Helsinki University of Technology
Laboratory of Work Psychology and Leadership
Doctoral Dissertation Series 2005/3
Espoo 2005

Social structures as communities for knowledge sharing in project-based environments

Inkeri Ruuska

Dissertation for the degree of Doctor of Science in Technology to be presented with due permission of the Department of Industrial Engineering and Management, Helsinki University of Technology, for public examination and debate in Auditorium TU2 at Helsinki University of Technology (Otaniementie 17, Espoo, Finland) on the 19th of August, 2005, at 12 o'clock noon.

inkeri.ruuska@hut.fi

Helsinki University of Technology
Department of Industrial Engineering and Management
Laboratory of Work Psychology and Leadership
P.O. Box 5500
FIN-02015 HUT
Finland
Phone: +358 9 451 2846
Fax: +358 9 451 3665
Internet http://www.tuta.hut.fi

ISBN 951-22-7670-4 (print)

ISBN 951-22-7671-2 (electronic)

ISSN 1459-8027 (print)

ISSN 1795-1550 (electronic)

Monikko Oy

Espoo 2005

Abstract

Project-based business environments pose special challenges for learning and knowledge sharing among the personnel primarily because projects are dispersed throughout the organizations, temporary and cross organizational. As a result many teachings may be lost once the project is completed. As people are dispersed, they may lose contact with their peers. This study focuses on the content of project knowledge and competences and communities for knowledge sharing in project-based business environments. Communities are special types of social structures involving people with a shared interest of a certain domain of knowledge. They share knowledge and experiences and create a shared understanding by interacting both face-to-face and virtually on an ongoing basis. Knowledge sharing is based on interaction between people (personalization strategy). Knowledge sharing strategies in project-based environments have mainly been based on codifying relevant knowledge into databases (codification strategy). Key concepts of social structures and practice-based learning theories offer the conceptual framework for the study.

The aims of the study are twofold. Firstly, this dissertation aims at studying project related knowledge and competences, as these form the content for knowledge sharing. Secondly, this study aims at reconceptualizing communities in project-based environments as recognized and formalized groups. The research is built around four data sets: 1) cases and qualitative interviews (N=36) on project related knowledge and competences; 2) one case with qualitative interviews (N=18) on social structures in a project-based organization; 3) a survey (N=150) complemented with qualitative interviews (N=11) on characteristics of 11 communities, and 4) a case study with qualitative interviews (N=11) on one specific community. The research methodology is based on the abductive approach, which allows a progressive dialogue between theory and empirical findings.

Project knowledge and competences have primarily been viewed as competence of a project manager and project group members at the individual level. However, the results of this study indicate that project groups need collective competence, which is based on shared understanding of the project as a whole, and which enables the group to achieve the ultimate goals of the project. Project knowledge management was insufficient in the projects and called for mechanisms to intensify interaction and enhance knowledge sharing in a complex project environment. Communities have been primarily studied as informal groups. This study argues that semi-formal communities in project-based environments serve as an overlapping semi-formal layer connecting the formal and informal structures. Knowledge sharing communities varied in their degree of formality from formal to semi-formal and informal. The dominant structure was a semi-formal community. Communities are learning-oriented and primarily the explicated learning goals promote outcomes at personal, community and organizational levels. Furthermore, in the task and goal oriented project environment, communities require certain formality, for example structure; project-related work activities, a coordinator who acts rather as a contact maker and not merely as an organizer of meetings, and organizational support in the form of encouragement to participate in the community. However, the boundaries of communities constantly shift as it is the members who socially set them. Therefore, despite the formalization that comes from the organization, it is the shared interest in the domain of knowledge, which binds the members together and communities thus remain self-organized.

Tiivistelmä (Finnish abstract)

Projektimainen liiketoimintaympäristö luo haasteita henkilöstön oppimiselle ja tiedon jakamiselle. Projektit ovat määräaikaisia, hajautettuja ja poikkiorganisatorisia. Projektin opetukset saattavat hävitä projektin päättyessä. Henkilöiden tehdessä hajautettua työtä eri puolilla organisaatiota yhteys saman alan osaajiin katkeaa. Tutkimuksessa tarkastellaan tietoa ja osaamista sekä niiden jakamiseen keskittyviä yhteisöjä projektimaisessa liiketoimintaympäristössä. Yhteisöt ovat sosiaalisia rakenteita, joihin kuuluu henkilöitä, joilla on yhteinen kiinnostuksen kohde tietyllä aihealueella. He jakavat tietoa ja kokemuksia olemalla säännöllisesti vuorovaikutuksessa toistensa kanssa joko kasvokkain tai virtuaalisesti. Yhteisöjen kyky jakaa tietoa ja osaamista pohjautuu vuorovaikutuksessa tapahtuvaan oppimiseen ja tiedonjakamiseen (personalization strategy). Tiedonjakamisen strategiat projektiympäristössä ovat perustuneet pitkälti tietojen tallentamiseen kodifioidussa muodossa (codification strategy). Tutkimuksen teoreettiset käsitteet pohjautuvat sosiaalisiin rakenteisiin liittyviin käsitteisiin sekä työkäytäntöihin perustuviin oppimisteorioihin.

Tutkimuskysymykset käsittelevät ensinnäkin projektien tiedon ja osaamisen sisältöä. Toiseksi ne käsitteleveät projektimaisessa ympäristössä toimivia tiedonjakamisen sosiaalisia rakenteita sekä yhteisöjä tunnistettuina ja tunnustettuina ryhminä. Väitöskirja perustuu neljään aineistoon: 1) kaksi tapaustutkimusta ja haastattelut (N=36) projektitiedosta ja osaamisesta; 2) yksi tapaustutkimus ja haastattelut (N=18) sosiaalisista rakenteista projektiorganisaatiossa; 3) kysely (N=150) täydennettynä haastatteluin (N=11) tiedonjakamisyhteisöjen piirteistä sekä 4) yksi tapaustutkimus ja haastattelut (N=11) yhden yhteisön toiminnasta. Tutkimus perustuu abduktiiviseen tutkimusotteeseen, jossa teorian ja empirian välillä käydään jatkuvaa vuoropuhelua.

Projektitietoa ja osaamista on tähän mennessä tarkasteltu lähinnä projektipäällikön ja projektiryhmän jäsenten näkökulmasta. Tutkimuksen tulokset osoittavat, että projektiryhmät kuitenkin tarvitsevat kollektiivista osaamista, joka perustuu yhteiseen ymmärrykseen projektista kokonaisuudessaan, ja joka auttaa projektiryhmää saavuttamaan projektille asetetut tavoitteet. Projektien tietämyksenhallinta osoittautui puutteelliseksi ja synnytti tarpeen syventää vuorovaikutusta ja edistää tiedonjakamista monimutkaisessa projektiympäristössä. Yhteisöjä on tutkittu pääasiassa epävirallisina ryhminä. Tutkimuksen mukaan projektiympäristön puoliviralliset yhteisöt yhdistävät organisaation virallisia ja epävirallisia rakenteita. Tiedonjakamiseen keskittyvät yhteisöt vaihtelivat virallisista puoli- ja epävirallisiin sosiaalisiin rakenteisiin. Pääasiallisin rakenne oli puolivirallinen yhteisö. Yhteisöt ovat oppimissuuntautuneita ja erityisesti tietoiset oppimistavoitteet edistävät tuloksellisuutta yksilö-, yhteisö- ja organisaatiotasolla. Lisäksi tehtävä- ja tavoiteorientoituneessa projektiympäristössä yhteisöjen toimintaan täytyy sisältyä tiettyä formaalisuutta (esim. rakenne); projektityöhön kytkeytyviä toimintoja; vetäjä, joka toimii erityisesti kontaktien luojana eikä pelkästään kokousten organisoijana sekä organisaation tuki, joka mahdollistaa yhteisöön osallistumisen. Yhteisöjen rajat ovat kuitenkin muuttuvia ja jäsenten sosiaalisesti määrittämiä. Näin ollen organisaation taholta tulevasta formalisoinnista huolimatta jäseniä sitoo yhteen yhteinen kiinnostus yhteisön tietoon ja oppimiseen ja yhteisöt säilyvät itseohjautuvina.

Acknowledgements

I have crossed many boundaries during my work career. Research work was a new frontier and a dissertation allowed me to enter the world of research. My experience in work organizations as a lawyer followed by the work in personnel development, management and consultancy has given me a practical basis for the research in organizations.

In the course of my research project, I have been fortunate to work with various communities who have helped and encouraged me along the way. The Laboratory of Work Psychology and Leadership has given me a great opportunity to be part of a research community, which has meant a lot growing up to be a researcher. I wish to thank Professor Matti Vartiainen, my instructor, making it possible for me to work as a researcher, which has allowed me concentrate on research work. I also thank him for reading and commenting on my manuscript. I am grateful to Professor Veikko Teikari, whose encouragement and understanding have pushed me to continue. Also, I am thankful to Professor Karlos Artto, who has provided me with insights into the project world, first as an inspector of my licentiate thesis, later commenting on my ideas and manuscript. I would like to thank Professor Eila Järvenpää for her analytical feedback on my ideas.

I am grateful to many colleagues. I would particularly like to thank Satu Kuokkanen, whose assistance gave an opportunity to learn about quantitative analysis. She was always hard working, fast and smart. I would also like to thank Marko Hakonen, for his help in many areas, not the least for his superior quantitative expertise. I am most grateful to Dr. Virpi Ruohomäki for reading my manuscript and for her valuable and wise comments, which helped me to finalize my manuscript. I owe thanks to Dr. Jyrki J.J. Kasvi and Milla Hailikari for their collaboration in the first case study. Finally, I am thankful to Kirsti Arjas-Kauranen for her sensitive listening and understanding during the challenging process and for her comments on my manuscript.

I have been fortunate also to have an extended academic community. I want to thank Dr. Kirsti Lindberg-Repo for her support. Besides understanding the demands of the research process, she commented on my manuscript and helped me to conceptualize my thinking. I am grateful to Dr. Jari Hakanen, who has helped me with the quantitative analysis and encouraged me to use triangulation. Feedback from Saara Repo-Kaarento has given me new insights on collaborative learning and groups and I am very thankful for her comments. I would like to express my most special thanks to Aino-Marja Rajaneva for sharing this academic trip with me. Finally, I would like to thank Tarja Vantunen for sharing both my happiness and sadness.

In the international research community, I would like to thank Professor J.H. Erik Andriessen and Dr. Robert Verburg from The Technical University of Delft, The Netherlands, for the cooperation and for their "Community Assessment Tool". Also, the opportunity of presenting my study in the Research Forum of the global community of practice "CpSquare" allowed me to receive feedback and comments, which helped me to reflect on my thinking. I am very grateful to Dr. Etienne Wenger for his encouragement and comments.

I have been able to conduct my study in various organizations. This dissertation was made possible with the kind cooperation of all the respondents, who have dedicated their scarce time to participate in the study. I would especially like to thank Vesa Ilmarinen and Anni Ronkainen for their cooperation.

I would like to thank Professor Erno Lehtinen, from The University of Turku and Professor Mariano Corso, from Politecnico di Milano, for their careful reading and commenting as preliminary examiners. I am grateful to Mr. Richard Hogan, from Stockholm International School, for correcting the language and to Kari Jalonen for the careful technical work. I would like to thank The Academy of Finland as well as The Finnish Work Environment Fund, The Jenny and Antti Wihuri Foundation, The Marcus Wallenberg Foundation, The Emil Aaltonen Foundation and The Ehrnroth Foundation.

Everyday life with various obligations has been challenging and would not have been possible without an extensive community of caring people. Many friends in the neighbourhood have been there to help when needed. Gyula Zcunics has been most flexible taking care of our children while I have done my research. I am very grateful to my mother Irja Vihonen and my mother-in-law Kaisu Hellman for the help they have provided our family.

Last, I would like to thank my family. Our children, Teemu, Lassi and Essi, are the most precious ones in my life. They have been very patient allowing me to do my work. I hope I have been able to show them what it means to have a dream and work for it. My husband, Jukka Ruuska, has encouraged me to fulfil this dream. He has supported me and listened to my endless ideas being very proud of me all the time. This has meant a lot to me.

Many times during my work, I have missed my father's advice. Now, as I am close to my dream, I can feel that he would be very proud. I wish to dedicate this dissertation to the memory of my father, Dr. Sakari Vihonen. He and my mother have given me the strength and courage to fulfil my dreams.

Stockholm, May 2005

Inkeri Ruuska

Contents

1 Introduction

1.1 Introduction to the research subject

The key issue facing knowledge-based business organizations is how to add more financial value to the work of organizational networks and communities, how to respond to the increased need of knowledge and competences and how to share them between individuals and groups. This work argues that organizational knowledge of this issue is not sufficient and the question should be addressed to broaden the scope on how knowledge and competences are shared in organizations.

Knowledge and competence and the ability to learn faster and better than competitors (e.g. Prahalad & Hamel, 1990; Nonaka & Takeuchi, 1995; Sveiby 1997; de Geus, 1997), and the ability to create and transfer knowledge within an organizational context (e.g. Kogut & Zander, 1997) have been argued as the most sustainable competitive advantage of companies. Learning has been considered as a necessary condition for any organization to support continuous changes to face the growing complexity of the market and it has been accepted as a strategic necessity (e.g. Argyris & Schön, 1978; Senge, 1990). The growing awareness of the importance of knowledge to organizational success has thus put the emphasis on creating tools, practices and processes to support the sharing of knowledge (Dixon, 2000).

However, the concepts of knowledge and knowledge sharing as sources of competitive advantages are undergoing a change. Wenger (2000a) refers to knowledge-based organizations, whose dominant structures are communities. A community-based view of an organization (Tuomi, 1999) has become a prominent way of viewing organizations as entities for knowledge creation. Communities have been recognized as ways to develop competences and knowledge, and as contexts for learning. In management studies, communities have received attention in the field of knowledge management, innovation, and work place learning**.** The concept of a community of practice (Lave & Wenger, 1991; Brown & Duguid, 1991; Wenger, 1998) and related concepts have received much attention. They have been studied mainly as informal phenomena. Informal interactions with peers have been detected as predominant ways of learning (Boud, 1999).

With these views I want to put forth two somewhat contrasting views on knowledge and competence in organizations. The resource-based view of the firm (e.g. Hamel & Prahalad, 1994, on core competences) considers knowledge and competence as production items, in parallel with the tangible production assets, and therefore views them as something that may be considered in isolation from their context. Competence and knowledge as such reside either in the heads of organizational members (e.g. management) or are bound in the processes and structures of organizations. The contrasting view, which may be

referred to as practice-based view (e.g. Lave & Wenger, 1991, on communities of practice) relates knowledge with practices of the organization and views knowledge and competence as social phenomenona and not as distinct production assets. This study adopts the ideas of the practice-based view, and views knowledge and competence residing in the groups and communities in organizations thus held collectively. Yet it is individuals who act in organizations, so knowledge and competence are not merely viewed from a collective viewpoint, but the individual perspective is also considered. This study focuses specifically on communities in business oriented organizations and positions itself in the field of management studies.

1.1.1 Project-based environment as the context of the research

Organizations are undergoing changes in the way work is organized. One of the changes is the increasing tendency of organizations to become more project-based as results are more often delivered through projects. Project-based organization's operations are partly or entirely based on delivering projects. The project-oriented working models offer, among other benefits, organizational flexibility (Rolstadås & Kolltveit, 1999). This has reinforced the importance of the study of inter-project dynamics. However, project organizations face many challenges. Projects are complex systems where technical, procedural, organizational, and human elements are integrated. All these elements have to be in balance since they are parts of a whole system and all parts effect each other. Projects are unique, goal-oriented systems, and consequently, complex in their nature (Frame, 1995). Project-based organizations must rely on persons moving between various projects having to refresh their skills and knowledge. As projects are organizationally dispersed, they may also be geographically dispersed. However, projects as organizational forms are nothing new. They are age-old structures and they have been conducted for millennia. Projects as they are practiced today came into being in the post-World War II era, in the 1950's (Frame, 1994; Engwall, 2000a).

Projects foster speediness, short-term efficiency (Engwall, 2000b), and market agility and customer focus (Wenger, 2000a). These very same features can easily become disadvantages, as the short-term focus on tasks may result in the loss or localization of learning (Wenger, 2000a). The most crucial and difficult problems to solve in multi-project environments are how to share knowledge and experiences gained in one project to other projects and non-projects of the company, and what methods, systems, and techniques are used (Engwall, 2000b). This forms the basis for this research.

The context throughout the study is a project-based environment, which refers to organizations, whose operations are partly or entirely delivered through projects. Project-based organizations and projects offer an interesting target for the study of knowledge sharing. Projects are temporary, cross-organizational and dispersed. This allows members to belong to multiple social structures. However, the lack of systematic learning (Pinto, 1999) and the continuous

reinvention of wheel (Järvinen, 1999) have been recognized as major knowledge management problems in project-based organizations. Project organizations require a different approach to their management than the functional, hierarchical, and line management approach (Turner & Keegan, 1999).

1.1.2 Problem area

Two major types of challenges in knowledge and competence sharing often arise in project-based organizations. Firstly, how to prevent the "reinvention of the wheel" and share knowledge and competences accumulated in one project with others? A lot of learning may be lost when projects disband. Because of their temporary nature new knowledge or know-how created in project teams is not easily transferred to other organizational members after the project is completed (Nonaka & Takeuchi, 1995). This requires us to focus on finding appropriate sharing mechanisms at both organizational and individual levels (e.g. Crawford, 1999). This thus arises the second challenge: how to enhance the communication of peers working in dispersed projects as relationships in project organizations are maintained cross-functionally. This may increase knowledge and competence sharing, yet at the same time isolate people from their peers. Therefore, some compensating and not only immediate performance-related mechanisms are needed to cross over the functional borderlines. However, in a task-oriented project where short-term pressures prevail, it is not easy to shift the focus from action to reflection which is needed in learning (Ayas & Zeniuk, 2001).

An additional challenge emerges as much of the work in organizations is done outside the formal structures, and formal descriptions do not necessarily provide solutions for occurring problems. Brown and Duguid (1991) argue that there is a remarkable gap between canonical and non-canonical practices in work. This means that there are significant differences between the way work is documented and the way it is actually performed. When facing problems, people tend to rely on solutions that are not provided by the formal structure. Informal mechanisms and systems, such as conversation with others, mentoring and storytelling are then used. Orr (1996) describes how service technicians of a copy machine turned to other technicians to solve emerging problems and to make sense of the repair work. Orr argues that knowledge relevant to the job of diagnosis cannot be precisely defined in the directive documentation. Also, professionals cannot rely solely on the technical knowledge (Schön, 1987).

To overcome the above-mentioned knowledge sharing challenges in project-based environments new mechanisms are needed. Formal structures, such as steering groups, are used to manage projects. At the same time, there is a need for more informal structures, designed or spontaneous, as more informal social structures may be able to provide solutions for emerging problems and support the non-canonical practices at work. I am focusing on social structures as recognized groups in organizations. In this sense, a special type of such a social structure is a community of practice (Lave & Wenger, 1991; Brown & Duguid,

1991; Wenger, 1998). A community, for the purposes of this study, is defined based on Wenger (1998) and Wenger et al. (2002), as:

> A group of people with a shared interest to a certain domain of knowledge, sharing knowledge and experiences and creating a shared understanding by interacting both face-to-face and virtually on an ongoing basis.

However, the term structure may cause some confusion, as it may also refer to the amount of explicit specification within the groups. In that sense, the amount of structure varies within communities and groups. I am using the both connotations in this study. To avoid misunderstandings I will explain my use of the term structure here. The second study involves discovering and defining social structures in a project-based environment. It shows the variety of social structures in the case company and therefore refers to the first definition of structure: recognized groups as social structures. The third and fourth studies refer to the second use of the term structure: how much structure the communities have, or should have. This is studied by analysing the characteristics of the target communities.

Project-based environments are often multidisciplinary requiring collaboration of people from various organizational units and backgrounds. This study approaches the knowledge sharing challenges by proposing communities as social structures for knowledge and competence sharing in project-based environments. Firstly, such structures may enhance knowledge sharing in and within projects. McDermott (1999a) refers to them as a "double-knit" organization. The multi-membership in organizations creates a learning loop. Multimembership contributes to informal webs of relationships (Wenger, 1998). As members of project teams, people are responsible for task performance. When the same people are also community members and develop the practice of that community, they bring their knowledge to communities and discuss problems, solve them, and integrate them in the community's practice. When they return to their projects they take the new solutions with them. Secondly, communities can help to connect peers working in various projects with each other. By interacting informally with their peers, people may be able to develop their competences and professional identity.

The main focus in this study is on project-related knowledge and competence and social structures, which are considered as communities who share that knowledge and competence. Brown and Duguid (1991, p. 55) argue that to understand the way information is constructed and travels within an organization, it is first necessary to understand the different communities that are formed within it and the distribution of power within them. This study represents the community-based view of the organizations, as proposed by Wenger (1998) and Tuomi (1999).

