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ILPO POHJOLA

COMMUNITIES OF PRACTICE AS AN OPEN INNOVATION ENVIRONMENT FOR KNOWLEDGE CREATION AND TRANSFER

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ABSTRACT

In knowledge-based organisations, a key element in building, gaining, and preserving competitiveness is knowledge capital, which is built on several elements. The acquisition, conversion, and application of knowledge are noteworthy among these elements, as they are the foundation of knowledge management in knowledge-driven organisations. In addition, the organisation has social, human, and organisational capital that combine to make up its intellectual capital. With these features, an organisation is more capable of innovations that can improve its competitiveness.

In this article dissertation, I examine the community of practice (CoP) as an open innovation environment. The main area of interest is the creation and transfer of new knowledge for the benefit of the organisation within this environment. The aim of the dissertation is to improve scholarly understanding of the limitations and possibilities that are involved in the social processes at work in the CoP. Limitations and possibilities of this study explains clearly the terms and conditions where CoP are working in the optimal way in studied environment. In these social processes, individuals' tacit and explicit knowledge is shared among participants and across organisational boundaries, creating new knowledge and skills.

I have studied this phenomenon in three different contexts: 1) cooperation between academia and public organisations and companies in the community; 2) international corporations working at the customer interface by utilising CoPs; and 3) the CoP itself as a forum of creating and transferring new knowledge.

This dissertation produces new scientific knowledge of the preconditions under which a CoP is optimally able to achieve the objectives set for it. According to the study, there is first a need to determine the right people to work in a given community and to clarify the fundamental concerns involved in the problem or

topic. Second, it is important to identify the true motives of participants who are involved in the work of the CoP. The third requirement is to lay out which collaborative learning and information exchange circumstances produce the best results.

The study also reveals that a CoP, under the right conditions, can improve individuals' skills and support organisations in their R & D activities, regional innovation, and the development of knowledge-based companies.

Keywords: Community of Practice, Open Innovation, Intellectual Capital, Knowledge Management, Knowledge Transfer, Absorption Capacity, Dynamic Capability

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TIIVISTELMÄ

Osaamislähtöisissä organisaatioissa kilpailukyvyn rakentamisen, kasvattamisen ja säilyttämisen keskeinen elementti on niiden osaamispääoma. Osaamispääoma rakentuu useista eri elementeistä, jotka ovat tietojohtamisen lähtökohtana. Erityisen huomionarvoisia ovat tiedon hankinta, hyödyntäminen ja soveltaminen. Lisäksi organisaatioilla on osaamispääoman elementteinä sosiaalista, inhimillistä ja organisaation pääomaa. Näiden avulla organisaatio on kykenevämpi sen kilpailukykyä parantaviin uusiin innovaatioihin.

Tässä artikkeliväitöskirjassa tutkin osaajayhteisöä avoimena innovaatioympäristönä. Keskeisenä tutkimuskohteena ovat uuden tiedon luominen ja siirtäminen organisaation hyödyksi tässä ympäristössä. Väitöskirjan tavoitteena on parantaa ymmärrystä niistä rajoitteista ja mahdollisuuksista, joita on yhteisöissä tapahtuvissa sosiaalisissa prosesseissa. Tutkimuksessa löydetyt rajoitteet ja mahdollisuudet selittävät niitä olosuhteita, joissa osaajayhteisöt kykenevät toimimaan parhaalla mahdollisella tavalla. Tutkimuksessa kuvatuissa organisaatioiden rajojen yli tapahtuvissa sosiaalisissa prosesseissa osallistujien hiljainen sekä näkyvä tietoa jaetaan osallistujien kesken. Parhaimmillaan näissä prosesseissa yhteisön jäsenet voivat omaksua uutta tietoa ja osaamista.

Tutkin tätä ilmiötä kolmessa eri kontekstissa: 1) Akateemisen maailman ja julkisten organisaatioiden sekä yritysten välistä yhteistyötä osaajayhteisöissä, 2) kansainvälisen konsernin työskentelyä asiakasrajapinnassa osaajayhteisöjä hyödyntäen sekä 3) osaajayhteisöä itseään uuden tiedon luomisen ja siirtämisen foorumina.

Tämä väitöskirja tuottaa uutta tieteellistä tietoa niistä ennakkoehdoista, joilla osaajayhteisö kykenee saavuttamaan parhaalla mahdollisella tavalla sille asetettuja tavoitteita. Tutkimuksen mukaan aluksi pitää tiedostaa millaiset ihmiset ovat

sopivimmat valitun ongelman ratkaisemisessa tai aiheen käsittelyssä. Toiseksi on tärkeää selvittää osallistujien motiivit osallistua yhteisön työhön. Kolmanneksi tulee kartoittaa ne olosuhteet, joissa yhteisöllinen oppiminen ja tiedonvaihto tuottavat parhaat mahdolliset tulokset.
Tutkimus osoittaa myös, että osaajayhteisö voi oikeissa olosuhteissa parantaa organisaatioiden osaamista ja tukea niiden tuotekehitystä, alueellisia innovaatioita sekä osaamiseen perustuvien yritysten kehittymistä.

Avainsanat: Osaajayhteisö, avoin innovaatio, osaamispääoma, tietojohtaminen, osaamisen siirto, omaksumiskyky, dynaaminen kyvykkyys

ACKNOWLEDGMENTS

I started this journey in February 2010; I can now say that I could not imagine then what I was really working for. In the beginning, I did not fully understand the idea of research work, and it took a couple of years before my research could progress. Finally, I grasped the idea in 2012, when I worked with Adjunct Professor Päivi Iskanius for a time at the University of Oulu. With her, I prepared my first research, which generated one conference paper that was an early version of a journal article that makes up part of this dissertation.

At first glance, this journey could be seen as a technical process, but in reality, it has involved listening to the advice of more experienced people and changing my own every day thinking to academic way of doing research. This journey has opened my eyes and my mind to much wider horizons. It has shown me that you have to travel far to see what is right in front of you.

The most important co-traveller during this journey has been my instructor, Professor Anu Puusa. Her advice and support have been literally invaluable. Regular meetings with her kept me on the right track, while her direct and intelligent feedback showed me how to think academically and conduct research. I am deeply grateful to her for this meaningful journey in my life.

I have had the pleasure of working with two talented women with strong academic backgrounds. In the role of co-authors, Professor Anu Puusa and Adjunct Professor Päivi Iskanius have made important contributions to the research presented in the articles in this dissertation. The feedback from our research group has been enormously valuable. Doctoral students Tiina Tarvainen, Kirsi Hokkila, and Antti Varis provided valuable feedback during both the research and publication process and during the preparation of the thesis itself. It has been my pleasure to take this journey with you.

The staff of the University of Eastern Finland have given me support and financial resources to carry out this effort. The most significant financial support has come from the Foundation for Economic Education, the support of which has been fundamental to the completion of my studies. The Regional Advisory Board, led by Antti Heliövaara, has supported me throughout the dissertation process. Thank you so much for your support.

I warmly thank the pre-examiners of this dissertation. The contributions and feedback of Adjunct Professor Mika Kautonen and Professor Wim Vanhaverbeke have helped me refine its contents further. I am also grateful to Professor Wim Vanhaverbeke for acting as an opponent.

It has been both a pleasure and a great benefit to have received so much content for the articles provided by the studied organisations. Interviewees have been very helpful and a font of superb research material. I give special thanks to Juha-Matti Arola at KONE Corporation and Santeri Lanér from the eCars-Now! community.

To combine full-time employment and serious scholarship at the same time would be hard for anyone. It has also been difficult for me, but I want to express my gratitude to my colleagues and my superiors at Joensuu Science Park for their many examples of support and understanding during this journey.

Last but not least, I wish to express my gratitude to my friends and family. My best friend Eero Jako has given me fatherly support and advice, always helping me with my daily problems. I also want to thank all my friends for encouraging me during these last several years, especially Minna Ikonen, who once told me that to pass my studies I only needed to have a backside strong enough to sit at my desk.

My family has been a source of vitality and inspiration for this long-term effort. I want to express my thanks to my late father Arvo and to my mother Irja, who is still with us. They gave me all the genes I needed to go through this. I also wanted to show my sons Taneli, Aleksi, and Eemeli what lifelong learning really is and to show them that you are never too old to learn something new, whether in school or in life. I am infinitely grateful to my spouse Sirpa. She has been patient during these long and sometimes difficult years. The last year was especially hard for her, because preparing the dissertation took all my time, and we had very little time to spend together.

Now I may have something else to do. Postdoc? In any case, I cannot wait to spend all my spare time with my family and friends.

Ilpo Pohjola
Liperi, January 1st 2017

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DEFINITIONS OF KEY CONCEPTS

Absorption Capability

Research and development (R&D) generates innovations and develops firms' ability to identify, assimilate, and exploit knowledge from the environment, which is called learning or absorptive capacity; this capacity is the ability to recognise the value of new information, assimilate it, and apply it to commercial ends (Cohen & Levinthal, 1990).

Community of Practice

Wenger, McDermott, and Snyder (2002, p. 4) define communities of practice (CoPs) as "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis". CoPs provide the social context (Correia, Paulos, & Mesquita, 2010) for collective learning through which people exchange knowledge based on their shared practices and collective identity (Correia et al., 2010; Kirschner & Lai, 2007; Wenger, 1998).

Dynamic Capability

Dynamic capability was originally defined by Teece, Pisano, and Shuen (1997, p. 516) as a "firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments". According to them, the concept of dynamic capability explains why some organisations are more successful than others in building competitive advantage within dynamic markets. A dynamic capability is a learned and stable pattern of collective activity through which the organisation systematically generates and modifies its operating routines in pursuit of improved effectiveness (Zollo & Winter, 2002, p. 5).

Intellectual Capital

Intellectual capital refers to the sum of all knowledge stocks that firms possess to acquire competitive advantage (Subramaniam & Youndt, 2005). Organisations have key mechanisms and processes to develop social capital that facilitates creating and sharing new intellectual capital (Nahapiet & Ghospal, 1998) and radical innovative capability (Subramaniam & Youndt, 2005).

Intellectual capital has also been identified as a set of intangibles (resources, capabilities, and competences) that drives

organisational performance and value creation (Bontis, 1998; Bontis, Chua Chong Keow, & Richardson, 2000; Roos & Roos, 1997).

Knowledge Management

According to Dalkir (2005), knowledge management (KM) is the deliberate and systematic coordination of an organisation's people, technology, processes, and organisational structure in order to add value through reuse and innovation. This coordination is achieved through creating, sharing, and applying knowledge as well as through feeding the valuable lessons learned and best practices into the corporate memory so as to foster continued organisational learning (Dalkir, 2005, p. 3).

KM is the "systematic and explicit management of knowledge-related activities, practices, programs, and policies within the enterprise and the goal of KM is to build and exploit intellectual capital effectively and gainfully". (Wiig, 1999, p. 4).

Knowledge Transfer

According to Lockett, Kerr, and Robinson (2008, p. 664), knowledge transfer means the two-way transfer of ideas, research results, expertise, or skills between one party and another that enables the creation of new knowledge to develop innovative new products, processes, and/or services.

Open Innovation

Chesbrough (2006, p. 1) defines open innovation as the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation, respectively. Open innovation is a paradigm that assumes that firms can and should use both external and internal ideas and internal and external paths to market as they look to advance their technology.

1 INTRODUCTION

1.1 BACKGROUND

In this dissertation, I have studied the phenomenon called the community of practice (CoP). This phenomenon belongs to the broader field of discuss intellectual capital and KM in scientific research. These concepts are the basis for scientific discussions and contribute to the emergence of aspects of innovation that improve knowledge creation and transfer in organisations. This thesis concentrates on exploring the limitations and possibilities of creating organisational advantage through a CoP in open innovation environments in different kinds of CoPs.

The CoP was originally defined by Lave and Wenger (1991, p. 98) as "a system of relationships between people, activities, and the world; developing with time, and in relation to other tangential and overlapping CoPs". For these scholars, such relationships are essential for knowledge and learning in communities. Lave and Wenger (1991) argue that CoP has become a desired way to promote knowledge, learning, and innovation in inter- and intra-organisational environments (e.g., Amin & Roberts, 2008; Swan, Scarbrough, & Robertson, 2002; West & Lakhani, 2008). Wenger (1998) traces the link between situated practice and learning and knowing to three dimensions of CoPs: 1) mutual engagement, 2) a sense of joint enterprise, and 3) a shared access to communal resources, which he proposes as sources of learning and knowing based on individuals doing things together, developing a sense of place, purpose, and common identity, and resolving their differences. The effectiveness of CoP is based on its social learning nature and promotion of knowledge, learning, and innovation (Swan et al., 2002; West & Lakhani, 2008).

Wenger (1998) defines the CoP as "the informal social context for learning and knowledge generation, where people from different organisations openly share their knowledge and expertise based on joint practices and a collective identity". CoPs offer an effective environment for uniting individuals from different backgrounds and cultures to participate in a collaborative and friendly environment through informal discussions and open dialogues (Nonaka & Takeuchi, 1995; Schenkel & Teigland, 2008). In an academia-industry collaboration, formal structures such as collaborative research project groups are quite typical. Unlike these structures, CoP structures are more informal, spontaneous, voluntary, and based on individual volition rather than organisational demands and constraints (Brown & Duguid, 1991). The strength of the CoP approach is its focus on relationships and on the social and practice-based interaction at the heart of the

learning process; CoP members have mutual engagement, a sense of joint enterprise, and a shared access to communal resources (Wenger, 1998). Community members are integrated by interacting with each other through numerous interpersonal contacts (Tsai, Huang, & Chiu, 2012). According to Tsai et al. (2012, p. 2) member activity involvement refers to the extent to which members actively participate in a community's endeavours, which should influence the evolution of the social system: "an interacting collectivity that has ongoing patterns of scripts, rules, norms, values, and models" (Zimmerman & Zeitz, 2002, p. 416). Simplican, Leader, Kosciulek, and Leahy (2015) make clear that people have different levels of engagement in communities and that their mere presence may be the most important component.

The affinity of external agents to embed a specific technique or program in a CoP will benefit the community (Ross, 1955). According to Israel, Checkoway, Schulz, and Zimmerman (1994), through participation, individuals and organisations which have an empowered community provide enhanced support for each other. They also handle conflicts in the community and gain increased influence and control over the quality of life in the community (Israel et al., 1994). Israel et al. (1994) add that they do not wish to suggest that a single focus on the individual, organisation, or community alone is not viable. Rather, they argue that a model of community is strengthened if links in all three levels provide the most effective means to provide collectively the support and control needed to develop the necessary skills, resources, and changes (Israel et al., 1994). A major problem with CoPs is that their organic and informal essence makes them highly sustainable to management supervision and interference in their activities; it is arguable that there are no clear ways to lead or manage them (Alani, Dasmahapatra, O'Hara, & Shadbolt, 2003).

CoPs help foster an environment in which knowledge can be created and shared, in addition to improving effectiveness, efficiency, and innovation (Lesser & Everest, 2001, p. 41). The tacit knowledge that is embedded in individuals is often the most valuable thing because it consists of a deep understanding of complex, interdependent systems that enable dynamic responses to context-specific problems (Wenger et al., 2002). Sharing tacit knowledge requires close involvement and cooperation, network relationships, face-to-face contacts, a shared understanding, and trust (Ardichvili, Page, & Wentling, 2003; Lam, 2000). Trust is a fundamental precondition for community outcomes such as good practices, assistance in problem solving, and developing new knowledge and fostering innovation (Eggs, 2012). Tacit knowledge also requires informal learning processes like storytelling, conversation, and coaching of the kind that a CoP provides (Wenger et al., 2002). Through these processes, CoP members can increase their own understanding and add to their community's collective knowledge (Brown & Duguid, 1991).

Appreciating the socially constructed nature of knowledge, McLure, Wasko, and Faraj (2000) recommend that organisations consider a third perspective on knowledge: not as an object to codify or something embedded in individuals, but as a social phenomenon and an integral part of a community. From this perspective, CoPs provide an appropriate tool to share knowledge.

CoP theory comes from KM theorists like Nonaka and Toyama (2003), Ardichvili et al. (2003), Hildreth and Kimble (2002), and Dalkir (2013), who have highlighted its value in relation to increasing firms' ACAP, i.e. the ability to recognise the value of new, external information, assimilate it, and apply it to commercial advantage (Cohen & Levinthal, 1990), and to their ability to innovate. West and Lakhani (2008, p. 223) report that an important development in innovation studies over the past decade has been the recognition of the role of communities outside the boundaries of firms in creating, shaping, and disseminating technological, and social innovations. At the same time, open innovation studies have enriched the meaning of communities in the innovation process (Chesbrough, 2003). Chesbrough's open innovation model encapsulates the business strategy and organisational changes that occur as innovation becomes a more distributed activity across a wide range of different actors (Dodgson, Gann, & Salter, 2006, p. 342). CoP activities can overcome corporate limits so that knowledge can flow effectively across firms established boundaries (Brown & Duguid, 1991). Innovations are becoming increasingly open, with knowledge collaboratively explored and exploited by communities and individuals within organisations (Chesbrough, 2006; Chesbrough, Vanhaverbeke, & West, 2006; von Hippel, 2005). Research on open innovation has increasingly emphasised the role of communities in creating, shaping, and disseminating innovations (Fichter, 2009, p. 357). Open innovation is not possible without ACAP as an internal capability found at innovating companies, and our understanding of ACAP can be enriched by linking it to open innovation (Vanhaverbeke, Cloodt, & Van de Vrande, 2008, p. 16).

CoPs are free-flowing collaboration environments that create an organisation's intellectual capital (O'Donnell et al., 2003). According to Bontis (1996), a firm's intellectual capital consists of human capital and structural capital, where human capital is employee-dependent and includes employee competence, commitment, motivation, and loyalty and is also the heart of intellectual capital creation (Bontis, 1999). By contrast, structural capital includes all the non-human knowledge in organisations, such as the databases, organisational charts, process manuals, strategies, routines, and anything else that offers a value to the company that is higher than its material value (Bontis et al., 2000). Intellectual capital has a positive impact on organisations' efforts to codify organisational knowledge and thereby further develop their structural capital, ultimately yielding a sustainable competitive advantage that turns into comparatively better business performance

(Bontis et al., 2000). According to Dzinkowski (2000), intellectual capital is both the end result of a knowledge transformation process and the knowledge itself, transformed into intellectual assets of the firm.

KM has an important role in facilitating innovations to improve organisational performance and is necessary for an organisation that is seeking to establish a competitive advantage based on innovation (Hsu & Sabherwal, 2012). To succeed with knowledge transfer, a firm's knowledge generation, dissemination, absorption, and adaptation and responsiveness capacities have to be taken care of systematically (Parent, Roy, & St-Jacques, 2007). Knowledge is dynamic, personal, and distinctly different from data (which consists of discrete, unstructured symbols) and information (a medium for explicit communication), according to Sveiby (2001a, p. 345), who adds that people are the only true agents in business; all tangible physical products and assets, along with intangible relations, are the results of human action and ultimately depend on people for their continued existence. Organisations create value from knowledge transfer in value networks (Allee, 2000) that are made up of interactions between people in different roles and relationships (Sveiby, 2001a). Value creation is primarily a transfer of tacit and explicit knowledge between individuals that converts knowledge from one type to another (Nahapiet & Ghospal, 1998; Nonaka & Takeuchi, 1995). Organisation boundaries are not important if all participants have a feeling of togetherness and are able to create value effectively (Sveiby, 2001b). Combining and exchanging knowledge are complex social processes, and much valuable knowledge is fundamentally socially embedded in particular situations, in coactivity, and in relationships (Nahapiet & Ghospal, 1998, p. 250). Knowledge is also both a resource and a process which involves interactions among actors in the concept of knowledge dynamics (Dahlström & Hedin, 2010). Knowledge creation is the generation and application of knowledge that yields new capabilities for an organisation (Leonard-Barton, 1995). Knowledge-intensive innovations depend on the availability of knowledge and new capabilities to transformation into products, processes, and services that have economic value in markets (Popadiuk & Choo, 2006). Most knowledge resides in people's brains in the form of tacit knowledge, which means that organisations should continue to strive to find the best possible solutions and knowledge sources to make these valuable intellectual assets explicit for long-term growth and success (Wiig, 1997). Because of this, organisations are increasingly realising that knowledge and intellectual assets and capital must be managed deliberately, systematically, and with expertise (Wiig, 1997).

Companies in the modern knowledge-intensive business environment are dependent on external information sources to promote innovation and improve their performance (Cassiman & Veugelers, 2002; Morgan & Berthon, 2008). Many of them have significant difficulties in benefiting from external knowledge flows, even

in knowledge-intensive industries (Cassiman & Veugelers, 2006; Escribano, Fosfuri, & Tribó, 2009). In order to overcome these shortcomings, companies have to develop their absorption capacity (ACAP), which is the "ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990, p. 128). ACAP involves mechanisms to identify and translate external knowledge inflows into tangible benefits, and the means of achieving superior innovation and continuous financial performance (Kostopoulos, Papalexandris, Papachroni, & Ioannou, 2011). External knowledge inflows are directly related to ACAP and indirectly related to innovation (Liao & Wu, 2010), and directly to innovation and financial performance, although these relations occur across different timespans (Kostopoulos et al., 2011).

Knowledge creation and ACAP both play roles in the creation of dynamic capability (Malhotra, Gosain, & Sawy, 2005; Zahra & George, 2002). Teece and Pisano (1994) point out that winners in the global marketplace are those companies that combine responsiveness and rapid and flexible product innovation with the management capability to coordinate and redeploy internal and external competences effectively. Dynamic capability is the source of competitive advantage (Eisenhardt & Martin, 2000) in two ways (Teece & Pisano, 1994). First, it refers to the shifting character of the environment; second, it emphasises the key role of strategic management in appropriately adapting, integrating, and re-configuring internal and external organisational skills, resources, and functional competences towards changing environments (Teece & Pisano, 1994, p. 537).

In sum, open innovation studies have elevated the meaning of communities in the innovation process (Chesbrough, 2003). However, CoPs as open innovation environments for knowledge creation and transfer remain insufficiently understood, because these kinds of environments involve a complex body of knowledge creation and transfer with multiple variables of actors and processes that make it multi-dimensional and abstract. This dissertation explains the limitations and possibilities, together termed the preconditions, of knowledge creation and transfer in CoPs in open innovation environments and fills in research gaps with empirical studies of the CoP phenomenon.

1.2 SCOPE, DELIMITATIONS, AND STRUCTURE OF THE DISSERTATION

The scope of this dissertation is to realise CoP (Wenger, 1998) in an open innovation environment (Chesbrough, 2003) as a knowledge-creating and knowledge-sharing phenomenon and find the preconditions required to take advantage of it in three different contexts: 1) academia-industry collaboration (articles I and II), 2) global

corporation (article III), and 3) the CoP itself (article IV). Knowledge creation and transfer are executed in CoPs in an open innovation environment, and the dissertation acknowledges the diversity found in different types of organisations and CoPs.

This thesis has identified intellectual capital and ways to manage it in an open innovation environment like a CoP. In research-related articles, the subject has been studied from different angles, which has brought to light issues that either allow or limit this kind of knowledge creation and transfer.

This study clarifies the issues that will help or hinder organisations in creating knowledge by participating in CoP activities and lays out the preconditions needed to take advantage of this knowledge. In this dissertation, the key issue is to strengthen knowledge creation and transfer from CoPs to organisations in the most successful way.

The key theoretical concept underlying the dissertation is that a CoP occurs in an open innovation environment. The usage of CoPs has been studied from different angles to obtain a better view of the preconditions needed for their success. The theoretical portion of the dissertation has a number of key interrelated concepts. The CoP and these interdependencies are described in Figure 1.

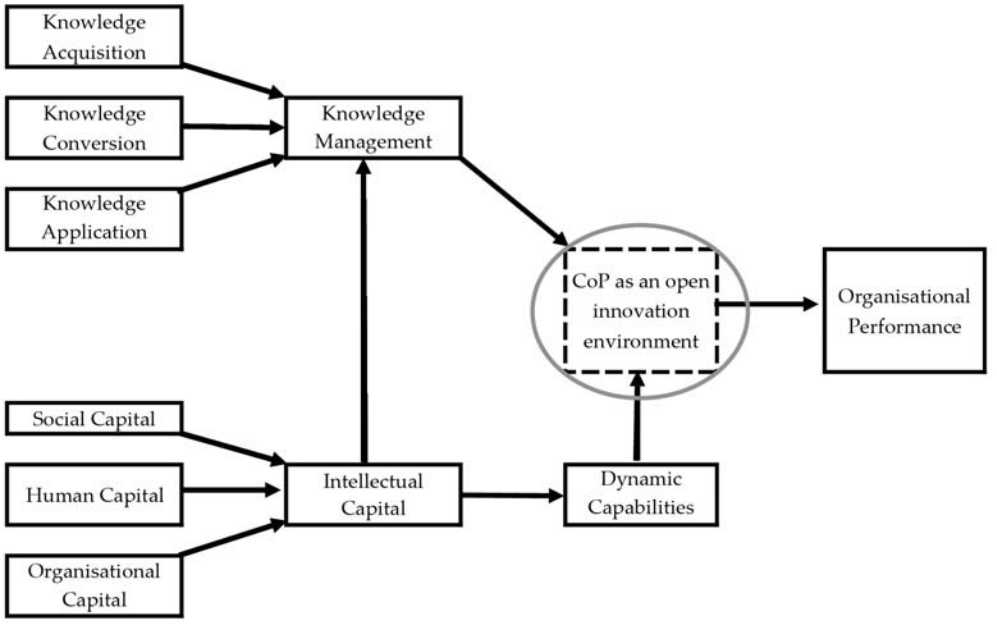

Figure 1: Interdependencies and relations between knowledge management and intellectual capital for organisational performance (Modified from Hsu & Sabherwal, 2012)

The empirical data in this dissertation was collected between the years 2007 and 2014. During those years, open innovation research and studies involving CoPs and intellectual capital expanded, meaning that there are a significant number of research contexts that can provide deep insights into academic research on this area of expertise. However, new scientific results were generated in this dissertation through the analysis of the material contained in many of those studies.

