whom is it new? (Johannessen,

Olsen and Lumpkin, 2001). This refers to the unit of adaptation which can be examined in terms of newness to the company, newness to the market (Cooper, 1993; Kotabe and Swan, 1995), and newness to the industry (Johannessen, Olsen, and Lumpkin, 2001).

The term innovation management encapsulates the management of the whole process of innovation from the idea generation stage through product or process development/adaptation to launch in the market or start. This includes both strategic and operational issues (Rothwell, 1992; Dickson and Hadjimanolis, 1998). On the rough level, according to Ojasalo (2003a), a new product development process can be divided into three phases: generating ideas, technical development, and commercializing. Dreijer (2002) brings forward the following activities and contexts of innovation management: technical integration, the process of innovation, strategic technology planning, organizational change, and business development. Technological integration refers to the integration between technologies and the product-markets of the firm and emphasizes the importance of satisfying the customer with the innovations of the firm. The process of innovation refers to the cross-functional activities that create innovations across the departments of the firm. Strategic technology planning means planning of technology and/or competence projects with the aim of maintaining a balanced portfolio of technologies and/or competencies. Organizational change is relevant in the context of innovation since often it is difficult to speak of innovation without considering organizational change. Business development is also relevant in the context of innovation because innovation can both drive and be driven by business development.

According to McCosh *et al.* (1998), the following guidelines are relevant to managers leading innovation. Firstly, the company, and the dominant coalition who manages it, must be firmly supportive of innovation as a way of life, by their example, their words, and their actions. Secondly, the company must keep close to its customers, partly to respond to their expressed needs, but mainly so that it can work out what they want in the future, preferably before customers know themselves. Thirdly, there must be an internal procedure for keeping all innovation projects under continuous reconsideration, so that the work is done simultaneously on all fronts, but remains cohesive and compatible. Fourthly, an innovative culture usually involves considerable freedom of action, substantial resources for educating all ranks in the firm about new technologies, and the use of small teams of employees who possess many skills between them. Fifthly, to sustain an innovative culture, it is important that employees who innovate successfully should be seen to have been rewarded by the other employees.

Market orientation has a significant positive influence on new product success and, consequently, and it is a crucial element of innovation management (Atuahene-Gima, 1995; Tomala and Senechal, 2003). Market orientation in innovation is fostered by contacts with the market/customers during product development, up-front marketing, representation of the marketing function in the development process, knowledge about markets and competitors, having marketing competence, the use of advanced marketing research techniques, and product superiority from the customer's point of view (Biemans and Harmsen, 1995).

Management of Business Networks

A business network consists of "nodes" or positions (occupied by firms, households, strategic business units inside a diversified concern, trade associations, and other types of organizations) and "links" manifested by interaction between positions (Thorelli, 1986). These links are usually called relationships. A network can be approached in terms of its activities, resources, and actors (Håkansson and Snehota, 1995). The activities and resources in two different relationships can complement each other, or they may be in competition. Similarly, actors can use the existence of complementarity or competitiveness in their relationships in different ways when interacting with each other. Networks are evolving organism and their dynamics is caused by the fact that actors, relationships, needs, problems, capabilities, and resources change over time (Ojasalo, 2002a).

The boundaries of a business network cannot be defined exactly (Håkansson and Snehota, 1995). From the management viewpoint, however, it is necessary to focus the company's effort on certain meaningful part(s) of the network. This focusing of effort in network management is occasionally referred in the network literature. For example, Jüttner and Sclange (1996) refer to determining upon which actors to focus, Möller and Halinen (1999) talk about management of relationship portfolio. Ford, Gadde, Håkansson, and Snehota (2002) refer to choices within the existing relationships as the first aspect of networking. Ojasalo (2004) refers to a key network which is a defined subnet, a defined set of access points to a larger unlimited network. The value received by the focal company, the company that is "focusing its effort" in the network, does not have to be created entirely in the key network; its creation is mobilized or received through the key network.

So far, the literature includes very few approaches for management of business networks, however some can be found. According to Thorelli (1986), network management involves marketing, technology transfer, information exchange, accounting and finance, as well as public and interpersonal relations. Håkansson and Snehota (1995) say that the most important dimension of change in business networks concerns the development of activity links, resource ties, and actor bonds in relationships. A company can facilitate and create changes in networks by novel connecting of ties, resources, and bonds. According to Jüttner and Schlange (1996), developing a network strategy includes determining a) what is the

strategic situation to be analyzed?, b) upon which actors to focus?, c) who determines the nature of the relationships?, d) what part in the network does each actor play?, and e) what leverage and what steering potential does each actor have? Möller and Halinen (1999) bring forward that network management includes four basic levels which are a) industries as networks level —involving network visioning; b) firms in networks level —involving net management, c) relationship portfolios level —involving portfolio management; and d) exchange relationship level —involving relationship management. Ford, Gadde, Håkansson, and Snehota (2002) say that management in networks involves a) network pictures, b) networking, and network outcomes. Network pictures refer to the views of the network held by participants in that network. Network pictures are the basis for the actors' perceptions of what is happening around them and of actions and reactions in the network. Networking encompasses all of the interactions of a company or individual in the network. Multiple network outcomes are continuously produced by networks, and the nature of network outcomes can be understood in terms of three dimensions: actors, activities, and resources. Ojasalo (2004) extends the idea of key account management into the network context and talks about key network management which includes a) identifying a key network, b) selecting strategies for managing the actors of a key network, and c) developing and applying operational level methods for managing the actors of a key network.

Innovation Networks

The literature includes some studies focusing on innovation in the network context. Biemans (1990, see also 1992) suggested five critical success factors for innovations management in networks. These are cooperation between parties, coordination of activities, communication between people, creativity, and level of chaos. The advantage of cooperation is that each party can do what it does best. The benefits of cooperation will be materialized when the parties involved establish effective and efficient coordination of activities to be undertaken. An important prerequisite for successful coordination includes creating and maintaining good and timely intra- and inter-organizational communications. Biemans (*ibid.*) suggests that cooperation, coordination, and communication reduce the level of chaos in an innovations process, and, thus, increases the probability of developing successful innovations. He (*ibid.*) also says that successful innovation is not achieved through routine adherence to prescribed detailed procedures, schedules, and measures.