Communities have been seen to provide a suitable social structure to support learning in organizations (Huysman & de Wit, 2002). However, much of the research on social structures has been rather abstract and theoretical in the field. Yet it is worthwhile to gather empirical data and to investigate which

social structures are in place and what they are like. In literature, social structures are referred to with the diversity of theoretical concepts, but more description and modelling based on empirical research of those structures is needed. Concepts in the field call for specification. The concept of communities is applicable in business contexts. More empirical research on communities of practice in the context of management studies is needed. Much of what people do in organizations occurs outside the context of the formal organizational structures. Nevertheless little is known about how to integrate these more informal structures into management of knowledge and competence and into the organization. This study aims at recontextualization the concept of a community in project-based business settings. The emergence of various communities of practice has been recognized in project-based companies (e.g. DeFillippi & Arthur, 1998; Prencipe & Tell, 2001; Ayas & Zeniuk, 2001; Sense, 2003; Garrety et al., 2004), yet these issues need to be explored in more detail in order to gain empirical data about how these communities emerge and how they function in the context of project-based environments. This study aims at contributing to the discussion on communities and places the focus on the characteristic features of communities in project-based environments. The concept of project knowledge and competence need to be reconceptualized accordingly.

1.2 Research design

This chapter provides methodological considerations of the study. Research design in general is described here. Additionally, study specific methodology is included in chapter 3 (3.1, 3.2, 3.3 and 3.4), which involves the empirical studies of the dissertation.

1.2.1 Objectives and research questions

This dissertation presents four interrelated empirical studies on project related knowledge and competence and social structures for sharing of knowledge and competences in project-based environments.

There are two primary objectives. Firstly, this study aims at studying project related knowledge and competence, as they form the content for knowledge sharing. It also serves as an analysis of the research context, as it addresses the challenges of project-based work. The problem with project knowledge and competence literature and research is that it has been largely based on the rather rationalistic view (Sandberg, 2000). Sandberg (1994; 2000) argues that this view perceives knowledge and competences as predefined sets of attributes that are more or less context-independent. The rationalistic "operationalizations" of attributes into quantitative measures may result in abstract and narrow, as well as simplified descriptions, which often do not represent the complexity of organizational reality (Norris, 1991; Sandberg, 1994; Sandberg, 2000). This study aims at contributing to the body of knowledge of project knowledge and competence by redefining project knowledge and competence and studying their content as experienced by the participants rather than as theoretical, predefined attributes. The focus is placed on the project group level.

As the second objective, this study aims at reconceptualizing the concept of communities as social structures for knowledge sharing in the context of project-based environments, and describes the characteristics and functionality of the communities. The field of community research is diverse and one of the challenges is the diversity of concepts. This study aims at contributing to the body of knowledge of communities and other social structures as personalized knowledge sharing mechanisms in project-based environments. The main research task is to explore social structures in practice and make them visible by conceptualising them. Furthermore, selected social structures are studied within the framework of communities of practice (Lave & Wenger, 1991; Brown & Duguid, 1991; Wenger, 1998). The main task is to explore their characteristics and explain the factors for beneficial outcomes of communities. Although the study on various social structures involves both intra- and inter-organizational structures, the further study on target communities focuses only on intra-organizational communities, as the dynamics of both types of communities are different.

The empirical part is based on four interrelated studies, and each study involves specific research questions, as described below.

Study 1, "Critical competences and knowledge in project contexts", aims at answering the research questions:

> *What are the competence and knowledge requirements in a project context and what types of challenges does the project-based work pose?*

Study 2, "Social structures for knowledge sharing in project context", answers the research questions:

> *What kinds of communities and other social structures are there to create and share knowledge and competences in a project-based environment?*

Study 3, "Characteristics and outcomes of communities", answers the research questions:

> *What are the characteristics of intra-organizational communities in project contexts:*
>
> > *What are the purpose and goals of the communities?*
> >
> > *What are the activities and practices in communities?*
> >
> > *How are the communities facilitated and coordinated and what is the role of a coordinator?*
> >
> > *How should communities be supported in project-based environments?*
> >
> > *What are the outcomes on the personal, community and organizational level?*
> >
> > *What factors are related to beneficial personal, community, and organizational outcomes?*

Study 4, "Communities as knowledge sharing mechanisms", answers the research questions:

> *How has the target community evolved and developed?*
>
> *How does the target community operate as a knowledge sharing mechanism in the project context?*
>
> *What are the outcomes and benefits of the target community?*

1.2.2 Research material

The common denominator of the target organizations is that they all involve project-based activities. The degree of activities varies though from all main activities being project-based to companies where only part of the activities is realized as projects. Projects in the target organizations were both client and research and development projects.

Study 1 involves two case companies. The first case organization is a Federation, which organizes and coordinates research and development projects in the field of the metal engineering and electro-technical industries. Multiple participants from public organizations and various metal engineering and electro-technical companies were involved in their projects. The second case company is a publicly listed company operating globally in the engineering industry.

Study 2 involves one case company, an Internet Consultancy company. All of the offices, at the time of the research five, were involved in the research.

Study 3 involves six organizations. The Internet Consultancy of the study 2 was involved with three target groups. Other organizations were, a Telecommunication company with one target group, A Network Service company with four target groups, A Messaging and Logistics company with one target group, A Banking group with one target group, and a Research Institution with one target group. The number of studied groups was eleven.

Study 4 involves one target group from the Internet Consultancy company, that was involved in the studies 2, 3 and 4.

More detailed description of each target organization is presented in chapter 3.

1.2.3 Research approach

Due to the nature of the research problems, as described earlier, an abductive research approach (Dubois & Gadde, 2002) was adopted (Figure 1). The approach was chosen because of the novelty of the research subject. Much of the discussion on communities is theory-based with little empirical evidence and the literature of project-based knowledge and competence is to a great extent practitioner-based. Knowledge sharing in project-based environments has primarily been studied as codification of critical knowledge or sharing of best practices and post-project reviews. Additionally, project knowledge and competence have been mainly studied from the individual point of view. This study aims at studying them primarily on the project group level and as experienced by the participants of projects.

Abductive research approach is positioned in relation to induction and deduction, in contrast with the polar opposites of inductive and deductive logic (Coffey & Atkinson, 1996). It is closer to an inductive than deductive approach, yet the continuous interaction of theory is stressed more heavily than in the grounded theory and has a stronger reliance on theory than is suggested

by true induction (Dubois & Gadde, 2002). Systematic combining builds on the developing of existing theories rather than generating them. The original framework is modified, partly as a result of unanticipated empirical findings, but also due to the theoretical insights gained during the research process (Dubois & Gadde, 2002). It allows for a more central role for empirical research in the generation of ideas as well as more dynamic interaction between the data and theory (Coffey & Atkinson, 1996). Abductive reasoning implies that we start with the particular and identify a particular phenomenon, and then account for that phenomenon by relating it to broader concepts (Coffey & Atkinson, 1996).

Dubois and Gadde (2002) argue that the dialogue between the theory and empirical data as a continuous movement between an empirical world and model world, is ongoing. It is defined as "a process where theoretical framework, empirical fieldwork, and case analysis evolve simultaneously" (Dubois & Gadde, 2002, p. 554). A researcher going back and forth from one type of research activity to another and between empirical observation and theory is able to expand his understanding of both theoretical and empirical phenomena. An abductive approach is fruitful if the researcher aims at discovering new things, variables and other relationships.

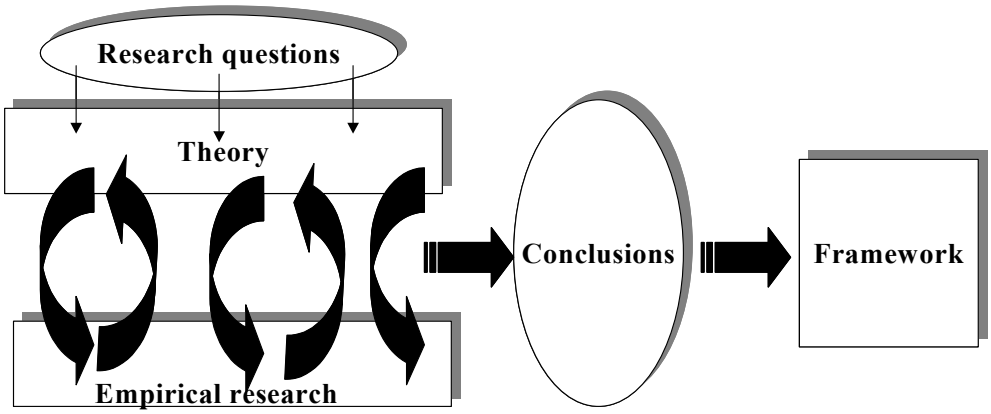

Figure 1 The research process

The research on project related knowledge and competences involves a loose framework of competence and knowledge areas collected from literature (e.g. Crawford, 2000). This framework was used as a stimulus to help the respondents to recall past events and experiences (Jokinen & Pelkonen, 1996). Figure 2 presents the process of interrelated studies of the dissertation. However, additional viewpoints emerged from the data, and this shaped the pre-defined model. The framework was modified based on the responses and was reflected against theory. Collective aspects of competence and focus on personalized interaction emerged from the data. The main problems called for mechanisms to intensify interaction and enhance knowledge sharing in a complex project environment. Seeing the whole project and its environment and not just individual parts was also emphasized. The results encouraged a

study of personalized, interaction based ways to approach the sharing of project related knowledge and competence.

The research on communities and other social structures for knowledge and competence sharing is based on a loose framework adopted from existing literature. In accordance to the data collection, the search for complementary theories took place (Dubois & Gadde, 2002). The objective of a case study on knowledge sharing structures in project-based environments is to collect data on various structures. Based on the results, a typology was made and compared with the theoretical framework. The results indicated that informal and semi-formal face-to-face social structures were dominant, and communities appeared in various forms. The next step of the research was to study deeper the concept of a community. Eleven groups based on the existence of nine qualifications were chosen as research targets: shared domain of knowledge, community of people, shared practice, voluntary membership, recognized status in the organization, self-managed, work-related, cross-organizational nature and project-context. The first three attributes, domain, community and practice are based on Wenger (1998). Additionally, other attributes were collected from community literature (e.g. Wenger, 1998; Botkin, 1999; Storck & Hill, 2000; Wenger et al., 2002). The method used was based on the Dynamic interaction model (Andriessen et al., 2001; Andriessen, 2003). Based on the results, the characteristics of communities were defined and were compared with the theory. Final case was conducted to deepen the data collection and validate the results.

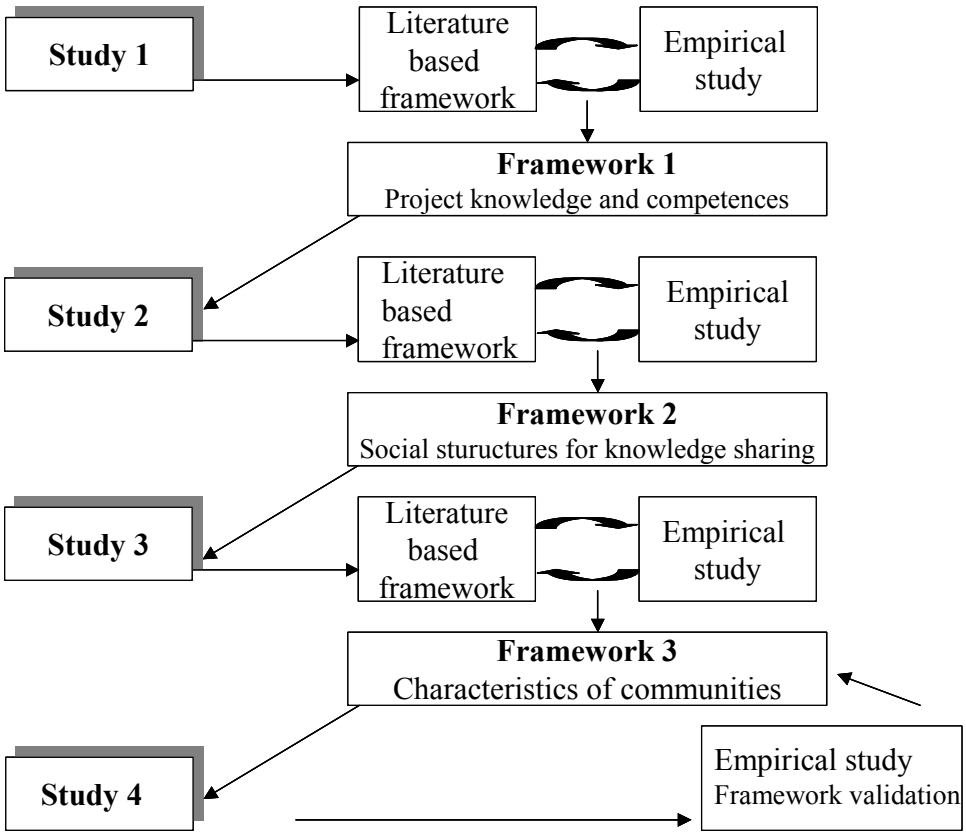

Figure 2 The process of interrelated studies 1 – 4

The research is based on case studies. Case study may be implemented in various ways, as suggested by Yin (1994). This study combines the elements of the case study research in the following manner (Eisenhardt, 1989). This study involves multiple cases, which are researched from various perspectives (Yin, 1994). The first study involves two cases, the second and the fourth study a single case whereas the third study involves eleven different target groups. The level of analysis is the project level in study 1, the organizational level in study 2, and the community level in studies 3 and 4. Various data collection methods were combined, as the study involves qualitative data from interviews and documents and quantitative data collected through a questionnaire.

This study aims at providing description (Eisenhardt, 1989) on critical project competences and knowledge, and further on communities and other social structures as mechanisms to share that competence and knowledge in project-based organizations. Additionally, the third study includes a brief explanatory study on the factors contributing to the beneficial outcomes of communities.

Triangulation was used as the combination of methodologies in the study of the same phenomenon (Denzin, 1978, p. 291). Approaches were combined attempting to capture divergent perspectives of the data (Eisenhardt, 1989), and triangulation was used so that the various data collection methods would supplement each other (Eskola & Suoranta, 2001). Triangulation was used as methods triangulation and as triangulation of qualitative data sources (Patton, 1990). Data collection from many sources enabled cross-checking of data and the validation of the interpretation (Bryman, 1992). Quantitative data on communities as knowledge sharing mechanisms allowed better generalizations than just qualitative data. The effectiveness of triangulation rests on the premise that the weakness in each single method will be compensated by the counter-balancing strengths of another (Jick, 1979). Multiple sources of data were also used to contribute to revealing unknown aspects and to discover new dimensions of the research problems (Dubois & Gadde, 2002).

1.2.4 Research methods

The research methods were mainly qualitative, although data was also collected by quantitative methods. Sources were used as highly complementary, and the use of qualitative and quantitative data was synergistic. Qualitative research was exploratory in nature aimed at understanding and describing concepts (Coffey & Atkinson, 1996). Qualitative research gives a strong sense of context, which promotes an understanding of what is going on in the research target (Bryman, 1992) and therefore seems suitable as the main research approach when studying social structures. Qualitative research is interpretative in nature (Creswell, 1994). The goal of the research was to understand the phenomena from the point of view of the respondents. Quantitative research, on the other hand, tends to give little attention to context, but enables data collection on matters that cannot be directly observed (Bryman, 1992) and permits receiving larger number of respondents than merely by qualitative research. Quantitative research was also mainly exploratory in nature with the

use of descriptives of the data, complemented with a brief explanatory study on the factors which contribute to the beneficial outcomes of communities.

The research methods were primarily interviews, along with examination of documents and the use of a questionnaire, as observation was more or less supplementary.

Documents as sources

In addition to interviews and a questionnaire, document sources were used, as they provided information on matters that could not be addressed through other methods. The document data consisted of internal and confidential data, such as policy documents and internal memos and plans, as well as public data in the form of annual reports and client magazines. Official policy as opposed to informal knowledge sharing practices was especially studied with the help of the formal documents.

Interviews

Interviews were the main method used for the data collection, as they allowed dialogue between the researcher and the respondents, as the purpose of qualitative interviewing is to understand others' meaning making (Warren, 2002) and to understand themes of the lived daily world from the subject's own perspectives (Kvale, 1996). Interview participants are viewed as meaning makers and constructors of knowledge in collaboration with interviewers, and not so much repositories of knowledge. Interviews are conversations, forms of discourse (Mishler, 1986; Kvale, 1996), and the discourse of interviews is constructed jointly by interviewers and respondents (Mishler, 1986). The epistemology of interviews tends to be more constructionist than positivist (Holstein & Gubrium, 1995).

Each study involved semi-structured thematic interviews. They followed certain interview guidelines and focused on certain themes. The questions were tested by pilot interviews and adjusted accordingly. All interviewees within a case study were asked basically the same questions in order to be able to make reasonable and valid comparisons across informants. This allowed the results to be analysed in a meaningful way. Although all interviews began with the same questions, each informant was encouraged to explain different points in more detail if necessary (Johnson & Weller, 2002). Emergent themes in each case were regarded as well, as the qualitative interviewer may remain flexible and attentive to the variety of meanings that may emerge as the interview progresses (Warren, 2002). The main problem with the standard, structured interviews is that respondents are presented with predetermined questions specified by the interviewers, and in the analysis the "meaning" is determined by these responses, whereas respondents in fact have not had an opportunity to offer alternative views (Mishler, 1986).

Questionnaire

A questionnaire (Community assessment tool) designed at the Delft University of Technology in the Netherlands[1] was used as a method to collect the data on eleven groups. The questionnaire was used online and operated by the Surveyor program. Each group involved also a supplementary interview with the coordinator of the group. The questionnaire involved questions on the membership, goals, activities, coordination, time spent, knowledge sharing, communication and tools and outcomes as well as the background information. The questionnaire consists of 42 questions.

1.2.5 Data analysis

Each study was first analysed individually. Data collection and analysis were done partly simultaneously (Eisenhardt, 1989). As described above, the abductive approach was applied combining various phases of the research. Individual studies were used abductively to derive empirical based ideas for further research (see Figure 2). Analysis involved case study descriptions for each case (Eisenhardt, 1989).

Documents

Documents were merely read through carefully. Themes related to research questions were recorded to be used in accordance with the interview data.

Analysis of the interview data

Interviews were transcriped from tapes by experienced transcribers. Then the transcripts were analysed using a text-analysis program Atlas.ti. However, the important analytic work was based on how to use the codings and not on the fact that software was used (Coffey & Atkinson, 1996). Data was first classified into categories (Eskola & Suoranta, 2001) based on the themes of the interview, which in turn were based on finding answers to the research questions. Rules for analysing data under classes were first defined (Eskola & Suoranta, 2001) and used as a coding manual. The coding manual included specifications of criteria for coding to ensure its consistency throughout the long process. Relevant answers according to the research questions were sorted under these categories. Categories and codes then formed the basis for the emerging story of the responses (Creswell, 1994). Codings were re-read to get an overview of the entire data. Simplifications were then created from the quotations of the answers. Coding may be considered in terms of data simplification or reduction (Coffey & Atkinson, 1996), and it enabled the data to be reduced into manageable proportions. Despite the pre-fixed coding manual, new categories were added if unexpected issues emerged from the data. Analysis was aimed at identifying linkages within the data. Coding was thus used to identify links between the data and the theoretical concepts

[1] Prof. J.H.Erik Andriessen and Dr. Robert Verburg

underlying the study. However, Coffey and Atkinson (1996) argue, drawing from the work of Strauss (1987), that coding is much more than giving categories to data, as it is also about conceptualizing the data, raising questions, providing provisional answers about the relationships, and discovering the data.

Coding, involving reading and selection of data, involved interpretation (Coffey & Atkinson, 1996). After the coding the data was retrieved (Coffey & Atkinson, 1996) and displayed in a way that made it accessible for reading and exploration. This allowed the coded data to be transformed into meaningful data for interpretation (Coffey & Atkinson, 1996). Analytic work included the identification of relevant concepts, as the main aim of the research was a conceptualization based on empirical evidence. Patterns, themes, similarities and commonalities, as well as anomalies, were searched in the data.

Quantified knowledge is not generally the goal of the interview research (Kvale, 1996). However, qualitative analysis was supplemented by frequency counts to offer a view of the frequency of responses in some cases. In the first study the appearance of various competence and knowledge areas were counted to get an impression of their frequency. Similarly, the number of social structures and their dimensions in the second study were quantified to get an idea of their existence. The interview data of the community coordinators in the third study involved data on the formality of communities. This data was quantified and the typology of the internal degree of formality was presented.

Main codes of individual studies are presented in the appendices 2, 3, 5 and 11.

Analysis of the questionnaire data

Questionnaire data were analysed by SPSS statistics program. Both sum scale variables and single items were used in the analysis. Sum scales were constructed by using explorative factor analysis. Scales and items were organized under the themes used to describe the characteristics of communities: structure, purpose and goals, activities, coordination, organizational support, and outcomes. Relations between scales and single item variables were studied by using the standard multiple regression (Tabachnick & Fidell, 1996). More detailed description is presented in chapter 3.3.

However, as the analysis was mainly descriptive, this data was partly used in a qualitative manner to provide descriptions on communities.

1.2.6 Research procedures

Data collection on project competence and knowledge (study 1) started in the spring of 2000. The data for the first case (Case A) was collected in 2000 – 2001 [2], and for the second case (Case B) in the fall of 2001. The data on social

[2] MET project memory –research project. Research group: Vartiainen, M., Kasvi, J.J.J., Hailikari, M. & Ruuska, I. The data was collected by Jyrki Kasvi and Milla Hailikari.

structures (study 2) was collected in the fall of 2002. The survey data on the characteristics of communities (study 3) was collected in the spring of 2003. The final data on one community (study 4) was collected in the spring of 2004.