This dissertation is divided into five sections, including this introduction. The second section presents the research design, including the epistemological and ontological assumptions, research approaches, and methods of data collection and analysis. The third section presents the theoretical background that serves as the foundation for this research and is built on the central CoP concepts of open innovation, intellectual capital, and KM. The combined key findings of the original four articles are reviewed in the fourth section to contribute to answering the dissertation's research question. In the fifth section, the contributions and practical implications of the research are discussed. At the end of that section, reliability and validity are discussed before suggestions for further research are provided. The original papers are appended to this dissertation (See Appendices I-IV).

1.3 EMPIRICAL CONTEXTS AND RESEARCH QUESTION

The aim of this dissertation is to develop new scientific knowledge for knowledge creation and transfer in organisations that are operating CoPs. In this study, CoPs are understood to be open innovation environments for inter-organisational collaboration. The dissertation focuses on the possibilities and limitations of creating and transferring knowledge from CoPs to organisations through social processes in which individuals' explicit and tacit knowledge is shared, organisational boundaries are crossed, and common is knowledge created, all of which enable the collaborating organisations to improve their organisational performance (Brown & Duguid, 2001; Majchrzak, Cherbakov, & Ives, 2012; Nonaka, Von Krogh, & Voelpel, 2006).

The research questions from four different articles all help to answer the research question presented in this dissertation: *Under which conditions do CoPs as open innovation environments support knowledge creation and transfer?*

The dissertation adopts the view that CoP participants from five different kinds of organisations and one CoP faced limitations and possibilities in knowledge creation and transfer. The dissertation investigates the nature of the CoP and how to use CoPs in an optimal fashion. This summary of the dissertation applies the theoretical viewpoints of knowledge creation and transfer through the CoP as an

open innovation environment when presenting and analysing the findings of the four published articles

1.3.1 Article I: The Northern Research and Innovation Platform (NRIP) as an open forum in northern Finland for university-industry collaboration

The material below is taken, with appropriate changes for consistency, from article I.

This article proposes the concept of the CoP to intensify university-industry collaboration. A CoP provides a social context for collective learning (Lave & Wenger, 1991). In this case study, the CoP concept is applied to the development of the Northern Research and Innovation Platform (NRIP). The NRIP is an open forum in northern Finland for university-industry collaboration established to promote knowledge and expertise in the environment, energy, and natural resources sectors, with a strong geographical emphasis on the Arctic aspect. The NRIP provides a platform for experts from different industries, disciplines, and regions to search for opportunities to cooperate in generating knowledge that will help solve the complex problems of the Barents region. Special emphasis is placed on scientific knowledge, research, and technology that is compatible with Arctic conditions. Here, the term "Arctic research" is used to refer to the multidisciplinary research relating to the special conditions of the Barents region, such as a high sensitivity to the phenomena of global change, cold climate, low population density, abundant natural resources, and a considerable diversity of cultures and identities. The term "university" includes public research organisations which are predominantly government-funded, including universities *per se*, research laboratories, and research institutes. The term "scientific knowledge" refers to knowledge that is produced primarily in universities, but also may be developed in cooperation with companies and other public organisations

The economic potential of the Barents region, including the northern parts of Norway, Sweden, and Finland and northwest Russia is associated with natural resources: oil, gas, and minerals (Doré, 1995; Hasle, Kjellén, & Haugerud, 2009; Tennberg, 2012) and new sea routes which may open because of climate change (Liu & Kronbak, 2010; Ragner, 2009). Major investments in mining and energy industries have resulted in extensive business opportunities, especially in the Arctic shipbuilding and offshore industrial sectors, transportation and infrastructure in cold climate conditions, and environmental engineering (Gunnarsson, 2013; Lehtinen & Atkova, 2013; Sonesson & Torstensson, 2010). However, the Barents region has not reached its full business development potential (Arbo, Iversen, Knol, Ringholm, & Sander, 2012; Asheim & Coenen, 2005). Another challenging task is to

create and maintain a balance between economic growth, human development, and environmental considerations (Tennberg, 2012). For sustainable development, natural and human resources must be exploited in a controlled manner, taking into account all the environmental, social, and economic effects (Eglington, Israel, & Vartanov, 1998). Iskanius (2011) proposes activities that support the fields of business which show an upward trend, identifying new priority areas and interdisciplinary research targets, and producing state-of-the-art research data for the use of firms to enhance business in the Barents region.

Solving the complex and typically cross-industrial and interdisciplinary problems of the Barents region requires open access to all public knowledge, as Chesbrough (2006) proposes in his open innovation paradigm. Traditionally, companies have invested in internal R&D but today they increasingly look for external ideas, research results, and technology that can be used in commercialisation (Chesbrough, 2006). Thus, external knowledge can be of equal importance to the internal knowledge of a firm. This, however, does not transfer automatically through the boundaries of an organisation; it first has to be identified, and then the mechanisms to assimilate and transform this knowledge must be determined (Teirlinck & Spithoven, 2008).

Inter-organisational collaboration is at the core of open innovation. Collaboration with suppliers and customers, universities and other research organisations, and even with competitors may give businesses new insights and accelerate innovation (Luoma, Paasi, & Valkokari, 2010). For the technological, organisational, and social innovations needed, Etzkowitz (2008) suggests deeper collaboration between science and business. Universities are often described as engines for growth and significant sources of industrial innovation. Thus, particular attention should be paid to intensifying university-industry collaboration (Kaufmann & Tödtling, 2001; Looy, Debackere, & Andries, 2003; Mansfield, 1991; Mansfield & Lee, 1996; Ramos-Vielba, Fernández-Esquinas, & Espinosa-de-los-Monteros, 2010; Siegel, Waldman, Atwater, & Link, 2004). Siegel et al. (2004) emphasise that university knowledge should be deployed effectively for the benefits of business; thus, new methods are needed to transform research results, research-generated ideas, and inventions into commercially profitable initiatives.

The research problems can be condensed into the following research questions:

- *RQ1: How is knowledge transferred in university-industry collaboration?*

The CoP concept was applied in the development of the NRIP based on the developmental framework of Wenger et al. (2002; see Figure 2).

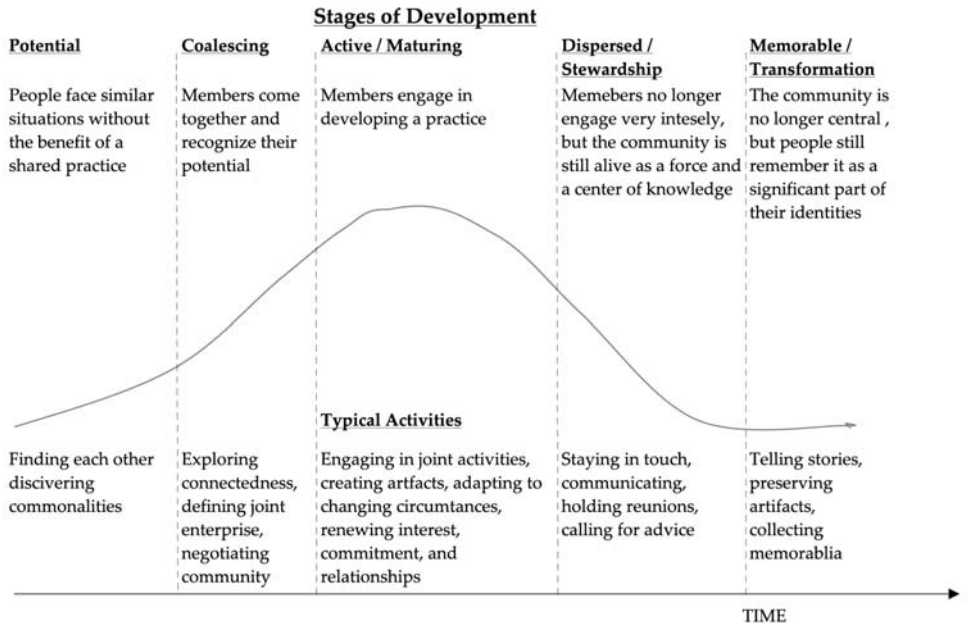

Figure 2. Developmental framework of CoPs (modified from Wenger et al., 2002)

In the *potential stage*, the target is to encourage people to find each other, discover commonalities, and become more conscious of the domain. The NRIP project manager identified R&D actors in the field, held discussions with potential members, and mapped the motivation issues for community development. The members came from a variety of scientific and industrial fields, different regions in northern Finland, and assorted companies, universities, financier groups, and other public development stakeholders. When the core group members of 10 people began to meet, discussions related to the community's agenda, this was a start of the community and provided a robust basis for debates between community members. Based on face-to-face meetings and negotiations, potential members were invited to a formal kick-off meeting. The objective was to activate and motivate people regarding the joint development of the NRIP and the determination of community elements. At this stage, most participants did not know each other, nor were there many joint R&D projects. One aspect of development was to study opportunities for virtual collaboration. Different social media tools were explored and a web-based portal was developed for virtual collaboration.

In the *coalescing stage*, the target was to build trust, explore connectedness, and define joint rules and practices. Three brainstorming sessions were arranged with the goal of gathering members together to recognise the community's potential. Between sessions, individual exercises were held to gather information for

developing the NRIP. In the workshops, members examined and made forecasts concerning developmental trends affecting the Barents region, guided by Finland's leading futurists. They analysed the manner in which regions should prepare for various possible future developments, centre and integrate activities, and develop research and infrastructures. They drafted the NRIP's common vision and research agenda. Based on the workshop process, the content, future research needs, cooperation methods and vision, strategy, research agenda, and joint operational program of the NRIP community were all formulated. 90 experts participated in the workshops.

In the *maturing stage*, the target was to engage in joint activities, create artefacts, adapt to changing circumstances, and renew interests, commitments, and relationships. Four workshops were arranged in which small thematic groups independently developed R&D projects. First, thematic research fields were selected and small interest groups established. As a result, 300 joint R&D ideas were identified and eight R&D projects were initiated. Members engaged in developing practices and began to trust each other; many informal contacts were created. The material generated during the development process was published in five reports. Additionally, a high-level seminar was arranged to present the results to local and national policymakers and industrial directors.

According to the framework, in the *stewardship stage*, members are no longer engaged intensively, but the community is still loosely alive as a force for and centre of knowledge. As the NRIP project approached its conclusion, the community's activities decreased. Face-to-face meetings were no longer arranged, but some activities occurred in particular thematic areas. Some members stayed in touch, communicated, and asked for advice in other contexts, while others returned to ad hoc activities. Altogether, the NRIP development work activated its participants, who now knew each other and had an opportunity for systematic development of joint R&D projects and other collaborations. Now in the *transformation stage*, the NRIP is no longer a central actor in the field, but participants still remember it as a significant part of their identities. NRIP members report having good feelings and memories concerning the active period.

- *RQ2: How is university-industry collaboration intensified by leveraging the CoP?*

The NRIP increased collaboration, coordination, and the sense of community in a fragmented field of Arctic research. The members participated voluntarily and in various ways to define, develop, and implement a common strategic framework for Arctic research. The basic structure of a CoP involves a domain of knowledge that defines a set of issues, a community of people who care about this domain, and the

shared practices that they develop to be effective in that domain (Wenger et al., 2002). The domain that brought people into the NRIP was a shared interest in R&D issues related to Arctic research. The NRIP focused particularly on scientific knowledge related to material and energy efficiency, renewable energy solutions, and waste management, along with water and wastewater treatment, air protection, environmental measurement, monitoring, and analysis, environmental law, and sustainable economy and climate-friendly and cost-effective processes, automation, and services. A shared vision of how societal and scientific challenges should be addressed was at the core of the NRIP. Optimally, the NRIP could produce knowledge that will enable its members to become entrepreneurs, support the mobility of researchers to work in business, and create new business opportunities in existing firms. It is clear that not all community members will become entrepreneurs, but the overall objective is to activate business through high-quality R&D cooperation.

- *RQ3: How can a CoP be applied to university-industry collaboration in the context of Arctic research?*

The adaptation of the CoP in the context of Artic research clearly increased R&D activities in northern Finland. In the NRIP, researchers and businesspeople met, became acquainted and comfortable with each other, created mutual trust, and began to share knowledge and plan collaborative actions. The actions of the NRIP over two years resulted in eight new R&D projects. The NRIP needed different kind of people to be involved at different stages of the innovation process; researchers and developers were an obvious need, but business-oriented people able to detect new opportunities were also key players. In total, 90 members joined the development process and there were over 300 seminar participants. Five reports were published and several conference and seminar presentations were held at the national and international levels. Although internationalisation was not the primary goal at this stage, negotiations began with more than 10 universities. Furthermore, one innovation centre in the field of environment and energy was established to continue the NRIP's work. Today, members are involved in the Technology and Innovation Centre of Finland's (TEKES) strategic project on Arctic research; its first innovation award was given to encourage researchers to pursue commercialisation and entrepreneurship.

In sum, university-industry collaboration has been widely researched, and this study has provided new empirical evidence concerning the adaptation of CoPs in university-industry collaboration targeted at solving cross-industrial and interdisciplinary problems in the Barents region. As there are a limited number of stakeholders present in the Barents region, it is fair to expect that cooperation

between the public and private sectors, academia, and industry is realistic and such a dialogue can produce fruitful results. This study contributes to the research on CoPs and helps realise shared knowledge as a basis of university-industry collaboration. It provides new empirical evidence on the power of working in CoPs to lead to more efficient and innovative approaches. We recommend that individuals in academia and industry select the open innovation strategy in their CoPs to achieve next-level collaboration.

1.3.2 Article II: Antecedents of successful collaboration in a community of practice between academia and industry: A case study

The material below is taken, with appropriate changes for consistency, from article II.

The global business environment is characterised by distributed knowledge, and the innovation process itself is distributed across a number of actors (Acha & Cusumano, 2005). Innovating firms search for promising ideas far beyond their organisational boundaries; they also leverage internal ideas outside their own businesses (Chesbrough, 2003). Collaborating to gain access to knowledge is an attractive alternative to strictly internal R&D efforts, and the rising popularity of open innovation has resulted in the emergence of new actors in the innovation process (Gassmann, 2006; Ollila & Elmquist, 2011), such as networks (Vanhaverbeke, 2006) and communities (West & Lakhani, 2008; von Hippel, 2007). As markets become more globally integrated and new forms of technology and competition emerge, firms adapt and exploit changes in their business environments and seek opportunities for change through technological, organisational, or strategic innovation (Helfat et al., 2009, Plattfaut et al., 2015). Firms adapt to and shape business ecosystems by innovating and collaborating with customers, competitors, suppliers, public and private research institutes and universities, and even unrelated businesses (Acha & Cusumano, 2005; Bessant & Phillips, 2013; Teece, 2007).

Cooke (2005) argues that achieving competitiveness through innovation demands greater scientific involvement; thus, firms are encouraged to intensify academy-industry collaboration. Interactions between academia and industry facilitate knowledge transfer and even stimulate new knowledge creation; this has a positive effect on industrial innovativeness (Kale & Singh, 2007) and regional economic growth (Audretsch & Keilbach, 2004; Kitagawa, 2009; Muller, 2006; Ramos-Vielba et al., 2010).

To achieve mutuality, universities and firms must first know each other, developing some kind of social glue in the same manner as occurs in clusters

(Gustavsen, Finne, & Oscarsson, 2001). Instead of formally established inter-organisational arrangements and rigid research collaboration structures, more informal relationships, human interactions, and social networks are needed (Baldwin & von Hippel, 2011; Franke & Shah, 2003; Perkmann & Walsh, 2007), while the locus of innovation is in innovation networks that involve a mix of partners: universities, labs, start-ups, multinationals, and governments (Powell, Koput, & Smith-Doerr, 1996). Wenger (1998) proposed the CoP as a knowledge transfer channel and social forum for learning and innovation in which people can work together to develop a shared identity, improving mutual understanding in order to transfer knowledge (Lave & Wenger, 1991; Wenger, 1998). CoPs, given the nature of collective learning, social interaction, trust-building, and users' commitment (Gassmann, 2006; Ollila & Elmquist, 2011), support open innovation when experts from different organisations establish self-organised communities and freely create and share knowledge for the development of innovation (Baldwin & von Hippel, 2011; Franke & Shah, 2003; O'Mahony & Lakhani, 2011).

This empirical qualitative case study was carried out within the NRIP. This article contributes to realising the potential of CoPs in promoting academia-industry collaboration. We analysed the experiences and expectations of members and the benefits gained, using a conceptual framework which could be applied to realise the antecedents needed for successful academia-industry collaboration in using CoP as an engine for knowledge development and improving organisations' dynamic capabilities. Our aim was to identify the conditions under which participants expected to benefit from taking part in the work of the community.

The research problems can be condensed into the following research questions:

- *RQ1: What antecedents are needed for academia-industry collaboration?*

The most prominent issue for the NRIP was the involvement of a wide range of different actors such as universities, public actors, corporations, small- and medium-sized enterprises (SMEs), and entrepreneurs as individuals embedded with their tacit knowledge in this open innovation community (Dodgson et al., 2006; Kitagawa, 2009). Kauppila, Mursula, Harkonen, and Kujala (2015) argue that the most prominent themes in academia-industry collaboration relate to organisational culture, aligning interests, and operating systematically and transparently.

The downside, from the companies' viewpoint, was that the knowledge transfer did not operate in both directions (Audretsch & Keilbach, 2004; Kitagawa, 2009; Muller, 2006; Ramos-Vielba et al., 2010). According to follow-up interviews, the knowledge provided to companies was too general and difficult to implement in their businesses. Additionally, the open nature of universities contrasts with the

more closed and protective approaches favoured by industry (Perkmann & Walsh, 2007); companies were more adaptive and absorptive of new knowledge, while universities tried to benefit from new projects.

The company representatives sought a competitive advantage through responsiveness and rapid and flexible product innovation (see Teece & Pisano, 1994). However, they were unable to coordinate and redeploy their internal and external competences in the community, even when a university offered new methods and models to transform research results, research-generated ideas, and inventions into commercially viable products (Bjerregaard, 2010; Boardman & Ponomariov, 2009; Kale & Singh, 2007).

We did not find results similar to those reported in Audretsch and Keilbach (2004), Kitagawa (2009), Muller (2006), or Ramos-Vielba et al. (2010); in their studies, communities featuring academia-industry collaboration allowed knowledge transfer in both directions and significantly stimulated regional economic growth by increasing the rate of innovation. Based on the present study, it is clear that this interaction facilitates knowledge transfer and interactions between academia and industry, as Kale and Singh (2007) suggested, but positive effects on industrial innovativeness were not as clear, nor did we find evidence that scientific involvement in the CoP directly resulted in innovations, as Cooke (2005) suggested would occur.

> • *RQ2: How do we use CoPs for knowledge development and dynamic capability in organisations?*

We have identified preconditions which have an influence on the success of this kind of community's ability to create dynamic capabilities for the CoP organisation. In this case, we found that these preconditions were not optimal; therefore, results from this community did not clearly develop the organisation's dynamic capability. Table 1 presents the established dimensions of the antecedents of successful academia-industry collaboration.

Table 1: Antecedents of successful academia-industry collaboration

Participants	Motivation to participate	Topic	Processes	Utilisation mechanisms
WHO	WHY	WHAT	HOW	KM

The work in the NRIP functioned moderately well, even though there were many elements requiring improvement. The following similarities to and differences from the theoretical approach were found during the empirical analysis. The CoP as a

collaboration forum for the parties worked quite well, even though the participants (WHO) had significantly heterogeneous backgrounds and widely varying expectations. The motivations and expectations (WHY) of the CoP members differed, which hindered the effective utilisation of knowledge gained for the benefit of the businesses. We evaluated many challenges with the topic (WHAT), because it appeared that the university, as a CoP organiser, ran the event based on its own interests, so that the NRIP was more or less designed to be science-driven rather than business-oriented. The forum was mainly characterised positively, but the companies lacked the knowledge implementation processes (HOW) needed to take advantage of the knowledge gained. Companies were lacking in resources and methods by which to implement this knowledge; our interpretation is that the universities and other public actors were not trying to improve their own dynamic capability; instead, they strove to take advantage of new projects and public funding.

Thus, we argue that while open forums such as the NRIP offer significant possibilities, their full potential remains unexploited. We conclude that shared objectives, relevant topics, suitable working methods, and composition of the group are all collaboration antecedents that are key to refining the knowledge created during each event. We suggest that these antecedents should be studied further from the KM point of view. Finally, we conclude that companies should acknowledge the potentially strategic value of the information gained from such forums and therefore should build established and effective mechanisms to capitalise on it.

1.3.3 Article III: Community of Practice as a Tool for Company Performance in Strategic Context: A Case Study

The material below is taken, with appropriate changes for consistency, from article III.

This study examines CoPs as a strategic tool for collective learning and knowledge creation and sharing. Wenger (1998) asserts that knowledge creation in CoPs occurs when people participate in problem solving and share the knowledge necessary to solve those problems. New knowledge can be created through the conversion of explicit (visible, codified) and tacit (invisible, difficult to code) knowledge in a social process between individuals (Nonaka & Takeuchi, 1995). From a business perspective, the tacit knowledge that is embedded in individuals is often the most valuable because it consists of a deep understanding of complex, interdependent systems that enable dynamic responses to context-specific problems; more importantly, it is very difficult for competitors to replicate (Wenger

et al., 2002). According to Chesbrough (2006, p. 44), there is an abundance of knowledge in virtually every field. The proliferation of public scientific databases and online journals and articles, combined with low-cost Internet access and high transmission rates, can provide widespread access to a wealth of knowledge that was far more expensive and time-consuming to obtain as recently as the early 1990s. Chesbrough (2006, p. 45) argues that the rise of excellence in university-based scientific research and the increasingly diffuse distribution of that research means that the knowledge monopolies built by the centralised R&D organisations of the twentieth century have ended. Companies must structure themselves to leverage this distributed landscape of knowledge instead of ignoring it in pursuit of their own internal research agendas. The sharing of tacit knowledge requires close involvement and cooperation, network relationships, face-to-face contacts, a shared understanding, and trust (Ardichvili et al., 2003; Lam, 2000). Tacit knowledge also requires informal learning processes such as storytelling, conversation, and coaching of the kind that CoPs provide (Wenger et al., 2002). Through these processes, CoP members can increase their own understanding and add to their community's collective knowledge (Brown & Duguid, 1991; 1998). Appreciating the socially constructed nature of knowledge, McLure et al. (2000) recommend that organisations consider a third perspective on knowledge: not as an object to codify or something embedded in individuals, but as a social phenomenon and an integral part of a community. According to Wenger et al. (2002, p. 6), cultivating CoPs in strategic areas is a practical way to manage knowledge as an asset, just as companies systemically manage other critical assets (Cross, Laseter, Parker, & Velasquez, 2006; Hanley, 1998; Lesser & Everest, 2001; Probst & Borzillo, 2008; Prokesch, 1997).

Companies not only compete for market share, but also for talent, the people with the expertise and capabilities to generate and implement innovative ideas (Wenger et al., 2002, p. 7). These companies may discover the hard way that useful knowledge is not a "thing" that can be managed like other assets as a self-contained entity; rather, they need to base their strategy on understanding the knowledge challenge in all its complexity (Anand, Gardner, & Morris, 2007; Barrow, 2001; Brown & Gray, 1995; McDermott & Kendrick, 2000; Saint-Onge & Wallace, 2003; Wenger, 1999; 2004; Wenger et al., 2002). Researchers argue that what companies have been missing to date is a clarification of the kind of social structure that can handle the responsibility of fostering learning, developing competencies, and managing knowledge. From this perspective, a CoP embedded in an open-innovation environment provides an appropriate tool to share and manage this knowledge both internally and with other stakeholders.

The case company, KONE Corporation, is a multinational firm with seven global production units and eight R&D centres. It provides elevator installation,

maintenance, repair, and modernisation to the construction and engineering industries. At the time of the study, the company anticipated growth driven by the recovery of Western economies and the continued expansion of developing markets in Asia Pacific and Eastern Europe; its growth was mainly expected to occur through acquisitions. The new strategy was launched in 2005 with the aim of growing by shifting from a completely technology-focused strategy to a competitive and innovative services and solutions strategy. To achieve its strategic goals, the company needed to create a new organisational culture and improve knowledge harmonisation, especially among global installation and maintenance personnel in different units worldwide, many of which had overlapping functions. New global business units, such as process-based organisations, were expected to collaborate more effectively. The company had to restructure many of its former units as virtual organisations to cut costs, compile globally fragmented knowledge, and harmonise its processes. The study was carried out in the Global eLearning and Collaboration Department (GeLCD) at KONE's headquarters. That department was responsible for global training programs and collaboration; the particular program studied was to create and train community-based knowledge transfer between supervisors on a global scale. The Supervisor Development Program was created to achieve this goal as part of the corporation's strategic goals.

The research problems can be condensed into the following research question:

- *RQ1: How are communities of practice used as a strategic tool in the case company?*

Through a case study, we analyse how a CoP increased the staff's motivation and ability to improve company performance and achieve the firm's strategic goals, which require new ways of knowledge harmonisation among different, mainly virtual, globally located business units and all stakeholders within the company. In this study, we constructed a model for virtual collaboration in the CoP.