Dickson and Hadjimanolis (1998, p. 15-16) examined innovation and networking among small manufacturing companies. They found some tentative evidence that companies operating in terms of "the local strategic network" are more innovative than those operating in terms of "the local self-sufficiency". Echeverri-Carroll (1999) examined knowledge flows

in innovation networks and compared "traditional" US firms and Japanese firms. The study found that Japanese firms tend to exchange information more frequently with their main suppliers, customers and other kinds of organizations (i.e. non-profit organizations). As a result they tend to develop new products and processes faster than "traditional" US firms. The study also suggests that non-Japanese firms that adopt the Japanese-style networks tend also to develop new products and processes faster than their competitors.

Swan, Newell, Scarbrough and Hislop (1999) examined roles of networks and knowledge management in interactive innovation projects. They brought forward two contrasting views of the knowledge management processes: cognitive network model and community networking model. Cognitive model assumes that transfer of knowledge through networks is unproblematic; knowledge is assumed to "flow" fluidly between people through networks. Community network model, on the other hand, assumes that knowledge (unlike information) cannot simply be processed; rather it must be continuously re-created and re-constituted through dynamic, interactive and social networking activity. This is especially important for innovation processes that are interactive. Knowledge is inherently sticky and must be given meaning through active networking processes which allow those involved to engage in negotiation and sense-making (Weick, 1990).

Cox and Mowatt (2004) examined the use of consumer-driven innovation networks within the UK food-retailing industry. They found that by exploiting information gathered directly from their customers at point-of-sale and data mining, supermarkets are able to identify consumer preferences and co-ordinate new product development via innovation networks. In their study, the examined innovation network included food manufacturers, packaging companies and retailers. The innovation network was able to establish a new competitive process in UK food-processing and retailing industry. Taatila, Suomala, Siltala and Keskinen (2006) examined social aspects of innovation networks. According to them (ibid.), an innovative idea is formed by a social network which "concentrates" the networks knowledge via one or more central persons, the "innovators". Their model of the social aspects of an innovation process includes three types of competence attributes: individual competence attributes structural competence attributes that contain the social aspects of innovation process, and resource-based competence attributes.

Indeed, all the previous studies tend to suggest that networked cooperation between individuals and organization enhance innovation. However, as referred earlier, there are also contradictory research results suggesting that new products developed in partnerships between companies are not automatically more successful than those developed in-house (Campbell and Cooper, 1999).

Methodology

The present empirical study draws on the case study method. This approach, in general, can be characterized as follows. *Holistic and detailed understanding:* The case study approach implies the detailed examination of a single example of a class of phenomena (Abercrombie, Hill and Turner, 1984). A case study allows an investigation to retain the holistic and meaningful characteristics of real-life events, such as organizational and managerial processes (Yin,1984). According to Gummesson (2000, p. 86), "An important advantage with the case study research is the opportunity for holistic view. ..case research seeks to obtain a holistic view of a specific phenomenon or series of events." *Single and multiple case studies:* Case studies can involve both single and multiple cases (Yin, 1984; Eisenrahardt, 1989). Single case studies have been used frequently and advocates of this approach propose that a single case would provide better theoretical insights than multiple-case research based on creating good constructs (Dyer and Wilkins, 1991). However, multiple case studies have also become popular in theory development. According to Eisenhardt (1991), multiple cases are a powerful means to create theory because they permit replication and extension among individual cases. Replication means that individual cases can be used for independent corroboration of specific propositions helping researchers to perceive patterns more easily. Extensions refers to the use of multiple cases to develop more elaborated theory since different cases often emphasize complementary aspects of a phenomenon. *Qualitative and/or quantitative data:* The empirical evidence of a case study may be qualitative, quantitative, or both (Eisenrahardt, 1989). Yin (1984) mentions the following sources of evidence in the data collection for case studies: interviews, direct observation, participant-observation, documentation, archival resources, and physical artifacts. Each form of empirical data require their own techniques for collection and analysis. *Purpose to provide description, develop theory, or test theory:* According to Yin (1984), there may be descriptive, exploratory, and explanatory case studies. Thus, case studies can used to accomplish various aims: to offer description, to develop a theory, and test a theory (Eisenrahardt, 1989). Developing a grounded theory (Glaser and Strauss, 1967) is very similar to theory development from case studies (Chetty, 1996). Thus, when the purpose of the case study is to develop (suggest) a theory the grounded-theory procedures and techniques are a usable way of conducting the study.

This paper is based on analysis of two case companies representing very different and contrasting approaches to management of innovation networks. The analysis of this paper is part of a larger multi-case research project on innovation management in the software business, in which the data were collected in two different phases from thirty seven companies; the first phase included fifteen and the second twenty two companies. The

companies examined were SMEs in the software industry. Empirical material was obtained from the case companies in terms of in-depth interviews of key people involved in new product development. Management of innovation networks was one of the central themes discussed in the interviews. The interviews were taped and transcribed for analysis. The two cases explained in this paper are selected from these companies because they represent very different management approaches, thus creating a fruitful contrast for the analysis. The present analysis draws on this data.

The analysis included two phases: open and selective coding of the data (Glaser, 1978). Firstly, in the open coding or initial coding phase, the emphasis was on identifying and grouping qualitative evidences related to various aspects of management of innovation networks. Differences in the management approaches of the examined companies were looked at, in particular. This coding phase resulted in an initial categorization of the qualitative evidence. Secondly, in selective coding or focused coding, the purpose was to make a deeper analysis on each initial category developed in the open coding phase. In this phase, all the qualitative evidences related to certain initial category were looked at and analyzed together.

As a result of the analysis, several aspects of management of innovation networks were identified and their nature was explained. These aspects were: a) duration of the network, b) rewards from the network, c) fundamental meaning of the network, d) the nature of the networked organization, e) planning, control, and trust, f) hierarchies, authority, and coordination. The analysis focused on these aspects because they seemed to be relevant and powerful in explaining the nature of management of innovation networks, and because these aspects often created a sharp contrast between the case companies. This served well the purpose of the study, which was to increasing the knowledge of management of innovation networks by mapping characteristics of management approaches.

The case companies of this report are characterized as follows. Company A develops mobile and voice platforms. Its applications connect Internet, wireless and wired phones, interactive digital voice, and databases. Their products include various software used in delivering services by phone. Users interact with such automatic services by pressing buttons on their phones and using their own voice. Company A has also developed their own markup language for programming voice applications. Company A's customers are b-to-b-customers. Company B has specialized in designing interactive Internet-based career tools. These tools are licensed to organizations that want to enhance their recruitment or career development services. These tools are a suitable addition to Internet-based online recruitment, outplacement and career development services within any company. The tools

include applications resembling Internet-based psychological tests. Companies advertising vacancies on web pages, such as recruitment offices and large newspapers, may also offer Internet-based services which help the users to map their profile and, thus, seek a suitable job. 95% of Company B's sales come from abroad. Indeed, Company B's customers are b-to-b-customers and the end users of their software are people looking for a job on the Internet.