Interviews lasted from 45 minutes to 1.5 hours. Each data was analysed accordingly during and after data collection and further studies were specified based on the results. In all case studies, the interviews were tape-recorded with the permission of the respondents. The tapes were transcriped verbatim by experienced transcribers. Transcripts were compared to the written notes taken during and right after the interviews. Verbatim transcriptions are limited in a way that they do not capture the aspects of emotional context expressed by an oral component, such as intonation of voice, pauses, sighs, and laughter, since these are not easily translated into the written record (Poland, 2002, p. 635). Recording pauses, laughter, interruptions, intonations, and so forth were not expressed in the written transcript.

Questionnaire data were collected online and the www-link was sent to respondents. Prior to sending the link coordinator of each community was interviewed. Coordinators also approached the members in order to motivate them to participate in the study. After analysis of the data, each community received an individual report concerning their results.

1.2.7 Structure of the dissertation

Introduction to the research subject and methodological considerations are presented in chapter 1. This chapter involves methodological considerations in general and study specific descriptions concerning studies 1 – 4 are dealt with individually in chapter 3. Conceptual and theoretical issues are explored and discussed in chapter 2. This is structured in four sections. Project related knowledge and competence as the content of sharing are covered first. Secondly, organizational structures, specifically projects are discussed, as they provide the context for the study. They also define the specific needs for knowledge and competence sharing in project-based work. Work groups in organizations are discussed, as communities are considered groups and studied as such and involve dynamics as any group of people. The main conceptual and theoretical discussion is contained in the sections of community as well as learning and knowledge sharing. Finally, the main concepts of the study are summarized in the last section of this chapter. The chapter of the empirical study (chapter 3) consists of case studies and a survey study, which together are used to find questions for managing and sharing knowledge and competences in a project-based environment in the way described in this dissertation (see Figure 2).

Chapter 4 discusses the contributions of the study and connects them with the current domain of knowledge on the field. Evaluation of the research, suggestions for future research, and managerial implications end this chapter.

2 Conceptual and theoretical framework

Groups evolve and are formed in all environments, as people have the need and the desire to interact and connect with others. People have families, belong to a neighbourhood community, join hobby groups, and maintain friendships. As members of a work organization people are part of multiple groups, such as project groups and work groups, but also form networks with other people. Some are formal while some remain very informal and invisible to others. Various groups in organizations are multiple and overlapping and serve multiple purposes. The focus in this study is on groups that are bound together by the domain of knowledge in the context of work organizations. They are considered as unbounded entities, as opposed to formal work groups. Non-work, social groups in organizations or outside them are not part of this study. The working definition of a community is based on Wenger (1998), who views communities as voluntary groups of people with shared interest in a shared domain of knowledge interacting on an ongoing basis. The concept of a community of practice provides a framework for the study, but also other concepts of social structures are used to complement it.

2.1 Project knowledge and competences

The discussion on knowledge and competences has been wide, and the subject has been approached from different viewpoints. In management studies, competence management literature partly overlapps with knowledge management. Knowledge has been viewed as a sustainable advantage in a firm in the writings of knowledge management (e.g. Nonaka & Takeuchi, 1995; Leonard-Barton, 1995; Davenport & Prusak, 1998, O'Dell & Grayson, 1998). More precisely, "the only sustainable advantage a firm has comes from what it collectively knows, how efficiently it uses what it knows, and how readily it acquires and uses new knowledge" (Davenport & Prusak, 1998, p. xv). Knowledge management (e.g. Nonaka & Takeuchi, 1995; Sveiby, 1997; Davenport & Prusak, 1998; Leonard-Barton, 1995) focuses on conceptualizing the processes of knowledge creation, and refining and developing practices to manage them. The concept of Intellectual capital (e.g. Edvinsson & Malone, 1997; Stewart, 1999) within knowledge management discussion is more precisely concerned with modeling knowledge as intangible capital of the company, and it has created techniques for codifying and measuring it. The primary output of strategic competence management (Kirjavainen & Laakso-Manninen, 2000) is to create ways to perceive company's strategy and competition (e.g. Hamel & Prahalad, 1994; Stalk et al., 1992; Ulrich & Lake, 1990). The concept of the Learning organization (e.g. Senge, 1990) is connected to competence management discussion, but it is more of a holistic development philosophy of an organization than a coherent theory.

The community-based stream of literature views knowledge and knowing as embedded in communities and groups of people, instead of in the minds of individuals, and thus studies communities as the main social structures for the creation and sharing of knowledge and competence. These ideas are represented by scholars like Lave and Wenger (1991), Brown and Duguid (1991; 1998), Wenger (1998), and Gherardi et al. (1998).

Learning that takes place in projects and communities may develop into competence and knowledge. The concepts of knowledge and competence occur simultaneously but also overlap, as two sides of the same coin. However, competence has been viewed to contain other elements as well, such as skills, experience, value judgements and social network (Sveiby, 1997).

2.1.1 Knowledge in project-based environments

Cook and Brown (1999) refer to two epistemologies. The epistemology of possession treats knowledge as something people possess. This view which places knowledge in the heads of individuals reflects the Cartesian tradition, which separates the mind and the body. This is reflected in many definitions of knowledge, such as "knowledge originates and is applied in the minds of knowers" (Davenport & Prusak, 1998, p. 5). The epistemology of possession places individuals over groups and ranks explicit knowledge over tacit knowledge. However, knowing as action calls for an epistemology of practice,

as the former epistemology cannot account for the knowing found in individual and group practice (Cook & Brown, 1999). The focus in the epistemology of practice is in knowing. Cook and Brown (1999) further distinguish individual from the group and propose all forms, tacit/explicit and individual/group should been seen as separate, distinct forms of knowledge. They see explicit and tacit conceptually separate and they cannot be converted into each another, as suggested by Nonaka and Takeuchi (1995). Discussion on communities of practice reflects the epistemology of practice. This stream studies how individuals establish themselves and function as a group by engaging in practices which are unique to or characteristic of that group (Cook & Brown, 1999).

Following a similar epistemological distinction, Ahonen et al. (2000) propose, following practice-based theories, that there are two generations in the discussion of knowledge management. The first generation is characterized by using an individual as the unit for mapping and enhancing knowledge and defines knowledge as discrete skills which thus uses external, outsider's point of view in the analysis of knowledge and competences. As the second generation, Ahonen et al. (2000) propose that knowledge is viewed embedded and constructed in collective practices. Communities of practice -perspective shifts the focus of knowledge from formal, abstract and individual to informal, collective and social in nature, as well as situated and context-dependent (Lave & Wenger, 1991). Tacit knowledge is shared through participation and social interaction (Wenger, 1998). The first and second generation approaches have different theoretical roots, and are different approaches to knowledge and competence rather than different generations.

The classical definition of knowledge defines it as "justified true belief" (Niiniluoto, 1989), following a concept introduced by Plato. This definition distinguishes knowledge from mere belief, mistake and hypothetic guess. Our belief of truth of something does not constitute our true knowledge if there is a chance that our belief is mistaken (Nonaka & Takeuchi, 1995).

Basically, distinction between data, information, and knowledge has been made in knowledge management literature (e.g. O'Dell & Grayson, 1998; Davenport & Prusak, 1998; Dixon, 2000). Data is described as facts and figures, without a context and interpretation (O'Dell & Grayson, 1998, p. 5). Information has been described as data that is "in information", which means data that has been sorted, analyzed, and displayed, and is communicated through spoken language, graphic displays, or numeric tables (Dixon, 2000, p. 13) or patterns of data (O'Dell & Grayson, 1998, p. 5). Finally, knowledge has been defined as information in action (O'Dell & Grayson, 1998, p. 5). Information becomes knowledge when it is interpreted by individuals and given a context (Nonaka et al., 2000a).

Epistemologically, knowledge has been referred to as tacit and explicit knowledge (Polanyi, 1966; Nonaka & Takeuchi, 1995). Polanyi (1966) first referred to tacit knowing by arguing "we can know more than we can tell" (p.

4). All people possess tacit knowledge. Polanyi describes tacit knowledge as being constructed from our experience in the world. Tacit knowledge is personal, context-specific, and hard to formalize and communicate (Nonaka & Takeuchi, 1995). Niiniluoto (1989) relates tacit knowledge with a skill: a child learning to speak has tacit knowledge of the rules of the grammar, even though no one has specifically taught him. A child is able to act according to them, even though he is not able to formulate and express their content. Therefore, according to Niiniluoto (1989), tacit knowledge is non-verbal in opposition to verbal or prepositional knowledge, which is expressed in the form of a declarative sentence.

Nonaka and Takeuchi (1995, p. 8) further segment tacit knowledge into two dimensions. The technical dimension encompasses the kind of informal and hard-to-pin-down skills or crafts encapsulated in the term "know-how". The cognitive dimension consists of schemata, mental models, beliefs, and perceptions so ingrained that they are taken for granted. A considerable amount of the expert's knowledge is tacit (Polanyi, 1966). Tacit knowledge is "sticky" in nature, which refers to the difficulty to explicate, absorb and apply it to new situations (Brown & Duguid, 2000). Tacit knowledge can only be shared through direct experiences, which go beyond individuals (Nonaka et al., 2000a). Nonaka et al. (2000a) refer to socialization as the process of converting new tacit knowledge through shared experiences. They see that socialization occurs in a traditional apprenticeship, where apprentices learn the tacit knowledge required in their craft, and also in informal meetings outside the workplace. Explicit knowledge refers to knowledge that is transmittable in formal, systematic language (Nonaka & Takeuchi, 1995). Wenger (1998) argues though that explicit and tacit knowledge are constituents of the same process and classifying knowledge as explicit or tacit runs into difficulties, as they are both present to some degree. Based on Polanyi, he refers to an example of bicycle riding. People who know how to ride a bike often cannot articulate how to keep the balance. Yet the skill of riding cannot be classified totally as tacit, as people are able to tell that you must, e.g., pedal and steer. Wenger (1998, p. 69) argues that classifying knowledge then becomes a matter of deciding what counts as explicit, and that depends on the enterprise we are involved in. Cook and Brown (1999) refer to the same bicycle riding example whereas neither type of knowledge is neither a variant of the other nor can do the work the other cannot. Therefore neither one can be made out of or changed into the other. They may, however, be used as an aid in acquiring the other, that is, explicit knowledge can be used as an aid to help to acquire tacit knowledge of riding a bicycle, but it cannot by itself enable one to ride.

Knowledge and knowing are not competing, but rather complementary and mutually enabling (Cook & Brown, 1999). As knowledge is static, it is necessary to see it as necessary to action. Accordingly, the term knowing is used to refer to the epistemological dimension of action itself and is something that is part of action rather than used in action or necessary to action. Knowledge is something that is possessed and therefore static, as knowing is

dynamic, concrete, and relational (Cook & Brown, 1999). Schön (1987) uses the term knowing-in-action to refer to the sorts of know-how we reveal in our intelligent actions, which are publicly observable physical performances. Knowing is in the action, and we are unable to make it explicit. Sometimes it is possible to make descriptions of what is "tacit knowing" by making observations. However, those descriptions are constructions, attempts to put into explicit knowledge, thus static, whereas knowing-in-action is dynamic. The process of knowing-in-action involves surprises, something that may fail to meet expectations. Subsequently we may reflect-in-action, as our thinking serves to reshape what we are doing while we are doing it. The processes of knowing-in-action and reflecting-in-action are processes we can deliver without being able to say what we are doing.

Knowledge has been viewed as context-specific, dynamic, relational and humanistic, thus created in social interaction and related to human action (Nonaka et al., 2000a; Nonaka et al., 2000b). Learning is related to both concepts of knowledge and competence. Learning related to knowing can be seen as an act of acquiring knowledge (Cook & Yanow, 1993).

This study, based on the community of practice perspective (Lave & Wenger, 1991; Wenger, 1998), ranks the epistemology of practice over the epistemology of possession (Cook & Brown, 1999). Knowledge and knowing are viewed in the context of projects and related communities. Individuals and groups are viewed as two entities. Cook and Brown (1999) argue that individuals and groups each carry out epistemic work the other cannot. Following Orr's (1996) example of service technicians of the copy machine, it is the individual technician who knows how a certain machine runs, yet it is a group of technicians who possess stories about various problematic situations and how to overcome them. In both cases, domain is possessed by in partly the individual and in partly the group. Even though individuals act in the groups, knowledge and knowing as concepts are referred to as a concept that resides primarily within a group of people and is developed collectively in the activities of a project group or a community. Therefore the primary level of analysis in this study is on a project group or a community level. Activities and collective work in the group are vital, as collective knowledge is developed and maintained by acquiring shared understanding of what the group is all about and what it does. Yet the focus is simultaneously placed also in the individuals, as actors in these groups. Knowledge is not seen as entirely collective phenomenon.

2.1.2 Organizational and collective competences

In the resource-based view of the firm, the concept of competence is connected to the business strategy. Competences have been described as corporate or organizational competences (e.g. Turner & Crawford, 1994) or more precisely core competences (Prahalad & Hamel, 1990; Hamel & Prahalad, 1994). Competence management has been seen as a way and means to implement business strategy. As strategic competences are mainly realized at the

organizational level, there are groups and individuals who are central in implementing them in the company. On the other hand, competences as a collective concept (e.g. Hansson, 1998; Sandberg & Targama, 1998) view them as embedded in groups and existing in a social context. Several authors (e.g. Lave & Wenger, 1991; Brown & Duguid, 1991; Weick, 1995) have pointed out that even if it may be the individuals who possess knowledge, these individuals are participants in a collective community.

Basically, there are both rationalistic and interpretative, or phenomenographical, approaches to competence (Sandberg, 1994; 2000). Organizational competences (e.g. Prahalad & Hamel, 1990; Turner & Crawford, 1994; Hamel & Prahalad, 1994) reflect the rationalistic approach, while collective competence (e.g. Hansson, 1998; Sandberg & Targama, 1998) represents the interpretative approach. In the rationalistic approaches, human competence is seen as being constituted by a specific set of attributes, such as knowledge and skills needed and used in performing particular work. In contrast, the interpretative approach suggests that the meaning work takes on for workers in their experience of it constitutes the competence (Sandberg, 1994; Sandberg, 2000).

Competence as seen by the set of attributes may be criticized. The rationalistic operationalizations of attributes into quantitative measures may result in abstract and narrow, as well as simplified descriptions, which often do not represent the complexity (Norris, 1991; Sandberg, 1994; Sandberg, 2000). Many approaches tend to predefine what constitute the competence (Sandberg, 2000). Sandberg (2000) argues that there are two reasons why the rationalistic approach produces attributes lists. Firstly, rationalism is based on the dualistic view of the reality. Human being and reality are viewed as separate. It is possible to research both separately and subsequently combine the findings. Similarly, as discussed in the section of knowledge, ranking explicit knowledge over tacit knowledge reflects the same dualism. Attribute lists contain explicit knowledge, as they are based on visible and measurable competence. They also emphasize individual competence, as individuals are assumed to possess the competence. Secondly, rationalism is based on the objective view of the reality, according to which there is an objective reality outside the human consciousness. These two aspects together produce indirect competence descriptions. Dualism separates a human being from his work and the objective view of the competence sees the work achieved by a person as separate from his understanding of the work. Brown and Duguid (1991) criticize many organizations that assume that complex tasks could be mapped onto set of simple, Tayloristic, canonical steps that can be followed without any need of significant understanding of insight.

The interpretative approach views individuals in the context in which they act and work. As competence does not consist of two separate entities, worker and work are seen to constitute one entity through the lived experience of work (Sandberg, 2000). Competence is constituted by the meaning the work takes on

for the worker in his or her own experience of it (Sandberg, 1994). Competence therefore is necessarily context-bound. The starting point for analyzing the competence therefore is the worker and the way he has experienced his work and related competence. Rationalistic and interpretative approaches as argued by Sandberg (1994; 2000) reflect similar epistemological roots as suggested by Cook and Brown (1999) concerning the epistemologies of possession and of practice. The epistemology of possession reflects the rationalistic view, as it is the individual who is seen to possess competence. Both views are based on dualism. On the other hand, the epistemology of practice and practice-based theories are necessarily interpretative and based on the lived experience. As a practical implication the interpretative approach calls for taking the point of departure in the experience of the worker. Rationalistic framework may be used to explain this experience with prior, general knowledge, but priority is placed on the interpretation of the worker himself. This study takes as its point of departure the experience the members of project teams and communities have on knowledge and competence. Therefore it involves interpretative features. The used framework of competences is only provisional and used as a stimulus in the interviews to help the respondents name tag their experiences.

Virkkunen (2002), in accordance with Ahonen et al. (2000), refers to a transformation of competence and knowledge management. Focus in the so-called second-generation approach is in the creation of new competences and in communities and networks that create and maintain these competences, while the first generation approach mainly focuses on mastering the present tasks on an individual level, which corresponds to what Sandberg calls the rationalistic approach. The second generation focuses on collective competence at the community level and how new competence and new ways of action are created in cooperation with many parties.

Organizational aspects of competence

Discussion on competence strategy has emphasized the importance of organizational level competences and their role in creating sustainable competitive advantage (e.g. Prahalad & Hamel, 1990; Helledoid & Simonin, 1994). In order to bring competitive advantage, competences must align with business strategy. Customers help a company focus on a strategy; then the company aligns competences to deliver strategy (Ulrich, 1998). The distinctive structure of competence applies to a combination of competences, which gives the organization a competitive advantage (Turner & Crawford, 1994). These views perceive competences as assets similar to other assets, such as machinery and capital.

Organization level competences are seen independent of individuals and embedded in an organization's systems, mechanisms and processes and diffused in its people, technology and structures (Turner & Crawford, 1994). Clearly defined and well-formulated procedures are created for supporting the work performance. Organizational competences as structural capital are partly independent of individuals, as they remain in the organization even when the

employees leave (e.g. Sveiby 1997; Turner & Crawford, 1994). Being independent of individual persons refers to what Turner and Crawford (1994) call corporate competences.

The discussion of organizational level competences has been going on since the 1950's. The concept of distinctive competence can be traced from the studies of Selznick (1957), Snow and Hrebiniak (1980) and Prahalad and Hamel (1990). These authors write about the core competences of the organization. Turner and Crawford (1994) refer to distinctive corporate competences, which are owned by the organization and apply to any combination of basal competences, which gives the organization a competitive advantage and can therefore be viewed as strategic.

Hamel and Prahalad (1994) view core competences as cross-organizational and delivering customer-value. They are largely tacit assets resulting from collective learning in the organization. They represent an integration of a variety of individual skills and this integration is the distinguishing hallmark of a core competence (Hamel, 1994). Helledoid and Simonin (1994) define a core competence as a capability, which encompasses an organization's unique human, physical, organizational and coordinating resources and it is interrelated with the concepts of organizational learning and sustainable competitive advantage.

Tuomi (1999) criticizes Hamel and Prahalad's definition, as it only includes proven and validated assets, and therefore the idea of strategic development of new core competences is somewhat contradictory. He also sees the organization-wide nature of competences ambiguous. Javidan (1998) argues that Hamel and Prahalad's definition of the core competence is problematic in two ways. Firstly, it is too narrow, since it only focuses on a limited aspect of the company's value chain, mostly in manufacturing, ignoring possibilities in other steps throughout the value chain. Secondly, the definition has generated confusion in the relationship between competences and capabilities. Stalk et al. (1992) have differentiated between the two. Whereas core competences emphasize technological and production expertise at the specific points of the value chain, capabilities are more broadly based, encompassing the whole value chain. Capabilities are more visible to the customer. Capabilities are collective and cross-functional. A capability is a set of business processes strategically understood. A capability has also been viewed as a company's resource, in addition to physical and intangible resources, where it is embedded in a company's routines processes, and culture (Collis & Montgomery, 1995). Day (1994, p. 38) has defined capabilities as "complex bundles of skills and collective learning, exercised through organizational processes, that ensure superior coordination of their functional activities. But, according to Day (1994), only some processes will lead to competitive advantage. Strategically significant processes are the ones that provide superior value to customers, are hard to imitate, and render the organization more adaptable to change. This definition corresponds to the characteristics of core competences (Hamel &

Prahalad, 1994). Achieving on-going adaptability requires the creation of a set of metacapabilities (Liedtka, 1999). These metacapabilities provide the kinds of skills and knowledge that underlie the process of capability building itself (Liedtka, 1999). Further, metacapabilities must be coupled with a particular set of business-specific capabilities (Liedtka, 1999), so that the three above-mentioned conditions (Day, 1994) can be satisfied.

Organizational, or strategic competences, hardly ever reside in one business unit. Mechanisms that are used to connect these competences are required. The concept of constellations of communities of practice (Brown & Duguid, 1991; Wenger, 1998; Tuomi, 1999) connects the community literature to the discussion of organizational competences, as they may be seen to explain how competences are combined in a company to produce capabilities. Competences are dispersed in various parts of the organization, and various communities of practice correspond to these competences. The constellations of interacting and overlapping communities of practice coordinate with each other to enact capabilities that depend on multiple competences (Snyder, 1997).