The current organisational structure, capabilities, and challenges of strategic management of the case company were analysed from the CoP perspective. In this study, large differences between cultural and geographical areas and local managers' knowledge of strategy in the case company were revealed. An effective corporate practice in an organisation built through acquisition is challenging to implement because there is a lack of cohesiveness of the corporation's different departments and units, which leads to the development of boundaries and silos within the organisation. The official strategy of the firm did not fully support working in an open environment with customers, sub-contractors, and other network actors in and around the corporation. It was also noted that management must realise that there is a wealth of knowledge and professionalism already

present in the local branches worldwide, because employees work continuously with competitors and within informal networks. CoPs are new organisational groups and can be the key to managing knowledge and innovation (Brown & Duguid, 1991, 2000; Brown & Gray, 1995; Kimble & Bourdon, 2008; Wenger and Snyder, 2000). In particular, CoPs are a strategic tool for executive management and supervisors. The chief challenge in the CoP context comes from middle management, which does not necessarily have a deeper involvement in knowledge-driven businesses. Despite that, supervisors can be highly motivated to work in a CoP. The case company faced a significant challenge because the CoP was not recognised as a vital organ and was therefore not led or managed systematically. Furthermore, many individuals were not actively seeking advantages from the CoP. The company should take advantage of the personnel who are committed to collaborating to solve business problems and increase their own performance capabilities. The company should prioritise the support of focused opportunities for employees to increase capabilities that will improve organisational performance and help achieve strategic goals. Converting information into knowledge is the most important issue in strategy improvements and a best practice for the case company, because benefits and feedback are essential for the organisation's practitioners in their dual roles as community practitioners and operational team members; that conversion will help link the capabilities of the CoP into the knowledge requirements of teams and business units. Another challenge was KONE's outsourced information and communications technology (ICT) department, whose old-fashioned processes prevented it from using modern knowledge-sharing tools and channels. This disadvantage appears to be a major handicap in using CoP for knowledge creation and knowledge sharing through an entire, virtually connected global corporation. Without reasonable tools and environments, it is difficult to achieve the best feedback and benefits from a CoP. The lack of a documentation process to convert tacit knowledge appears to retard the adoption of strategic change and new business processes. The key suggestion for improving collaboration on an organisational level in the case company is to establish informal networks with modern tools for sharing and documenting knowledge. Additionally, the relationship between the CoP and its stakeholders should be strengthened.

The ability to lead the company has improved at the individual level as freedom to organise work has been given to first-line managers, which has simultaneously aligned it with the corporate strategy. The extensive use of virtual meeting tools (web-conferencing, audio-conferencing, instant messaging) and virtual team sites on which projects can be managed independently has increased the possibility of collaboration in the case company. Individuals have different skills and competences, and a CoP provides skilled individuals with a forum that brings

together people with different areas of expertise, allowing them to join forces to achieve a common goal.

Together, the pre-work and interviews for this article indicated that as long as the case company implements a clear strategy and fosters motivation while using a common language and appropriate tools, it has the capability to create a new, common knowledge for all stakeholders. Top management has made a strong commitment to learning and knowledge creation. Although its core competencies are protected by corporate policies, the case company is open to networking with their partners.

Partnership with customers is highlighted, with the target of creating a collaboration that will mean better services for customers. Under this approach, best practices that have been created with the customer are distributed to the whole organisation and its partners. The outcome of that kind of collaboration is content with global reach and local best practices. Generally, the atmosphere in the case company appears to indicate strategic and managerial sponsorship of working more openly in CoPs.

However, the case company has not yet recognised the full power of CoPs. During the study, it was not clearly recognised that statements about CoPs can be found in its Knowledge Management Strategy. It appears that when this study was completed, the case company had a good opportunity to create a successful strategy for working in CoPs. Clearly, it must be sponsored by someone in the top management. It could be rewarding to conduct a follow-up study to evaluate the current situation and identify possible improvements that have occurred in the case company. The interviewees for this study were running the Supervisor Development Program in practice, so during the interviews, they were already able to see the influence of a new kind of training program and had received substantial feedback about it. A good basis for follow-up research would be to enlarge the group of interviewees, which could strengthen the results of the research and provide more background to the conclusions.

1.3.4 Article IV: Group dynamics and the role of ICT in the life cycle analysis of community of practice-based product development: A case study

The material below is taken, with appropriate changes for consistency, from article IV.

This article examines the dynamics of a CoP through a case study of eCars-Now!, a community that was created in 2007 in Finland. While Finland is still the strongest base for the community's R&D, the true scope nature of this open source community is global. They offer open source blueprints for electric conversion kits

globally and leave the manufacturing of the kits to the markets. We analysed this CoP by considering its entire life cycle, starting from the motives for its establishment through its active performance to the stage at which the members needed to decide whether the community would remain viable. Particular attention was paid to the group dynamics and issues that appeared relevant to changes in dynamics that can determine whether a CoP's vitality is maintained or dissipates.

According to Cartwright and Zander (1960, p. 7), group dynamics apply to a "field of inquiry dedicated to advancing knowledge about the nature of groups, the laws of their development, and their interrelations with individuals, other groups, and larger institutions". Group dynamics assign a set of norms, roles, and relations in a certain social group with a common goal. Members of the group create interdependency, through which members' behaviours, attitudes, opinions, and experiences are collectively influenced by all other group members (Wageman, 1995). Some argue that the business community is missing clarity in terms of what kind of social structure can effectively promote learning, develop skills, and manage information (Uzzi, 1997; Wenger et al., 2002; Zahra and George, 2002). CoPs featuring open innovation environments are regarded as useful tools to share and manage knowledge internally and with other stakeholders (Hafkesbrink & Schroll, 2011; Michaelides & Kehoe, 2007).

According to Wenger (1998b), knowledge creation in a CoP takes place when people are involved in problem solving and are willing to share enough information to solve a given problem. New knowledge can be produced by converting tacit knowledge into explicit knowledge by communicating through the social processes that exist between individuals (Nonaka & Takeuchi, 1995; Puusa & Eerikäinen, 2010). Individuals' tacit knowledge is often the most valuable knowledge in a community, because it consists of people's expertise and deep perceptions of complex issues and enables the provision of adaptive responses to context-specific problems (Wenger et al., 2002). For people to share their tacit knowledge requires a close involvement of the community and the cooperation of all, along with the use of networks and face-to-face contact that increase mutual understanding and trust (Ardichvili et al., 2003; Lam, 2000). Tacit knowledge is transmitted in a CoP in an informal learning process that involves storytelling, discussion, and coaching (Wenger et al., 2002). Through these processes, CoP members are able to increase their own expertise and improve the collective knowledge of their community (Brown & Duguid, 1991; 1998). Thus, a CoP provides a social context (Correia et al., 2010) that all members can use to learn together, based on the fact that people exchange knowledge and common practices and share a collective identity (Correia et al., 2010; Kirschner & Lai, 2007; Wenger, 1998a).

This article examines a case CoP which was chosen because of its unusual revelatory value (Eisenhardt & Graebner, 2007); the studied organisation is creating tangible innovation by using an environment that is normally used for intangible problem solving (Wenger and Snyder, 2000). A qualitative case study was conducted, and one CoP-based product development process was analysed by considering the CoP's entire life cycle, starting from an analysis of the motives for its establishment through its active performance to the stage at which its members needed to decide whether the community would remain viable. This article deepens the shared understanding of group dynamics in a CoP; in the analysis, particular attention is paid to issues which appear relevant to changes in dynamics. Some new characteristics associated with roles in the community and the successful employment of ICT are also identified. This study demonstrates that effectively deployed wikis and blogs offer one important channel to enhance community members' engagement and collaboration within digital communication environments.

The case reveals the interconnectedness between the core idea of CoPs and group dynamics by describing how those dynamics are affected by varied agendas and by members who join the CoP with interests which may not be in accordance with the CoP's original idea but are strictly financial in nature. It is argued that if participants value only concrete results and look only for potential monetary value in those results, group dynamics are disrupted, the group's voluntary nature eroded, and the entire idea of the CoP may be undermined.

The research problems can be condensed into the following research question:

> • *RQ1: What are the critical features that explain changes in group dynamics and help explain why a CoP maintains or loses its vitality?*

According to our results, group dynamics appeared to be highly relevant in determining why a CoP would see its vitality maintained or dissipated. Shared interest can be a force for unity, but shared interest was affected by conflicting motives and the realisation of plans, the pace at which the CoP evolved, and the sense of communality. The roles adopted in the community were also reflected in the group dynamics, while different stages of the community's life cycle affected the motivation to keep the group together. Our life cycle analysis revealed four themes that explained the change in the group dynamics and the dispersal of the community: 1) differentiation and dispersal of interests, 2) growth that resulted in role differentiation, 3) inclusion of investors, and 4) virtuality in community development. The case community operated not only with knowledge, but also created a tangible product, which is relevant to all of these themes. Therefore, we conclude that the tangibility of a problem to be solved appears to play a pivotal role

in a CoP's operations and dynamics. As a result of a tangible objective's presence in the case study, outside investors were included in the operations. Our interpretation is that if a CoP needs external funding to achieve its goals, it creates a new situation that significantly affects its operations, especially group dynamics. Finally, we conclude that a CoP's group dynamics and cohesion are reinforced by shared interests and weakened by goals set entirely or nearly entirely by external stakeholders. Such goals affect all members' roles and can thus weaken the CoP's original idea.

In conclusion, at the beginning of the life cycle of the eCars-Now! community, ICT played a significant role. It helped increase awareness of the community in the first place and enabled people to join, which in turn helped the community to grow. As the operations evolved and the life cycle progressed, both the physical meeting space and personal interaction and communication became much more important. In the maturing stage, the role of ICT, especially social media, was the essential part of the community.

1.3.5 A Summary of the Research Contexts and Research Strategy

The target of the study is a complex social phenomenon for which the use of a qualitative case study method is appropriate (Yin, 2013). In this kind of study, the role of the researcher is to be an active player during data collection and to have close interaction with the subjects. Research has been carried out with case studies, which typically are combined with the collection of data, interviews, surveys and, monitoring of the particular case (VanWynsberghe & Khan, 2007). This study has identified the opportunities and limitations of an organisation in more effectively taking advantage of the knowledge creation possibilities presented by CoPs.

The dissertation consists of four articles that deal with the above subject areas. Article I deal with academia-industry cooperation between participants in the NRIP. The action takes place in a CoP, which is an open innovation environment for cooperation between individuals and different organisations.

In article II, we study the knowledge produced in an academia-industry collaboration to generate dynamic capability through the employees of the NIRP, which had adopted the CoP approach.

Article III addresses the corporation's point of view with a study of KONE Corporation, identifying the individuals acting in the organisation and its CoPs, along with the value they generated for the organisation. Stretching over a two-year data collection period, the study explores the strategic benefits received by the company and ways to take advantage of CoP adoption.

Article IV focuses on the CoP as a group-level activity in the eCars-Now! community. It examines the emergence, dynamics, and decline of a CoP, beginning with common interests and moving through the emergence of different roles in the work of the group.

This dissertation broadens the understanding of the possibilities and limitations of knowledge creation in CoPs in open innovation environments with a thematic analysis, which is a common form of qualitative research (Braun & Clarke, 2006; Guest, Namey, & Mitchell, 2012). Thanks to its theoretical freedom, thematic analysis is a flexible and useful research tool that can potentially provide a rich, detailed, and complex account of the data (Braun & Clarke, 2006, p. 81). The data collected was analysed by means of coding and the interpretation of the matches took place on the basis of encoding themes (Braun & Clarke, 2006). In this inductive analysis, the process of coding the data occurs without a pre-existing coding frame or analytic preconceptions, making this form of thematic analysis especially data-driven (Braun & Clarke, 2006; Patton, 1990). In this study, these themes were transferred to tables for the purpose observing the evidence to be found in the material, which is essential when combining denominators (Braun & Clarke, 2006).

2 RESEARCH DESIGN

According to Zalan and Lewis (2004), any specific research design is the result of the researcher's ontological and epistemological assumptions, the nature of the research problem, the body of research, and the objective of the study. In this section, the ontological and epistemological assumptions of the dissertation author are presented first, after which the case study approaches adopted in the original articles are discussed. At the end of this chapter, the data collection and analysis methods in the original papers are briefly outlined.

2.1 ONTOLOGICAL AND EPISTEMOLOGICAL ASSUMPTIONS

The fundamental purpose of science is the production and organisation of knowledge (Olkkonen, 1994). According to Olkkonen (1994), science is knowledge that has been gathered using scientific methods and the most appropriate scientific criteria. Aaltola and Valli (2001) describe science as a process that permits the acquisition of knowledge, particular new knowledge, and solutions to both old and new problems. The philosophical assumptions of a study create its foundation and define its objectives, implementation methods, and results (Puusa & Juuti, 2011); there is no one, single valid and undivided agreement on a specific research approach. Ontological and epistemological assumptions and the relationship between humans and their environment are related to the methodological choices made in any study (Hurmerinta-Peltomäki & Nummela, 2004).

According to Burrell and Morgan (1979), the nature of social sciences consists of subjective-objective dimensions that are the foundation of any scientific research approach (Figure 3).

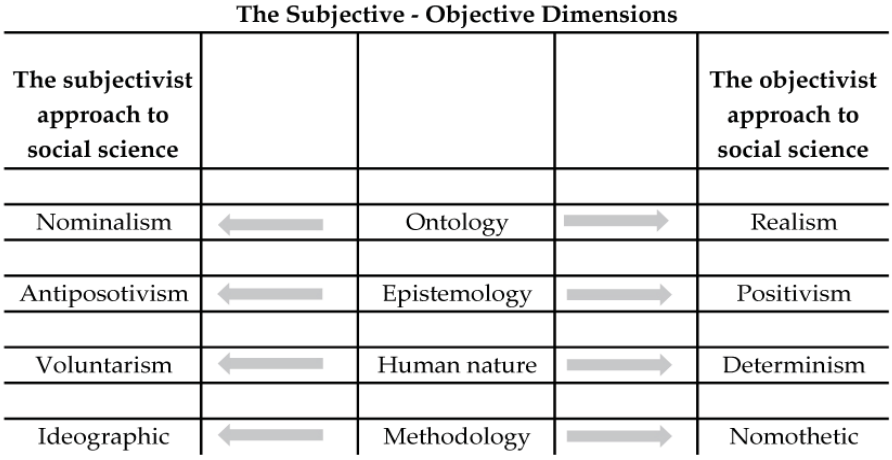

Figure 3: A scheme for analysing assumptions in the nature of social science *(Burrell & Morgan, 1979)*

Ontology relates to the nature of reality or the view that reality is "the product of one's mind" (Burrell & Morgan 1979, p. 1). In ontological discussions, William James (1906) stated that in true nominalist approaches, induction is primarily a solitary act that occurs when individuals are offered the opportunity to give rein to their natural reactions and can work out their own personal destinies, because for nominalists the world exists only so far as it is perceived in the mind. According to Burrell and Morgan (1979), the researcher's view of reality is the cornerstone for all of the researcher's other assumptions.

The second assumption regards epistemology – the nature of knowledge – and dictates what can be considered true or false or what is real (Guba, 1990; Hughes & Sharrock 1997). There are two basic epistemological points of view: positivism and anti-positivism. Positivists evaluate systems, processes, and changes (Burrel and Morgan, 1979) and traditionally seeks to explain things (Olkkonen, 1994), while anti-positivists see people as constructors of the social order and creators of symbols (Burrell & Morgan, 1979) and their own comprehension of things (Olkkonen, 1994). In this dissertation, following Guba and Lincoln (1994), epistemology is understood to be the kind of relationship that the researcher has with the subjects and what it is usually possible to know. An outside observer's perspective is not appropriate for this study, because the researcher can better understand the participants' points of view from inside the phenomenon under examination (Burrell & Morgan, 1979). The methodological choices made by the researcher are related to the paradigms chosen and to the logic of reasoning and methods (Puusa & Juuti, 2011). Methodological research options depend on the kinds of assumptions that the researcher has made from his or her ontological,

epistemological, and human insights, as Puusa & Juuti put it (2011). The author's personal position is that he cannot find an objective truth in this study, but can certainly offer a careful and rich explanation of the phenomena under examination.

Traditional hermeneutical research methods contain theoretical interpretations (Laine, 2001) relating to the purpose of a written text; these theories touch on the relationships between the author, the reader, and the text. For Olkkonen (1994), a hermeneutical research method is most useful in studies in which the results are used to guide the realisation of new knowledge, while Aaltola (2001) believes that hermeneutic research is well-suited to monitoring communications between people. Users of the hermeneutic paradigm are focused on producing a new understanding of the social world (Denzin & Lincoln, 2000, p. 158). Patton (2002) adds that researchers who undertake hermeneutic research also typically choose qualitative research methods to clarify the content and purpose of human activities. Hermeneutical scientists can see more clearly the fact that they construct reality by interpreting information obtained from the people who have produced that information for the research, as Patton describes the situation (2002).

The qualitative approach is relevant to this research because it helps to determine and describe social processes, complex factors, and research questions, starting with how and why (Merriam, 2009). Adopting this interpretive approach acknowledges the reality that data analysis is inherently complex and challenging and that the researcher must deal with the uncertainty of data and the presence of unclear patterns (Merriam, 2009).

In this dissertation, case studies are used to unlock the process of knowledge sharing and creation in the social context of community-based collaboration, because case study is an appropriate approach for clarifying human experience through the provision of rich and context-specific description (Lincoln & Guba, 2000). In this research, I strive to see phenomena as wholes, which is why I approached it from six different angles (five different kinds of organisations and one CoP). It combines participants (academia, research centres, other public organisations, corporations, SMEs, and the broader public), background, effects, and interdependencies, all of which combine to make the subject rich in potential insights. Qualitative research methods such as interviews of various types and group discussions can provide the kind of information that enables reaching the deepest possible essence of the phenomena in the four articles that make up the core of the dissertation. I assume my role as a researcher to be an active contributor to and participant in the activities of the investigated organs; by looking at the objects from the inside, I try to see the subjects through their own eyes. My research methods are not based on positivistic facts, but on my interpretation of the subject, so I situate my research such that it can be exposed to criticisms levied against qualitative research and its claims regarding validity and the reliability of its

results. The research method adopted and the subject of my research are not likely to be replicated in the same way by another researcher in another context, so there may be real limitations on the degree to which it can be generalised.

2.2 CASE STUDY RESEARCH

In the social sciences, the qualitative case study approach is commonly used to develop rich descriptions of meanings, behaviours, and feelings (Pratt & Rafaeli, 1997). Researchers are eager to sort out the processes by which meanings in qualitative research are constructed (Merriam, 2009); case study research can involve one case or multiple cases and several units and levels of analysis. "Why" and "how" questions are usually employed to explain causation when quantitative research aims to show correlations between constructs (Platt, 1992; Meyer, 2001). In the articles, a qualitative case study approach was used; a summary of the methodological choices and data collection and analysis in the original papers is presented in Table 2.

Table 2. A summary of the methodological choices, data collection, and analysis in the original papers.

	Article I	Article II	Article III	Article IV
Organisations	University, other public organisations, SME's and corporations	University, other public organisations, SME's and corporations	Corporation	Community of Practice
Business area	Academia, service and product industry	Academia, service and product industry	Product and service industry	Product development Community of Practice
Research approach	Qualitative case study in one community / open innovation program	Qualitative case study in one community / open innovation program	Qualitative case study in global development project	Qualitative case study in product development CoP
Time for data collection	January 2012 - March 2012	March 2015	August 2007 - August 2009	September 2013
Data collection	Semistructured interviews of NRIP core group members, notes in the workshops and archival data	Qualitative textual data from NRIP core group members, followed by a focused interview with the same issues	Semistructured interviews of the fasilitators of the community work	Qualitative textual data from core group members, followed by a group interview with the same questions
Analysis	Qualitative content analysis method	Qualitative content analysis method	Qualitative content analysis method	Qualitative content analysis method

In article I, the case study methodology was used to investigate issues in a real-world context (Creswell, 2012). Case studies have proven particularly useful for generating theoretical and practical insights (Gray & Wood, 1991). The research strategy and design were based on Yin's (2002) guidelines. First, the literature related to knowledge transfer, university-industry collaboration, and CoPs was explored as a theoretical basis for the study. The key scientific knowledge creation and transfer mechanisms were identified and the possibilities of using a CoP as a forum for scientific knowledge in university-industry interaction were explored. For data collection, several interviews and workshops were carried out.

Article II was carried out as a qualitative case study (Creswell, 1994; Stake 1995; Yin, 2003), which guides exploration of the target phenomenon by analysing textual

data. Creswell (1994, p. 12) describes a case study approach by stating that it is typically used to explore a single entity or phenomenon that is bounded by time and activity. The researchers collected detailed information through a variety of data collection procedures over a sustained period of time. Empirical data was collected in two stages. First, we sent a questionnaire to the core NRIP members seeking the following answers: What were the reasons you participated in the forum? Describe the workshops in your own words? How has your organisation benefited from your participation? Describe the mechanisms in use in your organisation to capitalise on the new knowledge gained/learned. We conducted a qualitative content analysis and used its conclusions as the basis for subsequent data collection, which was carried out in personal interviews. The second stage of data collection involved face-to-face interviews with seven key NRIP members, using a focused interview method. We used a dimensional sampling approach to choose the interviewees (Arnold, 1970). The interviews were transcribed and analysed using a qualitative content analysis method (Cavanagh, 1997).

In article III, in order to answer the research question, a two-year case study approach was adopted. This single case study expands the meaning of CoPs in strategic contexts and provides data regarding the actual application of a CoP in an effort to improve company performance. Research was implemented in two different steps. First, one researcher observed, participated in, and worked at the headquarters of the case company to obtain answers to the research questions. In addition, the case study involved a rich variety of qualitative data sources, archival data, and observations (Creswell, 2003). After the first step, semi-structured interviews with selected project personnel were carried out. The case study approach was chosen for article III primarily because it enabled the researchers to achieve a holistic and contextual explanation of the studied phenomena: the process of knowledge sharing and creation in inter-organisational business processes (Pettigrew, 1990). Another reason for choosing the case study approach was that the phenomena under examination were very difficult to separate from its context (Lincoln & Guba, 1985).

Article IV also adopted the case study as a research strategy (Yin, 1984), specifically an empirical study that "investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2009, p. 18). This study follows the agenda described by Eisenhardt (1989, p. 534): "the case study as a research strategy focuses on understanding the dynamics present within a single setting". This particular case was chosen because of its unusual revelatory value for a CoP: creating a tangible innovation in an environment that is normally used for intangible problem solving (Eisenhardt & Graebner, 2007). Data collection was conducted using method and researcher triangulation (Patton, 1990). Creswell

(1994), who defines case study strategy within the framework of an interpretative paradigm, reports that with a case study, a researcher characteristically concentrates on a single entity or phenomenon that is bounded by time and activity and collects detailed information by using a variety of data collection procedures. Morrow (2005) states that using multiple data sources enhances the interpretive value of the evidence. At first, participants were asked to write freely about how they initially became involved with the community, how they perceived the CoP's operations and functioning, and how they foresaw its future from both their personal outlooks and the CoP perspective. After a qualitative content analysis was conducted, its conclusions were used as a basis for subsequent data collection via personal interviews. Finally, a group interview was conducted using a focused interview method (Barbour & Kitzinger, 1999).

2.3 DATA COLLECTION AND ANALYSIS

Overlapping the processes of data collection and analysis improves the quality and flexibility of data by expanding the researcher's knowledge of the phenomenon studied, which can aid in creating new theoretical insights (Patton, 2002). In this dissertation, data collection and analysis in the original articles followed iterative and overlapping processes. After two or three rounds of data collection and analysis, compressed and clarified data was obtained. Thanks to this qualitative data collection process, data saturation increased in each round. For example, empirical data was collected first with a textual questionnaire; after a qualitative content analysis was conducted, its conclusions were used as the basis for subsequent data collection via personal interviews that were audio-recorded with the permission of the interviewees. If necessary, complementary oral questions were posed afterwards to deepen the researchers' understanding of certain elements of the phenomena being studied. All four articles' data collection and analysis procedures are summarised in Table 2.

Data collection for article I was carried out through several interviews and workshops, held in winter 2012 and led by the author and co-author, the latter of whom also worked as a consultant on NRIP development work. The data consisted of eight semi-structured interviews, workshop notes, and archival data. The interviewees were participants in the core group of the NRIP community. Based on a literature survey and empirical interviews, the NRIP was analysed from a theory-based approach (Puusa, 2007) by following the CoP development framework of Wenger et al. (2002).

The data collection in article II built on the work of article I and ended in March 2015. Data was collected in the same context as in article I, with the difference that

article I focused on the CoP as an environment for academia-industry collaboration, whereas article II concentrated on the benefits working in academia-industry collaboration. We collected the empirical data in two stages. First, we obtained qualitative textual data from the NRIP members by seeking the following answers: What were the reasons that you participated in the forum? What kind of expectations did you have? Describe the workshops in your own words. How has your organisation benefited from your participation? Describe the mechanisms in your organisation to capitalise on any new knowledge learned? We received 13 responses, of which five were from academics, four from other public actors, and four from industry representatives. After we carried out a qualitative content analysis, we used the conclusions as a basis for subsequent data collection through personal interviews with seven key NRIP members, using a focused interview method. Three interviewees were from research organisations and four from companies. All interviewees belonged to the NRIP's core group (see Wenger, 2000), which was actively involved in discussions and guiding the community along its learning agenda. This group was the heart of the community (Wenger et al., 2002, p. 56). Since the interviewees included representatives from academia, other public organisations, and private companies, we used a dimensional sampling method to choose them (Arnold, 1970). The interviews were transcribed and analysed with a qualitative content analysis method (Cavanagh, 1997).

The data in article III was collected between from autumn 2007 to autumn 2009, when the primary author was working as an entrepreneur and consulted the case company about virtual communities and the ICT tools related to them. In order to answer the research questions, a case study approach was adopted. This single case study expanded the knowledge of CoP in the strategic context and provided experiences of using a CoP to improve company performance. Research was implemented in two different steps. First, before the adoption of the Supervisor Development Program, the researcher observed, participated in, worked and later pre-worked with the GeLCD at the headquarters of the case company to obtain answers to the research questions. Second, semi-structured interviews with four project personnel were carried out. It is notable that global project manager and other interviewees came from different divisions in the company, so their answers were informed by a variety of corporate experiences.

The case company's internal and confidential archives and numerous observation periods in the GeLCD provided a substantial amount of material for qualitative research. For the on-location researcher, who was from outside the company, creating an open atmosphere and trust between interviewers and interviewees was important. Through co-operation with the GeLCD managers, a general overview of the company's organisational culture and knowledge exchange processes was obtained. Notes from interviews were made during each session and

later supplemented by reference to the recordings. The interviews were compiled and analysed using qualitative content analysis methods.