Empirical Findings:

Different Approaches to Management of Innovation Networks

This section explains the findings that have emerged from the present analysis. It is based on the examination of the two case companies described above and carrying out their product development in inter-organizational networks. The main findings and related case descriptions of the empirical study are summarized in Tables I-VI. As a result of the analysis, several aspects of management of innovation networks are identified and their nature is explained. These aspects are: a) duration of the network, b) rewards from the network, c) fundamental meaning of the network, d) the nature of the networked organization, e) planning, control, and trust, f) hierarchies, authority, and coordination.

Duration of the Network

The data of this study show that an innovation network may be project specific, in other words temporary, or continuous. When it concerns a situation in which the innovation network is project specific, the data show that the company, which developed the initial product idea in the first place, has the natural position to decide whether they want to carry out the product development project in-house or in networked cooperation with other companies. If they want to operate in terms of a network then they can establish an innovation network and select its members. The data show that the company which developed the initial product idea often, but not always, is also mainly responsible for managing the innovation process in the network context.

When it concerns a situation in which the innovation network is continuous, the data suggest that formation of such a continuous network is enhanced by a common professional history and friendship between the actors. The fact that a key network is continuous enhances the innovations management because the actors of the network learn to know each other. On the other hand, in such cases the network partners must ensure their operation does not turn into an isolated insider club. External state-of-the-art influence is absorbed, for example, by participating in conferences and discussing with various experts in the field. Actors of a continuous key network may also independently carry out other projects unrelated to the products developed in terms of the network. Of course, there are also changing and project

specific actors involved with different projects. However, they have a minor role in the overall operation.

Table I Empirical findings related to the duration of the network

		Main findings	Case description
Duration of the network	Project specific innovation network	● The initial idea owner decides on whether the product development project is realized in-house or in an inter-organizational network ● The initial idea owner decides on who manages the networked product development project	Company A continuously develops ideas for new products. In their case, developing an idea for a new product often includes the development of an initial demo-version, which already gives a certain functional and visual shape to the product. Instead of carrying out the whole product development project in-house, Company A sometimes wants to do this in cooperation with other companies, and starts looking for suitable partners in order to establish a network for further co-development of the innovation. Such an innovation network typically includes companies specialized in producing media content, planning voice effects, and designing the visual outlook of software. An important network partner may also be one who will take care of the distribution of the product once the product development project is completed. Company A is often, but not always, mainly responsible, in other words "the project manager", for the innovation network. In Company A, networks established for product development are project specific. This means that one innovation is developed and commercialized in terms of one innovation network, and another in terms of another.
	Continuous innovation network	● Cooperation is efficient because actors know each other well ● Receiving external	Company B has its history in the academic world. It was founded by an academic researcher who got interested in and carried out an academic R&D project related to Internet-based services for the enhancement of career planning. Besides the researcher, a skilled programmer and graphical designer also participated in this project. At some point, the founder of Company B decided to move from research to business, and put into practice the ideas developed in the academic world. The programmer and graphical designer also became interested in this idea, but these three did not found a company together. Instead, they all wanted to have their own companies and operate as a network of companies. Such an arrangement left everyone the freedom to independently carry out other activities and projects, in addition to those related to the career tools, which are the main business of Company B. When it concerns career tools, this innovation network has carried out several product development projects in this area. This network does not change from project to project. Indeed, it is continuous. Of course, there are also changing project specific actors involved with different product development projects, but they do not belong to the core of this network. The members of this innovation network actively participate in conferences in their professional field and also actively discuss with other experts, and, thus, are influenced by external and international ideas in their professional field.

Reward from the Network

According to the data of this study, companies carrying out product development in the network context may have very different orientations for using the network for profit making and personal self-fulfillment. In some cases, companies see new innovations as a means and in some cases as an end. The empirical material shows how a profit-oriented company aims at realistically executable development projects resulting in products successful in the marketplace. A profit-oriented company also bears in mind that the innovation network may include actors interested in creative and artistic self-fulfillment rather than realistic project management and commercial success of the product. A profit-oriented company naturally aims at directing the overall operation of the network onto the profit-oriented and realistic track.

The data of this study show that creative and artistic self-fulfillment, life-style entrepreneurship, and friendship between individuals may be the most important

motivation behind an innovation network. In such cases, developing and materializing new explorative products, which are excellent in the eyes of the developers, may be an end rather than a means. Product development in such a network may indeed result in products, which are excellent in the eyes of end users, but the commercial potential of such products remains easily unexploited. Lack of marketing, for example, is an important reason for this, according to the present data

Table II Empirical findings related to the primary reward from the innovation network

		Main findings	Case description
Primary reward from the innovation network	Profits	● Emphasis on commercial success of the innovation in the marketplace ● Realistically executable product development projects (time tables, costs, degree	Company A develops software products involving artistic audio elements. In other words, they combine information technology and "voice art". Consequently, the innovation networks they establish for product development include both technically and artistically oriented people. Company A has often experienced situations in which people in the network have become enthusiastic about the creative challenge and forgotten the main purpose, namely developing a commercially successful software product. Company A's project managers explicitly pay attention to the managerial aspects of the innovation project and often have to "calm down" the creative and artistic enthusiasm in the network and make sure that wild ideas do not become the main thing. Instead, Company A wants to make sure that, although people's creative self-fulfillment is important, it should not be the main thing in new innovations, but rather a realistically executable development project and commercially successful product.
	Personal self-fulfillment	● Creative and artistic self-fulfillment, life-style entrepreneurship, and friendship between individuals are the most important motivators ● Commercial potential of the	The owner and director of Company B sees that making money is not the most important motivation for the existence of their innovation network. In the case of Company B, creative and artistic product development and a certain life- style are more important than profits. The network of innovative and creative people who are good friends is an excellent platform for personal creative self-fulfillment. Together, they have for several years enthusiastically enjoyed developing new explorative products. Making money is, of course, important and necessary to Company B as well. However, a more important reward for them is to see that the result of their product development is brilliant in their own and the end users' eyes. In user surveys, their products have received excellent rankings. On the other hand, they have been ignorant of the commercial exploitation of their innovations. For example, Company B does not have a marketing budget. Company B's key network includes no one who would market their products; all their customers have heard about them through word-of-mouth or seen their products on the Internet.