Collective competence

Authors, mainly representing the interpretative approach (Sandberg & Targama, 1998; Hansson, 1998), have described collective competence at the group level as implying to a group's ability to work together towards a common goal. In the course of joint action or practice, a group creates a set of inter-subjective meanings that are expressed in and through their artefacts (Cook & Yanow, 1993). Collective competence is not related to one individual person, but instead resides in the groups of individuals. The aspect of collective learning and competence on a group level has become important as work is organized more often in groups and it is the constellations of people that form the basis for being and acting in organizations. In this research, collective competence is analytically separated from the strategic, organization level competence, which is collective in nature as well. In this study, collective competence is viewed, as suggested by Hansson (1998), both as a group's ability to solve a problem together to achieve the intended tasks and as interpersonal competence. Collective competence resides in the groups and communities of people and is viewed as a group level concept.

In order to organize collective work we have to understand what collective competence is about and how it is constituted. One aspect of the human capacity to act is the ability to act in groups (Cook & Yanow, 1993). Furthermore, the ability of the group is called collective competence. Competence in this respect is referred to as an ability to work together as a collective towards a goal. Collective competence is conclusively the phenomenon of a group to work towards a common task in a sufficient way (Hansson, 1998).

On the analytical level, Hansson (1998) focuses on two dimensions: the group's interactive process and the group's work towards a given goal. In

practice, these dimensions are integrated with each other when the group is working toward a task. Collective competences include, according to Hansson (1998), both the group's ability to solve a problem together and interpersonal competence that creates the ability to work together with different individuals.

Hansson (1998) defines the dimensions of collective competence as practical and interpersonal competence. Practical competence is primarily directed towards the task, which means the group's ability to solve problems together. It could be described as the ability to handle the assigned task in a proficient manner. This develops through practice in actual working situations. It can be described as a learned skill, working routines and the way to solve practical problems, but also as thinking chains and reasoning. It is always related to how the task should be accomplished. Interpersonal competence is different from the way social competence is usually defined in the literature. It means the capability to integrate with other members in the group and is always related to accomplishing the task directly or indirectly. Sympathetic competence, instead, includes all kinds of social interaction not related to accomplishing the task. It includes, e.g., coffee breaks and playing football at work. It is merely socializing without any practical, direct work-related purpose.

A collective competence is realized as a group works together with a special task or purpose. Group is a collective in which an individual cannot accomplish the whole task alone. Each field requires special kind of competence. Competences have to be put together to cooperate. A project group can organize its work the same way as, for example, a football team: unique competences represented in a group are put together. This may result in a data system which one person alone could not have developed or even understood it in its complexity, but as a collective the group succeeds in developing it. Firstly, it is a question of time. Carrying out the task alone requires more time. Secondly, it is seldom possible for any one person to possess all the competences needed (Sandberg & Targama, 1998).

Cook and Yanow (1993, p. 381) present an example of collective competence in making flutes. One should perform his role in the whole entity in order to get the flutes to sound like they should:

> The knowledge has been learned collectively, not individually. It is true that each flute maker knows how to perform his or her individual tasks, but the know-how required to make the flute as a whole resides with the organization, not with the individual flute maker because only the workshop as a whole can make the flute. This is demonstrated by the fact that flute makers have left one of the workshops, the knowledge needed to make the flutes has not been lost to the organization, as evidenced in the sameness of play and feel of the instruments produced by that workshop over the years.

Cook and Yanow's example presents how the flute makers keep the competence within the company, in spite of people being exchanged over the years the flutes still have their particular sound that the brand is known for. This is due to the fact that the organization, not an individual flute maker,

possesses the know-how and ability to make its own particular style of instrument. Collective learning is a collective activity rather than an individual one.

Shared understanding of the work forms a basis for collective competence (Sandberg & Targama, 1998). Therefore, in order to achieve the task in question people must have a shared understanding of their work. Therefore the process, by which the shared understanding is achieved, is essential in developing collective competence. Shared understanding is created in the meaning process, in which the members participate. Shared understanding can only be reached through social interaction and negotiation (Tynjälä, 2000). In order to be able to join and work in the community of practice, people need to have a shared understanding of the domain of knowledge the community is all about thus emphasizing that it is a matter of joint enterprise (Wenger, 1998). Membership is also a matter of mutual engagement and includes shared ways of doing things together.

Sandberg and Targama (1998) argue that collective competence can emerge only through socialization. This means both how an individual learns and develops his competence and also how the whole group develops and maintains its competence. Essential components of collective competence are not only in the heads of individuals. They become shared by communicating them, by sharing the common language, by understanding the rules, norms and circumstances, which are the basis of working together. For example, in apprentice-master relationship the communication between the two is important in order for the apprentice to be able to enter the collective competence. Communication is not just oral, but also tacit, such as body language.

Schein (1995) argues that dialogue is a basic process for building common understanding. It allows people to see the hidden meanings in words, first by seeing such meanings in one's own communication. The group gradually builds a shared set of meanings that make higher levels of mutual understanding and reactive thinking possible. In the process people build a common experience base, which allows them to learn collectively. The more a group reaches collective understanding, the easier it becomes to reach a decision and implement decisions constructively. The main purpose of the dialogue (Isaacs, 2001) is to reach a new understanding, which forms the basis for thinking and acting in the future. It enhances the capability to think together. People have to understand things from one's own point of view, but as well from the others'. Dialogue with colleagues is a form of reflection, where one's own and the others' understanding of the same work is reflected (Sandberg & Targama, 1998).

Previously, I have discussed competence primarily as a collective phenomenon. Similarly knowledge has been viewed as collective knowledge, referring to the type of performance that a group, or many individuals, can only perform together. People have to draw from each other's knowledge and apply their

collective knowledge. Empirical study of Orr (1996) suggests that communities of practice hold and share knowledge collectively because of their shared practice. Technicians rely on the collective knowledge of the technicians, developing the collective knowledge base by sharing war stories about problematic situations. Kolbotn (2004) refers to his empirical studies on volunteers in the Lifeboat Institution. He argues that it is based on the volunteers' collective and embedded knowledge in the work practices that enables them to responsd quickly in crisis situations. This type of collective ability to perform together to achieve the fulfillment of a task could also be called collective competence, as it reflects the group's collective ability and includes both practical and interpersonal competence, as suggested by Hansson (1998). Collective knowledge and collective competence as concepts are overlapping.

This study deals with knowledge and competence of project groups. Much of their knowledge and competence are developed and applied collectively. Collective competence based on the interpretative approach (Hansson, 1998; Sandberg & Targama, 1998) and community of practice literature (Lave & Wenger, 1991; Brown & Duguid, 1991; Wenger, 1998; Gherardi et al., 1998; Gherardi, 2001) share similar theoretical ground. Knowledge is embedded in groups and communities and learning involves interaction, and meaning making. Gherardi (2001) proposes an interpretative approach to learning, as she sees learning as an interpretative device. Competence and knowledge are viewed as a group level phenomenon, and the concept of collective competence and knowledge serves for the analytical purposes defining the required competence and knowledge. This does not, however, imply, that all competence is held collectively, yet it is always the individuals who act in organizations. Organizational actions are always based on human competence at work in such a way that enables the organization to remain viable (Sandberg, 2000). The idea of the existence of a totally collective competence and knowledge argues against human intuition, as technical competence involves features that are held individually, yet there are types of technical competence that requires the entire group. Nevertheless it is misleading to consider various levels of competences as hierarchically developed or as aggregate sums of each other. The problem of distinguishing levels of knowledge and competence is acknowledged, and different levels of analysis are used for analytical purposes, as in practice it is difficult to define the difference between organizational, collective and individual competence.

2.1.3 Project-specific knowledge and competences

This section provides a brief review on project-related knowledge and competence areas. A lot of attention has been paid to project management and project competences in the literature, but much of that knowledge is subjective, with little foundation in research (Crawford, 1999). The methodologies used to evaluate competences in projects are based on the performance-based approaches (Crawford, 1999) and reflect the competence areas defined in

standards, such as "*A Guide to the Project Management Body of Knowledge*" (PMBOK, 1996). They are mostly based on the rationalistic approaches of competence. Standards are practitioner-based and designed for the purposes of companies organizing project-based work. A more holistic approach viewing the project group as a collective working together towards defined goals is required, as even if it is the individuals who act in groups, it is the group as a whole who fulfils the task together.

Project management knowledge areas are defined by many standards, and usually divided into multiple project management knowledge areas, such as the management of integration, scope, time, cost, quality, human resources, communications, risk, and procurement (PMBOK, 1996). Additionally, competent project managers have been described by different attributes in literature, as a key aspect in a project's success are the competences of the project manager (Frame, 1995). The core skills are mostly seen in the areas of budgeting, scheduling, and resource allocation, as well as on the key tools related to those areas, such as scheduling networks and resource-loading charts (Frame, 1994). These areas emphasize the management of the project leaving little space for the questions of leadership.

However, there is also evidence that *leadership* and human skills are one of the most critical competence areas of project work (e.g. Webb & Vielvoije, 1999; Zimmerer & Yasin, 1998; Crawford, 2000; El-Sabaa, 2001). Leadership in projects is a challenging task of coordinating all parties involved, who may have varying motivations and goals. Project work involves temporary, cross-functional teams. The temporary nature of projects, coupled with the heavy reliance on borrowed resources, presents project managers with major leadership challenges (Frame, 1999). Generally project managers have little direct control over the resources, as they are borrowed. Frame (1999) argues that this feature distinguishes project leadership from leadership in general. In networked structures, which are similar to project structures, leadership is required not only to bring order to chaos, but also to find new innovative possibilities for arranging activities. Thus leadership must be seen as a process for developing and enhancing the activities of the entire network (Järvenpää & Immonen, 1999).

Communication involves a substantial body of knowledge that is not entirely unique to the project context. Communication involves several dimensions, such as written and oral, internal (within the project) and external (customers etc.), formal and informal, and vertical and horizontal (PMBOK, 1996). Building personal relationships between people is a necessary condition for successful teamwork. The role of communication is emphasized in networked organizations, where vertical and lateral communication flows must be complemented by the flows between various organizations (Järvenpää & Immonen, 1999). People from different backgrounds and with different experiences with communication need to understand each other.

The success of a project requires clearly defined *processes and procedures* and involves both seeing the project as an entity and as parts that are integrated. A project needs to be conceived as a whole, including purpose and goals and whether they are being achieved (Frame, 1994). Järvenpää and Immonen (1999) argue that networked business in this sense requires new types of competences. The long value chain forces everyone to see the value of his or her own work in the value chain. In practice, this means taking bigger responsibility of one's own work and understanding the value it creates to the entire value chain. Virkkunen (2002) argues that perceiving the wholeness requires interdependencies of different operations and an ability to anticipate which effect each action has on other parts. Therefore a worker who only "does his share" might be a risk factor.

Interest groups are both internal and external (Hall, 1992; Pinto & Rouhiainen, 2001) and include various networks of the organization. Networking is essential especially in large organizations in order to achieve synergy (Hall, 1992). Members of internal networks in project-based organizations include top management, accountants, other functional managers, and the project team (Pinto & Rouhiainen, 2001). External networks with customers, suppliers, government agencies, research institutes, and even competitors are needed to monitor the changing environment (Hall, 1992).

Project-related knowledge management has not been widely discussed in the literature. Lessons learned within and between projects, and practical project knowledge concerning both successes and failures should be continuously examined (Frame, 1995; Crawford, 2002). Both codification and personalization strategies (Hansen et al., 1999) apply to project knowledge management. Personalization concerns conveying lessons learned within and between projects. Many ways to convey the lessons learned are informal. These include passing knowledge to new staff, upper levels of management, and to fellow project managers when they ask for advice or during informal sessions (Frame, 1999). Crawford (2002) separates collecting, integrating, and organizing project information in a project information system as a task belonging to project integration management. These tasks represent the codification strategy in knowledge management (Hansen et al., 1999). PMBOK (1996) refers to project communications management, which includes tasks as generation, collection, dissemination, storage, and ultimate disposition of project information. It is seen to provide critical links among people, ideas, and information which are necessary for success.

Project success is largely defined by customer satisfaction. Customers of the project may be hard to identify since they are multiple, being both internal and external (Frame, 1994). Managing customer satisfaction in projects involves identifying who the customer is and understanding what leads to customer satisfaction (Frame, 1994). Customer needs get the project started, and requirements are created on the basis of the project team's understanding of

them (Frame, 1995). Besides customer feedback, cooperation, networking, and learning from customers' businesses are also emphasized (Artto, 2001).

The project team as a whole must possess collective competences to fulfill the task together, and this has been called a team competence (Frame, 1999; Crawford, 2000). It is not evident, though, that the various individuals who play a role in the project see themselves as parts of a larger entity, a cohesive team, because a project team is often an abstraction as the team members see only parts (Frame, 1994). Frame (1999, p. 8) defines the team competences as "those traits that enable teams to operate quickly and cost-effectively and develop superior solutions to problems". People working together have a chance to achieve results that no one could achieve alone. Crawford (2000) defines the competence of a project team as the project management competences of the project team members plus social knowledge and experience of the team to commonly create "the Big Picture", to produce synergies, to solve conflicts, and to ensure learning in the team.

Methodologies to study project knowledge and competences

This section describes some methodologies that have been used to study project knowledge and competences. However, the main difficulty is that they are difficult to quantify (Crawford, 2000). In the literature, much has been written on the competence requirements and the body of knowledge of project management. Most of these writings are practitioner-based and reflect the practical needs of project-based work. Most are more or less handbooks or standards. Much the research findings have mainly been based on collective opinions (Crawford, 2000). Behind the main stream of literature there is an assumption that project management standards describe the requirements for effective performance of project management, and those who meet the standards perform effectively. The methodologies used to evaluate competences in projects have been based on the performance-based approaches (Crawford, 1999) and reflect the competence areas defined in standards, such as "A Guide to the Project Management Body of Knowledge" (PMBOK, 1996).

Most studies have been quantitative in nature (e.g. El-Sabaa, 2001; Zimmerer & Yasin, 1998; Crawford, 2000; White & Fortune, 2002), either by asking to assess the importance of various given competence areas or by asking open-ended questions.

Crawford (2000) conducted a research to explore the relationship between performance against project management standards, and performance in the workplace. She used five instruments: The first one was used to gather general demographic information about the respondents and their project management role. Two were used to collect information on project management knowledge and practice of participants: A knowledge test and the self-assessment. Finally, two instruments were used to gather information on the perceived effectiveness

of project management performance. These were a self-rating questionnaire and a supervisor-rating questionnaire.

Questionnaires to capture the experiences of project managers and project group members have been used (e.g. Edum-Fotwe & McCaffer, 2000; Crawford, 2000; White & Fortune, 2002). Much of the research has been conducted on the relation of critical success factors and project management competence. Competence has to a great extent been seen to relate to the success factors. Firstly, the competence is in itself a factor in successful delivery projects, and secondly, the project managers need to have competence in those areas that have the most impact on successful outcomes (Crawford, 2000). Crawford (2000) studied what factors typically contribute to the success. This emphasized the competence of the project managers. White and Fortune (2002) delivered a questionnaire to identify common criteria used for defining project success and to establish a list of critical success factors, to explore the extent to which projects give rise to unexpected side-effects, as well as to identify the methods, methodologies, tools and techniques used.

In the study of El-Sabaa (2001) 85 project managers from a variety of public and private sector organizations were asked open-ended questions. They were asked to describe the personal characteristics, traits and skills of the best project manager they knew. Edum-Fotwe and McCaffer (2000) applied the interview technique and a structured questionnaire in their survey study on effective project management competency. The questionnaire was developed by employing the outcomes of the interview phase and other criteria identified from literature.

Concern for the competence of projects and project managers has given rise to standard and certification processes that can be used for assessment, for recognition and as a guide for development of project management competences (e.g. PMBOK, 1996). Standards primarily relate to what managers are expected to know. There are also standards that address what project managers are expected to be able to do, such as the occupational or performance based competency standards. There have also been some attempts in the standards to identify personal characteristics of effective project managers. The main interest has however been in required knowledge and skills, rather than in personal characteristics. The assumption behind the standards is that they describe the requirements for effective performance of project management in the work place and those who meet the standards, will perform effectively. Standards have also brought forth scales and tests to evaluate the competence, such as knowledge tests and self-assessments (Crawford, 2000). Standards view competence and knowledge context-free. Handbooks of project competences (e.g. Frame, 1999) and standards (e.g. PMBOK, 1996) are assumptions of the generic competence and view all competence and knowledge as generic. This very much reflects the rationalistic approach of competence, as described by Sandberg (2000), which seems to dominate the research on project competence.

However, though competence is very much context-dependent and situational, same kinds of competence areas appear in project contexts. This usually involves the generic body of knowledge required in performing work. There is, to some extent, generic competence requirements in projects, as suggested by many authors and researchers (e.g. Gareis, 2000; Crawford, 2000; El-Sabaa, 2001).

This study discusses competences both as phenomena at the project group level and at the individual level. However, I do not intend to provide an individualistic attribute list of required competences, but rather a description of the competence needs within a project group. Therefore, some of the competences are collective in nature and cannot be performed by one individual, but require the cooperation of the group, while some, such as technical competences, may be performed by an individual. Project knowledge and competence involve several areas, which are distinguished for analytical purposes, but in practice are intertwined. A loose framework based on the study of project competences is presented in figure 3.

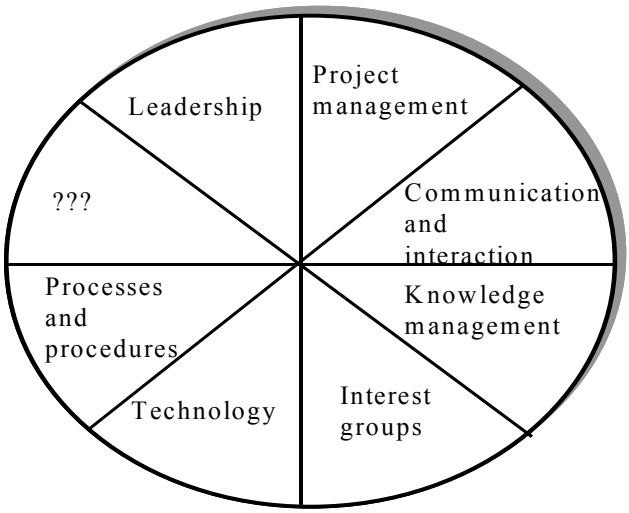

Figure 3 Competence and knowledge areas in project-based environment, based on the literature (e.g. Crawford, 2000)

2.2 Organizational structures

2.2.1 Formal and informal structures

Organizational structures are used to divide up activities to achieve specific organizational goals. These activities are coordinated and controlled to achieve the aims of the organization. This refers to an organization as a structure and assumes that organizational activities can be designed and controlled. Further, organization structure has been seen as "more than boxes on the chart; it is a pattern of interactions and co-ordination that links the technology, tasks and human components of the organization to ensure that the organization accomplishes its purpose (Duncan, 1979, p. 59). Yet the focus is in formal organizational structures.

Since early organization studies there has been a lot of research on the interdependence of formal and informal phenomena in organizations. Early studies, by Taylor, Weber and Fayol, emphasized the rationally designed, formal structures and tended to consider the organization separate from its environment. Organization was seen as a closed system. Though aware of the informal organization, they tended to ignore the existence of informal aspects. Tayloristic "scientific management" attempted to program every move of the worker into tightly managed routines to overcome the disturbing factors. Hawthorne studies (Roethlisberger & Dickson, 1939) can be seen as early empirical analysis of informal organizations, and they placed a focus on groups as important units of analysis. These studies sought to explain the existence of the social organization that determined much employee behavior in the bank wiring room. The point of departure was, however, the formal organization, as informalities were considered to create problems in the formal organization. They considered as well the organization apart from its environment. Barnard (1954) argued that interaction in informal organizations is based on personal rather than joint or common purposes and this gives rise to formal organizations, which are necessary to any large informal or societal organization. Formal organizations, once established, also create informal organizations, which are necessary for the operation of formal organizations as a means of communication, cohesion, and protecting the integrity of an individual.

Formal organizations are designed more or less intentionally to perform certain tasks in order to achieve goals in the context of particular assumptions about the relevant operating conditions (Chisholm, 1989, p. 20). They have been consciously designed by senior management to maximize efficiency (Huczynski & Buchanan, 2001). Informal organization has no such legal rationale for existence. It is not considered part of the design of organizations, yet it is pervasive factor in the life of organizations (Chisholm, 1989). Informal organization refers to the network of relationships that spontaneously establish themselves between members of the organization on the basis of their common interests and friendships. These are formed across functions and divisions

(Krackhardt & Hanson, 1993). The concepts of the formal organization and the informal organization have been mentioned in order to distinguish these two forms.

There are major differences in the way relationships are shown in the organizational charts and in the way they are lived in practice. The main problem with formal organizational charts is that they are static and do not show the changing aspects of organizational life, neither do they show the informal, social relations that exist between company employees (Huczynski & Buchanan, 2001). Personal relationships and networking change the image of an organization, which is very different from the classic corporation and it is hard to capture what the complex working roles are in a formal organizational chart (Nardi et al., 2000).