The data for article IV was collected in autumn 2013. This particular case was chosen because of its unusual revelatory value, as it involved a CoP that created a tangible innovation in an environment that is normally used for intangible problem solving (Eisenhardt & Graebner, 2007). The data collection was conducted using method and researcher triangulation (Patton, 1990). The interviews were conducted with three technology specialists and a community organiser, who collectively represented the heart of the CoP (Wenger et al., 2002). Morrow (2005, p. 255) points out that it is irrelevant to evaluate a qualitative study solely based on the number of informants, "as if sheer numbers are an assurance of the quality of the findings". She continues that numbers alone have little to do with the value or adequacy of qualitative data; particularly in an interview-based study, numbers mean little (Morrow, 2005). Insights and their meaningfulness depend on the case and the richness of the data rather than on sample size (Patton, 1990). At first, the participants were asked to write freely about how they initially became involved with the community, how they perceived the CoP's operations and functioning, and how they foresaw its future from both their own points of view and the broader CoP perspective. This textual data was analysed with qualitative content analysis methods. The conclusions from that analysis were used as the basis for subsequent data collection, carried out through personal interviews. Finally, a group interview was conducted using a focused interview method (Barbour & Kitzinger, 1999) and then analysed.

2.4 DATA ANALYSIS PROCESS

The rich data in each paper was qualitatively analysed using thematic classification, i.e. interpretation of the perceptions in the data. Classification involves assigning the analysed groups to predefined categories or according to indefinite similarities, which are also called themes (Mäkelä, 1995) so as to clarify the preconditions needed to take full advantage of knowledge creation and transfer possibilities. In this process, thematisation means conducting analysis to identify those features that are common to all four articles (Hirsijärvi & Hurme, 2001). Themes can be built around a pre-planned structure or can be found during data collection (Puusa, 2011); the latter approach was followed in this study. According to Puusa (2011), the designation of categories may be related to a characteristic of the phenomenon or by phenomenon determinants. All themes identified in this study are based on interpretations made by the researchers arising from phenomena found in the four articles (Koskinen, Alasuutari, & Peltonen, 2005).

3 THEORETICAL BACKGROUND

The body of theoretical knowledge to which this dissertation contributes is related to the themes found in the results of the four articles. Article I address the CoP as an open innovation environment, while article II identifies working and knowledge-creation processes, along with technologies that contribute to knowledge work. Article III shows that the academia-industry community's approach to the work of a CoP varied substantially between participants. Article IV draws on the significantly varied insights of different members of a CoP.

The results of the articles are shown as concepts on a map in Figure 4, divided into four themes and named according to the common denominators of the results. The theoretical background of the dissertation follows the structure shown in Figure 4.

Figure 4: Thematic results of the articles

The first subsection discusses the open innovation environment for individuals and organisations working together in a CoP. It addresses the motives of individuals and organisations to participate in an open innovation environment when the CoP has its own working principles. In the second subsection, knowledge transfer is discussed. The third subsection discusses processes and technologies, while the fourth considers theories of how to approach collaboration in a CoP. The fifth

subsection describes the terms and conditions under which participants are most able to take advantage of CoP work.

3.1 THE COP AS AN OPEN INNOVATION ENVIRONMENT

Innovations typically result from distributed inter-organisational networks rather than single organisations (Coombs, Harvey, & Tether, 2003; Powell et al., 1996), and concepts of interactive innovation are found in the non-linear, iterative, and multi-agent character of innovation processes (Kline, 1985; Lundvall, 1988). Inter-organisational and social networks are related to innovations by creating knowledge as a socially embedded process (Brown & Duguid, 1991) and play an important role in innovation processes (Müller & Ibert, 2015). According to Chesbrough (2003) and Laursen and Salter (2006; 2014), open innovation emphasises the ability to overcome the boundaries of an organisation so that ideas, resources, and individuals flow into and out of organisations. Open innovation as a business model incorporates value creation and value capture, enabling the firm to maintain its position in the industry value chain (Chesbrough, 2006). The open innovation model encapsulates the business strategy and organisational changes occurring as innovation becomes a more distributed activity across a wide range of different actors (Dodgson et al., 2006, p. 343). Organisations also need competencies which are related to external resources (Brusoni, Prencipe, & Pavitt, 2001), although organisations should maintain a balance between internal and external resources and always take care of their internal resources (Helfat, 2006). This approach is based on the idea that an organisation consciously chooses balance in resourcing, with specifics depending on its specific innovation culture and strategy (Herzog & Leker, 2010).

External actors leverage opportunities for connection of knowledge and capabilities across traditional boundaries (Fleming, 2001). Langlois (2003, p. 353) argues that innovation needs to proceed less along hierarchical lines because "large vertical integrated organisations are becoming less significant and are joining a richer mix of organizational forms". From this perspective, universities' economic and social assets like scientific knowledge and creating instrumentation infrastructures have long been recognised as an important source of industrial innovation (Cohen, Nelson, & Walsh, 2002; Salter & Martin, 2001). According to Stiglitz and Wallsten (1999), public-private research partnerships and pressure on universities to help improve national economic competitiveness are increasing the involvement of universities with industry (Greenaway & Haynes, 2000). Knowledge transfer between university and industry occurs in the concepts of open, networked, and interactive innovation collaboration and other types of

relationships that enable such transfers (Perkmann & Walsh, 2007). In inter-organisational networks, organisation-level relationships are often based on social relationships between individuals at the relevant organisations (Oliver & Liebeskind, 1998), and university-industry collaboration often relies on formal and informal social links (Audretsch & Stephan, 1996; Jaffe, 1989). According to Schartinger, Rammer, Fischer, and Fröhlich (2002 p. 305), academia-industry collaboration can be divided into 16 types of "knowledge interaction", grouped into four categories: joint research (including joint publishing), contract research (including consulting and financing of university research assistants by firms), mobility (staff movement between universities and firms and joint supervision of students), and training (cooperation in education, training of firm staff at universities, and lecturing by industry staff at firms). This provides a suitable starting point for the transfer of tacit knowledge, which is based on personal face-to-face contacts (Schartinger et al., 2002) and links with high relational involvement, including situations in which individuals and teams from academic and industrial contexts work together on specific projects to produce common outputs (Perkmann & Walsh, 2007). Especially in the open innovation environment, links with high relational involvement facilitate the construction and maintenance of inter-organisational relationships over a prolonged period of time, as Perkmann and Walsh (2007) emphasise. Powell et al. (1996) studied a learning-centred view of inter-organisational collaboration on the assumption that decisions to collaborate are not make-or-buy decisions; rather, collaboration is embedded in communities of learning that transcend the boundaries of single organisations.

Many surveys have revealed that universities and industrial respondents regard widespread use of university-industry relationships, collaborative research, and informal contacts to be valuable (D'Este & Patel, 2007; Meyer-Krahmer & Schmoch, 1998; Schartinger et al., 2002). The challenge is that relationship-based mechanisms are widely used in industrial organisations, but there are key systematic differences between industrial sectors and academic fields in terms of predominant linking mechanisms (Perkmann & Walsh, 2007). According to Perkmann & Walsh (2007, p. 265), science-based sectors like pharmaceuticals, biotechnology, and chemicals typically rely on collaborative research, while sectors that emphasise incremental improvement rather than scientific breakthroughs, such as mechanical engineering or software development, show a preference for research services. Many public research institutes provide ways of solving problems rather than suggesting concrete new project ideas (Cohen et al., 2002), which is consistent with non-linear views of the innovation process that emphasise the role of downstream development or consumers and buyers (Kline & Rosenberg, 1986). Similar evidence is provided by studies showing that consulting and contract research are widely practiced and judged to be important by both academics and industrial R&D

executives (Meyer-Krahmer & Schmoch, 1998; Cohen et al, 2002). Instead of cutting-edge research, consulting and contract research tend to provide more common but still specialised expertise that is especially crucial to the innovation cycle in areas like product differentiation and improvement (Polt, Rammer, Gassler, Schibany, & Schartinger, 2001). It is notable that consulting activities are relevant for the majority of SMEs, which do not have their own formal R&D activities (Perkmann & Walsh, 2007). The motives of companies for engaging in university-industry collaboration are more generic, such as gaining knowledge about emerging technologies and discoveries, rather than developing specific commercial innovations (Feller, 2005).

In discussing collaboration between companies, it is important to remember that no one firm has a monopoly on all the smart people, and that there are expert individuals outside firms whose knowledge is needed by firms (Chesbrough, 2003). According to Koschatzky (2001, p. 6) firms which do not cooperate and do not exchange knowledge reduce their overall knowledge base in the long run and lose the ability to enter into exchange relations with other firms and organisations. Although the era of open innovation has begun for many firms, there remains an insufficient understanding and appreciation of the mechanisms, both inside and outside organisations, that lay out when and how to profit fully from the concept (Enkel, Gassmann, & Chesbrough, 2009, p. 312). Business reality is not based on purely open innovation, because innovation processes that are too transparent can negatively impact companies' long-term innovation success through the possible loss of control and core competences (Enkel et al., 2009). From the process point of view at companies, Gassman & Enkel (2004, p. 1) have found that three core processes can be differentiated in open innovation:

1) *Outside-in processes,* in which a company's own knowledge base is enriched by integration of suppliers, customers, and external knowledge sources that increase innovativeness.
2) *Inside-out processes*, in which a company brings its own ideas to the market, sells its intellectual property, and multiplies the impact of technology by transferring it to the outside environment.
3) *Coupled processes,* in which a company relies heavily on co-creation with complementary partners through alliances, cooperation, and joint ventures, with reciprocity being critical to success.

According to Gassmann and Enkel (2004), any company needs certain capabilities to apply the open innovation approach effectively in these three processes:

An absorptive capability related to outside-in processes is needed to listen to the outside world and efficiently process the signals it receives.
A multiplicative capability related to inside-out processes is necessary for the company to be able to codify and share its knowledge with an external entity for successful commercialisation of ideas and strategic partners that are willing and able to multiply a new technology.
A relational capacity related to coupled processes is a necessary source of competitive advantage for a company that wants to build relationships with other companies, whether complementary firms or competitors.

By complementing the concept of ACAP, Lichtenthaler and Lichtenthaler (2009, p. 1315) moved towards a capability-based framework for open innovation processes, identifying six "knowledge capacities" as critical to a firm's ability to manage internal and external knowledge in open innovation processes: inventive, absorptive, transformative, connective, innovative, and desorptive capacities. According to these two scholars (p. 1334), these six knowledge capacities draw attention to the characteristics and challenges of different KM processes, while KM capacity emphasises the need for dynamically reconfiguring and realigning knowledge capacities.

Van de Vrande, De Jong, Vanhaverbeke, and De Rochemont (2009, p. 423) did not find any major differences between manufacturing and services industries, but did report that medium-sized firms were on average more heavily involved in open innovation than their smaller counterparts. SMEs tried to benefit from open innovation primarily for market-related motives like meeting customer demands or keeping up with competitors; their most important challenges related to organisational and cultural issues that arose as a consequence of dealing with increased external contacts (Van de Vrande et al., 2009). Different innovation practices appear to have the same underlying motives; the most important goals are improving product development, integrating new technologies, and keeping up with current market developments, according to Van de Vrande et al. (2009).

Open innovation studies have elevated the importance and even the very meaning of communities in the innovation process (Chesbrough, 2003). According to West and Lakhani (2008, p. 223), an important development in the last 10 years of innovation studies has been the recognition of the role of communities outside the traditional boundaries of firms in creating, shaping, and disseminating technological and social innovations. Individuals, organisations, and multinational corporations all struggle to compete in the global economy with its demand for new knowledge-intensive assets like value-creating networks, CoPs, advisory committees, educational and teaching resources, and R&D capacities (Javadi & Ahmadi, 2013; Parent et al., 2007). According to Israel et al. (1994), participation

allows individuals and organisations in an empowered community to provide enhanced support to one another. They handle conflicts in the community and gain increased influence and control over the quality of life in their communities (Israel et al., 1994). Israel et al. (1994) continue that they do not wish to suggest that a single focal point on the individual, organisation, or community alone is not viable in a categorical sense. Rather, they argue that a model of community is strengthened if links at all three levels provide the most effective means to provide collectively the support and control needed to develop any necessary skills, resources, and changes. One major challenge of CoPs is that their organic and informal essence makes them highly susceptible to management supervision and interference in their activities; it is even arguable that there are no clear ways to lead or manage them (Alani et al., 2003). Büchel and Raub (2002, p. 587) state that "the most valuable activities in knowledge management focus on creating knowledge networks that extend beyond the traditional concept of communities of practice". With good leadership and a clear structure, effective knowledge networks increase innovation and improve organisational efficiency by offering greater benefits (Büchel and Raub, 2002).

Organisational culture is the basis for knowledge sharing, which encourages mutually supportive relationships between employees (Ardichvili et al., 2003; Cabrera & Cabrera, 2005; David & Fahey, 2000), but personal advantages like the need to be an expert and the opportunity to share that expertise are also strong drivers for CoP participation. According to Ardichvili et al. (2003) and Riege (2005), the biggest barriers to people's sharing knowledge are uncertainty regarding the quality, validity, and importance of their knowledge. The willingness to use CoPs as sources of new knowledge is more complicated. Useful technology can help community members find the right knowledge from databases or in cooperation with other members to solve problems and stay informed regarding important developments (Ardichvili et al., 2003, Cross & Baird, 2000). In an open innovation environment, the CoP, as an informal social context for learning and knowledge generation, offers an effective environment for uniting individuals from different backgrounds and cultures to participate in a collaborative and friendly atmosphere through informal discussions and open dialogues (Nonaka & Takeuchi, 1995; Schenkel & Teigland, 2008). CoP structures are more informal, spontaneous, voluntary, and based on individuals' willingness rather than organisations' constraints (Brown & Duguid, 1991; Kimble et al., 2000). The strength of the CoP approach is its focus on relationships and on the social and practice-based interaction at the heart of the learning process; CoP members have mutual engagement, a sense of joint enterprise, and a shared access to communal resources (Wenger, 1998). Community members are integrated by interacting with each other through multiple interpersonal contacts (Tsai et al., 2012). According to Tsai et al.

(2012, p. 2) member activity involvement refers to the extent to which members engage in a community's activities, which should influence the evolution of the social system: "an interacting collectivity that has ongoing patterns of scripts, rules, norms, values, and models" (Zimmerman & Zeitz, 2002, p. 416). According to Simplican et al. (2015), people have different levels of engagement in communities; sometimes, people's mere presence may be the most important component.

CoPs help foster an environment in which knowledge can be created and shared, in addition to improving effectiveness, efficiency, and innovation (Lesser & Everest, 2001, p. 41). The tacit knowledge that is embedded in individuals is often the most valuable because it consists of a deep understanding of complex, interdependent systems that enable dynamic responses to context-specific problems (Wenger et al., 2002). Sharing tacit knowledge requires close involvement and cooperation, network relationships, face-to-face contacts, a shared understanding, and trust (Ardichvili et al, 2003; Lam, 2000; Riege, 2005). Tacit knowledge also requires informal learning processes, such as storytelling, conversation and coaching, of the sort that a CoP provides (Wenger et al., 2002). Through these processes, CoP members can increase their own understanding and add to their community's collective knowledge (Brown & Duguid, 1991). Recognising the socially constructed nature of knowledge, McLure et al. (2000) recommend that organisations consider a third perspective on knowledge: not as an object to codify or something embedded in individuals, but as a social phenomenon and an integral part of a community. From this perspective, CoPs provide an appropriate tool to share this knowledge.

3.2 THE PROCESSES AND TECHNOLOGIES FOR WORKING IN THE COP

Knowledge creation is a continuous, self-transcending process through which an individual overcomes the boundaries of the old self and develops a new self by acquiring a new context, a new view of the world, and new knowledge (Nonaka, Toyama, & Konno, 2000, p. 8). For dynamic knowledge creation, Nonaka et al. (2000) suggest creating knowledge (1) in SECI processes, in which knowledge creation occurs through conversations that involve tacit and explicit knowledge, (2) using *ba* (see below) to create knowledge in a shared context, and (3) by exploiting knowledge assets, the inputs, outputs, and moderator of the knowledge-creating process interacting with each other.

According to Nonaka et al. (2000), the SECI knowledge conversation process contains four modes: (1) socialisation (from tacit knowledge to tacit knowledge); (2) externalisation (from tacit knowledge to explicit knowledge); (3) combination (from

explicit knowledge to explicit knowledge); and (4) internalisation (from explicit knowledge to tacit knowledge).

By *ba*, Nonaka et al., (2000) refer to contexts in which knowledge must be created in interaction with others. With knowledge creation, an individual cannot be free from context, because social, cultural, and historical contexts are important for individuals; those contexts provide the basis for an individual to interpret information so as to create meanings.

Within organisations, knowledge creation assets are necessary to create value and see how knowledge assets are created, acquired, and exploited. Table 3 outlines the four categories of knowledge assets proposed by Nonaka et al. (2000).

Table 3: Four categories of knowledge assets (Adapted from Nonaka et al., 2000)

Experiential Knowledge Assets Tacit knowledge shared through common experiences • Skills and know-how of individuals • Care, love, trust, and security • Energy, passion, and tension	**Conceptual Knowledge Assets** Explicit knowledge articulated through images, symbols, and language • Product concepts • Design • Brand equity
Routine Knowledge Assets Tacit knowledge routinised and embeddded in actions and practices • Know-how in daily oprations • Organisational routines • Organisational culture	**Systemic Knowledge Assets** Systemised and packaged explicit knowledge • Documents, specifications, manuals • Databases • Patents and licences

Experiential knowledge assets consist of the combined tacit knowledge that is built through shared hands-on experience among the members of an organisation and between the members of that organisation and its customers, suppliers, and affiliated firms (Nonaka et. al., 2000, p. 21). According to Von Krogh (1998), tacit knowledge sharing through common experiences is enabled in conditions which are guided by values and care. Conceptual knowledge assets are those based on the concepts held by both customers and members of the organisation (Nonaka et. al., 2000, p. 21). Routine knowledge assets consist of continuous exercises by which certain patterns of thinking and action are reinforced and shared among organisational members (Nonaka et. al., 2000, p. 21). Systemic knowledge assets can be transferred relatively easily because they are the most visible type of knowledge asset, and current KM research primarily addresses managing knowledge assets, such as intellectual property rights, in a systematic fashion (Nonaka et. al., 2000).

Communication processes and information flows are fundamental in driving knowledge distribution in organisations; they influence knowledge transfer within a firm through the ACAP of the recipient, the nature of message, and the relationship between the source and recipient (Alavi & Leidner, 2001; Wilkinson & Young, 2002). Personalised tacit knowledge transfer has a strong influence on the development of innovative capabilities, and process innovation has a greater impact on organisational performance than product innovation (Rhodes, Hung, Lok, Ya-Hui Lien, & Wu, 2008, p. 84). Technology is a useful tool for explicit knowledge such as product designs, but personal transfer is more profitable in transferring tacit knowledge like beliefs and behavioural norms (Alavi & Leidner, 2001). ICT solutions can increase knowledge distribution by extending individuals' reach beyond formal communication lines, but the challenge is that individuals with a need to know may not be aware of knowledge sources that are available in the organisation (Alavi & Leidner, 2001). ICT systems support organisational knowledge transfer with the support of a structured learning strategy and an innovative organisational culture (Rhodes et al., 2008). Computer networks, electronic bulletin boards, and discussion groups can create a forum and an electronic CoP that facilitates contact between people seeking knowledge and those who may possess or at least have access to that knowledge (Alavi & Leidner, 2001, p. 45). According to Grant (1996), the essence of organisational capability is creating value through conversion of inputs to outputs in the form of organisational products and services. Challenges to knowledge transfer mechanisms arise from heterogeneous forms of knowledge that are difficult to transfer from one form to another (Szulanski, 2000; Zander & Kogut, 1995). According to Dalkir (2005), value-based KM contains three levels: the individual, the community, and the organisation itself. To retain valuable knowledge as lessons learned and best practices, knowledge needs to flow from individual to individual, between members of a CoP, and ultimately back to the organisation itself.

3.3 APPROACH TO KNOWLEDGE SHARING IN ACADEMIA–INDUSTRY PARTNERSHIPS IN THE COP

In public-private innovation partnerships (PPIs), heterogeneous organisations work together to develop innovative solutions (Dittmer, Christiansen, & Kierkegaard, 2008; Weihe, Højlund, & Helby, 2011). Activities which support the fields of business should develop interdisciplinary research targets and state-of-the-art research data to enhance business opportunities (Iskanius, 2011). The challenges for such collaboration come from the heterogeneity of the actors and their different values and objectives (Currie, Humphreys, Ucbasaran, & McManus, 2008). These

sectoral differences require management within PPI teams, because the heterogeneous actors have to define problems and explore solutions jointly, which requires knowledge sharing and integration and the ability to secure progress (Nissen, Evald, & Clarke, 2014, pp. 473-474). This means that the ability to perform as a team during the innovation process depends on team members' ability to hold both a common knowledge base that cuts across team members and different complementary knowledge bases attached to the tacit knowledge (or mental models) held by individuals (Nissen et al., 2014, p. 474). Cooperation and collaboration in PPIs can be seen in two ways, which means that collaboration and teamwork are similar in that there are strong linkages and interdependencies between members of a group or a team (Nissen et al., 2014), while collaborative learning explains how new approaches are generated through interaction within the groups (Bruffee, 1995).

Table 4: Key dimensions of cooperation and collaboration (adopted from Nissen et al., 2014)

Key dimensions of cooperation and collaboration

Central dimensions	Taskwork and cooperation	Teamwork and collaboration
Distribution of tasks and responsibilities	Separate assingments/distribution of tasks and delineation of responsibilities	Joint problem solving/community and common tasks
Type of task	Defined tasks	More open tasks
Linkages between the team members (degree of interactions, dialogue, etc.)	Weak linkages	Strong linkages
Context	Team members work in different context	Team members work in a common context

The differences between cooperation and collaboration and task work and teamwork are clarified in Table 4. According to Bruffee (1995), in practice they do not necessarily occur in their pure forms; rather, the degree of interaction appears on a continuum. Cooperation characterises a group in which each individual is regarded as autonomous and independent from the others, while collaboration is characterised by strong linkages that depend on a high level of trust and dialogue among several actors (Keast, Brown, & Mandell, 2007). Nissen et al. (2014, p. 480) emphasise the importance of being able to maintain different complementary knowledge bases among heterogeneous team members, as these, when they supplement a common knowledge base, can create momentum and progress during innovation processes. Disturbances that present new situations and knowledge also appear to be necessary elements to secure progress during

innovation processes, as long as these disturbances are handled in a manner that results in re-establishing a new shared knowledge base (Nissen et al., 2014, p. 480). The importance of knowledge sharing and integration of both tacit and explicit knowledge possessed by public and private members can be a very fragile process, and facilitators sometimes have to offer firmer guidance to participants (Nissen et al., 2014). According to Gallego, Rubalcaba, and Suárez (2013), firms must be connected to the open science community to share research results with scientists outside the boundary of the firm. This connection is important for companies to create and enhance their ACAP (Lim, 2009). Firms benefit from more scientific-based knowledge by increasing their potential for new combined knowledge that comes from multiple innovators; this plays a key role in supporting firms' knowledge when it is based on trust and collaborative culture (Gallego et al., 2013).

3.4 ADVANTAGE OF THE KNOWLEDGE IN THE COP WORK

Early organisational knowledge transfer models viewed knowledge as an object that could be passed on mechanically from its creator to a translator, who would adapt it in order to transmit the information to the user (Javadi & Ahmadi, 2013, p. 725); in this process, the user is normally entirely passive. This hierarchical, linear, top-down relationship between resource and user came in for significant criticism from numerous authors (Javadi & Ahmadi, 2013). Many researchers have proposed experiential processes of transferring theoretical knowledge into practical knowledge by using a real-life setting (Parent et al., 2007). The linear model of knowledge transfer ignores the reality of both the context and the use of knowledge generation, as has been pointed out by scholars like Inkpen and Dinur (1998). The model of experiential learning has a long history; it has received support from such authors as Lewin (the cycle of adult learning, 1951), Kolb and Fry (the model of experiential learning, 1975), and Honey and Mumford (the typology of learners, 1982). The latest models to capture the imagination of the research and practice communities are the CoP and the knowledge network models (Parent et al., 2007, p. 83). Companies in the modern knowledge-intensive business environment depend on external information sources to promote innovation and improve their performance (Cassiman & Veugelers, 2002; Morgan & Berthon, 2008), but many firms still have substantial difficulties in benefiting from external knowledge flows, even in knowledge-intensive industries (Cassiman & Veugelers, 2006; Escribano et al., 2009).

According to Parent et al. (2007), when identifying the required components for social systems to generate, disseminate, and use new knowledge, a novel systemic and generic framework can help obtain a better overview. They suggest that the

dynamic knowledge transfer capacity (DKTC) model solves problems in their broadest sense, when it is considered to be the primary reason for transferring knowledge within and between social systems, because the actors in knowledge transfer put their energy into the knowledge transfer processes that is required to address the relevant needs (Parent et al., 2007). Their model of four capacities shows that the continuous flow of existing and required knowledge makes clear that both knowledge and needs are infinite (Parent et al., 2007, p. 87):

1) *Generative capacity* refers to the ability to discover or improve knowledge and the processes, technologies, products, and services that derive from it, based on a system's intellectual and creative capital.
2) *Disseminative capacity* denotes the ability to contextualise, format, adapt, translate, and diffuse knowledge through social and/or technological networks and to build commitment from stakeholders, based on the existence of articulated social capital.
3) *Absorptive capacity*, initially conceptualised by Cohen and Levinthal (1990), is defined here as the ability to recognise the value of new external knowledge, assimilate it, and apply it to address the issues relevant to a system's stakeholders, based on the environments that possess prior related knowledge.
4) *Adaptive and responsive* capacity refers to the ability to learn continuously and renew elements of the knowledge transferring system in use to enable constant change and improvement, based on prior continuous learning experience, visionary and critical thinking, distributed leadership among stakeholders, multiple feedback loops, and monitoring mechanisms.