Fundamental meaning of the network

The data of this study suggest that an innovation network may be both a means and an end. In other words, the network may primarily be for business purposes or for self-fulfillment and social purposes. When the network is a means, the real benefits relate to the fact that the company is able to mobilize various important resources for innovations processes unavailable in-house. The need for external resources is because certain resources are needed so seldom that retaining them in-house would be too expensive. There are also resources that simply do not belong to the focal company's line of business and strategy.

Indeed, because of friendship and a common professional desire to develop new innovative products, the network may have such an important role that it already is an end as such. Then, a clear advantage of such an important and strong network is that it is supported

and enforced by each person's internal motivation. If products developed in such a network are not commercially successful in the short term, the actors' motivation for further cooperation is not lost. On the other hand, the disadvantage is that this may cause the nature of the operation to shift from business to hobby and less profitable life-style entrepreneurship. Consequently, if the operation is overly life-style entrepreneurship, this may be a barrier for external financing, larger scale product development projects, and expansion of the business.

Table III Empirical findings related to the fundamental meaning of the network

		Main findings	Case description
Fundamental meaning of the network	Innovation network as a means	● The network exists for business purposes only ● The company uses the network to mobilize various important resources for innovations	As explained earlier, Company A establishes a new network for each new innovation developed in terms of external cooperation. Moreover, as explained, they are oriented towards making profits rather than creative and artistic self-fulfillment. In their case, a key network established for innovations management is clearly a means. Through a network, they are able to mobilize project specific resources for innovations processes not available in-house. For product development and commercialization, Company A typically needs external resources, such as expertise related to media content production, planning voice effects, designing visual outlook of software, and distribution.
	Innovation network as an end	● The network is based on actors' friendship and a common professional desire to develop new innovative products ● Commercial failure is less likely to break the network ● The operation may shift from business to hobby	Company B's innovation network includes two other small companies. The people in these companies are very close friends. Both professional and social aspects are very important in the network. In fact, the social and life-style aspects may be even more important than the business aspect. Outside of the innovation network, Company B's network also includes many other distant and/or changing actors, such as relatives who are also entrepreneurs, researchers at home and abroad, customers, etc. According to the owner of Company B, the network is already an end as such. This gives a very strong motivation to the actors in the network to develop new innovative products even though the products would not be immediately commercially successful. On the other hand, Company B has also experienced that investors are unwilling to invest in such a network. Company B has had discussions with international business angels who become interested in Company B's products. Although the business angels considered Company B's products to be very promising they were unwilling to invest in Company B's network because its operation is overly life-style entrepreneurship.

The Nature of Organization

The present data show that the nature and practices of product development may vary significantly, and, consequently, the operation of an innovation network may resemble a traditional or virtual organization (see virtual organizations e.g. Mowshowitz, 1997; Christie and Levary, 1998). In an innovation network resembling a "traditional" organization, the innovation process is more restricted by location and time. In other words, the innovation process mostly takes place within the framework of physical offices and working hours.

In virtual organizations, individuals' work is not restricted by time and place, and communication is strongly facilitated by IT. Such a product development environment allows a greater degree of freedom to individuals involved with the development project. If the operation of the innovation network resembles a virtual organization people may even be located in different countries. Yet, this requires sophisticated project management tools accessible through the Internet. Indeed, a clear advantage of a virtual organization is the fact that it allows extensive freedom to individuals to organize their work. However, managing such an operation is somewhat more demanding. Also, a virtual organization may cause a

lack of personal contacts, and, thus, explicit attention must be paid to taking care of informal contacts between individuals in the innovation network.

Table IV Empirical findings related to the nature of organization

		Main findings	Case description
The nature of organization	Traditional organization	● The innovation process is more restricted by location and time	Company A can be characterized as "traditional company" rather than a virtual organization. It has a physical office, regular working hours, etc. Also, the other companies with which Company A cooperates in networked product development are similarly traditional companies. This means that also peoples' activities related to product development are traditional "regular" work taking place in terms of certain working hours and location. In other words, the individuals' freedom to choose own working hours and place is limited. Still, Company A's innovation networks have also many characteristics of a virtual organization, such as dependence of relationships with other organizations.
	Virtual organization	● The innovation process is more restricted by location and time ● Allows extensive freedom to individuals to organize their work ● Requires sophisticated project	The network related to Company B earlier had an office together, but they gave it up because they did not prefer to work in a certain restricted space. Each person preferred to work in different places and have the freedom to choose the place. People in Company B's network have conducted their product development work, for example, from Spain and the UK. In fact, personal freedom to choose the time and place for the work is one of the main reasons why the network holds together. Company B sees that an operation based on a virtual organization is what makes the network so comfortable for everyone, because people have their freedom. However, the lack of human contacts is occasionally perceived as a disadvantage. Company B has Internet-based project management and communications tools for managing their product development projects. Since these tools are accessible through the Internet, people can very freely choose their place of work. People belonging to Company B's network meet in person twice a month. Often, they see each other in meetings with customers. Outside these meetings, they often keep in touch by e-mail and phone. The experience of Company B is that project management is somewhat more demanding in a virtual environment than in a traditional office environment. Company B has also found that when the operation is based on a virtual organization they must explicitly pay attention to maintaining personal relationships, in other words, have personal activities together outside product development activities.

Planning, Control, and Trust

According to the data of this study, planning, control, and trust are important elements in innovations management in the network context. They are important, not only for coordinating activities in the development process, but also for the protection of intellectual properties of innovations, which is crucial in the software business. In some cases, planning and control of an innovation process seem to be very formal and structured. In other cases, planning and control seem to be less controlled, and the operation is rather based on trust between actors in the network.

Written agreements are used and followed in cases where the planning and control of innovation process in the network is required to be formal. The agreements define actors' roles and responsibilities, timetables, and their completion criteria in product development projects in the network context. Besides a written contract, trust is also important in product development networks. To a large extent, trust is based on former experience of earlier cooperation. Nevertheless, the practical level operation is controlled in terms of written contracts made in the beginning of the project when the innovation network is established.

The data show that the operation of an innovation network may, in some cases, be mostly based on trust and friendship. However, in such cases planning and agreeing on the product development project is also necessary. A certain amount of control is also required, for example, to ensure that the promised schedule is met. Furthermore, the network is not necessarily convincing in the eyes of customers if their operation is not defined in terms of legally valid agreements. Thus, written legally valid agreements are needed, although the operation is on a practical level based on trust.