The concepts of open and closed systems have been used to describe the connection of an organization to its environment (von Bertalanffy, 1971). A closed system is independent of its environment and no material enters or leaves it. An open system, on the contrary, is continually in contact with its environment, importing and exporting and therefore involving a change of components. Boundary is essential in an open system, as it is the exchanges at the boundary, both import and export, that enable an open system to maintain its dynamic equilibrium (de Board, 1988). If an organization is viewed as an open system, there are constant boundary crossing activities taking place between the so called formal and informal organizations. This also results in the difficulty of assessing these two as separable; they overlapp.

De Board (1988) argues that an organization is a complex system of interrelated departments, processes, and people. There is a boundary between the “inside” of the organization and the “outside”, although different people may locate these boundaries at different positions. An open system exists within an environment and must continually import energy, materials, and people from that environment. It maintains a steady state only as long as it continually changes and adapts to the forces outside. Put into business terms, it develops and maintains its effectiveness as long as it reacts to the changing needs of the market and of the society in general.

Lillrank (1988, p 120 – 121) discusses the dimension of informal – formal and he refers to the extent a situation is tied to a larger set of procedures. Furthermore he refers to the ceremonial – casual dimension, which refers to the extent certain commonly known rules or sequences of action are followed. Lillrank combines these two dimensions, into four different types of situations occuring in organizations:

> *Ceremonial* and *formal*: Board meetings with an agenda.
>
> *Ceremonial* and *informal*: Japanese situations like Quality Control Circle meetings and conferences.
>
> *Casual* and *formal*: A non-sense decision making situation with no fixed agenda: "corridor talk" between decision makers.
>
> *Casual* and *informal*: Most everyday encounters between friends and colleagues.

Lillrank (1988) introduces Quality Control Circles as parallel organizational structures of small groups of workers from the same workshop that meet to discuss the improvement of the quality of their work. They are most typically ceremonial – informal, as the content of the situation is informal, but there are clear rules about how meetings, conferences, and the presentation of suggestions should proceed (Lillrank, 1988). They function as part of a hybrid parallel organization operating with different premises than the formal organization and the formal organization of workers (Lillrank, 1988, p. 252).

The socio-technical systems approach focuses on the interrelation between the technological and the social structures in an organization and how each influences one another. The major components within an organizational system are the technological aspects concerning the machinery, the particular method of working, and the social aspects that involve the interpersonal relations between the employees (de Board, 1988, p. 96). These components are interlinked with each other and changes in one will automatically cause changes in the other. The whole system is perceived as a "socio-technical" system and its total effectiveness depends on the balance achieved with the social and the technological components.

The traditional dichotomy between communal or colleagual and rational or administrative forms of work organizations offers a definition in which to view the formal and informal (Van Maanen & Barley, 1984). Theories of organizations have adopted the administrative work organizations, community literature has been seen to represent the former. Work organizations differ from communities, which are bound together by shared interest in a certain domain of knowledge (Wenger, 1998). Vartiainen et al. (2004) argue that it is primarily the need for communication that creates organizational structures. Accordingly, Wenger (1998) argues that there are two views to an organization: the designed organization and the practice that gives life to the organization. The designed organization is called "institution" to distinguish it from the organization as

lived in practice, which gives life to the organization and is often a response to the designed organization. Both aspects contribute to making the organization what it is. Indeed, the organization itself, according to Wenger, could be defined as the interaction of these two aspects. Organizations are social designs directed at practice. It is through the practices they bring together that organizations can do what they do. Brown and Duguid (1998) propose for the conceptualization of an organization as a community of communities, acknowledging the many non-canonical communities in the midst. Wenger (1998) also views an organization as a constellation of communities of practice, and through these communities of practice an organization knows what it knows and becomes effective and valuable as an organization. Brown and Duguid (1998, p. 97) argue that most formal organizations are "hybrid groups of overlapping and interdependent communities". Nonaka et al. (2000b) view an organization as a knowledge creation entity and conceptualize the firm as a dynamic configuration of ba. They refer to the concept of ba as the context shared by those who interact with each other. The concept of ba will be discussed in more detail later on.

Brown and Duguid (2000) contrast the formal view of the structured organization (corresponding what Wenger (1998) calls designed organization), which they call the process view, with the informal and improvisational, which they argue, determine the success or failure of organizations. This is what Wenger (1998) calls the organizations as lived in practice. A downsize is when practice allows itself to evolve too independently and becomes too "coupled" to the organization. The balancing act requires a developing coupling system loose enough to allow groups to develop their own knowledge, but tight enough to be able to push that knowledge along the lines of process (Brown & Duguid, 2000, p. 115).

Tuomi (1999) suggests that organizations should be viewed as fractal communities and proposes a community view on organizations to understand learning, competences and knowledge generation in them. He argues that organizations in their complexity have multiple units of analysis, which are relevant for knowledge management in organizations. He distinguishes between bounded and open units. Bounded are conceptualized as autonomous entities that are agents for action, and they can be given responsibilities, goals and effects. Open units, on the other hand, are extended and unbounded and their membership is fluid and not well defined thus they have fuzzy boundaries. They are open as they couple lower-level units with higher-order units. Table 1 presents a summary of open and bounded units (Tuomi, 1999).

Table 1 Levels of analysis and bounded and open units (Tuomi, 1999, p. 261)

	Bounded	**Open**
Unit	Individual	Human-in-society
Unit group	Team	Community
Meta-unit	Organization	Society

Nonaka and Takeuchi (1995) describe the relationship between business units, project teams and knowledge base as a hypertext organization that is a structural base for organizational knowledge creation. They refer to different interconnected layers or contexts of an organization: the business system, the project team, and the knowledge base. The key characteristic is the ability of members to shift contexts. The business-system layer refers to the layer where normal, routine operations are carried out, and it is structured as a hierarchical and formal structure, and refers to the formal organization. In the project team layer multiple project teams engage in knowledge-creating activities, and bring together a variety of actors across the business system. The knowledge-base layer does not exist as an actual organizational entity, but is referred to as embedded in corporate vision, organizational culture, or technology. Organizational knowledge is generated and forms a connecting layer between the other two layers. Tuomi (1999) has viewed the knowledge-base layer as a set of communities of practice. He refers to the knowledge-base as a social meaning processing space, where knowledge is actively processed and created.

This study adopts the community-based view of the organization. The level of analysis, besides a project group, is a community, which is viewed, following Tuomi (1999), as an unbounded unit. Organizations are seen as dynamic, open systems interacting with their environment. Organizational structures cannot be separated from their context. Also, formal and informal organizations are not seen as dichotomies or opposite to each other, but as overlapping structures. Communities as seen in this study vary in their formality and in their relationship with the host organization. Some involve characteristics of the formal organizational structures, while some are informal and based solely on the interests of their members.

2.2.2 Project-based environments

Due to the growth of knowledge intensiveness, projects have become more common as a way of managing operations, as projects as operational devices suit knowledge intensive operations in a networked business environment (Artto, 2001). Projects as network structures relate to the concept of a virtual company (Kujala & Artto, 2000). A projecet-based environment in this study refers to a project-based organization, which is defined as “an organization in which the maturity of products are made against bespoke designs for customers” (Turner & Keegan, 1999, p. 59). Project-based organization is

distinguished from functional organization (Turner & Keegan, 1999). Turner and Keegan (1999) argue that as the design of the functional organization is underpinned by a strong theoretical base (classical management theory), the design of the project-based organization does not have such a solid theoretical base.

Projects

Projects are defined as "one time-efforts that produce a unique product", whereas portfolios are "collections of projects that fit into an organizational strategy and include the dimensions of market newness and technical innovativeness" (Githens, 2002, p. 84). Organizations are often multi-project environments, where several projects constitute a major part of the business and several project assignments are under implementation simultaneously (e.g. Frame, 1995; Gareis, 2000; Turner, 1999; Engwall, 2000b). In multi-project environment, most of the projects are usually small and fairly standardized (Engwall, 2000a).

Projects come in many forms and sizes and in almost any kind of organizations (Figure 4). Research has shown that projects are different from each other, they may not be entirely unique, but they are sufficiently unique to defy specialization (Lampel, 2001). As they can be unique or repetitive, they may be large or small, and they are performed simultaneously (Engwall & Sjögren Källqvist, 2000). The larger share of tasks in companies' "ordinary operations" are categorized as projects, and they can complement permanent functional organizations. In many manufacturing companies a major part of the operations are defined as projects. Larger projects bring together a wide variety of actors, such as developers, customers, financing institutions, regulatory agencies, contractors, designers, and suppliers (Lampel, 2001) forming networked structures. A project-based organization may use internal projects, e.g., for developing internal activities, or external projects that are used for delivering business solutions (Artto, 2001).

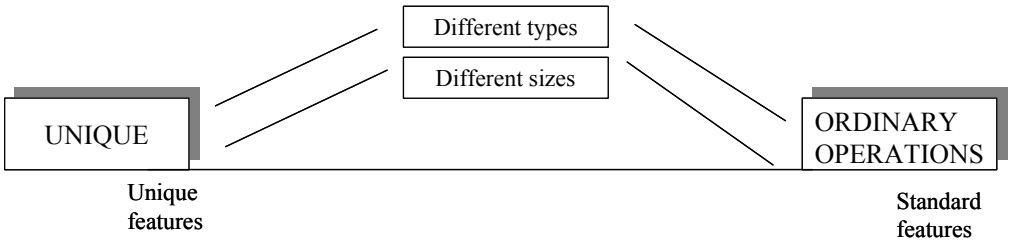

Figure 4 The spectrum of projects

Projects are complex working systems where many components have to be in balance. Complexity in organizations comes in many forms. Senge (1990) describes detail complexity, also having two components. Firstly, large things with many components have many connections that must be maintained between the components. The bigger a project team is the more relationships exist between members and the more complexity is involved. Secondly, the

sheer size of something makes it difficult to comprehend. Frame (1994) argues that projects tend to be more and more complex and have large volumes of information. Change contributes to two facets of complexity. Firstly, it leads to an increase in information which organizations must deal with. Knowledge grows over time. Secondly, change increases options. Complexity makes projects challenging to coordinate and manage, especially concerning issues of knowledge and competence, as they are intangible and tacit to a large extent. Additionally, they tend to be context-specific.

Project life cycle

As temporary structures projects have different phases and life cycles. The project life cycle can be broken into pieces in many ways. Regardless of the approach, the main point is that projects are dynamic, continuously evolving work systems.

According to Frame (1995) the dynamics of a project's life cycle begins with the needs that have to be fulfilled. Since resources are scarce, projects have to be selected and defined carefully. A project's plan defines how to reach the intended goals. Project milestones, tasks, and their interdependencies are identified. The plan undergoes continuous modification. The implementation phase includes carrying out the project. As the project is being implemented, project managers continually monitor progress and practice control. Both control and evaluation serve as important feedback functions. However, there are major differences. Evaluation takes place only periodically, whereas control is more or less continuous. Evaluation is more concerned with the big picture, whereas control is interested in details. Finally, evaluation is done by those not participating in the project, whereas control is carried out by the project manager as one of his tasks. Projects come to an end and will be terminated, but the duties still continue in the form of final reports. Maintenance follows termination, however, this is not included in the project life cycle.

Project characteristics

Few characteristics in a given project define what the project is all about (modified from Maurer, 1996; Frame, 1995; Frame, 1999; Gareis, 2000; Pinto & Rouhiainen, 2001):

Goals

Projects are goal oriented and directed at achieving specific results. This has implications for project management: one important feature in managing projects is to identify relevant goals. The given goals can be subdivided

Planning

Projects include one or more planning phases. By planning, goals are divided into sets of activities outlining who they are carried out by and when each will be performed.

Interrelated activities

Projects involve the coordinated undertaking of interrelated activities. Projects are complex systems that entail carrying multiple activities that are related to each other. A whole project is made up of interrelated parts.

Alternative decisions

For every problem, there are alternative solutions.

Several actors

Several actors must cooperate and act together. There are different categories of project players, such as project manager, project team member, project owner, sponsor, technical personnel, functional managers overseeing the efforts of the technical personnel, and support staff. Projects are also part of larger contexts involving networks of actors and stakeholders.

Temporary systems

Projects are temporary systems with beginnings and ends. Usually when the goals are achieved the project ends.

Constraints

The constraints of the project management are time, money and specifications. The time constraint deals with establishing deadlines and working with schedules. Money constraints handle the budgets. Specifications describe what the project should look like and what it should do.

Distributed conflicts

Decomposition of the top-level goal into sub-goals for different agents might lead to conflicts.

Unique undertakings

This varies from project to project: sometimes a project designs standard features of a product and sometimes something completely unique.

Specific characteristics of projects pose challenges in project-based environments. Especially three characteristics define the challenges for this research: temporary nature of projects, their cross-organizational nature as they cross organizational boundaries, and the way people in projects are dispersed in organizations. As temporary systems a lot of learning and knowledge are lost when projects disband. Some of the acquired knowledge is shared through databases, e.g., on the form of intermediate and final reports, based on the codification strategy (Hansen et al., 1999). A lot of knowledge, e.g., knowledge that is embedded in action and tacit in nature, is difficult to share in a codified form. Therefore knowledge needs to be shared during the project's lifetime by interacting with other actors in the project's environment. Schindler and Eppler (2003) discovered in their empirical study on project learning, that continuous project learning through regular reviews became a success factor of projects. Learning was more difficult to recall retrospectively and the procedural knowledge was easily forgotten. Projects are often virtual and people are dispersed, usually in multiple locations and even in many countries (Vartiainen et al., 2003). The cross-organizational and dispersed nature of projects isolates peers from each other and communication and interaction is needed in the projects' lifetime to enable peers to stay connected to each other across projects' boundaries. In this study, the personalization strategy (Hansen et al., 1999) is proposed as a starting point to encountering the challenges brought by the typical characteristics of projects.

2.3 Work groups in organizations

Communities are considered groups and studied as groups in this study. Communities are groups of people with a shared interest in a domain of knowledge, interacting on an ongoing basis and aware of their membership in the community. This section briefly discusses the characteristics of work groups in general.

People as social beings have the need to interact and connect with each other. Several organizational benefits of group working have been identified in literature, such as enabling organizations to learn, promoting to quality management, innovation, and reducing production time (Mohrman et al., 1995) as well as contributing to the member well-being (McGrath, 1991; McGrath & Argote, 2001).

Characteristics of groups

Brown (1988, p. 2) suggests that "a group exists when two or more people define themselves as members of a group and when its existence is recognized by at least one other". Huczynski and Buchanan (2001, p. 277) refer to the importance of social relations, and define psychological groups as "two or more people, in face-to-face interaction, each aware of his or her membership in the group, each aware of others who belong to the group and each aware of their positive interdependence as they strive to achieve mutual goals". Groups have also been seen to have common characteristics such as a shared sense of collective identity, shared goals, and group structure (Huczynski & Buchanan, 2001, p. 278). Groups involve awareness of the membership and therefore are distinguished from an aggregate as a collection of people. Groups are characterized by their interdependence: members are usually interdependent as one's experience, actions and outcomes are linked in some way to the others in the group (Brown, 1988). Lewin (1948) already recognized the meaning of interdependence in the formation and functioning of groups. He defined a group as a dynamic whole based on interdependence rather than on similarity. He argued that groups exist in a psychological sense as "it is not the similarity or dissimilarity of individuals that decides whether two individuals belong to the same or to different groups, but social interaction or other types of interdependence (Lewin, 1948, p. 184). The purpose of the existence of a group is based on task dependence, as the rationale for the existence is defined in terms of some common goal or objective (Brown, 1988). Becoming a member of a group embodies the reciprocity of the individual and the group: changes occur both in the individual and in the group. An individual experiences changes when entering the group, and the group has to adapt its new members.

Group structure is defined by Sherif and Sherif (1969, p. 150) as "an interdependent network of roles and hierarchical statuses". Role and status differentiation refer to the positions occupied by the individuals in the group (Brown, 1988). Roles in the group may be very specific in circumscribing behaviors, and other roles may be more generic, e.g., through movement

through distinct membership roles, such as a newcomer, a full member, an old-timer (Hogg, 2001). The structure of a group will be affected by a group's process, which refers to the patterns of interactions between the members of a group (Huczynski & Buchanan, 2001). A structure of a group and the group process will affect each other.

Groups have various sequential development stages (Tuckman & Jensen, 1977). The proposed model suggests that groups go though stages of forming, storming, norming, performing, and adjourning. The model assumes that these stages are sequential and groups need to go through them in order to develop to its highest state. The model has been criticized, as it is based on the subjective experiences of the group leaders and not on empirical research (Niemistö, 1999). Niemistö (1999) argues though that the model can be applied to the development of temporary work groups and educational groups.

Types of groups

The dichotomy of formal – informal is presented in the group literature and organizational behavior has often been seen as a continuum from being formally to informally organized. Informal groups have been seen arising out of propinquity, friendships, and other non-work bases, and as such are contrasted with formal groups, which are initially created by organizations for the purpose of fulfilling organizational missions (Guzzo, 1996). Formal groups are formed through the division of labor in formal organizations. Huczynski and Buchanan (2001, p. 290) argue that formal groups have certain characteristics: they are task-oriented, permanent, have formal structure, are consciously organized by management to achieve organizational goals, and their activities contribute directly to the organizations collective purpose. Informal groups, on the other hand, emerge from the informal interaction of the members of the formal organization, and emerge in the formal organization and are neither anticipated nor intended by those who create the formal organization. Group literature mainly discusses the formal work groups. Community and network literature, instead, focuses primarily on informal groups. Langley (2002) places the forms of work groups in a continuum. Project teams are result-driven, time restricted and involve formal management. They are tightly coupled and goal directed. Communities of practice are knowledge-driven, and have specilization delimited forms involving less formal management. Communities of interest are interest-driven with few restrictions and involve little management. They are loosely coupled and not goal directed.

Both external and internal, as well as "top-down" and "bottom-up" forces, operate in the formation of groups. McGrath and Argote (2001, p. 610) argue that these forces result in various forms of groups. Concocted groups are top-down or designed groups impelled by outside forces (e.g. a manager). Founded groups are top-down or designed groups impelled by inside forces (e.g. persons who will become members). Self-organized groups are impelled by bottom-up or emergent forces and internal forces. Circumstantial groups are impelled by

the situation, an external force, and the formation of a group is emergent or bottom-up. Lillrank (1988) refers to spontaneous, voluntary, or obligatory groups.

People working towards a common goal are gererally called work groups or teams. Guzzo and Dickson (1996) have defined work groups as groups of individuals who are seen by themselves and by others as a social entity. They are interdependent as they perform their tasks together. Thus they are embedded in larger social systems and perform tasks that affect others. The concept of a team is distinguished from other work groups. According to Katzenbach and Smith (1993) a team involves a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable. Task forces are kinds of groups created to solve problems (Lillrank, 1988; Guzzo & Dickson, 1996). Lillrank (1988) defines a team as a task force to solve a certain problem. All in all, work groups, teams and task forces are distinguished concepts from communities.

Functions of groups

McGrath (1991) argues that groups involve multiple functions. They make contributions to systems at each of the three levels:

1. To the systems in which they are embedded (e.g. an organization)
2. To the component parts, that is, their members, and
3. To the group, as an intact and continuing social structure.

Three functions are respectively distinguished analytically. McGrath (1991) and McGrath and Argote (2001) refer to the production function, membership function and group-well-being function.

Andriessen et al. (2001) use McGrath's functions of a group to describe the success of a group. A group is successful to the extent that it contributes (through its output) to the effectiveness and innovation of the organizational context (production function). Secondly, a group is successful to the extent that its activities contribute to its attractiveness and continuation (the group's well-being function). Finally, a group is successful to the extent that membership is rewarding for the individual group members. Individual members are only motivated to co-operate in a group if they can find personal outcomes such as satisfaction, learning new experiences, payment, and experience a feeling of belonging to the team (the member support function).

The dynamic interaction model

The interaction and outcomes of a group have been described by Andriessen et al. (2001) and Andriessen (2003) in the dynamic group interaction model (Figure 5). According to the model, the success of any group (outcomes) depends firstly on the way group members interact (five processes plus feedback), and, secondly, on the characteristics of the setting (context), i.e., characteristics of the individuals, the group, the tools and the environment. These characteristics, however, are not static but can change continually, particularly in the early stages of a group. The interaction processes in a group change the context-characteristics of the group, thereby leading the group through certain 'life cycle stages'. In this dynamic perspective, context characteristics such as the group task or trust and cohesion are both conditions for and output of group processes, depending on the moment of observation.