According to Parent et al. (2007), the first three capacities are central to the model, with their relative importance varying with the specific problem. Table 5 illustrates the resources required, typical activities associated with, and results generally obtained for each of the capacities contained in the model.

Table 5: The dynamic knowledge transfer capacity model (adapted from Parent et al., 2007, p.88)

DYNAMIC KNOWLEDGE TRANSFER CAPACITY (DKTC)				
	Generative capacity	**Disseminative capacity**	**Absorptive capacity**	**Adaptive/responsive capacity**
Primary focus	Discovery	Diffusion	Application	Renewal
Assets generally associated with each capacity	Research and Development Intellectual Capital Creativity and imagination Advisory networks Alliances	Social capital Social and technological infrastructure Information technology Knowledge brokers (translators, gatekeepers, boundary-spanners, facilitators…	Prior related knowledge Readiness to change Trust between partners Trust between partners Flexible and adaptable working organisation Management support	Prior continuous learning experience Visionary and critical thinking Distributed leadership among stakeholder Multiple feedback loops Monitoring mechanisms
Activities generally associated with each capacity	Matching stakeholders' needs and ressearch Linking researchers and practitioners Scanning external sources of knowledge Attracting creative leaders from different perspectives (disiplines, sectors, education) Creating "think tanks" Building alliances (expertise, "best practices") Inventing (externalizing ideas, intuitions, combining, experimenting, testing, revising)	Networking, clustering and building commitment of stakeholders Brokering and negotiating knowledge transfer arrangements Contextualising the new knowledge Adapting/translating the new knowledge to end-users' reality Formatting knowledge (publications, activities, IT) Delivering transferable knowledge to different stakeholders Working with opinion leadership Developing iterative mechanisms to facilitate a large diffusion of knowledge	Recognising external relevant knowledge to solve problems and/or address critical issues Managing stages of change Exploring the new knowledge Deciding to change (evaluation) and/or adopt the new knowledge Experimenting/combining/ modifying practices, technologies … Internalizing the new knowledge Utilizing the new knowledge	Monitoring knowledge transfer (KT) system Critically reflecting on KT "best practices" and mechanisms Exploring/comparing multiple KT systems' perspectives Combining/experimenting with new practices Upgrading or redesigning KT system
Outputs generally experienced	New or improved knowledge (codified or not) relevant to issues or problems: concepts; processes/routines; technologies; and products/services (patents, databases)	Knowledge adapted and shared with committed stakeholders: transferable knowledge; adaptable/applicable knowledge; and meaningful knowledge	Knowledge identified, assimilated and applied by end-users (other researchers, policy makers, decision makers, providers, operators, technicians) to solve problems and/or issues: application of new concepts; new integrated practices/processes/routines; new technologies adopted; and new products/services in place	Improved knowledge transfer "best practices", mechanisms and norms: KT practices continuously assessed repositories of best KT practices and their specific context processes and mechanisms of KT well adapted to context culture of creativeness, sharing, trust and learning

The rapid change in the economy highlights the need for continuous contingency and adoption of new knowledge (Teece et al., 1997). Dynamic capabilities thus reflect an organisation's ability to achieve innovative forms of competitive advantage (Zahra & George, 2002). Winter (2003, p. 992) notes that "there is a broad consensus in the literature that 'dynamic capabilities' contrast with ordinary (or

operational) capabilities by being concerned with change". The DKTC model focuses on the assets that a system must possess to improve knowledge transfer and how these assets can be deployed and redeployed in a changing market, as Teece et al. (1997) argue. To succeed with knowledge transfer, knowledge generation, dissemination, absorption, and adaptation and responsiveness capacities have to be managed systematically (Parent et al., 2007). The DKTC model can help identify and facilitate the capacities required for knowledge transfer and value creation in complex and heterogeneous networked organisations that operate autonomously and interdependently at the same time.

Dynamic capability, according to Teece et al. (1997, p. 516), is "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments", suggests that intangible assets, including the knowledge and skills of the workforce, can be reconfigured into routines to create capabilities to respond to changes in the business environment. Eisenhardt and Martin (2000, p. 1107) later defined dynamic capability as "the firm's processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change." Dynamic capabilities reflect an organisation's ability to achieve innovative forms of competitive advantage, given definite managerial and organisational processes, the particular company's asset positions, and the evolutionary paths followed (Lawson & Samson, 2001; Teece et al., 1997).

The process of learning is an essential element of the creation and renewal of dynamic capability (Easterby-Smith & Prietow, 2007; Zollo & Winter, 2002); thus, examination of knowledge-sharing mechanisms and learning processes is critical to accurately identifying dynamic capability. The dynamic capability approach emphasises the importance of relationships and interactions for knowledge transfer both within and across organisational boundaries (Eisenhardt & Martin, 2000; Teece et al., 1997).

Teece (2007, p. 1319) has divided dynamic capabilities into the following three categories: (1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to maintain competitiveness through enhancing, combining, protecting, and when necessary reconfiguring the business enterprise's intangible and tangible assets. According to Teece (2007), dynamic capabilities include the difficult-to-replicate enterprise capabilities required to adapt to changing customer and technological opportunities. They also embrace the enterprise's capacity to shape the ecosystem it occupies, develop new products and processes, and design and implement viable business models (Teece, 2007, p. 1320).

Underlying these three dynamic capabilities is the idea of strategic change (Helfat et al., 2009). In order to detect new business opportunities, an organisation must identify new business processes that relate to the business environment

(Teece, 2007). An organisation with strong sensing capabilities learns to market changes, which refers to the company's market research efforts as they are reflected in its ability to anticipate market trends and clients' requirements (Weerawardena & O'Cass, 2004). Seizing capabilities explains how companies can sense any opportunities that allow them to develop new services and products and choose to exploit new opportunities for the best possible business model (Teece, 2007). Seizing capabilities also refers to sensing opportunities to take advantage of investments (Helfat et al., 2009). Reconfiguring helps companies develop their capabilities and potential on a continuous basis, particularly when they are engaged in organisational learning (Weerawardena & O'Cass, 2004). Helfat and Peteraf (2003) argue that companies have surprisingly few generative mechanisms that allow them to manifest their dynamic capabilities.

3.5 KNOWLEDGE TRANSFER PROCESSES IN THE COP

The last thematic result drawn from the articles involves explaining the knowledge transfer processes found in the CoP. To be highly competitive and successful, enterprises must create and sustain a balanced intellectual capital portfolio and must clarify how to set broad priorities and integrate the goals of managing intellectual capital with the detailed machinery of managing the corresponding effective knowledge processes (Wiig, 1997, p. 404). The relationship between intellectual capital and KM is rooted in the knowledge-based perspective (Simon, 1965). It is the role of intellectual capital and KM to keep the body of knowledge alive and vibrant to secure an enterprise's well-being and long-term viability; neither can be pursued independently of the other (Wiig, 1997). KM and intellectual capital literature have the same outlook on how knowledge and KM can lead to an organisation's success and competitiveness (e.g., Argote, McEvily, & Reagans, 2003; Nahapiet & Ghoshal, 1998; Nonaka & Takeuchi, 1995). While KM involves appropriate stewardship of the knowledge resources of an organisation (Dalkir, 2013), intellectual capital involves summing up the knowledge present in an organisation in order to utilise it as a competitive advantage (Subramaniam & Youndt, 2005). Organisational knowledge is at the centre of intellectual capital, while KM deals with processes and management (Alavi & Leidner, 2001). Intellectual capital refers to those pieces of knowledge that have business value to organisations (Bontis & Nikitopoulos, 2001). According to Subramaniam and Youndt (2005), intellectual capital is measurable when categorised into three components: *human capital* (knowledge, skills, and capabilities); *organisational capital* (knowledge of the organisation and the codified experience residing in databases, manuals, culture, systems, structures, and processes); and *social capital* (the

knowledge embedded in networks of relationships and interactions among individuals). Organisational KM involves three major processes: *knowledge acquisition* refers to developing new knowledge from data, information, or other knowledge; *knowledge conversion* is the means by which knowledge is made useful for the organisation; and *knowledge application* refers to the use of knowledge to perform specific tasks (Gold & Malhotra, 2001).

Hsu and Sabherwal (2012) suggest that the importance of intellectual capital and a learning culture, especially for firms that are not competing based on efficiency, does not depend either directly or indirectly on any of the other constructs, including intellectual capital, KM, or learning culture (see Figure 2 in section 1.2). Organisations should create an atmosphere of learning by creating a learning culture (Xue & Xia, 2008). According to the definition by Xue & Xia (2008, p. 191), a learning culture has the following significant features: (1) a good atmosphere for work and study, (2) sharing concepts, (3) a management philosophy that is in accord with human nature, and (4) a lasting sense of innovation. Figure 2 illustrates the interdependencies and other relationships between KM and intellectual capital.

According to Hsu and Sabherwal (2012), intellectual capital benefits an organisation through improvements in dynamic capabilities and KM, both of which benefit the organisation and the learning culture by enabling innovations. They suggest that the development of intellectual capital and a learning culture may be more important than investments in KM processes because KM does not affect either intellectual capital or dynamic capabilities, whereas learning culture *does* affect intellectual capital and innovation. KM has an important role in facilitating innovations that will improve organisational performance; an organisation seeking to establish a competitive advantage based on innovation must grasp that KM can help achieve that goal (Hsu & Sabherwal, 2012).

According to Alipour (2012), intellectual capital is defined as the group of knowledge assets owned or controlled by an organisation and, most significantly, drive organisation value creation mechanisms for key company stakeholders. Intellectual capital is divided into three basic components: *human, organisational,* and *social capital* (Reed, Lubatkin, & Srinivasan 2006; Subramaniam and Youndt 2005). A very similar classification was proposed in earlier studies by Bontis (1998), Roos, Roos, Dragonetti, and Edvinsson (1997), Sveiby (1997), and Edvinsson and Malone (1997), with intellectual capital consisting of three elements: *human capital, relational capital,* and *structural capital*. Schiuma, Lerro, and Sanitate (2008) add a sixth dimension of intellectual capital: *stakeholder capital*.

1) Economic value is created by *human capital,* which includes knowledge, experience, and the special skills possessed by a business entity's personnel

(Cohen & Kaimenakis, 2007); Schiuma et al. (2008, p. 167) also incorporate the intellect, relationship, attitude, talent, and behaviour of employees.

2) *Relational capital* is created through the connections between an organisation and its network of suppliers, shareholders, and other individuals, along with relations between the organisation and the broader society (Grasenick & Low, 2004).
3) *Organisational capital* contains production or other processes, specialisation, and the flow of information (Roos and Roos, 1997); it is intangible social or collective knowledge (Bueno, Salmador, Rodriguez, & de Castro, 2006).
4) *Structural capital* is the supportive infrastructure for human resources like organisational culture, management philosophies, organisational processes, systems, and informational resources (Benevene & Cortini, 2010)
5) *Social capital* takes in the relationships of individuals, organisations, communities, or economic actors that support growth (Schiuma et al., 2008).
6) *Stakeholder capital* includes certain forms of structural capital that, due to their importance for a firm's success, have been addressed separately from the broader concept of structural capital (Schiuma et al., 2008).

According to Cheng, Lin, Hsiao, and Lin (2010, pp. 446-447), intellectual capital significantly influences company performance because an input-process-output concept shows that innovative capacity and efficient operating processes are antecedent factors which represent the resources invested in inputs. Human value added and maintainable customer relationships are also factors in the competitive advantage of a company, while innovative capacity and efficient operating processes indirectly affect company performance via maintainable customer relationships and human value added resources. (Cheng et al., 2010, p. 447).

Intellectual capital, especially structural capital, has a significant and substantive relationship with business performance, regardless of the underlying industrial sector (Bontis et al., 2000, p. 9). Intellectual capital has a positive impact in service industries but is less substantive and significant for non-service industries; in either case, organisations' efforts to codify organisational knowledge and thereby further develop their structural capital ultimately yields a sustainable competitive advantage that in turn leads to relatively higher business performance (Bontis et al., 2000).

The ability to manage knowledge is becoming increasingly more crucial in today's knowledge economy (Dalkir, 2005, p. 2), an ever more valuable strategic asset in organisations (Zack, 1999) and an emerging organisational and management challenge (Grant, 1996; Halawi, McCarthy, & Aronson, 2006). KM was originally defined to help organisations capture, structure, manage, and

disseminate systematically their existing knowledge (Davenport and Prusak, 1998; Nonaka & Takeuchi, 1995; Ruggles & Holtshouse, 1999). According to Wiig (1999), the purpose of KM is to maximise companies' knowledge related to their effectiveness and to renew that knowledge on a regular basis. Progressive managers have recognised that an enterprise's viability depends directly on the competitive quality of its knowledge-based intellectual capital and assets, and the successful application of these assets in its operational activities to realise their value in fulfilling the enterprise's objectives (Wiig, 1997, p. 399).

Davenport, Jarvenpaa, and Beers (1996) present four key processes for KM: finding existing knowledge, creating new knowledge, packaging created knowledge, and externally using existing knowledge. To take advantage of those processes, organisations must find ways to use beneficial explicit and implicit knowledge processes to add value for their customers and involve them in the process (Davenport et al., 1996). From the knowledge-based perspective of the firm, the firm can be seen as a knowledge system engaged in knowledge creation, storage, transfer, and application (Alavi & Leidner, 2001, p. 6), a perspective that is consistent with the definition of organisational cognition as the ability to acquire, store, transform, and utilise knowledge. Grant (1996) emphasises that creating, acquiring, storing, and deploying knowledge are fundamental organisational activities. According to Ruggles (1998, p. 82), there are eight basic processes: generating new knowledge; accessing valuable knowledge from outside sources; using accessible knowledge in decision making; embedding knowledge in processes, products, and/or services; representing knowledge in documents, databases, and software; facilitating knowledge growth through culture and incentives; transferring existing knowledge into other parts of the organisation; and measuring the value of knowledge assets and the impact of KM. As a summary, Alavi & Leidner (2001, p. 26) suggest that these many parallel views of KM processes can be classified into four major processes:

1) the process of creating knowledge (including knowledge maintenance and updating)
2) the process of storing and retrieving knowledge
3) the process of transferring or otherwise sharing knowledge
4) the process of applying knowledge

According to Malhotra (1998), meaning and knowledge can only be achieved in a human community through the use of dialogue. Additionally, O'Dell and Grayson (1998) state that the most important organisational knowledge is too complex to be captured electronically. Others, however, have made clear that ICT can be called

upon to assist in maximising KM (Alavi & Leidner, 2001) in the following specific ways:

1) the coding and sharing of best practices
2) the creation of corporate knowledge directories
3) the creation of knowledge networks

Transferring internal best practices is one of the most common applications that exploits ICT in KM (O'Dell & Grayson, 1998), as in using online directories and searching databases, sharing knowledge and working together in virtual teams, accessing information on past projects, and learning about customer needs and behaviour by analysing transaction data (KPMG, 1998). Knowledge networks have been less fully addressed in mapping expertise or benchmarking than bringing experts together to share and amplify important knowledge (Alavi & Leidner, 2001).

4 KEY FINDINGS

This section synthesises the perceptions that were culled from the research results of the four original articles. These results are interpreted using the following process. The perceptions of the results were placed into a summary of concepts (Figure 5) and divided into four themes that were named according to the common denominators of the results, in the same way as laid out in the theoretical portion of this dissertation. Since the results of the original articles were generated on the basis of key personnel in small communities, those results cannot be considered universal, but they do increase scholarly knowledge in the dissertation's research area. The following subsections present the synthesis of the original papers. In the original articles, many different results touch on KM processes and technologies and participants' approaches to the CoP. The article results also offer several possible advantages regarding the use of the CoP.

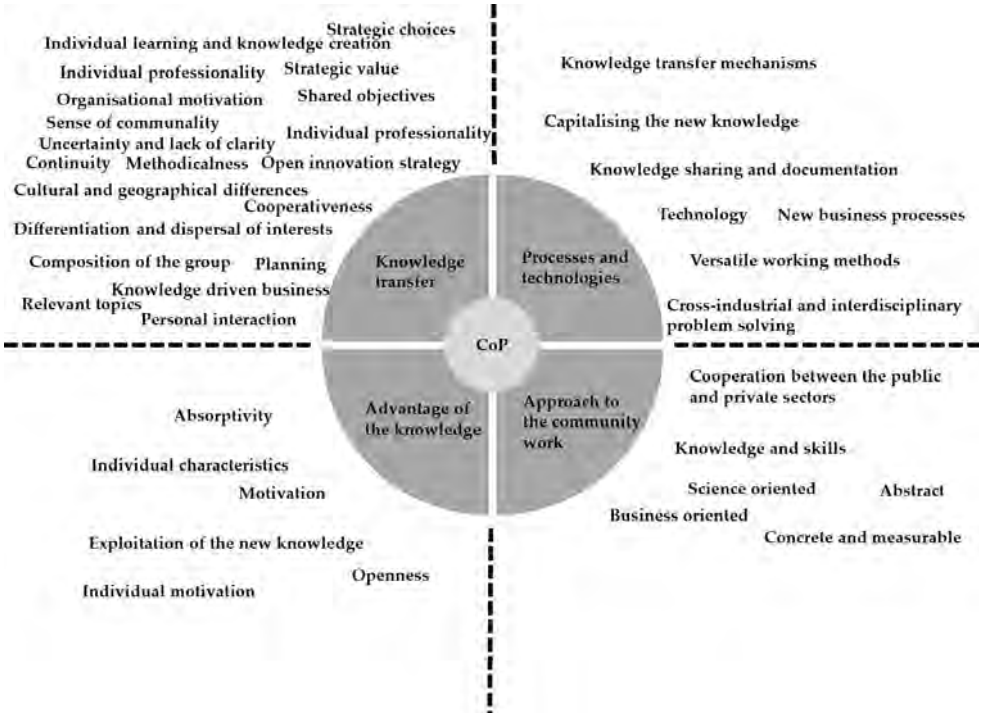

Figure 5: Summary of concepts from the four original articles

To clarify the results in the tables, limitations are marked with "L", possibilities with "P", and not available with "N/A" (meaning that this item was not queried in the research). "L/P" means that the item is both a limitation and a possibility. Finally, in the tables below ovals are used to highlight the most important findings from the synthesis. From the perspective of this dissertation, the most significant findings are those that relate to the creation and transfer of knowledge in the communities under examination.

4.1 THE PROCESSES AND TECHNOLOGIES FOR WORKING IN COPS

Table 6 refers to the processes and technologies that the organisations and the CoP in this study used to manage knowledge and improve their knowledge creation and transfer. In creating intellectual capital and KM processes, public organisations appear to be more advanced than the private sector and the CoP itself.

Table 6: Processes and technologies in the work of the CoP

Processes and technologies	Feature	Universities	Research Centers	Other public organisation (e.g. TEKES)	Corporation	SME's	Community of Parctice
	Knowledge transfer mechanisms	P	P	P	P	L	L/P
	Mechanisms to capitalise on the new knowledge	P	P	P	L/P	L	L/P
	Knowledge sharing and documentation	P	P	P	L/P	L	L/P
	Versatile working methods	P	P	P	L/P	L/P	L/P
	Cross-industrial and interdisciplinary problem solving	L/P	L/P	L/P	P	L	P
	New business processes	L/P	L/P	L/P	P	L	L/P
	Technology	P	P	P	L/P	L	L/P

The study implies that the combination of KM, new business processes, and technologies is quite scattered, although universities, research centres, and other public organisations appear to have more possibilities available to them than the other participants. Knowledge transfer mechanisms had already been implemented in these organisations and offer possibilities for them, as well as for the global

corporation, which had newly established knowledge transfer mechanisms. This implies that SMEs did not have these mechanisms, a clear limitation for them. In the CoP, there were both limitations and possibilities, because the high volume of communication both within and beyond the community could transfer knowledge even though formal mechanisms had not yet been established.

It is also clear that universities, research centres, and other public organisations had advantages in capitalising on new knowledge, sharing it, and documenting it, along with their versatile working methods. For the corporation, these were both challenges and advantages because they were in the process of creating these processes during the study. From the CoP side, voluntary participation did not lead to clear processes, which could limit their KM processes rather than enable them. SMEs lacked resources, which limited their ability to capitalise, share, and document new knowledge and implement versatile working methods.

In cross-industrial and interdisciplinary problem solving, the corporation and the CoP both appeared to have clear possibilities, thanks to their heterogeneous structures and the different skills of the individuals involved. The corporation was also conducting business in a global context with a wide range of customers, sub-contractors, research organisations, and cultures. The CoP also had a tie to companies, universities, and global networks. Contrary to expectations, cross-industrial and interdisciplinary problem solving appeared to be the weakest area for public organisations like universities, research centres, and other public actors in the open CoP environment. They had the possibility of exploiting advantages in this area, but in this study, they appeared to focus more on taking ideas from others and using those ideas in their own traditional ways of operating, such as seeking externally funded projects. It is clear there were also possibilities for them if they could work equally and interactively with other CoP participants.

The corporation found new business processes, value, and possibilities during the work of the CoP, according to their strategic decisions. The public actors were not seeking new business processes, so that was not a clear advantage for them. However, this kind of thinking limited their possibilities of evaluating new procedures that might improve their competitiveness.

The corporation was actively implementing a necessary technology upgrade and wanted to take advantage of it. That process was kept inside the company, because corporate policy significantly limited communication in an open innovation environment with parties from outside the corporation. The CoP was quite successful in communicating with its network and sharing knowledge through the Internet but lacked the resources to take full advantage of all the technological opportunities available.

4.2 APPROACH TO THE WORK OF THE COP

The approach to collaboration between parties is shown in Table 7. The main observation from this table is that universities, research centres, and other public organisations worked at an abstract level, at which knowledge and skills have a primary role. In contrast, companies stressed business-oriented approaches and had concrete and measurable goals for their work in the CoP.

Table 7: Approach to the work of the CoP

		Universities	Research Centers	Other public organisation (e.g. TEKES)	Corporation	SME's	Community of Parctice
Approach to the community work	Feature						
	Business oriented	L	L	L/P	P	P	L/P
	Concrete and measurable	L	L	L/P	P	P	P
	Science Oriented	L/P	L/P	L/P	L	L	L
	Abstract	P	P	P	L/P	L	L/P
	Knowledge and skills	P	P	P	P	L/P	L/P

The various actors had notably different approaches to collaboration between the public and private sectors. For the public actors, collaboration was both a limitation and a possibility. They limited their benefits themselves by not building interaction between parties to benefit companies. Their possibility was new ideas for starting projects funded by government or central EU authorities. In this study, the corporation's collaboration with the public sector was not clear, because it focused its CoP involvement on the customer interface. SMEs' possibility of taking advantage of the CoP was limited because of the resource gap between them and the public actors. The possibility for SMEs was the fact that the university started this kind of CoP to collaborate with them. The CoP had also contacts with the university but they did not find relevance to their work in the CoP.

Public funding organisations like TEKES were closer to the company point of view because they work with companies on a daily basis to fund companies' R&D projects. The CoP had a fairly practical point of view, given its role in facilitating the building of electric vehicles. For that reason, they had a limited ability to take advantage of collaboration with universities.

The perspective on knowledge and skills was positive in the public sector and proved to be a possibility for them. The corporation also viewed this area positively, because it was able to create (including maintaining and updating), store, and retrieve knowledge, transfer or otherwise share knowledge, and it had a process for applying knowledge. SMEs and the CoP both displayed limitations in

taking advantage of the knowledge and skills created in the CoP, even though they saw the attractiveness of this area to their operations.

4.3 ADVANTAGE OF THE COP

Absorptivity and the ability to take advantage are presented in Table 8. Universities and research centres' absorptivity and adaptivity appear to be limited. In fact, they were willing to accept ideas and knowledge from others but not to adapt it to their own knowledge bases; rather, they used these ideas to generate more fundable projects. By contrast, companies appeared to be more adaptive regarding new knowledge.

Table 8: Advantages of knowledge in the work of the CoP

		Universities	Research Centers	Other public organisation (e.g. TEKES)	Corporation	SME's	Community of Parctice
Advantage of the knowledge	Feature						
	Motivation	L	L	L	P	P	P
	Absorptivity	L	L	L	L/P	L/P	L/P
	Openness	L	L	L	L	P	P
	Exploitation of the new knowledge	L	L	L	P	P	P
	Individual motivation	L	L	L	P	P	P
	Relevant topics	P	P	P	P	P	P

It appears that openness and working in an open innovation community were more natural and offered clearer possibilities for SMEs and of course for the CoP than for the public sector. Organisational and individual motivation was also better in the private sector, which could be related to its direct responsibility for the success of the company. The corporation had its own challenges in balancing its intellectual property rights while trying to work in an open environment. The private sector was more willing to take advantage of new knowledge than the public sector, because the private sector participants could see that they would be able to improve their organisational performance with the new knowledge if it was at a concrete enough level to implement in their organisations. However, even the private sector could not change their established routines too often. Fundamentally, the public sector, especially universities and research institutes, produced the knowledge themselves and disseminated it to the private sector, but according to this study, that knowledge was in too abstract a format.

4.4 KNOWLEDGE TRANSFER PROCESSES IN THE COP

This section identifies the possibilities and limitations of individuals, communities, and organisations when collaborating in a CoP in an open innovation environment.

4.4.1 Organisation

From the organisational point of view, there are no clear possibilities or limitations (see Table 9), but some reasonably clear lines can be drawn, based on the results of the four studies. Generally, SMEs and the CoP have more limitations than the others as organisations, even though clear possibilities did not exist from the organisational point of view as a general rule.

Table 9: Organisational point of view of the work in the CoP

		Universities	Research Centers	Other public organisation (e.g. TEKES)	Corporation	SME's	Community of Parctice
Oganisation	Feature						
	Strategic value	L	L	L	P	L	L
	Open innovation strategy	L/P	L/P	L/P	L/P	L/P	L
	Knowledge driven organisation	P	P	P	P	L	L
	Organisational motivation	L/P	L/P	L/P	L/P	L	L

For the public actors, strategic value was a limitation because it appeared that working in that kind of environment was not a strategic priority for them. SMEs and the CoP also lacked strategic goals and thus displayed limitations in obtaining strategic value from CoP participation. The exception was that the corporation was seeking strategic value from this environment, even though they did not have a clear open innovation strategy, due in part to intellectual property rights concerns. In fact, the lack of an open innovation strategy at the organisational level limited every kind of organisation's work in the open innovation environment, but the freedom of not having to adhere to a strategy also meant possibilities for all parties. From the CoP point of view, the lack of strategic work limited its effectiveness.