Table V Empirical findings related to planning, control, and trust

		Main findings	Case description
Planning, control, and trust	Planning and control most important, trust desirable	● Written agreements integrally belong to the planning and control of operation ● Agreements define actors' roles and responsibilities,	Company A sees that a central problem with the development of new products in the network context is to decide how much of their initial product idea should be shared with potential actors in the network and how much should be kept secret when they introduce the idea to potential network members in the first place and no written agreements exist. The other actors should know enough of the product idea in order to become interested and join the development network. On the other hand, they should not know too much because they may steal the idea and develop it by themselves. Thus, Company A requires that a written agreement on secrecy and intellectual property rights is made at a very early stage with other companies in the innovation network. After that, the actors in the network make agreements on roles, responsibilities, and schedule in the product development project. This includes a description of each phase of the development process. It also includes the criteria and methods concerning how the completion of each phase will be verified. Lawyers are involved when agreements are drafted. Thus, Company A makes a careful execution plan and sets up a control mechanism in terms of written contracts with other parties in the network for the development project. Besides careful plans, control methods, and legal terms, trust is also extremely important. Company A trusts the companies which have in earlier projects turned out to be capable of taking care of their responsibilities and fulfilling promises. Still, written agreements play the major role in planning and control of the operation
	Trust most important, planning and control desirable	● Operation is mostly based on trust between individuals ● Certain amount of control is required ● The network may not	Before the network related to Company B starts a product development project, the members of the network meet, discuss, and agree on the project plan. In their network, it is enough when people just promise to take care of certain tasks within a certain time frame. No written agreements are needed, at least not for their own sake. The operation of the innovation network related to Company B is, to a large extent, based on trust and friendship between the individuals. During the projects, Company B functions as a project manager, and, for example, reminds other actors if the schedule does not hold. Companies in the network related to Company B also have written agreements, for example, concerning confidentiality and rights to products. This is because Company B's major clients request that internal agreements related to the operation within Company B's network have to be legally valid. However, such written agreements are primarily for the sake of their customers, not for their own sake.

Hierarchies, Authority, and Coordination

The present data show that the companies examined carrying out product development in the network context do not want to create hierarchies in their network. The various advantages gained from networked product development would be lost if the operation becomes too hierarchic and rigid. Indeed, one of the main reasons for carrying out product development in a network is to have access to resources not available in the own company. Hierarchies in the network tend to block access to external resources and slow down the development process.

On the other hand, the data suggest that companies do not want to carry out product development in a network that is totally "wild". Indeed, at the same time as companies aim at avoiding hierarchies, they want someone to have the highest authority in the network. This actor is expected to take care of coordinating activities in the network and also using his authority on behalf of the network in decision-making if necessary. In other words, an innovation network also needs a project manager.

Table VI Empirical findings related to hierarchies, authority, and coordination

	Main findings	Case description
Hierarchies,	● Hierarchies in an innovation network tend to block access to external resources and slow down the development process ● Still, companies want someone to have the highest	Company A explicitly wants to avoid hierarchies when they carry out networked product development projects with other companies. However, they consider it very important that there is a "project manager" in the network having the authority to make decisions for the network and coordinate the operation. Company A is often, but not always, the project manager of a network developing new products. Company B sees that when product development is carried out in the network context, the "hierarchy should be very low." The experience of Company B is that there should be substantial freedom in the network, but there should be still one who coordinates and "makes

Indeed, the previous analysis identified and explained the nature of several aspects of management of innovation networks. These aspects are powerful in mapping and explaining the characteristics of innovation network management. Company A's approach is here called "rigid" and Company B's is called "free" (Table VII).

Table VII Rigid and free approaches to management of innovation networks

	Rigid	Free
Duration of the network	Project specific network	Continuous network
Reward from the network	Profits	Personal self-fulfillment
Fundamental meaning of the network	Network as a means	Network as an end
The nature of networked organization	Traditional organization	Virtual organization
Planning, control, and trust	Planning and control most important, trust desirable	Trust most important, planning and control desirable
Hierarchies, authority, and coordination	Hierarchies should be avoided or minimized,	Hierarchies should be avoided or minimized,
	however there must be someone who has the highest authority and coordinates the cooperation	however there must be someone who has the highest authority and coordinates the cooperation

Discussion

Duration of the network. It was found that an innovation network may be project specific, in other words temporary, or continuous. It should be noted that, although a company operates in terms of project specific and temporary networks, its general orientation to *networking* –network based operation– may be continuous. That seemed to be the case with Company A. Hermes (2001) talks about knowledge exchange in strategic alliances and distinguishes short- and long-term orientation in this context. Short-term orientation is operationalized in terms of the degree to which partners focus on quick and tangible results. Long-term orientation is operationalized in terms of the degree to which partners focus on developing the alliance rather than concentrate on achieving short-term goals. An overly short-term orientation may limit the capital, resources, and time exposure of individual partners to a collaborative relationship. On the other hand, a long-term orientation may tend to ignore the short-term performance, and consequently make the alliance vulnerable. Alliance duration is often uncertain (Newman, 1992).

Reward and fundamental meaning of the network. It was found that companies carrying out product development in the network context may have very different orientations for using the network for making profit and personal self-fulfillment. According to Ahmed (1998), freedom from rules and flexibility in budgets promote innovation. This is in line with Company B's approach. Company B's reward from innovation network was characterized by free and creative personal self-fulfillment with less profit orientation. Company A was fundamentally oriented to profit maximization, and in their case, the network was clearly subordinated to this goal it was a means. In the case of Company B, on the other hand, the innovation network was an end as such. It represented values, such as friendship and possibility to realize the desire to develop something new. When it concerns the economic aspect, in the case of Company B, the network was used to generate an adequate level of income rather than maximize it. Company A's management approach was in line of any company's "natural" desire to maximize cash flow and return of investment ROI. Interestingly, the literature suggests that, this natural goal has largely been neglected in marketing theory and practice (Srivastava, Tasadduq, and Fahey, 1999) because the management of various business processes (for example networking) have not been connected to their cash flow consequences. The reasons why profit maximization may not be of high priority, like in the case of Company B, are explained in the entrepreneurship literature. Profit generation is just one reason for entrepreneurial behavior. There several others, such as need for achievement, internal locus of control, high propensity for risk taking, need for independence, and innovative behavior (Deakins, 1996).