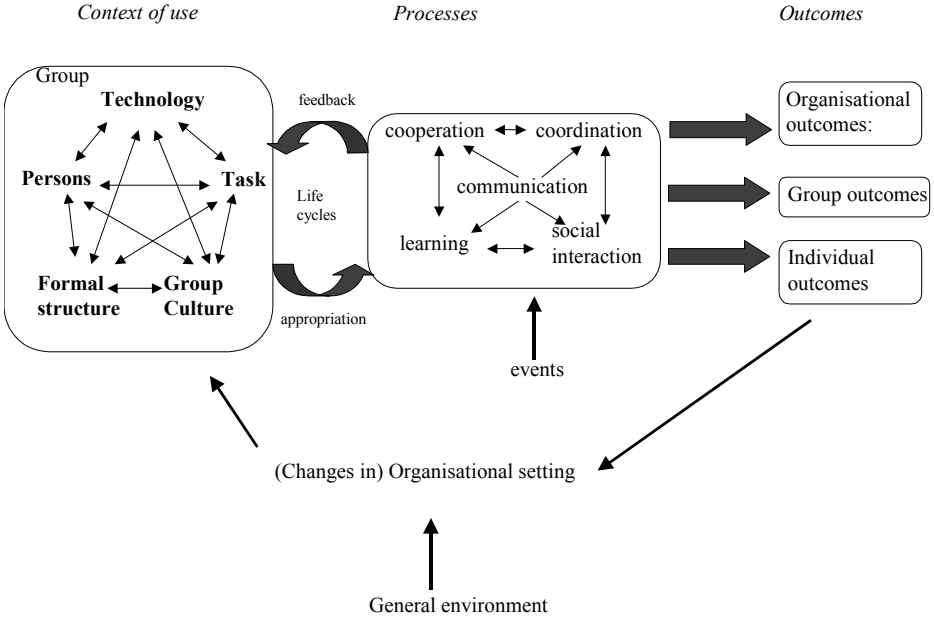

Figure 5 Dynamic Group Interaction Model (Andriessen et al., 2001; Andriessen, 2003)

The model is based on McGrath (1984). McGrath argues that the central feature of a group lies in the interaction of its members, therefore the group interaction process is the centrepiece of the model. He distinguishes major classes of inputs: properties of group members, properties of the standing group (group structure), properties of the task/situation, and properties of the surrounding environment. Participants come into a group interaction with their "properties" (e.g. characteristics and beliefs) and some of them may affect group interaction, so they need to be taken into account. Also, patterns of relations between members, as an aspect of group structure, need to be considered. Further, group interaction takes place in certain environments, which includes both physical and social aspects. They may effect how members behave, hence can alter the group's interaction process. In addition to the context, group interaction involves the group doing something. Group

interaction can be characterized by the task or the tasks the group or its members are trying to carry out. This affects the group interaction process as well. These major classes are the forces that shape the group's interaction process. The interaction process itself is both the result of these forces and the source of some additional forces. The group interaction is additionally patterned by forces internal to the interaction process itself. The interaction process and its results may potentially lead to changes in the input conditions, that is, changes in the members themselves, in the group structure, or the patterns of relations among members, and in the relation of the group to its tasks and to its environment.

In summary, Johnson and Johnson (1994, p. 58 – 59) present five essential components for successful cooperation in groups, which reflect the characteristics of groups:

Positive interdependence

> Members feel they need each other and are linked with other in such a way that it is not possible to succeed alone and working together involves mutual benefits.

Face-to-face promotive interaction

> The group intends to achieve shared understanding of the domain by interacting, helping each other, and by exchanging material etc.

Individual accountability

> Each member also has individual responsibility and shares in achieving the mutual goal.

Social skills

> Contributing to the success of a cooperative effort requires interpersonal and small-group skills.

Group processing

> The group reflects its activities and discusses how well they are achieving their goals and maintaining good working relationships.

However, a group does not only constitute a meeting place, or a context to achieve goals, but also a context for learning. Group members as individuals, through their active participation in the life of a group and shared reflection on their own experiences and learning, add knowledge and renew skills and competences that are fundamental for the support of their own capability (Battistelli & Picci, 2003). The construction of a real and virtual learning group has been considered as an innovative place for the development of new knowledge and competence. This study proposes that communities in project-based environments provide such a context for learning and knowledge sharing. Communities as groups are informal as opposed to to formal groups,

which are task-oriented, permanent, have formal structure, and are consciously organized by management to achieve certain organizational goals. Informal groups emerge from the informal interaction of the members of the formal organization and are not necessarily anticipated by those who create the formal organization, yet they may be designed. This study adopts a view that these groups are emergent and as such, designed. The needs and goals may be both organizational and personal.

2.4 Social structures as communities

Nonaka et al. (2000a) argue that knowledge is created through the interactions among individuals or between individuals in their environments, rather than by an individual operating alone. Basically, it is the social nature of learning (Wenger, 1998) and the need for interaction (e.g. Cross et al., 2001) that creates social networks between people. Cross et al. (2001) discovered that a significant component of a person's information environment consists of relationships he or she uses for information needs. People as knowledge sources were used twice as often as other categories, such as PC archives, Internet, K-Base and others. They argue that relational qualities that promote effective knowledge sharing between people are knowledge, access, engagement and safety. Knowing what someone else means is a prerequisite for seeking out a specific person. Additionally, one wants to gain timely access to what that person thinks. Finally, willingness to engage in problem solving and safety in the relationship are required for effective knowledge sharing. Many people emphasize the centrality of personal relationships and networking for the success of their work (Nardi et al., 2000). Yet it is common that people do not know what others know, which hinders the collaboration. Mechanisms that build this awareness of who knows what, and what projects and knowledge activities are taking place within different departments and communities are needed. Social interaction may have various forms, besides face-to-face communication; people may communicate virtually.

The term social structure is used in this study to cover social forms that are both emergent and designed in organizations. Social refers here to groups of people interacting with each other. The term social structure covers social forms, which together act as more or less a stable and organized framework within which basic needs of the individual may be met (Wilson et al., 1990). Social structures cover a wide range of structures from economic to kinship, and they are external to the individual. Social phenomena of small group activities in organizations have been defined as "any group of people operating within the framework of a formal host organization" (Lillrank, 1988, p. 23). Social group activities exist within a formal organization, although they may to some extent be independent from it. The relation to the host organization is the variable that defines much of the social form of a social group activity.

2.4.1 Potential communities

Community building often starts as informal interaction. In this study, social interactive networks and enabling communication spaces as contexts for interaction are considered as potential communities (Figure 6). Community is the central concept for studying social structures in project-based environments in this study. Therefore other related concepts are studied in relation to this concept and reflected against it. It is worth mentioning though that networks are not necessarily generally defined as potential communities, as they have been distinguished from communities as being looser sets of relationships.

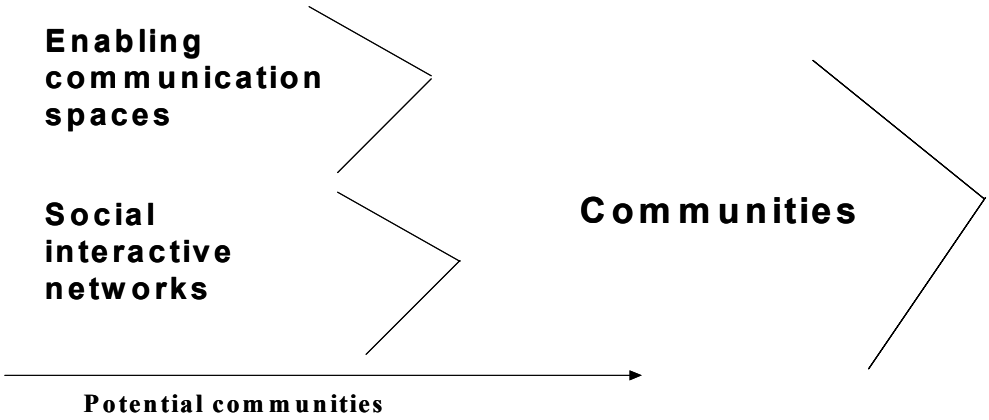

Figure 6 Potential communities

Social networks as platforms for community development

Social networks enable informal community development. They consist, more or less, of people continually in communication with one another (Davenport & Prusak, 1998). Informal communities as social structures emerge from those social networks that exist in an organization or between them. Wenger et al. (2002) argue that community development often begins with an extant social network. Important topics attract an informal group of people who begin networking. Communities usually start as loose networks that hold the potential of becoming more tightly connected. Networks may be detected, e.g., by conducting a formal or informal social network analysis to identify who are involved in the networks and how strong the ties are (Scott, 1991). Relations are central to network analysis because they define the nature of the communication connections between people, groups, and organizations (Monge & Contractor, 2000, p. 441).

Historically, organizational scholars have made important theoretical and empirical distinctions between formal and emergent networks (Monge & Contractor, 2000). Emergent structures have been seen as more important to study than formal ones, because they are seen to better promote an understanding of organizational behavior (Monge & Contractor, 2000; Krackhardt & Hanson, 1993). There are streams of communication network theories. Communication networks are described as (Monge & Contractor, 2000, p. 440):

> The patterns of contact between communication partners that are created by transmitting and exchanging messages through time and space.

They take many forms in contemporary organizations, including personal contact networks, flows of information within and between groups, strategic alliances between firms, and global network organizations (Monge & Contractor, 2000).

The term “network” implies that relations among network members are significantly looser than the ones within a community of practice (Brown & Duguid, 2001). All people within a network will never know of one another

and yet are capable of sharing a great deal of knowledge. They are more or less sets of relationships. They also may remain invisible to others who are not involved in them. As the informal networks of people with ability and passion to develop competences already exist in organizations, the challenge is to identify them and help them to develop (Wenger & Snyder, 2000).

Krackhardt and Hanson's (1993) study revealed three types of emergent relationships, which formed informal networks in organizations: advice networks, i.e., who depends on whom to solve problems and provide information; trust networks, in which employees share potential information and back each other in a crisis, and communication networks, in which employees regularly talk to each other on work-related matters. They are formed across functions and divisions, and do not respect the organizational boundaries and do not respect the formal reporting relationships or authority (Krackhardt & Hanson, 1993).

Nardi et al. (2000, p. 3) refer to intentional networks, intentional reflecting the effort and deliberateness with which people construct and manage personal networks. They see a community of practice as a more encompassing and general concept than intensional networks. Wenger (1998) draws attention to the general process of learning and defines the community of practice to describe large sociological categories, whereas Nardi et al. (2000) focus on more specific forms of workplace practice. In Wenger's definition central points are negotiation of meaning, shared identities, and common language. The social landscape in intensional networks is different, as people do not share a backdrop of common experience and constantly adjust their language to suit different audiences and relationships (Nardi et al., 2000). This makes them more heterogeneous than communities of practice, as they also include people who may share little in common with each other (Nardi et al., 2000). Communities of practice have their focus at the community level, whereas intentional networks are the creation of individuals, yet these people need to create a collectively constructed understanding (Nardi et al., 2000). Nardi et al. (2000) argue that communities of practice usually point to a specific place such as a classroom or an office (as an example they present Orr's, 1996, copier repair people) and are characteristic of more traditional offices such as those devoted to clerical work, and not as distributed as intentional networks. However, much study on virtual communities of practice, that do not mainly rely on face-to-face communication or a specific place, has been conducted (e.g. Rheingold, 1993; Johnson, 2001; Palloff & Pratt, 1999). In fact, research on dispersed, virtual communities has emerged as a strong stream among community research.

Dixon (2000, p. 9) describes intentional problem-solving networks, which are designed to help groups to solve problems more efficiently and faster. "Peer Assist Program" in British Petroleum enables a team that is working on a project to call upon another team (or a group of individuals) that has had experience in the same type of task. The teams are temporary networks and

meet face-to-face for one to three days to work through the issue. Knowledge networks focus on knowledge exchange between members. They have been described as social networks referred to as "a specific set of linkages among a defined set of actors, with the additional property that the characteristics of these as a whole may be used to interpret the social behavior of the actors involves" (Enkel, 2002, p. 10).

Nonaka and Takeuchi (1995) argue that formal and informal communication networks in Japanese companies are used as organizational devices to increase and maintain redundancy. Redundancy is referred to as the existence of information that goes beyond the immediate operational requirements of organizational members (p. 80). Sharing redundant information promotes the sharing of tacit knowledge, because it helps people to sense what others are trying to articulate.

Networks are generally described as looser than communities. They may be based on ad hoc relationships and are therefore very informal (Krackhardt & Hanson, 1993). Yet they may involve an ongoing process to keep the network working. Nardi et al. (2000) refer to three tasks which workers constantly do to keep the network going: building a network by adding new nodes (people) into it; maintaining the network by keeping in touch with extant nodes, and activating selected nodes at the time the work is to be done. Mutual engagement defines a community of practice, it is not just an aggregate of people, and a set of relationships, and therefore not a synonym for a group, a team, or a network (Wenger, 1998). It is not defined merely by who knows whom as in a network of personal relations. Communities of practice need mutual engagement and development of shared identities, whereas networks do not necessarily engage its members in mutual meaning making.

The concept of network has been used to describe multiple types of relationships in network theories. In this study networks are viewed as relationships between people, or between different groups, both within and between organizational entities. Networks between companies or larger global networks are beyond the scope of this research. Based on the relationships of people and groups of people, networks are labelled social interactive networks. These types of networks are necessarily social and interactive, as social implies the social nature of doing and interactive refers to interactions and communication that take place between the members.

Spaces as contexts for community development

Organizations may promote community development by providing time and space, which enables communication. People communicate naturally in informal spaces, usually without the traditional hierarchies of an organization. Hallways and cafeterias are generally considered as active spaces for informal communication.

Nonaka and Konno (1998) distinguish ba from networks as a space, where information resides. Ba is a specific time and space, where knowledge is

created in the organization. The most important aspect of a ba is interaction, as knowledge is created through interactions among individuals and with the environment (Nonaka et al., 2001). It is dynamic in nature (Nonaka & Konno, 1998). Ba is a context for knowledge creation, it sets a boundary for interactions among individuals, yet its boundary is open (Nonaka et al., 2001). Ba is complex and ever-changing in nature (Nonaka et al., 2000a). Ba can be understood as a "platform" where knowledge creation occurs (Tuomi, 1999). Knowledge is embedded in ba, where it is then acquired through one's own experience or reflections on the experiences of others. Knowledge is context-bounded, and if separated from ba it becomes merely information (Nonaka et al., 2001). Ba is a place where information is interpreted to become knowledge, as contexts provide the basis for the interpretation of information to create meanings (Nonaka et al., 2000a). Knowledge creation cannot be free from context, as social, cultural and historical contexts provide the basis for individuals to interpret information to create meanings (Nonaka et al., 2000a).

Nonaka and Konno (1998 p. 40), define ba as:

> A shared space for emerging relationships. This space can be physical (e.g. office, dispersed business space), virtual (e.g. e-mail, teleconference), mental (e.g. shared experiences, ideas, ideals), or any combination of them.

Ba can be built intentionally, or they form spontaneously (Nonaka et al., 2000a). Forming a task force would be, according to Nonaka et al., an intentional building of a ba. Accordingly, intentional forming of a community could be considered as an intentional ba. However, spontaneous ba holds potential as a platform for a community development, as it may be based on shared interests of people who are taking part in it.

Nonaka and Konno (1998) introduce four types of ba, which correspond to the four phases of knowledge conversion in the SECI model. In Originating ba individuals share feelings, emotions, experiences, and mental models. This corresponds to the socialization phase in the SECI-process. Physical, face-to-face experiences are the key to conversation and transfer of tacit knowledge. Interacting ba is more consciously constructed, and it is the place where tacit knowledge is made explicit, so it represents the externalisation process. Through dialogue, an individual's mental models and skills are converted into common terms and concepts. Cyber ba is the space for interaction in a virtual world instead of real space and time, and it represents the combination phase. Exercising ba supports the internalisation phase. Active participation rather than teaching based on analyses is stressed, as the exercising ba facilitates the conversation of explicit knowledge to tacit knowledge.

Referring to the concept of the space metaphor, Dixon (1997) uses the metaphor of hallways of learning to describe the temporal spaces where collective meaning in organizations is made. This means that meaning is constructed in the dialogue that takes place between organizational members. The fundamental assumptions on hallways, i.e., ordinary people thinking

together are able to generate problem solving with many potential solutions, is based on the view that in human systems, meaning is constructed rather than discovered. Hallways of learning require interaction and discussion. Hallways reject hierarchies, as it is more effective if organizational members talk with each other as equals. Diversity and multiple perspectives foster collective learning. Dixon sees hallways also as a shared experience of interacting in new ways. Hallways may be intentional and may take the form of meetings and conferences, as well as processes to facilitate learning and discussion or integrating mechanisms for dispersed members in organizations.

Networks and spaces are referred to as contexts for community building in this study, as communities often emerge from social networks or as a result of the interaction of people with shared interests within a shared space. However, not all networks need to develop into communities, as they may have purposes that are better served as looser sets of relationships. Similarly, not all interaction in various spaces will lead to community building. But potentially they may develop into social forms that involve characteristics of a community. Therefore they are, for the purposes of this study, referred to as potential communities.

2.4.2 Communities as professionally defined groups

The concept of communities is discussed by various scientists and practitioners. In management studies communities have received attention in the field of knowledge management, innovation, and work place learning. Wenger et al. (2002) argue that communities as social structures have existed as long as people have had the need for communication and interaction. More formally, there were corporations in ancient Rome and guilds in the Middle Ages. Originally Lave and Wenger (1991) used the concept of community of practice as a context for apprenticeship learning and referred to legitimate peripheral learning to characterize this type of learning. They extended the traditional connotations of the concept of apprenticeship to participation and identity transformation in a community of practice. Later on the concept of community of practice has been extended to apply to various settings even without the apprenticeship relation. Many companies have adopted the concept, perceiving groups and teams belonging to the hierarchical past (Huysman, 2002).

Communities emerge and exist in their host organization. Communities as social structures cannot be understood in isolation, without their relations to the larger activity system (Tuomi, 1999). Therefore they need to be supported in relation to the organization and other communities. Learning in communities is seen as a social process, and a fundamentally social phenomenon (Wenger, 1998) rather than something that takes place in an individual's head or being a sum of individual learning processes. Learning in communities is discussed in more detail in chapter 2.5.

In most studies (e.g. Lave & Wenger, 1991; Brown & Duguid, 1991; Wenger, 1998; Liedtka, 1999) communities are conceptualized as informal and emergent groups in organizations. However, they have also been described as intentionally created and highly managed (e.g. Botkin, 1999; Storck & Hill, 2000). Communities have been viewed as social structures that are able to combine work, learning and innovation (Brown & Duguid, 1991). This section discusses some of the conceptualizations of communities.

Communities as occupationally and professionally defined groups

Communities have been to a large extent studied as occupationally and professionally defined groups, e.g., midwives (Lave & Wenger, 1991), flutemakers (Cook & Yanow, 1993), service technicians (Orr, 1996), and claims processors (Wenger, 1998).

Professions are seen as occupational communities (Van Maanen & Barley, 1984). These communities differ from other lines of work and from each other by the virtue of the relative autonomy each is able to sustain within their society. Van Maanen and Barley (1984) refer to the dictonomy in literature between communal or colleagual, and rational or administrative form of work organizations. Representing the former dictonomy, they discuss occupational communities. They define (p. 287) an occupational community as:

> A group of people who consider themselves to be engaged in the same sort of work; whose identity is drawn from the work; who share with one another a set of values, norms and perspectives that apply to but extend beyond work related matters; and whose social relationships meld work and leisure.

Opening up this definition requires further discussion, based on the ideas of Van Maanen and Barley (1984). “A group of people who consider themselves to be engaged in the same sort of work” refers to boundaries of a community. Van Maanen and Barley (1984) argue, referring to the ideas of Gusfield (1975), that the relevant boundaries of an occupational community are those set by the members themselves. Crucial parameters therefore for identifying communities are the social dimensions used by the members themselves for recognizing each other, the social limits of such bonds, and the situational factors which amplify or diminish the perceived community identity. Community is composed of members who consider themselves “to be” members of the same occupation rather than people who “are”. This distinction is of theoretical and methodological significance as the social organization of an occupation is seen by insiders, which usually differs from what is seen by outsiders. The fact is that many communities are not seen by outsiders, only by those involved as members.

Van Maanen and Barley (1984) argue that the second definitional feature refers to social identity. Members derive valued identities or self-images directly from their occupational roles. Members create role special signs, which serve as indirect evidence of identification with occupation and these are

demonstrated by distinctive costumes and jargon (Van Maanen & Barley, 1984).

The third definitional feature is the reference group (Van Maanen & Barley, 1984). Members take other members as their primary reference group and the membership comes to share a distinct pattern of values, beliefs, norms, and interpretations for judging the appropriateness of one another's actions and reactions. Members make use of the collective perspective.

The final attribute is the blurring of the distinction between work and leisure activities within occupational communities. The leisure activities may be connected to one's work or there may be an extensive overlap between work and social relationships. The point, according to Van Maanen and Barley, lies in the tight network of social relationships created when members of an occupation seek close relationships with one another outside the workplace.

Occupational communities are seen to create and sustain relatively unique work cultures, consisting of, among other things, task ritual, standards for proper and improper behavior, work codes surrounding relatively routine practices and, for the membership at least, compelling accounts attesting to the logic and value of these rituals, standards and codes (Van Maanen & Barley, 1984, p. 287). Occupational communities transmit to new members shared occupational practices, values, vocabularies, and identities (Van Maanen & Barley, 1984), and form a context for apprenticeship learning. In this sense occupational communities are conservative in preserving and transmitting the existing work practices rather than creating new ones.

Orr (1996) has described the work practice of service technicians. They make sense of the world and solve problems by communicating with other technicians across formal boundaries. Conversation reflects their understanding of their work and the world of service, and it creates their world and their identities. However, Orr points out, that it is not the talk or identity which is the goal for the technician's practice. The actual goal is to get the job done, keep the customers happy, and keep the machines running. The telling of narratives concerning problematic situations demonstrates and shares the technician's mastery. The telling of stories is situational as some stories only emerge in certain contexts, or emerge differently in different contexts. Orr views the service technicians as occupational communities, as they are focused on the work and not on the organization. The stories that the technicians tell are part of the occupational communities and they have little to do with the entire organization. The only valued status is the full member being considered as a competent technician.