Public actors have the role of knowledge-driven organisations, so it is a possibility for them if they use other CoP organisations to take advantage of working in an open innovation environment. The case corporation made a strategic decision to evolve from a traditional technology-focused strategy to a competitive and innovative services and solutions strategy; to achieve its new strategic goals,

the firm had to create a new organisational culture and improve knowledge harmonisation, especially among installation and maintenance personnel spread across many different units worldwide. This goal also shifted the case corporation into being more of a knowledge-driven organisation.

A lack of structured organisation and resources limited SMEs' ability to work in an open innovation environment; the same issues were also found in the CoP itself. Public organisations appeared to be motivated to work in this kind of forum but it was not within their key focus area, so some individuals could have been interested while the organisation as a whole did not regard the work of the CoP as central to its mission.

4.4.2 Community of Practice

The size of and resources available to each organisation were also visible in the CoP, in which larger and more structured organisation demonstrated more possibilities than limitations. The other notable conclusion was that public actors had the resources for planning and working in a collaborative context on an ongoing basis. They also already have in place the tools and processes needed to deal with cultural and geographical differences and work in a virtual environment. The advantages for the companies were shared interests and objectives; they also had a better sense of communality and found it easier to integrate into the CoP.

Table 10: Community point of view in the work of the CoP

Community	Feature	Universities	Research Centers	Other public organisation (e.g. TEKES)	Corporation	SME's	Community of Parctice
	Cooperativeness	L/P	L/P	L/P	L/P	P	P
	Planning	P	P	P	P	L	L
	Continuity	P	P	P	P	L	L
	Shared interest	L	L	L	L/P	P	P
	Shared objectives	L	L	L	P	P	P
	Sense of communality	L	L	L	L	P	P
	Composition of the group	L	L	L	P	P	P
	Cultural and geographical differences	P	P	P	P	L	L
	Virtuality in community development	P	P	P	P	L/P	L/P
	Collaboration mechanisms	P	P	P	P	L	L

In features that are related to social interaction like cooperativeness, shared interests, shared objectives, a sense of communality, and the composition of the group, SMEs and the CoP had more possibilities; by contrast, public actors and corporation had limitations in these areas. SMEs and the CoP shared their interests and objectives very openly, while public actors were more willing to take advantage of the CoP for their own purposes. SMEs and the CoP appeared to be more willing to create communality. Organisational structures and performance like planning, continuity, virtuality, and collaboration mechanisms were possibilities for public actors and the corporation because of their greater resources. Cooperativeness was both a limitation and a possibility for public actors and the corporation. Corporate policy defined the level of cooperation of the company's personnel, which may have prevented them from participating in some methods of collaboration. For the corporation, shared interests and objectives arose from their own strategic goals, which narrowed the possibility of working in the CoP but also provided clearly defined possibilities for its personnel to work in an open innovation environment.

4.4.3 Individuals

From the individual point of view reported in Table 11, individuals from SMEs and the CoP had more possibilities to contribute in an open innovation environment. The representatives from public actors and corporation had to deal with more structures and policies, some of which did not always support individuals in the CoP.

Table 11: Individuals' point of view in the work of the CoP

		Universities	Research Centers	Other public organisation (e.g. TEKES)	Corporation	SME's	Community of Parctice
Individual	Feature						
	Personal interaction	L	L	L	L	P	P
	Individual	L	L	L	L/P	P	P
	Individual learning and knowledge creation	L	L	L	L/P	P	P
	Individual professionalism	L	L	L	L/P	P	P

Interaction between community members is regulated by public actors and corporate policy. Institutional and corporate representatives could share their personal opinions while working in the CoP, but they had to work and make many decisions based on institutional policy. SME representatives were mainly business owners and entrepreneurs, meaning that their opinions were also their firms' opinions. CoP members are individuals who create a community policy together and are therefore more competent to work in the CoP itself. This could also have been a driver of individual motivation. From the corporate point of view, individual motivation, learning, and knowledge creation and professionalism were not as clear, because companies were looking for new knowledge and know-how to uncover new professional and business opportunities.

5 CONCLUSIONS AND DISCUSSION

This study examined knowledge creation and transfer in a CoP. In this study, the synthesis of the four articles shows the limitations and possibilities for different parties involved in the CoP work. Based on this study, public actors faced more limitations in their work in the CoP than companies did. It is conspicuous that the handicaps for public actors lay in the area of personal and organisational attitudes, which were also possibilities for them. It appears that they have to make strategic choices around the CoP. The main challenges for companies arose from inadequate resources and processes rather than a failure of will.

Knowledge transfer was simultaneously a limitation and a possibility for individuals. Each individual's background organisation clearly influenced how individuals participated in and contributed to the work of the CoP.

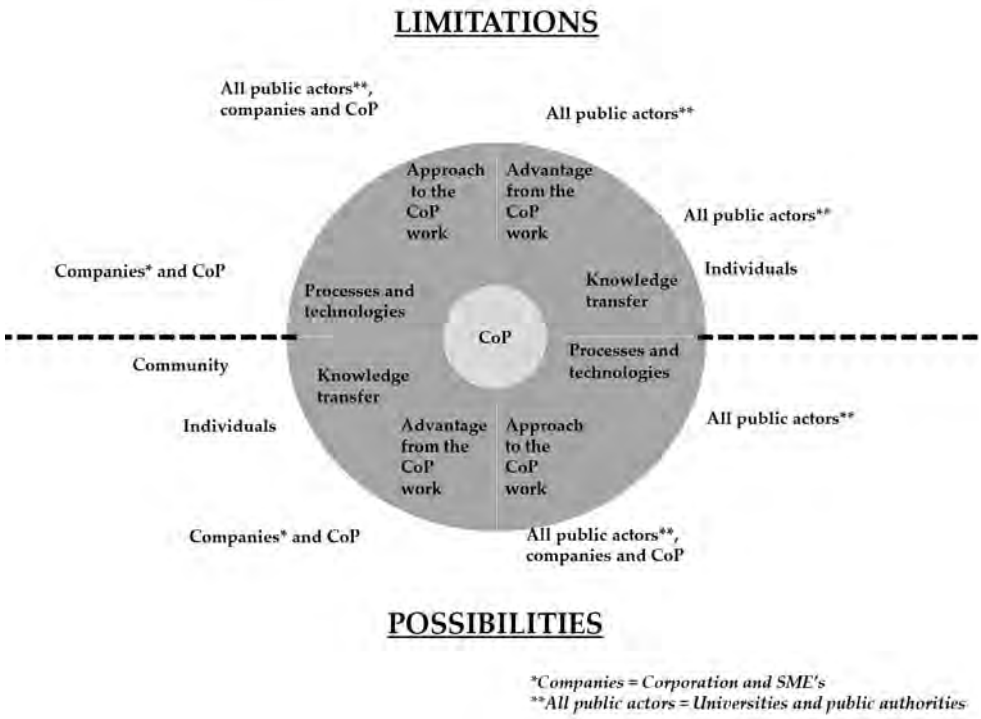

Figure 6: Limitations and possibilities in the work of CoPs

According to this study, companies and the CoP faced challenges with processes and technologies, as they appear not to have adopted the processes or technologies needed to work successfully in a CoP, even though they had different kinds of Internet-based tools for communication and some processes for working in the CoP. By contrast, universities and other public actors had more advanced possibilities for exploiting technology and virtuality.

The study also shows that public actors approached the work of the CoP from a different angle than the private sector. Public sector actors, especially universities, approached the CoP from an abstract point of view, while the companies approached it in a very practical way. The real possibilities for the companies were concrete measurable results from the work of the CoP, and they needed more practical knowledge to implement any innovations into their practices. This arrangement limited the emergence of a common knowledge and smooth cooperation.

CoP utilisation between the various actors made a significant difference. Companies appeared to be more willing to exploit the results of the work and placed more emphasis on the importance of the benefits obtained. In contrast, the motives of universities and other public actors appeared to involve factors other than exploiting the knowledge created. Even though public actors had established processes and technologies, they did not take advantage of them to promote knowledge transfer from the CoP for their own benefit. According to this study, universities and other public actors used the CoP to collect data for their own uses, chiefly creating new fundable projects. This situation in universities could be changed based on internal rationale and specific incentives for personnel. Knowledge transfer in its original form for the purpose of developing their organisations' knowledge and skills did not occur. The conclusion is that universities and other public organisations did not use the CoP as it was meant to be employed.

Regarding knowledge transfer, research shows that organisational structures can complicate human activities and thus prevent the transfer of knowledge. In this study, the small companies and CoP members studied appeared to be detached from those kinds of governing organisational structures and activities, which restricted the transfer of knowledge from the CoP.

Taking proper account of these boundary conditions could improve knowledge transfer from the CoP in an open innovation environment. All actors should take into account the limitations revealed in this study and, after appropriate analysis, strive to discover ways to take advantage of working in a CoP. Similarly, the recovery and strengthening of the possibilities could clearly improve the transfer of new knowledge from the CoP for the benefit all involved parties.

The empirical research in this dissertation was executed in four articles that dealt with an open innovation environment in which three different kinds of CoPs (Academy-Industry, KONE, and eCars Now! communities) worked for innovation and the creation of new knowledge. The study concentrated on the possibilities of and limitations to achieving these objectives. In the first two articles, an academia-industry collaboration in CoP was studied to add to our comprehension of shared knowledge as the basis of university-industry collaboration. The case study research approach was applied to understand the process and how parties could benefit more from this kind of collaboration.

The third article reported on a multinational company's possibilities of using CoPs as a strategic tool for expanding methods of collective learning and knowledge creation and sharing. The authors applied a qualitative case study approach to clarify how to construct a model for virtual collaboration in a CoP and provide effective competence creation. The fourth article increased scholarly knowledge of the work in the CoP itself. A qualitative case study approach was applied to resolve how to encourage group dynamics and explain the changes in those dynamics.

These four articles together offer a versatile overview of CoPs in an open innovation environment for knowledge creation and transfer and to fill possible research gaps in this phenomenon. Altogether, the findings of this study imply that, under certain conditions, working in CoPs in an open innovation environment offers possibilities for organisations and individuals to create new knowledge.

The next subsection lays out this study's contributions to the literature in the relevant research areas before presenting its managerial implications. The reliability, validity, and limitations of the study are then addressed. The final subsection suggests avenues for further research.

5.1 THEORETICAL CONTRIBUTION

5.1.1 Contribution to the CoP literature

This dissertation contributes to literature on open innovation studies and elevated the meaning of communities in the innovation process (Chesbrough, 2003). According to West and Lakhani (2008, p. 223), an important development in the past decade of innovation studies has been the recognition of the role of communities outside traditional firm boundaries in creating, shaping, and disseminating technological and social innovations. CoPs help foster an

environment in which knowledge can be created and shared, in addition to improving effectiveness, efficiency, and innovation (Lesser & Everest, 2001, p. 41).

The findings in article I indicate that CoPs in university-industry collaboration can help solve cross-industrial and interdisciplinary problems, that cooperation between the public and private sectors is a realistic aspiration, and that such a dialogue can produce fruitful results (Coombs et al., 2003). These results support earlier research on the need for academia-industry collaboration (Greenaway & Haynes, 2000; Stiglitz & Wallsten, 1999). Article I provide new evidence on the power of working in a CoP to develop more efficient and innovative approaches and shows that a CoP in an open innovation environment could help parties achieve better collaboration. The adoption of the CoP approach clearly increased R&D activities, and the CoP supported regional innovation activities and entrepreneurship while promoting equitable regional development.

Article II reinforces the results of article I and strengthens the idea that under the right conditions, a CoP is a valuable method of collaboration. The CoP as a collaborative environment worked quite well, even though the participants (WHO) had heterogeneous backgrounds and their expectations varied significantly. The motivations and expectations (WHY) of the CoP members differed, which did hinder the effective utilisation of knowledge gained for the benefit of businesses. Challenges with the content (WHAT) were revealed, because it appeared that the university as a CoP organiser ran the operation largely for its own interests. The forum was mainly characterised positively, but the companies involved lacked the knowledge implementation processes (HOW) needed to take advantage of the gained knowledge. The companies lacked the resources and methods needed to implement this knowledge, and our interpretation is that the universities and other public actors were not trying to improve their dynamic capability; rather, they were striving to take advantage of new projects and public funding.

The major difference that divides CoPs into two parts is the science vs. business orientation (Nissen et al., 2014). While public actors viewed the CoP work in a more abstract fashion, companies wanted to have more concrete and measurable results. For this reason, shared objectives, relevant topics, suitable working methods, and composition of the group have been shown in this dissertation to be crucial antecedents of successful collaboration. It appeared that working in that kind of environment was not a strategic question for public actors, whereas SMEs and the CoP needed certain capabilities to handle the open innovation approach at the organisational level (Gassmann & Enkel, 2004). According to the study, the SMEs tried to benefit from the CoP primarily for market-related reasons like meeting customer demands or keeping up with competitors; their most important challenges related to organisational and cultural issues that came from dealing with an increased volume of external contacts (Van de Vrande et al., 2009).

It is clear that companies should be connected to the open science community to share research results with scientists (Lim, 2009). Challenges for knowledge transfer mechanisms arise from heterogeneous forms of knowledge that make it difficult to implement transferring knowledge from one form to another (Szulanski, 2000; Zander & Kogut, 1995). The public sector saw the CoP positively because they were able to create (including maintaining and updating), store, and retrieve knowledge, transfer or otherwise share knowledge, and they had processes in place for applying knowledge. SMEs and the CoP faced limitations in taking advantage of the knowledge and skills created in the CoP, even though they saw it as attractive and potentially profitable to their operations.

Contrary to expectations (Gallego et al., 2013), cross-industrial and interdisciplinary problem solving appeared to be the weakest area for the public organisations in the CoP environment. They have possibilities of taking advantage of this area but this study found that they were likely to take ideas from others and use them in their traditional ways of operation, such as developing externally funded projects (Currie et al., 2008). This study showed that universities and other public actors did not use the CoP for its intended purpose of creating and transferring knowledge interactively among all participants.

Academia-industry actors are heterogeneous and have quite very different perspectives on collaboration (Currie et al., 2008). Public actors should see this kind of collaboration and teamwork as a strong linkage and interdependency between academia and industry (Nissen et al., 2014). SMEs should also be connected to open science communities to share research results with scientists outside the boundaries of firms (Callego et al., 2013). According to this study, SMEs were not able to take full advantage of the CoP because of the resource gap between public actors and these smaller organisations.

Article III makes clear that a CoP can be useful for a strategic transition from a traditional technology-focused company to a competitive and innovative services and solutions corporation. The CoP can be used to create a new organisational culture and improve knowledge harmonisation among personnel in different units around the globe. The CoP can also help corporations become more knowledge-driven organisations when their organisational cultures are transformed into prioritising knowledge sharing, which encourages mutually supportive relationships between employees (Ardichvili et al., 2003; Cabrera & Cabrera, 2005; David & Fahey, 2000) who work in a multi-cultural environment or in different geographical areas.

Article III demonstrates that companies should take advantage of personnel who are committed to collaboration for solving business problems and increasing their performance capabilities. The study shows that companies should prioritise the support of focused opportunities for employees to increase capabilities that will

improve organisational performance and help achieve strategic goals. This is important because organisations themselves are not that intelligent – regardless of the expertise present among their staff – and need guidance to change their established routines or implement new strategies (Alvesson & Spicer, 2012). Against this background, converting information into knowledge is the most important issue for companies. Without reasonable tools and appropriate environments, it is difficult to achieve the best feedback and maximise benefits from a CoP. The lack of a documentation process to convert tacit knowledge appeared to slow down the adoption of strategic change and new business processes. The main suggestion for improving collaboration on an organisational level is to establish informal networks with modern tools for knowledge sharing and documentation. A CoP brings skilled individuals together to share different areas of expertise and allows them to join forces to achieve a common goal; organisations simply have to develop the appropriate tools that allow those individuals (and the organisations themselves) to actualise the benefits offered by the knowledge-related achievements that a well-run CoP offers.

Article IV affirms that different roles and status differentials (see Jex and Britt, 2008 and Wenger et al., 2002) are relevant from the group dynamics point of view. Group dynamics appear to be key to understanding why a CoP either maintains or loses its vitality. At a personal level, the driving force is individualistic motivation, while at the community level, the CoP's own objectives and goals are the driving force. Therefore, the conclusion is that the tangibility of a problem to be solved appears to play a pivotal role in a CoP's operations and dynamics. The interpretation in this study is that if a CoP needs external funding to achieve its goals, it creates a new situation that can significantly affect and even hamper its operations, particularly with regard to group dynamics. CoPs' group dynamics and cohesion are reinforced by shared interests and are weakened by goals set by external stakeholders.

5.1.2 Contribution to the knowledge creation and transfer in the CoP literature

Companies in the modern knowledge-intensive business environment are dependent on external information sources to promote innovation and improve their performance (Cassiman & Veugelers, 2002; Morgan & Berthon, 2008). According to this study, absorptivity and the ability to take advantage differ widely between the public and private sectors; organisations have varying abilities to achieve innovative forms of competitive advantage (Zahra and George, 2002). The motivation to adapt knowledge created in the CoP appears to be limited in the public sector, but the need to improve national economic competitiveness is driving

the increasing involvement of universities with industry (Greenaway & Haynes, 2000). Private sector actors are motivated and actively seek to obtain advantages from CoP work, which departs from the findings of Cohen et al. (2002) and Salter and Martin (2001), who found universities to be important sources of industrial innovation. At the company level, firms must take care of their internal processes while creating real possibilities of working in open innovation communities. It appears that openness and working in an open innovation community are clearer and more natural possibilities for SMEs and of course for the CoP itself than for the public sector. The challenge is that relationship-based mechanisms are widely used in industrial organisations, but there are systematic differences between industrial sectors and academic fields in terms of the predominant linking mechanisms (Perkmann & Walsh, 2007, p. 13). This study shows that the private sector is more interested in taking advantage of new knowledge generated in a CoP than the public sector (Feller, 2005). The private sector believes that it can improve organisational performance with new knowledge if it is at a concrete enough level to implement in their organisations, as Meyer-Krahmer and Schmoch (1998), and Cohen et al. (2002) have stressed.

In sum, this study offers a valuable contribution to the scientific discussion of CoPs in an open innovation environment and explains the preconditions for knowledge creation and transfer. It shows that, under optimal conditions, collaboration in a CoP can clearly increase knowledge in organisations and support their R&D activities, regional innovations, and entrepreneurship by helping them to evolve into truly knowledge-driven organisations. This study also contributes to the processes and technologies that allow firms to take advantage of the knowledge while providing new perspectives on the work of the CoP in an inter-organisational environment.

The main contribution to the scientific literature is a deeper understanding of the preconditions for a successful CoP. The first need is to determine the right people to work in a particular CoP and to clarify the fundamental concerns of the problem or topic for which the CoP was established. Second, there is a pressing need to clarify the primary motives for the interaction of each participant. The third need is making clear the conditions under which collective learning and exchange of knowledge generate the best results.

Altogether, this study adds new insights to the literature on CoPs and open innovation by explaining how they are related to the intellectual capital and KM literature. It also deepens our understanding of knowledge transfer and dynamic capability literature when they are combined with CoPs and open innovation.

5.2 MANAGERIAL IMPLICATIONS

In creating intellectual capital and KM processes, public organisations appear to be more advanced than the private sector or CoPs themselves. SMEs and CoPs face more limitations on the organisational level, even though clear possibilities did not exist from the organisational point of view generally.

From the point of view of individuals working in an open innovation CoP, individuals from SMEs and the CoP itself have more possibilities to contribute, because their organisations provide greater degrees of freedom (or at least lesser degrees of restriction) in the work of the CoP. The representatives from public actors and corporations have more structures and policies that do not necessarily support the focus on individual members found in the CoP. With regard to features related to social interaction like cooperativeness, shared interest, shared objectives, a sense of communality, and the composition of the group, SMEs and CoP have more possibilities, while public actors and corporations have limitations and internal regulations on social interaction features.

The absorptivity and adaptivity of universities and research centres both appear to be limited. They are willing to accept ideas and knowledge but not to adapt it to their knowledge base; rather, they use the ideas to generate more fundable projects. According to this study, absorptivity and the ability to take advantage of new knowledge differ widely between public and private sectors.

The major difference that divided CoP work into two parts was the science versus business orientation, which led simultaneously to possibilities and to limitations. While public actors saw the CoP in a more abstract fashion, companies wanted to have more concrete and measurable results.

5.2.1 Universities and other public actors level

Knowledge creation and transfer mechanisms are already implemented in public organisations, so they are better situated to take advantage of new academic knowledge arising from companies. Public actors should also ensure that this knowledge is easy to exploit outside universities by adopting versatile working methods because, contrary to expectations, cross-industrial and interdisciplinary problem solving was shown in this study to be the weakest area in an open innovation environment for public organisations like universities.

Public actors should develop business processes to evaluate new methods to improve their competitiveness and ability to co-operate with companies and other key actors in society. At the same time, they should develop interaction techniques between parties to benefit companies in strategic collaborations.

Public actors naturally have the role of knowledge-driven organisations, and they have the possibility of using their organisational culture to take advantage of work created in open innovation environments. Public organisations appear to be motivated to work in this kind of forum, but it is outside their core areas of focus, so even if their personnel are highly interested in the work of a CoP, that work is not at the centre of the organisation's mission.

5.2.2 Corporation level

The case corporation had enough resources to work in the open innovation environment, and that concept was supported by its new strategy. The firm had partially implemented open innovation and CoP processes but had not yet adopted them at every level and location of the firm. The corporation found new business processes, value, and possibilities during the work of the CoP, according to their strategic decisions. Their next step is to take advantage of the technology and implement all the processes to support communication in an open innovation environment with parties outside the corporation. In cross-industrial and interdisciplinary problem solving, corporations have clear possibilities because of the heterogeneous structures and the number and diversity of personnel in a global organisation.

The corporation had its own challenges in balancing the protection of its intellectual property rights and making a genuine commitment to working in an open environment. This means that it must institute processes that enable it to create (including maintaining and updating), store, retrieve, and transfer or otherwise share knowledge. It is positive that the corporation was genuinely seeking strategic value from this environment, even if it did not yet have a clear open innovation strategy. While the lack of an open innovation strategy at the organisational level limited its work in an open innovation environment, a clear open innovation strategy could also be a possibility for all parties.

Corporate policy defined its personnel's level of cooperation, which may limit it or at least restrict possible avenues of collaboration. Corporate policy and strategy should support shared interests and objectives, which are the possibility of working in a CoP and clear opportunities for personnel to work in an open innovation environment. From the corporate point of view, individual motivation, learning, and knowledge creation are attributes to look for in new professional profiles and business opportunities.

5.2.3 SME level

SMEs' possibilities to take advantage of the work in the CoP was limited because of the resource gap between them and the public actors. SMEs should develop resources to the greatest extent possible and build mechanisms to take advantage of open innovation work, even with limited resources, to capitalise on, share, and document new knowledge and implement versatile working methods.

The real possibility for companies involves concrete measurable results from the CoP, but they need more practical knowledge to implement CoPs into their practices and cooperate more with public funding organisations like TEKES. This cooperation is closer to the practical company point of view, because these actors work with companies on a daily basis to fund company development and R&D projects.

SMEs should set strategic goals and obtain value from working in an open innovation environment like a CoP. Because SME representatives are mainly business owners and entrepreneurs, their opinions are their companies' opinions, so they are not hindered by corporate policies.

Openness and working in open innovation communities come more naturally to and provide a clearer possibility for SMEs, and the private sector should take advantage of the new knowledge available in CoPs. The private sector should seek to convert new knowledge into a concrete enough level to take advantage of it.

5.2.4 Community of Practice level

Voluntary-based participation is not a successful way of building clear processes; it can limit KM processes rather than enable them. CoPs should concentrate on establishing structures and processes for KM and creation. In cross-industrial and interdisciplinary problem solving, CoPs offer clear possibilities because of their heterogeneous structures and the varied backgrounds of the people involved. The CoP is also tied to companies, universities, and global networks in taking advantage of the knowledge that is developed.

CoP members are individuals who jointly develop community policies and therefore are most competent to work under those policies. CoPs should communicate with their networks and share knowledge over the Internet with low-cost technologies that can help address their lack of resources.

In sum, all studied organisations are different in terms of their particular approaches to the work of CoPs. It is important to evaluate all the pain points in the different parties to identify possible solutions so that all parties feel that they benefit from cooperative work in CoPs.

5.3 RELIABILITY, VALIDITY, AND LIMITATIONS

The reliability of research refers to repeatability and coherence with the research aims (Robinson, 2014). Traditionally, reliability in quantitative research answers the question: Can the study be repeated and the same findings retrieved? A good qualitative study can help us "understand a situation that would otherwise be enigmatic or confusing" (Eisner, 1991, p. 58). In qualitative research, reliability depends on human behaviour, which is context-dependent and not static, meaning that it is impossible to measure the same thing twice, even using exactly the same target group. Lincoln and Guba (2000) conceptualised reliability in a qualitative study as dependability, by which they mean a researcher who was not involved in the research process should be able to examine the research process and its findings. In this dissertation, this criterion has been fulfilled by describing the research approaches, data, and data collection and analysis methods of each original article. The research processes of all four original articles, each of which underwent a double-blind review, are disclosed to give other researchers the opportunity to evaluate the reliability of the original articles. The data analysis in each article was improved for the journal articles based on valuable comments received at the international conferences where all four studies were presented. The double-blind review process, using two anonymous reviewers in each case, has also improved the content of these articles. All the theories of CoPs in an open innovation environment for knowledge creation and transfer to improve organisational performance are summarised from the four original articles to demonstrate that the dissertation's conclusions are drawn from appropriate theoretical viewpoints that are backed up by solid empirical results.