The nature of networked organization. The nature of Company A's innovation network was found to resemble traditional centralized organization. This approach in innovation

management is supported by Drucker (2002), who agues that innovation is real work, and it can and should be managed like any other corporate function. Company A's approach is also in line with Levitt's (2002) discussion on the need for discipline also in innovation management. This is because creativity and innovation tend to disturb the organization's order (ibid.). Organizations, according to him (ibid.), are created to achieve order: they have policies, procedures, and formal or powerfully informal (unspoken) rules. He says that the job for which the organization exists could not possibly get done without these rules, procedures, and policies. In contrast, the nature of Company B's innovation network was found to resemble virtual organization. According to Christie and Levary (1998; see also Gummesson, 1996; Mowshowitz, 1997; Bourdreau et al., 1988; Achrol and Kotler, 1999, Chutchian-Ferranti, 1999, Hoogeweegen et al., 1999; Ojasalo, 2001b), virtual organizations have the following characteristics: a) they are continuously evolving networks of independent companies linked together to share skills, costs, and access one another's market and data, b) they end up with more capabilities and power than they inherently possess, c) information technology plays a central role in their development, functioning, and success, d) they have no physical office or hierarchy, e) they are often temporary and loose coalitions which come together for a specific purpose, and f) they enable companies to work concurrently rather than sequentially. Virtual organizations often allow individual employees to perform their work in a variety of locations: home, car, office, or on airplanes (Bourdreau et al. 1988). Company B emphasized the freedom of time and location related to work as an important aspect of their innovation network, in particular.

Planning, control, and trust. When it concerns planning, control, and trust, it was found that Company A held planning and control most important, and trust desirable. Company B, on the other hand, held trust most important, and planning and control desirable. Trust and control are essential elements of relationships (e.g. Ford 1982; Håkansson, 1982; Dwyer, Schurr and Oh 1987; Liljegren 1988; Wilson and Mummalaneni 1990). According to Ritter and Gemünden (2003), planning and control belong to the network management task which influence innovation success. Indeed, the more there is trust, the less there is need for control. Control and planning are inherent parts of any management process, also management of innovation networks.

Hierarchies, authority, and coordination. The present data showed that the companies examined carrying out new product development in the network context do not want to create hierarchies in their networks. However, at the same time they want someone to have the highest authority and responsibility in the network. This empirical finding is somewhat contradictory. In principle, it should be interpreted so that two hierarchical layers represent the optimum. However, is likely that this issue is much more complicated and there is no

general rule for it. Indeed, one function of a network is to reduce hierarchies and open firms to their environments (Achrol and Kotler, 1999). According to Håkansson and Ford (2002), the network is the outcome of the deliberations, aims and actions of a number of participants, and no company is the "hub" of the network or is likely to have complete control over it. Indeed, the empirical finding related to minimizing hierarchies is clearly supported by the network literature. But can a network, which aims at achieving certain goals, be totally free from hierarchies and "hubs"? The present cases suggest that, in effective networking, someone is needed who has the highest authority and responsibility, and who coordinates the cooperation. This is supported by Biemans (1990) who says that the benefits of innovation in business networks will be materialized when the parties involved establish effective and efficient coordination of activities to be undertaken. Similarly, Ritter and Gemünden (2003), include coordination in their network competence concept which was found to be important for achieving innovation success. However, this does not have to mean opportunistic use of the hub-position and too detailed control of actors and their various activities. According to Ojasalo (2004), a focal company trying to control too many activities of other actors in the network is likely to reduce the effectiveness and efficiency of the network. As a conclusion, a "manager" or "coordinator" is likely to be needed in effective networking, however his or her role and management approach should differ from the roles and approaches typical in organizations characterized by hierarchies, bureaucracy, centralization, and opportunism.

Theoretical Implications

The following discussion explains the theoretical implications of the present study. Firstly, the literature dealing with business networks is largely conceptual and descriptive. It includes very little empirical knowledge of the management methods actually used by companies. This study makes contribution to the literature by empirically mapping characteristics of companies' management approaches in the context of inter-organizational innovation networks. It identified various aspects, which are relevant in understanding and explaining the nature of innovation network management. These aspects of network management are: duration, primary reward, the fundamental meaning, nature of networked organization, planning, control, trust, hierarchies, authority, and coordination. By paying attention to these aspects it is easy to get a comprehensive grasp of how a company manages its innovation network. These aspects also provide a usable framework for comparing the management approaches of different innovation networks.

Secondly, both the empirical material of the present study and the existing literature include two different fundamental views on how controlled and structured the innovation

and network management should be. In the present study, Company A was clearly more oriented and Company B less oriented towards controlled and structured management. This juxtaposition can also be found in the innovation and network management literature as discussed in the following.

In the case of innovation, the literature often talks against more controlled and structured management, and instead emphasizes freedom. Ahmed (1998; see also Judge, Fryxell, and Dooley, 1997; O'Reilly, 1989; Scheider, Brief, and Guzzo, 1996) summarizes factors promoting innovation and innovative culture: "freedom from rules," "do not be obsessed with precision," "freedom to experiment," "freedom to try things and fail," "non-hierarchical," "acceptance of mistakes," "no punishment for mistakes," "move people around," "flexibility in jobs, budgets, functional areas," "quick, flexible decision making," "minimize bureaucracy." As discussed earlier, these characteristics were found in Company B's management approach. Ahmed (1998) also lists hinders of innovation: "many rules and set procedures," hierarchical," little individual freedom of action, "formal reporting." In contrast, Drucker (2002) discusses how much of innovation is free inspiration, and how much hard work. He argues that, in business, innovation rarely spring from a flash of inspiration. He says that most innovations, especially the successful ones, result from a conscious, purposeful and cold-eyed analysis of seven kinds of opportunities: unexpected occurrences, incongruities, process needs, industry and market changes, demographic changes, changes in perception, and new knowledge. Similarly, Levitt (2002) criticizes the over emphasized freedom- and creativity thinking in innovation and addresses the importance of implementation. He says that by failing to take into account practical matters of implementation, big thinkers can inspire organizational cultures dedicated to abstract chatter rather than purposeful action. The worst thing a company can do, in Lewitt's view, is to put innovation into the hands of 'creative types'–compulsive idea generators whose distaste for the mundane realities of organizational life renders them incapable of executing any real project. Quinn (1985) and Biemans (1992) argue that innovation processes are very much characterized by chaos, in the sense of surprises and unexpected changes, however they can still be controlled to a certain extent. As mentioned earlier, Company A's management approach was better in line with the more controlled and structured innovation management approach.