Occupational communities involve rather stable patterns. They permit the members identify with colleagues of the same profession. They may emphasize stability rather than change as they intend to preserve and strengthen existing practices. Their focus is not explicitly on learning, but rather on occupational career development. They lack the boundary crossing, which is necessary in

knowledge brokering in organizations. Therefore the concept of a community of practice is considered as a more appropriate framework for this study to be applied in project-based environments, which are based on boundary-crossing and the dispersed nature of groups. However, even communities of practice have to a great extent been seen as occupational groups representing a certain profession.

2.4.3 Communities of practice

Communities of practice are special types of communities. Wenger et al. (2002, p. 4) define a community of practice as:

> A group of people who share a concern, a set of problems, or a passion about a topic, and who deepen their understanding and knowledge of this area by interacting on an ongoing basis.

Lave and Wenger (1991) present a theoretical basis for the concept of communities of practice. In their work learning in communities of practice is referred to as "situated learning". Situated learning in communities of practice involves learning that takes place at the time and place in which the actual task is performed (Johnson, 2001). The theory of Lave and Wenger (1991) has also been referred to "practice-based" (Brown & Duguid, 1991).

The terms "community" and "practice" together refer to a special type of social structure with a special purpose (Wenger et al., 2002). The concept of community of practice was first defined by Lave and Wenger (1991, p. 98) as:

> An activity system about which participants share understandings concerning what they are doing and what that means in their lives and for their community.

According to Lave and Wenger (1991), the term community does not necessarily imply co-presence, well-defined, identifiable group, or socially visible boundaries. A community of practice is a set of relations among persons, activities, and the world, over time and in relation to other tangential and overlapping communities of practice (Lave & Wenger, 1991). Liedtka (1999, p. 5) describes them as composed of groups of individuals united in action.

Communities of practice have been seen to offer a level of analysis for looking at work, learning, knowledge, and work identity formation. In these contexts members construct both shared identities and the social context that helps those identities to be shared (Brown & Duguid, 2001). Liedtka (1999) argues that communities of practice evolve and are not created and as such are not a form of formal structure like a department. They only exist in the minds of their members and it is the members who set the boundaries.

Schön (1987) refers to a community of practitioners as a group of individuals who share common conventions of actions. Their special knowledge sets them apart from other individuals in relation to whom they hold special rights and privileges (p. 32).

Lave and Wenger (1991) refer to legitimate peripheral participation as a process by which newcomers become included in a community of practice. To open up a practice to newcomers, peripheral participation must provide access to all three dimensions of practice: to mutual engagement with other members, to their actions and their negotiation of the enterprise, and to the repertoire in use (Wenger, 1998, p. 100). Communities of practice have their histories and developmental cycles and reproduce themselves, as newcomers become old-timers (Lave & Wenger, 1991). Practice should be understood in its temporal dimension (Wenger, 1998). Tuomi (1999) argues that the conceptualization of Lave and Wenger assumes a relatively stable community, which is reproduced through its practices and knowledge creation is mainly the appropriation of existing knowledge. In the legitimate peripheral learning, organizational learning becomes socialization of existing practice. Legitimate peripheral learning is discussed in more detail in chapter 2.5.

Lave and Wenger stress the interactional context (participants are participating in interactional context). Elkjaer (1999) argues that the concept of communities of practice is not clear as it may connote both interactional contexts and different groups of employees. Lave and Wenger (1991), according to Elkjaer, emphasize the interactional context and not just participants' skills, knowledge and professions. Elkjaer (1999, p. 80) disagrees and sees that Lave and Wenger focus too much on the context and too little on individual experience, as she finds it difficult to envision an interactional context of learning that is not based on actions, interactions, experiences, emotions and thoughts of individuals, but socially shaped and shaping individuals. In its earlier forms, communities of practice were much concerned about occupational career development and learning traditions within these occupations. This makes them rather conservative in nature, which may be considered as a limitation if put into a business context.

Brown and Duguid (1991) built on the theory of Lave and Wenger (1991), Orr's investigation of knowledge-practice of Xerox's service technicians (reps), and Daft and Weick's interpretative account of enacting organizations. Brown and Duguid view communities of practice as non-canonical and not recognized by the organization. They often cross boundaries of an organization involving people from outside. As they see communities of practice emergent, the central questions involve detection and support of these emergent communities. They argue that group theory in general (e.g. Hackman, 1990) focuses on groups as canonical, bounded entities that lie within an organization. Yet when facing problems, people rely on solutions that are not provided by the formal structure. Informal mechanisms and systems, such as conversation with others, mentoring and storytelling are then used. The main problem with the documentation, according to Brown and Duguid (2000), is that it tells workers what to do, but not why, as it is not designed for sense making, but rule following. For instance, in the case of the service reps (Orr, 1996), if the machine did something unpredictable, reps did not know what to do. They needed to make sense of the machine in order to fix it, but that could

not be found in canonical, documented practices defined in the directive documentation. Instead, they turned to other reps, to the community of other technicians, to solve the problem and make sense of the repair work. Orr argues that knowledge relevant to the job of diagnosis cannot be precisely defined in the directive documentation. Schön (1987) refers to the gap between description and action in professional practice. The gap between a description and knowing-in-action that corresponds to it must be filled by reflection-in-action. The clarifications of the descriptions require dialogue in which understandings and misunderstandings are revealed through action.

Wenger (1998) further developed the concept of communities of practice. He refers to communities of practice as social networks that take place informally within, between or outside organizations. He bases on the social theory of learning, which views learning as social participation. Main traditions that have affected his thinking involve, on the other hand, theories of social structure (e.g. Giddens' structuration theory) and theories of situated experience (e.g. Schön). On the other hand, theories of practice (Lave, Bourdieu, Vygotsky) and theories of identity (e.g. Strauss, Giddens) are central. In the area of theories of structure and theories of practice, theories of collectivity address the formation of social configurations of various types, from the local to the global and define basic types of social configurations (Wenger, 1998).

According to Wenger (1998), communities of practice are combinations of three elements (Figure 7), which can be used to distinguish them from other social structures: a domain of knowledge, which defines the key issues in the community, a community of people who care about the domain, and the shared practice that they create. The domain gives members a sense of a joint enterprise and brings them together. It is the knowledge the community shares. An area of a common interest may vary, as McDermott (1999a) suggests. It can be a professional discipline, a skill, a topic, an industry or a segment of a production process. Community refers to the degree of connection between members, the informal and personal relationships. The boundaries do not respect functional or geographic borders.

The concept of practice points out that the community concentrates on learning that takes place through working in practice, so it is as much learning as it is doing (Wenger, 1998). Practice refers to how closely integrated knowledge is with members' everyday work. As the community does not respect the functional boundaries, neither does the practice correspond to functional practices. Through practice, a community of practice develops a shared understanding of what it does, of how to do it, and how it relates to other communities and their practices (Brown & Duguid, 1998). According to Brown and Duguid (1998), this understanding comprises the community's collective knowledge base and knowledge is related to practice. The processes of developing the knowledge and the community are interdependent in the way that practice develops the understanding, which can change the practice and extend the community.

Practice implies doing real work (Cook & Brown, 1999). It has been defined as "the coordinated activities of individuals and groups in doing their "real work" as it is informed by a particular organizational or group context" (Cook & Brown, 1999, p. 384) and "undertaking or engaging fully in a task, job, or profession" (Brown & Duguid, 2001, p. 203). Practice is made of various activities, which are divisible into more or less familiar types and each calls for the exercise of a certain kind of knowledge (Schön, 1987). Practice connotes knowing-in-action (Schön, 1987).

Brown and Duguid (1991) have described the central features of practice. They base their analysis on Orr's (1996) description of the service technician's practice through the overlapping categories of narration, collaboration, and social construction. They view that these three categories have no place in the organization's abstracted, canonical accounts of the work. Narration and storytelling are crucial within the activities. In the case of the service technicians, narration reflects the stories that the technicians tell. Stories and their telling can reflect the complex social web within which the work takes place and the relationship of the narrative, narrator, and the audience to the specific events of practice. As the stories help the technicians to analyze their work and work towards a coherent result, they also act as repositories of accumulated wisdom. The second important aspect of practice, according to Brown and Duguid (1991), is that the work is communal and therefore collaborative. Learning is inseparable from working, and also individual learning is inseparable from collective learning. The insight that is accumulated is not private substance, but rather socially constructed and distributed. Thirdly, according to Brown and Duguid (1991), social construction has two parts. The understanding constructed during the process reflects the rep's view of the world. The approach is highly situational and improvisational.

Wenger (1998) argues that practice is seen as a source of coherence of a community. This is characterized by three dimensions. Firstly, membership is a matter of mutual engagement of participants. That is what defines the community. It allows for dynamic negotiation of both tacit and explicit knowledge. Interaction builds trust between the members and this allows all sorts of subjects to be taken into discussion (Wenger, 2000b). Secondly, a community is a joint enterprise, which keeps the community of practice together and builds a sense of accountability to a body of knowledge. Thirdly, the members together develop a shared repertoire, which includes routines, words, tools, stories and so on.

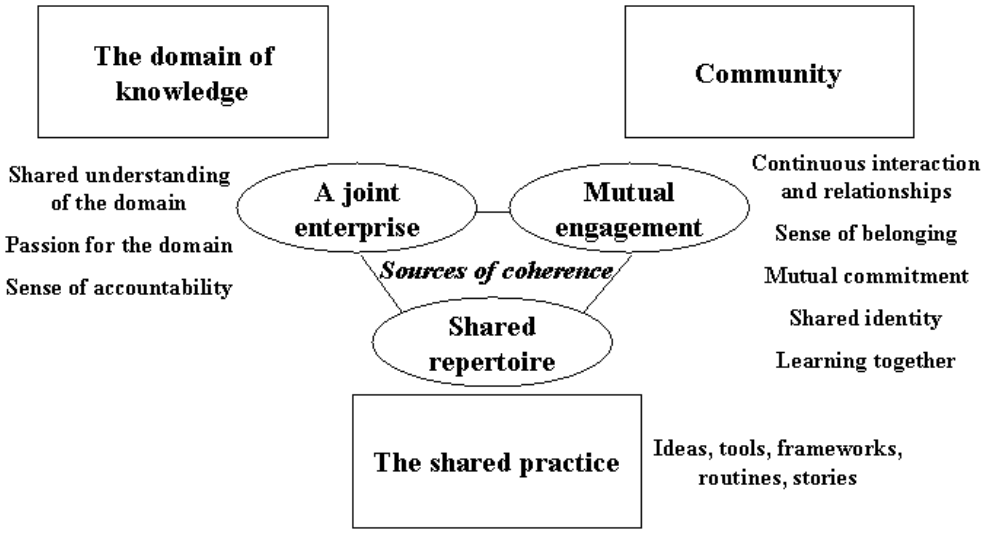

Figure 7 Basic elements of a community of practice (modified from Wenger, 1998)

The concept of negotiation of meaning is referred to as a process by which people experience the world and the engagement in it as meaningful (Wenger, 1998, p. 53) Whatever people are involved in involves meaning. Wenger (1998) discusses two central community processes (Figure 8): participation and reification. The negotiation of meaning involves the interaction of these two constituent processes. Participation refers to a process of taking part and also to the relations with others that reflect this process. It suggests both action and connection (Wenger, 1998, p. 55). Participation is a way of learning (Lave & Wenger, 1991). Reification refers to the process of giving form to experience by providing objects that congeal this experience into "thingness" (Wenger, 1998, p. 58). Processes of participation and reification are a duality and they are intrinsic to the process of negotiation of meaning. Learning should be construed as a process of participation, whether for newcomers or old-timers. Communities should be engaged in the design of their practice as a place of learning (Wenger, 1998, p. 66).

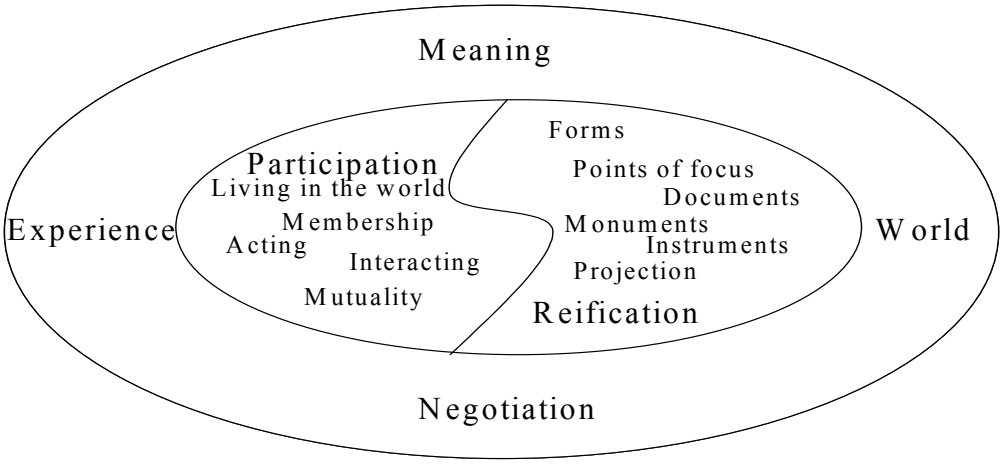

Figure 8 The duality of participation and reification (Wenger, 1998, p. 63)

Members in the community produce shared views to look at the world. Boland and Tenkasi (1995) have referred to the process of acquiring and communicating such common views as perspective making. It is a process whereby a community of knowing develops and strengthens its own knowledge domain and practices (p. 356). The role of the narrative is critical in perspective making. Perspective taking, in turn, is a process, which improves the ability to take the knowledge of other communities into account. Boland and Tenkasi (1995) talk about the community of knowing as a community of specialized knowledge workers. Organizations in their complexity are characterized by distributed cognition, as their environment and processes are too complex to be understood and handled by one individual. Therefore the members in the community of knowing involve specialized groups of workers. The term community of practice is close to the concept of the community of knowing. Yet Boland and Tenkasi (1995) argue that they rather focus on knowledge intensive firms and are concerned with the interaction of different knowledge groups in the process of knowledge creation, therefore they label their concept as a community of knowing.

In addition to the three structural elements of domain, community, and practice of Wenger (1998), communities of practice are based on voluntariness. Members are passionate about the domain. "Passion" is a word that is often used by Wenger to describe the members' affiliation to the domain and to the community of practice. Communities of practice are also self-managed and loosely connected as well as informal. They may be highly institutionalized in the organization, but yet these elements are present. Institutionalizing means that they have certain status in the organization, but they are not a part of the official organizational structures, in the way that, e.g., business units are. The term community of practice implies both a community of people and the practice they share and develop together. In this research, the focus is placed more on the notion of community than to that of practice. Practice is central as it implies the doing in the community. Practice is viewed twofold here, both as taking place in conversations and in the project-related work activities members participate in.

Much social interaction in organizations remains invisible and unrecognised. Thus not all social structures reminding a community of practice are labelled communities. More important than the label, however, is the way the group is engaged in learning. Wenger has given a vocabulary to talk about communities of practice as social phenomena involving engagement in social practice and learning. The vocabulary helps us to recognize these social forms in organizations. Wenger (1998) argues that an adequate vocabulary and concepts direct both our perception and our actions. However, discussion around the concept of the community of practice is still evolving and rather metaphorical and lacks theoretical concensus. More empirical evidence and theoretical argumentation is needed.

2.4.4 Related definitions of communities

Most definitions of communities have been derived from those of Lave and Wenger (1991), Brown and Duguid (1991), and Wenger (1998). Communities have mainly been seen as informal, even so informal that they remain unknown and do not come into explicit focus in organizations. Some authors, however, have discussed communities as formalized, coming close to a concept of a team or a task force.

Botkin (1999) refers to knowledge communities as groups of people with a shared passion to create, use, and share new knowledge for tangible business purposes. They are similar to the way Wenger (1998) describes communities of practice. The main difference is in the formalization of knowledge communities and in the link to business goals. Botkin distinguishes knowledge communities from communities of practice, which, according to him, are informal groups, shaped by circumstances and visible only to social anthropologists. Instead, knowledge communities are purposely formed and their purpose is to shape future circumstances. They are also highly visible to everyone in the organization. The existing communities of practice, according to Botkin, need to be made visible by formalizing them. Wenger (1998) emphasizes the informal nature of the communities of practice. If the communities of practice are based on the topics that people are passionate about and want to improve their capabilities on these topics (Wenger, 1998), knowledge communities are usually based on product/service, markets/clients, function, or geography (Botkin, 1999). Further Botkin (1999) argues that knowledge communities are similar to communities of practice in the way the work gets done and how participation gives identity and meaning to their members' work. They are larger than task forces and live longer than teams. They are like departments, but cross-functional. However, they come close to formal organizational structures and resemble a matrix organization.

Similar to Botkin, Storck and Hill (2000) argue that strategic communities differ from communities of practice as they are created by management to address broad strategic objectives, and they are focused on achieving specific goals. They have a clear relationship to formal organizational objectives. They are even more management driven and formal than knowledge communities. The long-term value they are seen to provide comes through learning, innovation, and knowledge transfer. As communities of practice are informal voluntary groups, the strategic communities are quite deliberately established by the management. Storck and Hill call them communities, because they argue that they differ from traditional teams since they are not integrated into management process and corporate intervention is rather minimal. They are strategic in a sense that its members' activities focus on a broad goal that is integral to overall business strategy. Additionally, they prefer to call them communities because they believe that the term captures the sense of responsible, independent action that characterizes this group, which, at the same time, continus to function within the standard boundaries of a larger

organization (Storck & Hill, 2000, p. 67). However, the resemblance to a cross-functional team or a task force is strong, even though Storck and Hill argue that there are differentiating characters. The members of a strategic community do not select the facilitators, it is more of a corporate initiative. Secondly, members make a distinction between facilitators and "knowledge leaders", as the facilitators promoted the discussion and the latter transferred their experience. Communication patters and work processes as distinguished characters describe strategic communities as an organizational form, as they do not, unlike most teams, need to communicate or report information formally to some other parts of the organization. Finally, Storck and Hill see similarities with communities of practice in the way the focus of activities is negotiated. Most teams are dissolved after achieving a specific task, whereas in strategic communities objectives are expanded. However, the formulation of strategic communities turns out to be somewhat problematic. They are formed to meet short term operational needs and this reflects their short term, focused operational nature and the specific operational goals. What they seem to lack is the focus on social learning, which is an incremental feature of communities of practice. They may be considered as strategic task forces, rather than communities.

Even though originally communities of practice are perceived as informal (Lave & Wenger, 1991), and often even invisible (e.g. Brown & Duguid, 1991), the concept has in Wenger's and his colleagues later work been extended to more institutional forms. Storck and Hill (2000) and Botkin (1999) extend the concept close to the concept of a team (e.g. Katzenbach & Smith, 1993) or a task force.

There are examples of practical implementations of communities in business settings in literature. Learning communities (McDermott, 2000) are similar to communities of practice. They are formed around topics that are important to both the business and community members. In Shell, these learning communities are each responsible for managing the knowledge in its topic area. Learning communities in Shell were made part of the "official organization". At the World Bank (Wenger et al., 2002), Thematic Groups have been established to strengthen knowledge sharing across the organization, involving community leaders, community support functions, and systematic Web-based repositories and a website. Knowledge workshops at Unilever, which bring specialists together around a certain domain, promoted the ability to identify what the company knows and does not know (von Krogh, 1998; Huysman & de Wit, 2002). They produced communities of practice. These examples are based on the ideas of Wenger (1998) and represent the variety of business cases as the realizations of communities of practice in organizations.

Hakkarainen et al. (2003) have criticized the concept of community of practice as being conservative and merely replicating existing practices and knowledge. They argue, instead, that Innovative knowledge communities focus primarily on creating new knowledge and practices to support it. Whereas communities

of practice function in stable environments, innovative knowledge communities function in environments, where the criteria for successful performance is in constant change. In communities of practice, they further argue, knowledge and experience are transferred one-way from experts to newcomers, which involves power relations. Innovative knowledge communities are not free from this tension of power, yet they are seen to involve equally strong hierarchical relations as evidenced in traditional expert communities. Therefore knowledge and competence sharing between the members of the community is much more symmetrical and reciprocal. Innovative knowledge communities are deliberately created to support the creation of new knowledge (Hakkarainen et al., 2003). Communities of practice are more stable concerning membership than innovative knowledge communities. The turnover of membership is central also in intentional networks (Nardi et al., 2000). However, as Hakkarainen et al. (2003) also state, the distinction is rather very fragile than a categorical difference between these communities. Hakkarainen et al. (2003) argue that knowledge transfer works one-way from experts to newcomers. Diverse expertise may cause power relations, however, at the same time it enables also the experts to learn, as they are forced to freshen their ideas and learn new things, when they get new insights (Lave & Wenger, 1991). Traditional apprenticeship-based communities are more likely to involve one-way knowledge sharing, while heterogeneous communities with diverse competence backgrounds and experience may function on a reciprocal basis. Communities of practice in many cases also focus explicitly on innovation and creation of new knowledge, e.g., strategic communities in an Internet Consultancy company aim at creating new knowledge on customer offerings to be utilized in client project teams (Ruuska & Vartiainen, 2003).