Regarding a researcher's ability and skill in conducting qualitative research, it has been stated that reliability is a consequence of the validity in a study (Golafshani, 2003, p. 602). The concept of validity is not a single, fixed, or universal concept, but "rather a contingent construct, inescapably grounded in the processes and intentions of particular research methodologies and projects" (Winter, 2000, p.1). According to Creswell and Miller (2000, p. 124), validity in a qualitative study can be assessed by "how accurately the account represents the participants' reality of the social phenomena and is credible to them". Precautions also affect the validity of research, as Jarvenpaa, Dickson, and DeSanctis (1985, p. 151) indicate: "Even if all possible precautions are taken, a researcher may never design a perfect study because validity is a relative measure and therefore can only be estimated".

A researcher's ontological and epistemological assumptions guide the evaluation criteria options of any study. Because the author of this dissertation has taken an interpretivist position, validity should be evaluated through the three

validity procedures for constructivist paradigms shown in Table 12 (Creswell and Miller, 2000, p. 126).

Table 12: Validity procedures within the qualitative lens and paradigm assumptions (adapted from Creswell and Miller, 2000).

Paradigm assumption / Lens	Positivist or Systematic Paradigm	Constructivist Paradigm	Critical Paradigm
Lens of researcher	Triangulation	Disconfirming evidence	Researcher reflexivity
Lens of participants	Member checking	Prolonged engagement in the field	Collaboration
Lens of people external to the study (Reviewers, Readers)	The audit trail	Thick, rich description	Peer debriefing

Disconfirming evidence procedure is closely related to triangulation when a researcher is disconfirming or searching for negative evidence (Huberman & Miles, 1994). This is a process in which investigators first establish the preliminary themes or categories in a study and then search through the data for evidence that is either consistent with or disconfirms those themes (Creswell and Miller, 2000, p. 127), a process that was carried out in each original article. In this process, the researcher relies on his or her own lens, which is a less systematic procedure and relies on examining all of the multiple perspectives on any one theme or category (Creswell and Miller, 2000).

The second validity procedure is using repeated observation to build trust with participants, find gatekeepers to allow access to people and sites, establish rapport so that participants are comfortable disclosing information, and reciprocate by giving back to the people being studied (Creswell and Miller, 2000). In the original studies, a long-term research approach was adopted in which the researchers actively engaged with study participants. The research covered long timespans, which enabled the collection of more valid empirical data (Creswell and Miller, 2000).

The third validity procedure is thick, rich description, which establishes credibility in a qualitative study through depictions of settings, participants, and themes (Creswell and Miller, 2000). In this case, the dissertation author has met

these criteria fully, both in the original articles and in the study, that brings them together.

This dissertation may also contain research limitations, but every effort has been made to minimise them. The limitations may include or arise from the participative role of the researcher during the data collection process for the articles. The collection process and close interaction with interviewees may have caused some personal and subjective reactions in the observations, although in qualitative research, complete objectivity is an impossible standard (Niiniluoto, 1984; Yin, 1989). The objectivity and transparency of the dissertation were increased by following a carefully planned research process in collecting and analysing the data, which is explained in the methodology sections of the four articles and the overall study.

5.4 FURTHER RESEARCH

The findings of this dissertation lay out the possibilities and limitations for CoPs to improve the creation and transfer of knowledge in an open innovation environment. The dissertation reports that to understand knowledge creation in that kind of environment demands better knowledge of the CoP itself in an open innovation environment. Multiple limitations and possibilities are expressed in this dissertation from the different participants' viewpoints; based on those results, a set of preconditions for effective CoP work is presented in the study.

To obtain more advantages from CoPs in an open innovation environment and thus improve organisational performance, the following questions should be answered by future research:

- What is the optimal combination of participants for CoPs to obtain greater advantages for all members?
- How do academia's abstract and companies' concrete perspectives on the CoP affect knowledge transfer?
- What is the best way for companies to obtain advantages from a CoP?
- What are the optimal processes and technologies for the CoP itself?
- How can the ACAP of these kinds of CoP members be improved?

In sum, in this dissertation the key concept is that the CoP is an open innovation environment. To understand better its influence on the intangible assets of organisations, further research is needed to clarify the connections between CoPs and those assets (see Figure 7).

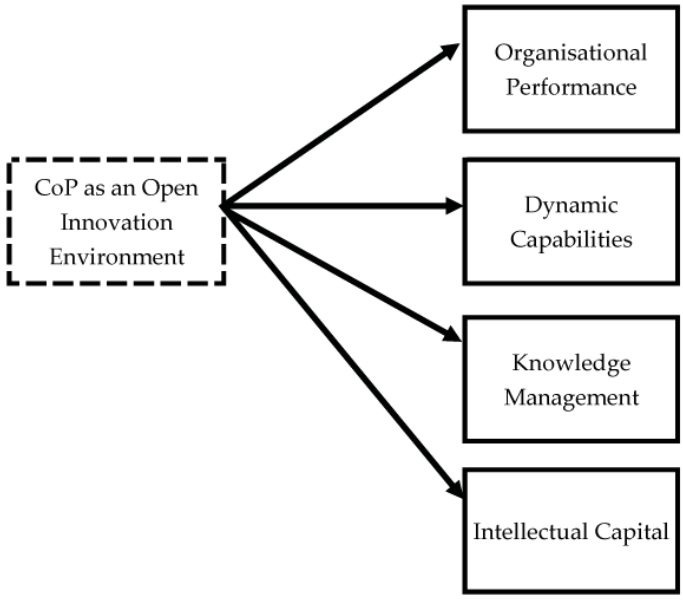

Figure 7: Further research on CoPs as open innovation environment

To answer these questions in further research, qualitative case studies could be valid research methods, given the complex and abstract phenomena involved. It would be also valuable if researchers could find similar communities and compare them with this Finnish example. Managers and the organisations they represent could benefit more fully from CoPs if they had answers to these questions.

REFERENCES

Aaltola, J., & Valli, R. (2001). Filosofia, tiede, ymmärtäminen. In J. Aaltola & R. Valli (Eds.). *Ikkunoita tutkimusmetodeihin II, PS-kustannus* (pp. 10-25).

Acha, V., & Cusumano, L. (2005). Governance and co-ordination of distributed innovation processes: Patterns of R&D co-operation in the upstream petroleum industry. *Economics of Innovation and New Technology, 14*(1-2), 1–21.

Alani, H., Dasmahapatra, S., O'Hara, K., & Shadbolt, N. (2003). Identifying communities of practice through ontology network analysis. *IEEE Intelligent Systems, 18*(2), 18-25.

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly 25*(1), 107-136.

Alipour, M. (2012). The effect of intellectual capital on firm performance: An investigation of Iran insurance companies. *Measuring Business Excellence, 16*(1), 53-66.

Allee, V. (2000). Reconfiguring the value network. *Journal of Business Strategy, 21*(4), 36-39.

Alvesson, M., & Spicer, A. (2012). A stupidity-based theory of organizations. *Journal of Management Studies, 49*(7), 1194-1220.

Amin, A., & Roberts, J. (2008). Knowing in action: Beyond communities of practice. *Research Policy*, *37(2)*, 353–369.

Anand, N., Gardner, H. K., & Morris, T. (2007). Knowledge-based innovation: Emergence and embedding of new practice areas in management consulting firms. *Academy of Management Journal, 50*(2), 406-428.

Arbo, P., Iversen, A., Knol, M., Ringholm, T., & Sander, G. (2012). Arctic futures: Conceptualizations and images of a changing Arctic. *Polar Geography, 36*(3), 1-20.

Ardichvili, A., Page, V., & Wentling, T. (2003). Motivation and barriers to participation in virtual knowledge-sharing communities of practice. *Journal of Knowledge Management, 7*(1), 64-77.

Argote, L., Ingram, P., Levine, J. M., & Moreland, R. L. (2000). Knowledge transfer in organizations: Learning from the experience of others. *Organizational Behavior and Human Decision Processes, 82*(1), 1-8.

Argote, L., McEvily, B., & Reagans, R. (2003). Managing knowledge in organizations: An integrative framework and review of emerging themes. *Management Science, 49*(4), 571-582.

Arnold, D. O. (1970). Dimensional sampling: An approach for studying a small number of cases. *The American Sociologist, 5*(2), 147-150.

Asheim, B. T. & Coenen, L. (2005). Knowledge bases and regional innovation systems: Comparing Nordic clusters. *Research Policy, 34*(8), 1173-1190.

Audretsch, D. B., & Keilbach, M. (2004). Entrepreneurship and regional growth: An evolutionary interpretation. *Journal of Evolutionary Economics, 14*(5), 605-616.

Audretsch, D. B., & Stephan, P. E. (1996). Company-scientist locational links: The case of biotechnology. *American Economic Review, 86*(3), 641-652.

Baldwin, C., & von Hippel, E. (2011). Modeling a paradigm shift: From producer innovation to user and open collaborative innovation. *Organization Science, 22*(6), 1399-1417.

Barbour, R. S., & Kitzinger, J. (1999). *Developing Focus Group Research. Politics, Theory and Practice*. London, Sage.

Barrow, D. C. (2001). Sharing know-how at BP Amoco. *Research Technology Management, 44*(3), 18-25.

Benevene, P., & Cortini, M. (2010). Interaction between structural capital and human capital in Italian NPOs: Leadership, organizational culture and human resource management. *Journal of Intellectual Capital, 11*(2), 123-139.

Bessant, J., & Phillips, W. (2013). Innovation management and dynamic capability. In C. Harland, G. Nassimbeni, & E. Schneller (Eds.), *The SAGE Handbook of strategic supply management* (pp. 353-371). London: Sage.

Bhaskar, R. (1979). *The Possibility of Naturalism*. Brighton, UK: Harvester Press.

Bjerregaard, T. (2010). Industry and academia in convergence: Micro-institutional dimensions of R&D collaboration. *Technovation, 30*(2), 100-108.

Boardman, P. C., & Ponomariov, B. L. (2009). University researchers working with private companies. *Technovation, 29*(2), 142-153.

Bontis, N. (1996). There's a price on your head: Managing intellectual capital strategically. *Business Quarterly, 60*(4), 40-78.

Bontis, N. (1998). Intellectual capital: Exploratory study that develops measures and models. *Management Decision, 36*(2), 63-76.

Bontis, N. (1999). Managing organizational knowledge by diagnosing intellectual capital: Framing and advancing the state of the field. *International Journal of Technology Management, 18*(5-8), 433-62.

Bontis, N., Chua Chong Keow, W., & Richardson, S. (2000). Intellectual capital and business performance in Malaysian industries. *Journal of Intellectual Capital, 1*(1), 85-100.

Bontis, N., & Nikitopoulos, D. (2001). Thought leadership on intellectual capital. *Journal of Intellectual Capital, 2*(3), 183-191.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101.

Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of practice: Toward a unified view of working, learning, and innovation. *Organization Science, 2*(1), 40-57.

Brown, J. S., & Duguid, P. (1998). Organizing knowledge. *California Management Review, 40*(3), 90-111.

Brown, J. S., & Duguid, P. (2001). Knowledge and organization: A social-practice perspective. *Organization Science, 12*(2), 198-213.

Brown, J. S., & Gray, E. S. (1995). The people are the company. *Fast Company, 1*(1), 78-82.

Bruffee, K. A. (1995). Sharing our toys: Cooperative learning versus collaborative learning. *Change: The Magazine of Higher Learning, 27*(1), 12-18.

Brusoni, S., Prencipe, A., & Pavitt, K. (2001). Knowledge specialization, organizational coupling, and the boundaries of the firm: Why do firms know more than they make? *Administrative Science Quarterly, 46*(4), 597-621.

Bueno, E., Salmador, M. P., Rodriguez, O., & de Castro, G. M. (2006). Internal logic of intellectual capital: A biological approach. *Journal of Intellectual Capital, 7*(3), 394-405.

Burrell, G., & Morgan, G. (1979). *Social paradigms and organisational analysis: Elements of the sociology of corporate life.* Aldershot, UK: Ashgate.

Büchel, B., & Raub, S. (2002). Building knowledge-creating value networks. *European Management Journal, 20*(6), 587-596.

Cabrera, E. F., & Cabrera, A. (2005). Fostering knowledge sharing through people management practices. *The International Journal of Human Resource Management, 16*(5), 720-735.

Cartwright, D., & Zander, A. (1960). *Group Dynamics* (3rd ed.). New York, NY: Harper and Row.

Cassiman, B., & Veugelers, R. (2002). R&D cooperation and spillovers: Some empirical evidence from Belgium. *The American Economic Review, 92*(4), 1169-1184.

Cassiman, B., & Veugelers, R. (2006). In search of complementarity in innovation strategy: Internal R&D and external knowledge acquisition. *Management science*, 52(1), 68-82.

Cavanagh, S. (1997). Content analysis: Concepts, method and applications. *Nurse Researcher, 4*(3), 5-16.

Cheng, M. Y., Lin, J. Y., Hsiao, T. Y., & Lin, T. W. (2010). Invested resource, competitive intellectual capital, and corporate performance. *Journal of Intellectual Capital, 11*(4), 433-450.

Chesbrough, H., (2003). *Open innovation: The new imperative for creating and profiting from technology.* Boston, MA: Harvard Business School Press.

Chesbrough, H. (2006). Open innovation: A new paradigm for understanding industrial innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 1-12). Oxford: Oxford University Press.

Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds). (2006). *Open innovation: Researching a new paradigm*. New York, NY: Oxford University Press.

Cohen, S., & Kaimenakis, N. (2007). Intellectual capital and corporate performance in knowledge-intensive SMEs. *The Learning Organization, 14*(3), 241-262.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128-152.

Cohen, W. M., Nelson, R. R., & Walsh, J. P. (2002). Links and impacts: The influence of public research on industrial R&D. *Management Science, 48*(1), 1-23.

Cooke, P. (2005). Regionally asymmetric knowledge capabilities and open innovation: Exploring 'globalisation 2' – a new model of industry organisation. *Research Policy*, *34*(8), 1128-1149.

Coombs, R., Harvey, M., & Tether, B. S. (2003). Analysing distributed processes of provision and innovation. *Industrial & Corporate Change, 12*(6), 1125-1155.

Correia, A. M. R., Paulos, A., & Mesquita, A. (2010). Virtual communities of practice: Investigating motivations and constraints in the processes of knowledge creation and transfer. *Electronic Journal of Knowledge Management, 8*(1), 11-20.

Creswell, J. W. (1994). *Research design: Qualitative and quantitative approaches.* London: Sage.

Creswell, J. W. (2012). *Qualitative inquiry and research design: Choosing among five approaches*. London: Sage.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice, 39*(3), 124-130.

Cross, R., & Baird, L. (2000). Technology is not enough: Improving performance by building organizational memory. *MIT Sloan Management Review, 41*(3), 69-78.

Cross, R., Laseter, T., Parker, A., & Velasquez, G. (2006). Using social network analysis to improve communities of practice. *California Management Review, 49*(1), 32-60.

Currie, G., Humphreys, M., Ucbasaran, D., & McManus, S. (2008). Entrepreneurial leadership in the English public sector: paradox or possibility? *Public Administration, 86*(4), 987-1008.

Dahlström, M., & Hedin, S. (2010). Regional trajectories to the knowledge economy-Nordic-European comparisons. *Studies*, 38, 1001-1014.

Dalkir, K. (2005). *Knowledge management: Converting theory into practice*. Boston, MA: Butterworth-Heinemann.

Dalkir, K. (2013). *Knowledge management in theory and practice*. London: Routledge.

Davenport, T. H., Jarvenpaa, S. L., & Beers, M. C. (1996). Improving knowledge work processes. *MIT Sloan Management Review, 37*(4), 53-65.

Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Boston, MA: Harvard Business School Press.

David, W., & Fahey, L. (2000). Diagnosing cultural barriers to knowledge management. *The Academy of Management Executive, 14*(4), 113-127.

Denzin, N. K., & Lincoln, Y. S. (Eds.). (2000). *Handbook of qualitative research.* Thousand Oaks, CA: Sage Publications.

D'Este, P., & Patel, P. (2007). University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry? *Research Policy, 36*(9), 1295-1313.

Dittmer, M. A., Christiansen, C., & Kierkegaard, G. F. (2008). Public private partnership for innovation (PPPI) in Denmark. *European Public Private Partnership Law Review, 4*(4), 240-242.

Dodgson, M., Gann, D., & Salter, A. (2006). The role of technology in the shift towards open innovation: The case of Procter & Gamble. *R&D Management, 36*(3), 333-346.

Doré, A. G. (1995). Barents Sea geology, petroleum resources and commercial potential. *Arctic, 48*(3), 207-221.

Dzinkowski, R. (2000). The measurement and management of intellectual capital: An introduction. *Management Accounting, 78*(2), 32-37.

Easterby-Smith, M., & Prietow, I. M. (2007). Dynamic capabilities and knowledge management: An integrative role for learning? *British Journal of Management, 19*(3), 235-249.

Edvinsson, L., & Malone, M. S. (1997). *Intellectual capital: Realizing your company's true value by finding its hidden brainpower.* New York, NY: HarperCollins.

Eggs, C. (2012). Trust building in a virtual context: Case study of a community of practice. *Electronic Journal of Knowledge Management, 10*(3), p. 212-222.

Eglington, A., Israel, R. & Vartanov, R. (1998). Towards sustainable development for the Murmansk region. *Ocean and Coastal Management, 41*(2), 257-271.

Eisner, E. W. (1991). *The enlightened eye: Qualitative inquiry and the enhancement of educational practice*. Upper Saddle River, NJ: Prentice Hall.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review, 14*(4), 532-550.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal, 50*(1), 25-32.

Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: What are they? *Strategic Management Journal, 21*(10-11), 1105-1121.

Enkel, E., Gassmann, O., & Chesbrough, H. (2009). Open R&D and open innovation: Exploring the phenomenon. *R&D Management, 39*(4), 311-316.

Escribano, A., Fosfuri, A., & Tribó, J. A. (2009). Managing external knowledge flows: The moderating role of absorptive capacity. *Research policy, 38*(1), 96-105.

Etzkowitz, H. (2008). *The triple helix: University-industry-government innovation in action.* New York, NY: Routledge.

Feller, I. (2005). A historical perspective on government-university partnerships to enhance entrepreneurship and economic development. In S. Shane (Ed.), *Economic development through entrepreneurship: Government, university and business linkages* (pp. 6-28). Cheltenham: Edward Elgar.

Fichter, K. (2009). Innovation communities: The role of networks of promotors in open innovation. *R&D Management, 39*(4), 357-371.

Fleming, L., (2001). Recombinant uncertainty in technological search. *Management Science, 47*(1), 117-132.

Franke, N., & Shah, S. (2003). How communities support innovative activities: An exploration of assistance and sharing among end-users. *Research Policy, 32*(1), 157-178.

Gallego, J., Rubalcaba, L., & Suárez, C. (2013). Knowledge for innovation in Europe: The role of external knowledge on firms' cooperation strategies. *Journal of Business Research, 66*(10), 2034-2041.

Gassmann, O. (2006). Opening up the innovation process: Towards an agenda. *R&D Management, 36*(3), 223-228.

Gassmann, O., & Enkel, E. (2004). Towards a theory of open innovation: Three core process archetypes. In *Proceedings of the R&D Management Conference (RADMA), Sessimbra (*pp. 1-18).

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report, 8*(4), 597-606.

Gold, A. H., & Malhotra, A. H. S. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems, 18*(1), 185-214.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal, 17*(S2), 109-122.

Grasenick, K., & Low, J. (2004). Shaken, not stirred: Defining and connecting indicators for the, measurement and valuation of intangibles. *Journal of Intellectual Capital, 5*(2), 268-281.

Gray, B., & Wood, D. J. (1991). Collaborative alliances: Moving from practice to theory. *The Journal of Applied Behavioral Science, 27*(1), 3-22.

Greenaway, D., & Haynes, M. (2000). Funding universities to meet national and international challenges. Nottingham: University of Nottingham.

Guba, E. G. (Ed.). (1990). *The paradigm dialog*. Sage Publications.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105-117). London: Sage.

Guest, G., Namey, E. E., & Mitchell, M. L. (2012). *Collecting qualitative data: A field manual for applied research*. London: Sage Publications.

Gunnarsson, B. (2013). Knowledge transfer and cooperation on shipping and logistics in the High North. In U. Wråkberg (Ed.), *Futures of northern cross-border collaboration* (pp. 61-76). Tromsø, Norway: Tromsø University.

Gustavsen, B., Finne, H., & Oscarsson, B. (Eds.). (2001). *Creating connectedness: The role of social research in innovation policy*. Amsterdam: John Benjamins Publishing.

Hafkesbrink, J., & Schroll, M. (2011). Innovation 3.0: Embedding into community knowledge-collaborative organizational learning beyond open innovation. *Journal of Innovation Economics & Management*, *1*(7), 55-92.

Halawi, L. A., McCarthy, R. V., & Aronson, J. E. (2006). Knowledge management and the competitive strategy of the firm. *The Learning Organization, 13*(4), 384-397.

Hanley, S. (1998). Knowledge-based communities of practice at AMS. *Knowledge Management Review, 1*(3), 8-9.

Hasle, J. R., Kjellén, U., & Haugerud, O. (2009). Decision on oil and gas exploration in an Arctic area: Case study from the Norwegian Barents Sea. *Safety Science, 47*(6), 832-842.

Helfat, C. E., (2006). Review of *Open innovation: The new imperative for creating and profiting from technology. Academy of Management Perspectives, 20*(2), 86-88.

Helfat, C. E., Finkelstein, S., Mitchell, W., Peteraf, M., Singh, H., Teece, D., & Winter, S. G. (2009). *Dynamic capabilities: Understanding strategic change in organizations*. London: Blackwell-Wiley.

Helfat, C. E., & Peteraf, M. A. (2003). The dynamic resource-based view: Capability lifecycles. *Strategic Management Journal, 24*(10), 997-1010.

Herzog, P., & Leker, J. (2010). Open and closed innovation – Different innovation cultures for different strategies. *International Journal of Technology Management, 52*(3/4), 322-343.

Hildreth, P. M., & Kimble, C. (2002). The duality of knowledge. *Information Research, 8*(1), Paper 142. Retrieved from: http://www.informationr.net/ir/8-1/paper142.html

Hildreth, P. M., & Kimble, C. (Eds.). (2004). Knowledge networks: Innovation through communities of practice. Hershey, PA: Idea Group Publishing.

Hildreth, P., Kimble, C., & Wright, P. (2000). Communities of practice in the distributed international environment. *Journal of Knowledge Management, 4*(1), 27-38.

Hirsijärvi, S., & Hurme, H. (2001). *Tutkimushaastattelu. Teemahaastattelun teoria ja käytäntö* (2nd ed.). Helsinki: Yliopistopaino.

Honey, P., & Mumford, A. (1982). *Manual of learning styles*. London: P. Honey Publications.

Hsu, I., & Sabherwal, R. (2012). Relationship between intellectual capital and knowledge management: An empirical investigation. *Decision Sciences, 43*(3), 489-524.

Huberman, A. M., & Miles, M. B. (1994). Data management and analysis methods. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research,* London: Sage.

Hughes, J. A., & Sharrock, W. W. (1997). The philosophy of social research. Retrieved from: http://tucnak.fsv.cuni.cz/~hajek/Metodologie/texty_seminar/lay%20vs%20scientif.doc

Hurmerinta-Peltomäki, L., & Nummela, N. (2004). First the sugar, then the eggs… or the other way around? Mixing methods in international business research. In R. Marschan-Piekkari, & C. Welch (Eds.), *Handbook of qualitative research methods for international business* (pp. 162-180). Cheltenham: Edward Elgar Publishing.

Inkpen, A. C., & Dinur, A. (1998). Knowledge management processes and international joint ventures. *Organization Science, 9*(4), 454-468.

Iskanius, P. (2011). Operational platform for the northern research and innovation. In M. Savolainen, H. Kropsu-Vehkaperä, A. Aapaoja, T. Kinnunen, & P. Kess (Eds.), *Proceedings of the Technology Innovation and Industrial Management Conference, Oulu, Finland* (pp. 1255-1271).

Israel, B. A., Checkoway, B., Schulz, A., & Zimmerman, M. (1994). Health education and community empowerment: conceptualizing and measuring perceptions of individual, organizational, and community control. *Health Education & Behavior, 21*(2), 149-170.

Jaffe, A. B. (1989). Real effects of academic research. *The American Economic Review, 79*(5), 957-970.

James, W. (1906). Stanford's ideal destiny. In *The Will to Believe and other essays in popular philosophy: Human immortality,* Reprint: New York, NY: Dover. (1956).

Jarvenpaa, S. L., Dickson, G. W., & DeSanctis, G. (1985). Methodological issues in experimental IS research: experiences and recommendations. *MIS Quarterly, 9*(2), 141-156.

Javadi, M. H. M., & Ahmadi, A. (2013). Investigating the roles of organizational culture, leadership style, and employee engagement in knowledge transfer. *International Journal of Academic Research in Business and Social Sciences, 3*(9), 717-734.

Kale, P., & Singh, H. (2007). Building firm capabilities through learning: The role of the alliance learning process in alliance capability and firm-level alliance success. *Strategic Management Journal, 28*(10), 981-1000.

Kaufmann, A. & Tödtling, F. (2001). Science-industry interaction in the process of innovation: The importance of boundary-crossing between systems. *Research Policy, 30*(5), 791-804.

Kauppila, O., Mursula, A., Harkonen, J., & Kujala, J. (2015). Evaluating university-industry collaboration: The European foundation of Quality Management excellence model-based evaluation of university-industry collaboration. *Tertiary Education and Management, 21*(3), 229-244.

Keast, R., Brown, K., & Mandell, M. (2007). Getting the right mix: Unpacking integration meanings and strategies. *International Public Management Journal, 10*(1), 9-33.

Kimble, C., & Bourdon, I. (2008). Some success factors for the communal management of knowledge. *International Journal of Information Management, 28*(6), 461-467.