Similar difference of views is also included in the network management literature. It contains arguments against more controlled and structured network management. According to Håkansson and Ford (2002, p. 137), "Companies try to control the network that surrounds them and to manage their relationships to achieve their own aims. This ambition is one of the

key forces in developing networks. But, the paradox is that the more that a company achieves this ambition of control, the less effective and innovative will be the network." Similarly, Ford, Gadde, Håkansson, and Snehota (2002) say "A company centered view of the network provides an inadequate basis for understanding the dynamics within that world or for helping the company to understand the pressures that are or may affect the company of the opportunities open to it. Despite this, the view of a network that is limited to the set of other companies that the single company knows of, or thinks of or deals with is common in the managerial literature. Such a view is often associated with the illusion that the company then *controls* that network or more simply that it is their network." Company B's management approach resembles the above ideas. In contrast, some structured frameworks have been introduced for network management aiming at facilitating the focal company to control the business network around it to achieve its own goals, at least to certain extent. Jüttner and Schlange (1996) suggested a framework for strategic decision-making in business networks including the following phases and measures: 1. Context description (Which is the strategic situation to be analyzed?), 2. Set of actors (Which are the actors to be focused?), 3. Interdependence matrix (Who determines the nature of the relationships?), 4. Portfolio of interdependencies (Which part in the network does each actor play?), and 5. Strategy matrix (What leverage and what steering potential does each actor have?). Ojasalo (2004) introduced a systematic approach for managing business networks, called Key network management. This approach included three basic elements: 1. Identifying a key network, 2. Strategies for managing actors of the key network, and 3. Developing and applying operational level methods for managing actors within the key network. Company A's network management resembled these more controlled and structured approaches. The need for more controlled and structured management of business networks is also addressed by Srivastava, Tasadduq, and Fahey (1999). According to them, as we move from stand-alone competition to networked rivalry, we must learn to move from a complete dependence on our own capabilities to managing a network of relationships. In this context, according to them (ibid., p. 178), it is important to seek knowledge of the following issues: "What are the best practices for participation in and virtual integration of supply chain/value networks?", "How should a firm manage a network of relationships across channel partners, customers, partners, and competitors?", and "What are the best ways to measure superior performance in network management (versus performance of stand-alone products and services)?"

The above discussion concerning the two views on how controlled and structured the innovation and network management should be resembles the discussion on environmental determinism vs. strategic choice in marketing. According to Varadarajan, Clark, and Pride

(1992), believers of environmental determinism argue that environmental forces, for example regulation, changing tastes, and foreign competition, are essentially unmanageable. The organization is a rudderless ship in a storm of environmental forces, unable to steer or chart a course; the crew and vessel are at the mercy of the elements. Strategic choice advocates presume that decision makers can control the environment (the words "managing," "shaping," "influencing," "controlling" may also be used here). Managers can mold both people and events to their advantage. Still, firms cannot do everything, but they can do something.

How should the terms "management" and "control" be used in the context of networks and innovation? Management should be understood as *a conscious attempt* to define and reach the goals with certain actions as well as possible, rather than an ability to reach all the goals with 100%. Also, management and control do not mean *total* management and control of each aspect of the subject. For example, a company wishes to create a supplier network for itself, and the objective is to establish supplier relationship with four different suppliers. If the company succeeds to establish only three supplier relationships, we can still refer to supplier network management. Also, the company may wish to control the quality of the products bought from the suppliers, but not any other aspect of their operation. We can still talk about controlling the actors, although there is no attempt to control any other aspects of the suppliers' operation. "Managing" and "controlling" in the context of networks do not mean total management and control, and they are not synonym for "command" and opportunistic use of coercive power Ojasalo (2004). In the context of innovation, Quinn (1985) and Biemans (1992) say that innovation can be controlled to a certain extent. Varadarajan, Clark, and Pride (1992) discuss "controlling the uncontrollable" and say that successful managers believe that organizations can create their own futures.

Thirdly, the study showed that management of innovation networks may be driven by other than economic objectives, although economic realities are always present. It was found that, for example the personal creative self-fulfillment and freedom may be more important than profit maximization. Also, there is likely to be a numbers of other objectives which may override the profit maximization in innovation networks. The examined companies were SMEs in the software business. The entrepreneurship literature has identified several reasons for why people become enterprising. In addition to gain profits, there are factors such as the need for achievement, ability to learn, locus of control (i.e. control over one's own [internal] and other's [external] actions), as well as need for autonomy and independency (Deakins, 1996; Mazzarol et al., 1999; Ojasalo, 2003b). From the future research viewpoint, this finding calls for further examination of the role of economic and other drivers of innovation networks. Forgetting the economic realities may lead into waste of resources and unsuccessful products. On the other hand, overemphasizing short-term profits may overly decrease the networks' creativity and risk taking willingness which important for successful innovation (Ahmed, 1998).

Managerial Implications

This study found that innovation networks may be project specific or continuous. New products are always developed in projects. The focal company may choose to establish a new network for each product development project or carry them out with the same network composition. The terms project-specific and continuous network relate to this decision. In any case, the focal company needs capabilities related to management of networks, projects and product development processes. In the case of project specific networks, the actors, activities, and resources are inherently reviewed and renewed in the establishment of a new innovation network. In the case of continuous network, most of the elements remain the same. Bryde (2003) classifies the properties of project management into enablers and results. Enablers include leadership, people, policy and strategy, partnership and resources, and processes. Results include key performance results, people results, customer results, and society results. Indeed, in the case of project specific innovation networks, it is likely that both enablers and results change inherently from one project to another. In contrast, in the case of continuous network, it is likely that only results change, unless explicit effort is invested in the renewal of enablers. It is clear that any continuous innovation network needs to improve and refresh all the aspects of management in order to respond to the dynamics of environment and to maintain its competitive strength. Furthermore, if the focal company prefers continuous networking rather than project specific, it is important to enhance the network actors' commitment to long-term relationships. Commitment to long-term relationships is enhanced by trust, satisfaction and relationship benefits, investments and adaptations, sharing of information, good personal relationships between individuals, consistency of interaction, contractual terms, conflict handling, uncompensated short-term sacrifices, and shared values and culture (Ojasalo, 2001a; 2002b).

It was found in the present study that companies emphasize differently the role of planning, control, and trust in their network management. Indeed, all aspects of networks can never be managed and controlled by the focal company, and it is not even meaningful to have such an aim. The focal company can decide which aspects of networks should and could be managed and controlled with the following evaluation (Varadarajan, Clark, and Pride, 1992): Is the issue a priority?, Is issue manageable/influenceable?, Do cost & benefits of action balance favorably?, and Is it ethical/appropriate to influence the issue?

This study found that the primary reward from the network and its fundamental meaning may be very different to different companies. The network may be a means for profit maximization, or represent an end as such in terms of creative self-fulfillment and friendship. This is due to the fact that objectives and priorities in different innovation networks vary. Because of this, there may be need to emphasize different aspects in the

management. According to Jaafari and Manivong (2000), the management process needed may include emphasis on hard or soft aspects, or a combination of both, depending on the case under consideration. It is suggested here that, when the innovation network's primary goal is in profit maximization, particularly in the short term, then the emphasis should be in the management of hard aspects. In contrast, if the short-term profit maximization does not have the highest priority, the emphasis may be on the management of soft aspects. However, if the emphasis is on management of hard aspects, the importance of management of soft aspects should also be recognized, and visa versa. Soft functions are those which do not lend themselves to quantitative, reductionist-type evaluation, but nevertheless are important to the success of the project (ibid.). Budgeting, risk management, and control plans are examples of hard aspects. In contrast team management, communication management, and human and industrial relations management are examples of soft aspects.

It was found that the innovation network may resemble virtual organization. In such a case, also the management has different requirements. Management of team issues, process issues, appropriate technologies, security, and interoperability and standards have different nature in virtual than in traditional organizations (Chinowsky and Rojas, 2003). The following guidelines and characteristics of managing virtual teams have been brought forward. *(1) Team issues.* Virtual teaming requires initial face-to-face meetings to develop a sense of "team". Managers must visit remote participants during the course of project. Trust between team members is difficult to establish when operating in a virtual environment. Virtual team leaders should be selected with an acknowledgement of the unique demands placed on distributed teams. *(2) Process issues.* The project objectives must be restated and reinforced frequently to ensure that all members remain focused on a common outcome. Conflicts must be addressed quickly to prevent unresolved issues from interfering with communications. Discussions on decisions will be more difficult to contain as participants continue discussions via electronic media. Expectations of each team member must be stated clearly to assist then members as they work independently. Team member workloads should be monitored to ensure that significant increases do not occur due to increased electronic communication, regular training must occur equally for all members of the virtual team. *(3) Appropriate technologies.* Selection of collaboration tools must be made to establish an integrated virtual environment. Project management tools must support the virtual environment and the project process. *(4) Security.* Documents must be secured before, during, and after transmission to ensure the integrity of the information. Participants must be authenticated to ensure that information is distributed between project participants. Secure transmission tunnels must be established if secure information is being transmitted within the virtual team

environment. *(5) Interoperability and standards.* Interoperability of software must be established prior to inclusion within the virtual team environment. The virtual team and environment must address the spectrum of interoperability definitions that are appropriate in the given project (Chinowsky and Rojas, 2003).

But when should companies organize for innovation by using decentralized virtual approaches and when by using traditional more centralized approaches? According to Chesborough and Teece (2002), this depends on the innovation in question. When the innovation can be pursued independently from other innovations, the decentralized virtual organization can manage the development and commercialization quite well. For example, a new turbocharger of an automobile engine can be developed without complete redesign of the engine. In contrast, when benefits of the innovation can be realized only in conjunction with, related complementary innovations, then more centralized approaches suit better (ibid.).

This study found that in innovation networks hierarchies should be minimized, however there must be someone who has the highest authority and coordinates the cooperation. Indeed, hierarchies tend to cause bureaucracy and frustration of creative people. But can an innovation network be totally free from hierarchies? If not, how many hierarchical lawyers are needed? Indeed, it is likely that a network established to accomplish certain task usually cannot operate totally free from hierarchies. This is because someone always has to coordinate the operation and be authorized for decision making concerning common issues of the network. Also, it is likely that the network may not look like a credible partner in the eyes of external stakeholders, such as investors or key accounts, if it remains unclear which person or persons are responsible for the operation and authorized for decision making. In many cases, already the juridical aspects related to contracts require hierarchies. However, a network may also have a "formal manager" whose role is merely to function as figurehead to external stakeholders rather than be a "network commander". At concrete level, the operation may be very unhierarchic, even though there are formal hierarchies to satisfy the requirements of various stakeholders. Indeed, many traditional hierarchical organizations have both formal and informal organization inside them. Fundamentally, the amount of hierarchies and their real nature should be decided or should allowed to be formed based on the efficiency and effectiveness of the network in respect of the network's objectives. Minimization of hierarchies is the rule of thumb.

Conclusions

The empirical study reported in this article aimed at increasing the knowledge of

management of innovation networks by mapping characteristics of management approaches of two case companies. The case companies operated in the software business and developed their products in inter-organizational networks. Special attention in the analysis was paid to differences in the management approaches between the case companies. The theoretical contribution of the study relates to the identification various aspects, which are relevant in understanding and explaining the nature of innovation network management. These aspects of network management are: duration, primary reward, the fundamental meaning, nature of networked organization, planning, control, trust, hierarchies, authority, and coordination. In terms of these aspects it is easy to get a snapshot on how an innovation network is managed. These aspects also provide a usable framework for comparing the management approaches of different innovation networks. The second theoretical contribution relates to the identification of two different fundamental views on how controlled and structured the management of innovation networks should be. The empirical material found that the degree to which companies are oriented towards controlled and structured management in inter-organizational innovation networks may vary significantly. One company may prefer very free management approach while another applies controlled and structured one. The third contribution relates to the finding that management of innovation networks may be driven by other than economic objectives, although economic realities are always present. The management of the network is likely to be different when the orientation to profit maximization varies. This article also offered a number of managerial guidelines for management of innovation networks.

The following suggestions for further research emerge from the present study. Firstly, aspects characterizing management approaches in innovation networks should be identified in quantitative studies as well, for example with factor analysis. The findings of the present study can function as a starting point for such an endeavor. Secondly, the frequencies of different characteristics related to management of innovation networks could be examined. This would be particularly interesting in international and cross-cultural comparison. Thirdly, the success of more and less controlled/structured management approaches could be investigated. Different management approached in innovation and networks could be evaluated, for example in terms new product success, uniqueness of innovations, duration of product development process, number of innovations, profitability, decrease of costs, increase of revenues, brand equity, attraction of investors and cost of capital, attraction of competent employees, employee satisfaction and turnover, quality of products, and customer satisfaction. Fourthly, the study indicates that, in innovation networks, hierarchies should be avoided or minimized. However, the study suggests that there has to be someone who has the

highest authority and coordinates the operation. This finding calls for further examination. How the question of hierarchies should be dealt with at concrete level to maximize the efficiency and effectiveness of the innovation network?

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