Kirschner, P. A., & Lai, K.-W. (2007). Online communities of practice in education. *Technology, Pedagogy and Education, 16*(2), 127-131.

Kitagawa, F. (2009). Universities-industry links and regional development in Japan connecting excellence and Relevance? *Science Technology & Society, 14*(1), 1-33.

Kline, S. J. (1985). Innovation is not a linear process. *Research Management, 28*(4), 36-45.

Kline, S. J., & Rosenberg, N. (1986). An overview of innovation. In R. Landau & N. Rosenberg (Eds.), *The positive sum strategy* (pp. 275-305). Washington, DC: National Academy Press.

Kolb, D., & Fry, R. (1975). Toward an applied theory of experiential learning. In C. Cooper (Ed.), *Theories of group process* (pp. 33-57). London: John Wiley.

Koschatzky, K. (2001). Networks in innovation research and innovation policy – An introduction. In K. Koschatzky, M. Kulicke, & A. Zenker (Eds.), *Innovation networks: Concepts and challenges in the European Perspective*. Heidelberg: Physica Verlag.

Koskinen, I., Alasuutari, P., & Peltonen, T. (2005). *Laadulliset menetelmät kauppatieteissä*. Tampere, Finland: Vastapaino.

KPMG Management Consulting. (1998). Case study: Building a platform for corporate knowledge.

Kostopoulos, K., Papalexandris, A., Papachroni, M., & Ioannou, G. (2011). Absorptive capacity, innovation, and financial performance. *Journal of Business Research, 64*(12), 1335-1343.

Laine, T. (2001). Miten kokemusta voidaan tutkia? Fenomenologinen näkökulma. In J. Aaltola, & R. Valli (Eds.), *Ikkunoita tutkimusmetodeihin II, PS-kustannus* (pp. 27-43).

Lam, A. (2000). Tacit knowledge, organizational learning and societal institutions: an integrated framework. *Organization Studies, 21*(3), 487-513.

Langlois, R. N. (2003). The vanishing hand: The changing dynamics of industrial capitalism. *Industrial and Corporate Change, 12*(2), 351-385.

Laursen, K., & Salter, A. J. (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal, 27*(2), 131-150.

Laursen, K., & Salter, A. J. (2014). The paradox of openness: Appropriability, external search and collaboration. *Research Policy, 43*(5), 867-878.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge, UK: Cambridge University Press.

Lawson, B., & Samson, D. (2001). Developing innovation capability in organisations: A dynamic capabilities approach. *International Journal of Innovation Management, 5*(03), 377-400.

Lehtinen, U. & Atkova, I. (2013). Challenges for effective logistics in the Barents region. In P. O. Arnäs et al. (Eds.), *Proceedings of the 25th NOFOMA Conference, Gothenburg, Sweden.*

Leonard-Barton, D. (1995). Wellsprings of knowledge: Building and sustaining the sources of innovation. University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship. Available at SSRN: https://ssrn.com/abstract=1496178

Lesser, E., & Everest, K. (2001). Using communities of practice to manage intellectual capital. *Ivey Business Journal, 65*(4) 37-41.

Lewin, K. 1951, *Field theory in Social science: Selected theoretical papers*. D. Cartwright (Ed.). New York, NY: Harper & Row.

Liao, S. H., & Wu, C. C. (2010). System perspective of knowledge management, organizational learning, and organizational innovation. *Expert Systems with Applications, 37*(2), 1096-1103.

Lichtenthaler, U., & Lichtenthaler, E. (2009). A capability-based framework for open innovation: Complementing absorptive capacity. *Journal of Management Studies, 46*(8), 1315-1338.

Lim, K. (2009). The many faces of absorptive capacity: Spillovers of copper interconnect technology for semiconductor chips. *Industrial and Corporate Change, 18*(6), 1249-1284.

Lincoln, Y. S., & Guba, E. G. (2000). The only generalization is: There is no generalization. In R. Gomm, M. Hammersley, & P. Foster (Eds.), *Case Study Method* (pp. 27-44). London: Sage.

Liu, M. & Kronbak, J. (2010). The potential economic viability of using the Northern Sea Route (NSR) as an alternative route between Asia and Europe. *Journal of Transport Geography, 18*(3), 434-444.

Lockett, N., Kerr, R., & Robinson, S. (2008). Multiple perspectives on the challenges for knowledge transfer between higher education institutions and industry. *International Small Business Journal, 26*(6), 661-681.

Looy, B. V., Debackere, K. & Andries, P. (2003). Policies to stimulate regional innovation capabilities via university-industry collaboration: An analysis and an assessment. *R&D Management, 33*(2), 209-229.

Lundvall, B.-Å. (1988). Innovation as an interactive process: From user-producer interaction to the national system of innovation. In G. Dosi, C. F. Silverberg, & L. Soete (Eds.), *Technical change and economic theory*. London: Pinter Publishers.

Luoma, T., Paasi, J. & Valkokari, K. (2010). Intellectual property in inter-organisational relationships – Findings from an interview study. *International Journal of Innovation Management, 14*(3), 399-414.

Majchrzak, A., Cherbakov, L., & Ives, B. (2009). Social networking within corporations. *MIS Quarterly Executive, 8*(2), 103-108.

Malhotra, Y. (1998). Tooks@ work: Deciphering the knowledge management hype. *The Journal for Quality and Participation, 21*(4), 58-60.

Malhotra, A., Gosain, S., & Sawy, O. A. E. (2005). Absorptive capacity configurations in supply chains: gearing for partner-enabled market knowledge creation. *MIS Quarterly, 29*(1), 145-187.

Mansfield, E. (1991). Academic research and industrial innovations. *Research Policy*, *20*(1), 1-12.

Mansfield, E. & Lee, J.-Y. (1996). The modern university: Contributor to industrial innovation and recipient of industrial R&D support. *Research Policy, 25*(7), 1047-1058.

McDermott, R., & Kendrick, J. (2000). How learning communities steward knowledge: Shell Oil Company. In P. Harkins, L. L. Carter, & A. J. Timmins (Eds.), *Best Practices in Knowledge Management & Organizational Learning Handbook*, (pp. 194-226). Lexington, MA: Linkage Incorporated.

McLure, M., Wasko, M., & Faraj, S. (2000). It is what one does: Why people participate and help others in electronic communities of practice. *The Journal of Strategic Information Systems, 9*(2), 155-173.

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation* (Rev. ed.). San Francisco, CA: Jossey-Bass.

Meyer, C. B. (2001). A case in case study methodology. *Field Methods, 13*(4), 329-352.

Meyer-Krahmer, F. & Schmoch, U. (1998). Science-based technologies: University-industry interactions in four fields. *Research Policy, 27*(8), 835-851.

Michaelides, R. & Kehoe, D. (2007). Internet communities and open innovation: an information system design methodology (pp. 769-775). *6th IEEE/ACIS International Conference on Computer and Information Science (ICIS 2007).* Piscataway, NJ: IEEE.

Morgan, R. E., & Berthon, P. (2008). Market orientation, generative learning, innovation strategy and business performance inter-relationships in bioscience firms. *Journal of Management Studies, 45*(8), 1329-1353.

Morrow, S. L. (2005). Quality and trustworthiness in qualitative research in counseling psychology. *Journal of Counseling Psychology, 52*(2), 250-260.

Muller, P. (2006). Exploring the knowledge filter: How entrepreneurship and university-industry relationships drive economic growth. *Research Policy, 35*(10), 1499-1508.

Müller, F. C., & Ibert, O. (2015). (Re-) sources of innovation: Understanding and comparing time-spatial innovation dynamics through the lens of communities of practice. *Geoforum, 65*, 338-350.

Mäkelä, K. (1995). Kvalitatiivisen analyysin arviointiperusteet. In K. Mäkelä (Ed.), *Kvalitatiivisen aineiston analyysi ja tulkinta* (pp. 42-61). Saarijärvi, Finland: Gummerus Kirjapaino.

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review, 23*(2), 242-266.

Niiniluoto, I. (1984). *Tiede, filosofia ja maailmankatsomus: Filosofisia esseitä tiedosta ja sen arvosta*. Helsinki: Otava.

Nissen, H. A., Evald, M. R., & Clarke, A. H. (2014). Knowledge sharing in heterogeneous teams through collaboration and cooperation: Exemplified through public-private-innovation partnerships. *Industrial Marketing Management, 43*(3), 473-482.

Nonaka, I. (1994). A dynamic theory of organizational knowledge. *Organization Science, 5*(1), 14-37.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation.* Oxford: Oxford University Press.

Nonaka, I., & Toyama, R. (2003). The knowledge-creating theory revisited: Knowledge creation as a synthesizing process. *Knowledge Management Research & Practice, 1*(1), 2-10.

Nonaka, I., Toyama, R., & Konno, N. (2000). SECI, Ba and leadership: A unified model of dynamic knowledge creation. *Long Range Planning, 33*(1), 5-34.

Nonaka, I., Von Krogh, G., & Voelpel, S. (2006). Organizational knowledge creation theory: Evolutionary paths and future advances. *Organization Studies, 27*(8), 1179-1208.

O'Dell, C., & Grayson, C. J. (1998). If only we knew what we know: Identification and transfer of internal best practices. *California Management Review, 40*(3), 154-174.

O'Donnell, D., Porter, G., McGuire, D., Garavan, T. N., Heffernan, M., & Cleary, P. (2003). Creating intellectual capital: A Habermasian community of practice (CoP) introduction. *Journal of European Industrial Training, 27*(2/3/4), 80-87.

Oliver, A. L. & Liebeskind, J. P. (1998). Three levels of networking for sourcing intellectual capital in biotechnology: Implications for studying interorganisational networks. *International Studies of Management and Organization, 27*(4), 76-103.

Olkkonen, T. (1994). *Johdatus teollisuustalouden tutkimustyöhön* (2nd ed). Report No 152. Helsinki: Teknillinen korkeakoulu, Tuotantotalouden laitos.

Ollila, S., & Elmquist, M. (2011). Managing open innovation: Exploring challenges at the interfaces of an open innovation arena. *Creativity and Innovation Management, 20*(4), 273-283.

O'Mahony, S., & Lakhani, K. R. (2011). Organizations in the shadow of communities. *Research in the Sociology of Organizations, 33*, 3-36.

Parent, R., Roy, M., & St-Jacques, D. (2007). A systems-based dynamic knowledge transfer capacity model. *Journal of Knowledge Management, 11*(6), 81-93.

Patton, M. Q. (1990). *Qualitative evaluation and research methods*. Thousand Oaks, CA: Sage Publications.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Perkmann, M., & Walsh, K. (2007). University-industry relationships and open innovation: Towards a research agenda. *International Journal of Management Reviews, 9*(4), 259-280.

Pettigrew, A. M. (1990). Longitudinal field research on change: Theory and practice. *Organization Science, 1*(3), 267-293.

Platt, J. (1992). Case study in American methodological thought. *Current Sociology, 40*(1), 17-48.

Plattfaut, R., Niehaves, B., Voigt, M., Malsbender, A., Ortbach, K., & Poeppelbuss, J. (2015). Service innovation performance and information technology: An empirical analysis from the dynamic capability perspective. *International Journal of Innovation Management, 19*(04), 1550038.

Polt, W., Rammer, C., Gassler, H., Schibany, A. & Schartinger, D. (2001). Benchmarking industry-science relations: The role of framework conditions. *Science and Public Policy, 28*(4), 247-258.

Popadiuk, S., & Choo, C. W. (2006). Innovation and knowledge creation: How are these concepts related? *International Journal of Information Management, 26*(4), 302-312.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly, 41*(1), 116-145.

Pratt, M. G., & Rafaeli, A. (1997). Organizational dress as a symbol of multilayered social identities. *Academy of Management Journal, 40*(4), 862-898.

Probst, G., & Borzillo, S. (2008). Why communities of practice succeed and why they fail. *European Management Journal, 26*(5), 335-347.

Prokesch, S. E. (1997). Unleashing the power of learning: An interview with British Petroleum's John Browne. *Harvard Business Review, 75*(5), 146-168.

Prusak, L. (1996). The knowledge advantage. *Strategy and Leadership, 24*(2), 6-8.

Puusa, A. (2007). *Tulkinta organisaatio-identiteetin luonteesta ja ilmentymisestä: "Keitä me organisaationa oikeastaan olemme?"* Helsinki: Edita.

Puusa, A. (2011). Laadullisen aineiston analysointi. In A. Puusa & P. Juuti (Eds.), *Menetelmäviidakon raivaajat* (pp. 114-125). Helsinki: Johtamistaidon Opisto/Hansaprint.

Puusa, A., & Eerikäinen, M. (2010). Is tacit knowledge really tacit? *Electronic Journal of Knowledge Management, 8*(3), 307-318.

Puusa, A., & Juuti, P. (Eds.) (2011). *Menetelmäviidakon raivaajat – Perusteita laadullisen tutkimuslähestymistavan valinta.* Helsinki: Hansaprint.

Ragner, C. L. (2009). *Northern Sea Route cargo flows and infrastructure – Present state and future potential*. Lysaker, Norway: The Fridtjof Nansen Institute.

Ramos-Vielba, I., Fernández-Esquinas, M., & Espinosa-de-los-Monteros, E. (2010). Measuring university-industry collaboration in a regional innovation system. *Scientometrics, 84*(3), 649-667.

Reagans, R., & McEvily, B. (2003). Network structure and knowledge transfer: The effects of cohesion and range. *Administrative Science Quarterly, 48*(2), 240-267.

Reed, K. K., Lubatkin, M. & Srinivasan, N. (2006). Proposing and testing an intellectual capital-based view of the firm. *Journal of Management Studies, 43*(4), 867-93.

Rhodes, J., Hung, R., Lok, P., Ya-Hui Lien, B., & Wu, C. M. (2008). Factors influencing organizational knowledge transfer: implication for corporate performance. *Journal of Knowledge Management, 12*(3), 84-100.

Riege, A. (2005). Three-dozen knowledge-sharing barriers managers must consider. *Journal of Knowledge Management, 9*(3), 18-35.

Robinson, O. C. (2014). Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitative Research in Psychology, 11*(1), 25-41.

Roos, G. & Roos, J. (1997). Measuring your company's intellectual performance. *Long Range Planning, 30*(3), 413-426.

Roos, J., Roos, G., Dragonetti, N. & Edvinsson, L. (1997). *Intellectual capital: Navigating in the new business landscape*. New York, NY: New York University Press.

Ross, M. G. (1955). *Community organization*. New York, NY: Harper & Brothers.

Ruggles, R. (1998). The state of the notion: knowledge management in practice. *California management review,* 40(3), 80-89.

Ruggles, R. & Holtshouse, D. (Eds.) (1999). *The knowledge advantage*. Dover, NH: Capstone Publishing Limited./Ernst & Young LLP.

Saint-Onge, H., & Wallace, D. (2003). *Leveraging communities of practice for strategic advantage*. Burlington, MA: Butterworth-Heinemann.

Salter, A. J. & Martin, B. R. (2001). The economic benefits of publicly funded basic research: A critical review. *Research Policy, 30*(3), 509-532.

Schartinger, D., Rammer, C., Fischer, M. M., & Fröhlich, J. (2002). Knowledge interactions between universities and industry in Austria: sectoral patterns and determinants. *Research Policy, 31*(3), 303-328.

Schenkel, A., & Teigland, R. (2008). Improved organizational performance through communities of practice. *Journal of Knowledge Management, 12*(1), 106-118.

Schiuma, G., Lerro, A. & Sanitate, D. (2008). The intellectual capital dimensions of Ducati's turnaround: Exploring knowledge assets grounding a change management program. *International Journal of Innovation Management, 12*(2), 161-93.

Siegel, D. S., Waldman, D. A., Atwater, L. E., & Link, A. N. (2004). Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: Qualitative evidence from the commercialization of university technologies. *Journal of Engineering and Technology Management, 21*(1), 115-142.

Silverman, D. (2006). *Interpreting qualitative data: Methods for analyzing talk, text and interaction.* Thousand Oaks, CA: Sage.

Simon, H. (1965). *Administrative behavior*. New York, NY: Free Press.

Simplican, S. C., Leader, G., Kosciulek, J., & Leahy, M. (2015). Defining social inclusion of people with intellectual and developmental disabilities: An ecological model of social networks and community participation. *Research in Developmental Disabilities, 38*, 18-29.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage.

Stenbacka, C. (2001). Qualitative research requires quality concepts of its own. *Management Decision, 39*(7), 551-556.

Stiglitz, J. & Wallsten, S. (1999). Public-private technology partnerships: Promises and pitfalls. *American Behavioral Scientist, 43*(1), 52-73.

Sonesson, L., & Torstensson, P. (2010). *Supply services to Arctic offshore operations: Macro-environment, market demand and business potentials – The case of Maersk Supply Service*. Lund, Sweden: Lund Institute of Technology.

Subramaniam, M., & Youndt, M. A. (2005). The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal, 48*(3), 450-463.

Sveiby, K.-E. (1997). *The new organizational wealth: Managing and measuring knowledge-based assets*. San Francisco, CA: Berret Koehler.

Sveiby, K.-E. (2001a). A knowledge-based theory of the firm to guide in strategy formulation. *Journal of Intellectual Capital, 2*(4), 344-358.
Sveiby, K.-E. (2001b) Intellectual capital and knowledge management. Retrieved from: http://www.sveiby.com/articles/IntellectualCapital.html
Swan, J., Scarbrough, H. & Robertson, M. (2002). The construction of communities of practice in the management of innovation. *Management Learning, 33*(4), 477-496.
Szulanski, G. (2000). The process of knowledge transfer: A diachronic analysis of stickiness. *Organizational Behavior and Human Decision Processes, 82*(1), 9-27.
Teece, D. J. (1998). Capturing value from knowledge assets: The new economy, markets for know-how, and intangible assets. *California Management Review, 40*(3), 55-79.
Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal, 28*(13), 1319-1350.
Teece, D., & Pisano, G. (1994). The dynamic capabilities of firms: An introduction. *Industrial and Corporate Change, 3*(3), 537-556.
Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509-533.
Teirlinck, P. & Spithoven, A. (2008). The spatial organization of innovation: open innovation, external knowledge relations and urban structure. *Regional Studies, 42*(5), 689-704.
Tennberg, M. (Ed.) (2012). *Politics of development in the Barents Region*. Disserttation. University of Lapland, Rovaniemi, Finland.
Tsai, H. T., Huang, H. C., & Chiu, Y. L. (2012). Brand community participation in Taiwan: Examining the roles of individual-, group-, and relationship-level antecedents. *Journal of Business Research, 65*(5), 676-684.
Uzzi, B. (1997). Social structure and competition in interfirm networks: the paradox of embeddedness. *Administrative Science Quarterly, 42*(1), 35-67.
Van de Vrande, V., De Jong, J. P., Vanhaverbeke, W., & De Rochemont, M. (2009). Open innovation in SMEs: Trends, motives and management challenges. *Technovation, 29*(6), 423-437.
Vanhaverbeke, W. (2006). The interorganizational context of open innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 205-219). Oxford: Oxford University Press.
Vanhaverbeke, W., Cloodt, M. & Van de Vrande, V. (2008). Connecting absorptive capacity and open innovation. Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1091265
VanWynsberghe, R., & Khan, S. (2007). Redefining case study. *International Journal of Qualitative Methods, 6*(2), 80-94.
Von Hippel, E. (2005). *Democratizing innovation*. Boston, MA: MIT Press.
Von Krogh, G. (1998). Care in knowledge creation. *California Management Review, 40*(3), 133-153.
Wageman, R. (1995). Interdependence and group effectiveness. *Administrative Science Quarterly, 40*(1), 145-180.
Weerawardena, J., & O'Cass, A. (2004). Exploring the characteristics of the market-driven firms and antecedents to sustained competitive advantage. *Industrial marketing management, 33*(5), 419-428.
Wenger, E. (1998a). *Communities of practice: Learning, meaning, and identity*. Cambridge, UK: Cambridge University Press.
Wenger, E. (1998b). Communities of practice: Learning as a social system. *Systems Thinker, 9*(5), 2-3.
Wenger, E., McDermott, R. A., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Boston, MA: Harvard Business School Press.
Wenger, E., & Snyder, W. M. (2000). Communities of practice: The organizational frontier. *Harvard Business Review, 78*(1), 139-145.
West, J. & Lakhani, K. R. (2008). Getting clear about communities in open innovation. *Industry and Innovation, 15*(2), 223-231.

Wiig, K. M. (1997). Integrating intellectual capital and knowledge management. *Long Range Planning, 30*(3), 399-405.

Wiig, K. M. (1999). What future knowledge management users may expect. *Journal of Knowledge Management, 3*(2), 155-166.

Wiig, K. M. (2000). Knowledge management: An emerging discipline rooted in a long history. In D. Charles & C. Daniele (Eds.), *Knowledge horizons: The present and the promise of knowledge management* (pp. 3-26). New York, NY: Butterworth-Heinemann.

Wilkinson, I., & Young, L. (2002). On cooperating: Firms, relations and networks. *Journal of Business Research, 55*(2), 123-132.

Winter, G. (2000). A comparative discussion of the notion of 'validity' in qualitative and quantitative research. *The Qualitative Report, 4*(3), 1-14.

Winter, S. G. (2003). Understanding dynamic capabilities. *Strategic management journal*, 24(10), 991-995.

Xue, Y., & Xia, E. (2008). Study on realizing model of organizational learning and its application. In *2008 International Conference on Computer Science and Software Engineering* (pp. 190-193). Piscataway, NJ: IEEE.

Yin, R. K. (2002). *Case study research* (3rd ed.). Thousand Oaks, CA: Sage.

Yin, R. K. (2013). *Case study research: Design and methods*. Thousand Oaks, CA: Sage.

Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review, 27*(2), 185-203.

Zalan, T., & Lewis, G. (2004). Writing about methods in qualitative research: Towards a more transparent approach. In R. Marschan-Piekkari & C. Welch (Eds.), *Handbook of qualitative research methods for international business* (pp. 507-528). Cheltenham, Edward Elgar.

Zander, U., & Kogut, B. (1995). Knowledge and the speed of the transfer and imitation of organizational capabilities: An empirical test. *Organization Science, 6*(1), 76-92.

Zack, M. H. (1999). Developing a knowledge strategy. *California Management Review, 41*(3), 125-45.

Zimmerman, M. A. & Zeitz, G. J. (2002). Beyond Survival: Achieving new venture growth by building legitimacy. *Academy of Management Review, 27*(3), 414-431.

Zollo, M., & Winter, S. G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science, 13*(3), 339-351.

ORIGINAL PUBLICATIONS

This doctoral dissertation consists of a summary and the following four original papers, which are referred to in the summary by their Roman numerals:

ARTICLE I

Iskanius, P., & Pohjola, I. (2016). Leveraging communities of practice in university industry collaboration: A case study on Arctic research. *International Journal of Business Innovation and Research*, *10*(2/3), 283-299. ISSN: 1751-0252. Copyright: Inderscience.

An early version of this paper was delivered as a conference paper: Iskanius, P., & Pohjola, I. (2013). Applying the concept of communities of practice – An empirical study of innovative collaboration between academy and industry. 14th European Conference on Knowledge Management – ECKM 2013, Kaunas University of Technology, Kaunas, Lithuania, 5-6 September 2013.

ARTICLE II

Pohjola, I., Puusa, A., & Iskanius, P. (2016). Antecedents of successful collaboration in community of practice between academia and industry: A case study. *The Electronic Journal of Knowledge Management, 14*(3), 154-165. ISSN: 1479-4411. Copyright: Open access publication.

An early version of this paper was delivered as a conference paper: Pohjola, I., Puusa, A., & Iskanius, P. (2015). Potential of community of practice in promoting academia-industry collaboration: A case study. 12th International Conference on Intellectual Capital, Knowledge Management & Organisational Learning – ICICKM 2015, Bangkok, Thailand, arranged by the Institute for Knowledge and Innovation Southeast Asia (IKI-SEA) of Bangkok University, Bangkok, Thailand, 5-6 November 2015.

ARTICLE III

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ARTICLE IV

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AUTHOR'S CONTRIBUTIONS

Ilpo Pohjola is principal author of papers II – IV and a secondary author of paper I. The contributions of Ilpo Pohjola are as follows:

ARTICLE I

Originally research idea came from Dr Päivi Iskanius during development work on the Northern Research and Innovation Platform. Dr Iskanius was jointly responsible for the research approach and theoretical background with Ilpo Pohjola. Dr Iskanius collected and analysed the data, was responsible for writing of manuscript, and acted as the corresponding author throughout the publication review process. Ilpo Pohjola wrote parts of the case description and provided content for the theoretical portion of the paper.

ARTICLE II

Ilpo Pohjola was responsible for the research idea and design, theoretical background, the collection of data, and writing the article. Professor Anu Puusa advised on research design and took part in planning the research design. Professor Anu Puusa analysed the data. The finalising of the article was carried out collectively by Ilpo Pohjola, Professor Puusa, and Dr Iskanius. Professor Puusa and Dr Iskanius offered constructive comments and content suggestions on the theoretical and empirical portions of the article. Ilpo Pohjola acted as the corresponding author throughout the publication review process.

ARTICLE III

Ilpo Pohjola was responsible for the research idea and design, theoretical background, the collection and analysis of data, and writing the article. Professor Anu Puusa provided constructive comments on the paper. Ilpo Pohjola was the author in charge throughout the publication review process.

ARTICLE IV

Ilpo Pohjola was responsible for the research idea and design, theoretical background, the collection of data, and writing the article. Empirical analysis was carried out by Professor Anu Puusa and Ilpo Pohjola. Professor Puusa provided advice on the research design and provided constructive comments on the article. Lessons learned and conclusions were determined jointly by Ilpo Pohjola and Professor Puusa. Ilpo Pohjola was the author in charge throughout the publication review process.

ILPO POHJOLA

Community of practice (CoP) as an open innovation environment is creating and transferring new knowledge for the benefit of the organisation within this environment. The aim of the dissertation is to improve scholarly understanding of the limitations and possibilities that are involved in the social processes at work in the CoP. Limitations and possibilities of this study explains clearly the terms and conditions where CoP are working in the optimal way in studied environment.

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