Andriessen et al. (2002) have studied both intra- and inter-organizational communities. Intra-organizational communities of practice have been clustered under four clusters based on their empirical studies on Dutch companies (Andriessen et al., 2002, pp. 4 –5). A daily practice community consists of both experienced workers and newcomers, working in physical proximity and having mainly face-to-face meetings. A formal expert community is a group of a limited number of dispersed experts. It is formally instituted, interaction being both face-to-face and via ICT. An informal network community is a medium sized group, spontaneously originated, freely accessible and interacting informally, geographically widely dispersed and communicating mainly via ICT. Finally, Problem solving communities involve large numbers of geographically dispersed employees with the same function, focused on daily problem solving through email questions and answers. Additionally, they describe inter-organizational communities, whose members come from different organizations. These are generally formal expert and the informal network types.

In addition, various groups in multiple contexts have been studied as communities of practice, e.g., Hodkinson and Hodkinson (2003), discovered that the department of the secondary school teachers in England exhibited

many characteristics of a community of practice (based on the ideas of Lave & Wenger, 1991; Wenger, 1998). A school environment may involve communities at many levels; a classroom or a faculty may be considered as a community (Graves, 1994). Graves (1994) describes school communities through three elements: A community involves a sense of belonging and mutual respect, ongoing, regular and face-to-face interaction, and cohesiveness and self-reflection. These very much follow the definitions of communities of practice.

This study focuses explicitly on the business environment. Various groups that are not part of the functional organization are studied as communities mainly following the ideas of Lave and Wenger (1991) and Wenger (1998). Yet the variety of social structures and their defining features pose an additional challenge. There are informal networks in the organizations that promote learning, yet they may not meet the criteria of communities of practice. Boud and Middleton (2003) discovered in their empirical studies of four groups, that some of them could be identified as communities of practice, while some did not help at building identification with a practice thus they did not have common activities. The organizational reality is complex, which promotes to the development of various types of social structures.

Virtual communities

Interaction may also take place in a virtual world instead of physical space and time (Nonaka & Konno, 1998). The development of Internet and electronic communication tools has affected the communication between people. Jarvenpaa and Tanriverdi (2003) argue that there are two forces central to the development of companies' virtual networks. Firstly, information technologies make the coordination across time and space boundaries possible. Secondly, products, services, and processes are becoming more knowledge intensive and many products and services are being digitised and traded over virtual media. As communities were originally formed in the same physical environment, they were based on living and acting in the same neighborhood or working in a physical proximity. New technologies allow people to connect virtually. People, who are dispersed geographically, can become connected in a virtual community with a shared interest.

Rheingold (1993) defines virtual communities as:

> Social aggregations that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace.

Virtual communities have also been referred to as groups that use networked technologies to communicate and collaborate (Johnson, 2001). Johnson (2001) sees them as designed, as communities of practice are emergent. However, many communities may also emerge in a virtual world, as people start interacting via ICT, e.g., informal communication by email may be a basis for the emergence of a virtual community of practice. Loose relationships and

accidental communication may develop into a community. Wenger et al. (2002) prefer to call them distributed communities, as these communities generally connect in many ways, including face-to-face, although they may rely primarily on "virtual" communications. They call distributed any community of practice, which cannot rely on face-to-face meetings and interactions as its primary vehicle for connecting members. Palloff and Pratt (1999) argue that a virtual community requires a clearly defined purpose and a distinctive gathering place for the group.

Concerning dispersed community development, research has also introduced a concept of a network of practice, a NoP (e.g. Brown & Duguid, 2000; Brown & Duguid, 2001; Vaast, 2004). These epistemic networks (Brown & Duguid, 2001) are composed of people who are geographically separate but who will still share work-related practices (Vaast, 2004, p. 216). People do not necessarily know each other, yet they still share practices and a great deal of knowledge (Brown & Duguid, 2001). Relationships are looser than the ones within communities of practice. They may be comprised of several communities of practice, which together form a part of a larger network cutting across and beyond company borders (Brown & Duguid, 2001). Vaast (2004) argues, based on her studies on NoPs, that local communities of practice have appropriated intranet systems and their use of these systems has contributed to the emergence of networks of practice. Following Brown and Duguid (2000), Teigland and McLure Wasko (2004) refer to emergent virtual communities as "Electronic Networks of Practice" (EnoP), which are enabled by investments in information technologies. These networks are designed to enable the creation of electronic "bridging ties" between geographically dispersed organizational members working with similar problems providing a communication space for the quick solution of these work related problems. In their empirical studies they discovered that EnoPs were means of improving one's level of technical competence. A norm of reciprocity developed in the networks, as to receive help required providing help for the others. The members felt that they had been able to solve their problems faster and receive new insights. Finally, their results proved that the level of participation in the network was more important than the length of membership.

In summary, the definitions of communities are presented in table 2. These definitions show a variety of attributes and features detached from the concept. The development of the concepts from apprentice-grounded to professionally based groups may be detected. Later development in the area has focused on heterogeneously based communities, which do not necessarily imply apprenticeship relation. The most recent development, along with the emergence of information technologies and the more dispersed nature of work, has contributed to the development of virtual communities, where face-to-face communication is not the primary form of interaction.

Table 2 Summary on definitions of communities central to this research

Authors	Definition
Van Maanen & Barley, 1984 Occupational community	A group of people who consider themselves to be engaged in the same sort of work; whose identity is drawn from the work; who share with one another a set of values, norms and perspectives that apply to but extend beyond work related matters; and whose social relationships meld work and leisure.
Lave & Wenger, 1991 Community of practice	An activity system about which participants share understandings concerning what they are doing and what that means in their lives and for their community. Thus, they are united in both action and in the meaning that the action has, both for themselves and for the larger collective.
Wenger, 1998 Community of practice	A kind of community created over time by the sustained pursuit of a shared enterprise involving practices that reflect both the pursuit of our enterprises and the attendant social relations.
Wenger, Snyder & McDermott, 2002 Community of practice	A group of people who share a concern, a set of problems, or a passion about a topic, and who deepen their understanding and knowledge of this area by interacting on an ongoing basis.
Botkin, 1999 Knowledge community	Group of people with a shared passion to create, use, and share new knowledge for tangible business purposes.
Storck & Hill, 2000 Strategic community	Groups that are created by management to meet short term operational needs and achieve specific goals.
Rheingold, 1993 Virtual community	Social aggregation that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace.
Johnson, 2001 Virtual Community	Group that use networked technologies to communicate and collaborate.
Wenger, Snyder & McDermott, 2002 Distributed community of practice	Any community of practice, which cannot rely on face-to-face meetings and interactions as its primary vehicle for connecting members.

This study focuses on communities that rely primarily on face-to-face interaction, although, email communication is used accordingly. The apprenticeship relation is not a defining feature in the communities, as they are seen both as heterogeneous, involving a diversity of backgrounds and competences, as well as homogeneous, members with similar backgrounds. The main connecting bond is the domain of knowledge and interest in that domain. Members share a practice, yet the focus is more on the notion of

community than in the practice. Communities are not referred to as communities of practice due to this emphasis, as the depth of the practice varies. The characterizing feature is learning and the sharing of project-related knowledge and competence, therefore this study chooses to conceive and label these communities as knowledge sharing communities.

Communities distinguished from other social structures

Wenger et al. (2002) argue that communities of practice differ from other organizational structures. They differ from business or functional units, as they are more loosely connected, informal, and self-managed, even when they are highly institutionalized. Communities of practice resemble the matrix organization, with multiple reporting relationships. Even though the structure may seem similar there are main differences. Communities of practice have flexible boundaries with no reporting relationships or resource allocation responsibilities (McDermott, 1999a). They remain self-managed and self-organized. They are based on collegial relationships and they focus on knowledge sharing (Wenger et al., 2002).

Hackman (1990) refers to groups as intact social systems, complete with boundaries, involving interdependence among members, and differentiated member roles. Also, members have one or more tasks to perform and they operate in an organizational context, in a larger social system in which the group operates. Task forces are kinds of groups created to solve problems (Guzzo & Dickson, 1996). They are temporary and disband when the task is accomplished. The term community does not necessarily imply co-presence, well-defined, identifiable group, or socially visible boundaries (Lave & Wenger, 1991). The purpose of the existence of a work group depends on task dependence (Brown, 1988), yet communities of practice are bound together by shared interest in a certain domain of knowledge (Wenger, 1998) and members are connected by interdependent knowledge and not by interdependent subtasks (Wenger et al., 2002). In teams, legitimation is derived from the formal hierarchy, as in communities of practice, it is more informal and members earn their status (Hildreth et al., 2000). Ongoing operational teams focus on their own task, so their knowledge often remains local as well. Projects as groups are more clearly instrumental than communities of practice (Garrety et al., 2004). Projects have defined completion points, whereas communities of practice exist on an ongoing basis. Projects have an ad hoc nature, as they have no shared, collective history or future. They also differ from communities of practice in their purposes, and project team members do not develop a mutually negotiated shared practice consisting of historical artifacts (Sense, 2003).

Compared to informal networks, communities of interest, and professional associations, which are seen more as a set of relationships, communities of practice are “about” something and their domain gives them an identity, and commitment for the domain gives it a cohesiveness and intentionality (Wenger et al., 2002). Informal networks merely exist for the sharing of knowledge, as they do not share a practice. Tuomi (1999) proposes the concept of an

organizational community as one which combines a traditional community of practice and a team. As an underlying idea he states that some of the members of the community are given organizational responsibility over some activities of the community. A special type of an organizational community is the traditional team, where there are no formally legitimated peripheral participants. Members of the team use their memberships in communities of practice to recruit services from outside. The second type is a pure community of practice, which has no formally defined core or externally assigned goals. Without legitimation, they usually have no institutional support. Most organizational communities fall in between these two defined types. In many cases communities of practice are institutionalized as different types of coordinating mechanisms, such as steering groups and forums (Tuomi, 1999).

Nonaka et al. (2000a) distinguish between the concept of ba and the concept of community of practice (Lave & Wenger, 1991). They view ba as a more flexible and ever-changing concept than a community of practice. They base their analysis on the apprenticeship model and focus on members learning through participation in the community of practice and gradually memorizing jobs. However, this argument is based on the traditional apprenticeship concept rather than reconceptualizations by, e.g., Wenger (1998) and Gherardi et al. (1998). These conceptualizations of community of practice do not necessarily imply apprenticeship relation, but view communities of practice as contexts for learning and the creation of new knowledge. The concept has been redefined as also consisting of members from many professions and being heterogeneous. In this study, communities are viewed as social structures where people interact, and ba is the context for interaction, a space where interaction may take place. Nonaka et al. (2000a) state that ba offers a context for socialization and interaction. Therefore ba in relation to communities may be a potential space for a new community to emerge. Community involves more structure. Nonaka et al. (2000a) state that ba can be built intentionally, or created spontaneously. As an example they offer forming a task force, which is an intentional building of ba. Task force is a formal structure and ba is the context for it. Table 3 summarizes the differences between ba and a community of practice as conceptualized by Nonaka et al. (2000a).

Table 3 Differences between communities of practice and ba according to Nonaka et al. (2000a)

Feature	Community of practice	Ba
Content of learning	Members learn knowledge embedded in the community.	New knowledge is created
Learning occurs	In any community	Needs energy to become active
Boundary	Firmly set by the task, culture and history of the community.	Fluid, can be changed quickly as it is set by participants.
Relation to change	Constrained by history	"Here and now" quality, constantly changes.
Level of the changes	At the micro (individual) level, as new participants learn to be full participants.	Both at the micro and macro level, as participants change both themselves and ba itself.
Membership	Fairly stable, takes time for a new participant to become full participant. Members belong to the community.	Not fixed, participants come and go. Members relate to ba.

In summary, communities in this study are groups of people who share an interest in a certain domain, interact regularly to develop that domain and produce a shared practice. Communities are studied as recognized social structures in work organizations. This does not imply, however, that there would not exist as invisible, very informal communities. Yet the invisible communities are not in focus of this study. Communities are distinguished from groups in general.

2.4.5 Characteristics of communities

A study of literature shows various dimensions and characteristics by which communities and other social structures are described. Andriessen et al. (2001) state that communities of practice have a few characteristics in common, e.g., focus on knowledge sharing around a certain "practice", and having loosely coupled membership. However, they differ in many dimensions, amongst the following (Andriessen et al., 2001, p. 8):

1. Purpose: individual learning and daily problem solving, organizational innovations, or networking.
2. Formalization.
   - Of set-up: top-down formally initiated, with centrally selected members, or of informal, spontaneous, bottom-up, origin.
   - Of co-ordination: appointed facilitator, co-ordinator, or other roles, or emerging "leaders".
3. Size: from small to very large.
4. Boundary: open or closed for people inside or outside the organization.
5. Composition: only experts or experts plus newcomers.
6. Virtuality: high (not meeting face-to-face) or low (meeting mainly face-to-face).
7. ICT support: simple or sophisticated.

Tuomi (1999) distinguishes between communities as homogeneous, which implies that membership is differentiated based on their levels of expertise, or heterogeneous, which in turn implies that members have different areas of expertise. New communities, according to Tuomi, are always heterogeneous when they emerge, as then there is no shared language or practice that would provide the basis for the emergent community.

Below I have summarized, for this study, the central characteristics of communities:

a. The degree of formality

Communities are not viewed only as informal, as their degree of formality may vary. Communities have been described in a continuum of informal (Lave & Wenger, 1991; Brown & Duguid, 1991; Wenger, 1998) and formalized structures (e.g. Botkin, 1999; Storck & Hill, 2000). On the other end of a continuum, Brown and Duguid (1991) argue that communities are emergent, and membership emerges from the process of activity, as opposed to being created to carry out the task. Even though the degree of formalization may vary from being invisible to others, to institutionalization, they are always self-managed and not part of the official business units.

Communities have generally been viewed as distinct concepts from teams (e.g. Katzenbach & Smith, 1993) or work groups (e.g. Hackman, 1990), and are not seen as a part of the formal organization. The degree of formalization in this study refers to the degree within a community, yet it also reflects the community's relation to its host organization.

b. Purpose and goals

Generally communities form around knowledge needs. What binds a community of practice together is the shared interest in a domain of knowledge (Wenger, 1998), as knowledge sharing focus has been seen as a common characteristic to various communities of practice (Andriessen et al., 2001). Learning intrinsic in communities is emphasized by many authors (e.g. Lave & Wenger, 1991; Brown & Duguid, 1991; Wenger, 1998, Gherardi et al., 1998). The formality of goals varies in different definitions of communities, e.g., strategic communities are focused on achieving specific goals, which are integral to achieving overall business strategy (Storck & Hill, 2000), while Wenger (1998) sees communities of practice directed to achieve various, rather heterogeneous goals, even the ones not related to working. In occupational communities (Van Maanen & Barley, 1984) work and social relationships are overlapped, and they serve the achievement of multiple goals for their members.

Besides the shared purpose, members' personal motivation may vary. The value does not come only from benefits to the work, but from all aspects of the community. Topics that are important to both business and community members should be focused on. McDermott (1999b) emphasizes strategically

important topics in building communities. As communities are based on voluntary participation, personal motivation and passion are central.

c. Activities

Shared practices bring people to communities of practice. They are linked together by various, common activities. The content of joint activities vary. Conversations and experience sharing as activities are important, as learning is supported by conversations and stories about problematic and difficult cases (Lave & Wenger, 1991). Lave and Wenger (1991) distinguish "talking about" (e.g. exchanging information necessary to the progress of ongoing activities) and "talking within" (e.g. stories) practice. Brown and Duguid (2000) argue that chat continuously adjusts a group's collective knowledge and individual member's awareness of each other. By trading experiences and telling stories, people gradually bring their separate understandings closer together and simultaneously come closer to a collective understanding of the target of the work. Stories can be means to discover something new about the world, as their value lies not in their telling but also in their retelling (Brown & Duguid, 2000). As stories pass on to newcomers what old-timers know, they are critical to learning as they allow people to learn from each other (Brown & Duguid, 2000).

Wenger et al., (2002) distinguish between different levels of participation in communities. Core group is usually rather small consisting of people who actively participate in many forms. Outside the core group is the active group, who attend the meetings regularly. Usually there are many peripheral participants and the ones who rarely participate. Boundaries of the community are fluid and the membership levels might shift over time. Outside the main levels are people who are not members, but are interested in the community, such as suppliers and customers. Peripherality originally refers to the varied ways of engaging in participation in the community involving newcomers moving from the periphery to full participation of a community (Lave & Wenger, 1991). Partial participation does not imply, however, that newcomers are disconnected from the practice of interest (Lave & Wenger, 1991). Various places and positions in the community may also influence one's view on the community. Members in the core experience the community features more readily, while those on the periphery may see the community as a looser network (Stuckey & Smith, 2004). Stuckey and Smith (2004) discovered a rich and well-tended periphery, which attracted people from diverse backgrounds and perspectives, in their case study on seven communities of practice. As engagement varies through times, the value of community may be perceived differently at different times.

Communities of practice can be partly characterized by the nature of the relationships in the community. Interaction can be either face-to-face or virtual using communication technology tools. Face-to-face opportunities have been seen to create value (Storck & Hill 2000; Cross et al., 2001). Hildreth et al. (2000) discovered in their case studies of distributed communities that knowing

each other gave members a greater feeling of unity and common purpose, and built confidence and trust in each other. They gained legitimation in the eyes of each other. These were implications of face-to-face meetings.

d. Coordination and facilitation

The leadership is often distributed and diverse. Leadership tasks may be divided, formal or informal, or concentrated in a sub-group. Wenger et al. (2002) argue that the community coordinator helps the community to focus on the domain, maintain relationships, and develop its practice. Facilitators promote and advance the discussion while knowledge leaders transfer their experience and share their insights with the group as a whole (Storck & Hill, 2000). Facilitators and leaders need to emphasize the partnership mentality (Botkin, 1999). Various other roles in the community help members to participate and engage in the development of practice.

The coordinator's tasks include planning and facilitating events, linking members informally and crossing boundaries, fostering the development of the community, and managing the boundary between the community and the formal organization. McDermott (1999a) suggests that the coordinator should be well respected by the community. Creating and maintaining social relationships is required in integrating knowledge across communities, as it is not merely a technical task (Garrety et al., 2004). Being a coordinator of a community as a knowledge broker may promote knowledge integration. Stuckey and Smith (2004) argue that building a successful community depends on the passion and personal involvement that community leaders bring to their work as well as the vibrancy of the core group.

e. Organizational support

Communities are parts of the organizations, in which they exist. Although they are fundamentally informal and self-organizing, they can benefit from intentional cultivation (Wenger et al., 2002), and people should have time and encouragement to participate (McDermott, 1999b). The level of external management and support is critical in two ways: on one hand communities require recognition and support, but on the other hand the voluntary and informal aspect might lose its value by too much interference. Wenger and Snyder (1999) refer to the management paradox, as management and recognition of the communities promotes to losing of their voluntary and specific nature. Focusing only on measurable work and underestimating the value of talk, self-forming groups may be discouraged (Davenport & Prusak, 1998). Organizational support requires legitimating participation, recognizing the work of sustaining them and allocating members time for participation. The language of communities helps members to discuss and recognize the participation and value in various communities in the organization (Wenger, 2000b). Vocabulary, the concepts that are used to make sense of the world, helps to direct perceptions and actions (Wenger, 1998).

More generally, Huysman and de Wit (2002) refer to the management of knowledge sharing, which requires the structured support and guidance of acquiring knowledge, exchanging knowledge and using it. Involvement and support from senior management was found as an enabler for knowledge management activities in general (Huysman & de Wit, 2002).

Outcomes of communities

Communities may have outcomes on many levels. This study distinguishes outcomes on the individual, community and organizational levels.

A member's personal connection to the domain enhances commitment to the work of the community. As benefits to the community members, Wenger et al. (2002) mention both improvement of work and fostering professional development. Improvement of work includes such benefits as getting help with challenges, access to expertise, being better able to contribute to the team, sense of belonging, but also the pleasure of being with colleagues. Professional development may be enhanced, for example, by having a forum for expanding skills and expertise, keeping updated by networking, enhancing professional reputation, increasing marketability and employability, and strengthening the sense of professional identity (Wenger et al., 2002).

Collective practice leads to forms of collective knowledge, shared sensemaking, and distributed understanding that does not reduce the content of individual heads (Brown & Duguid, 1998, pp. 96). A community of practice develops, through practice, a shared understanding of what it does, of how to do it, and how it relates to other communities of practice and their practices (Brown & Duguid, 1998). Brown and Duguid argue that the processes of developing knowledge and the community are interdependent in the way that practice develops understanding, which changes the practice and extends the community. Increased trust and sense of belonging may help the members to engage with the community.

There has been relatively little research on effects of organizational performance. The difficulty in many cases is that communities are hidden assets, appearing neither on an organizational chart nor on the balance sheet (Lesser & Storck, 2001). This, however, views communities from the resource-based approach, seeing them as assets in the organizations. Lesser and Storck (2001) discovered areas of organizational performance that were impacted by the ongoing activities in communities of practice in seven cases. Communities of practice were valuable in decreasing the learning curve of new employees. Communities helped newcomers to identify subject matter experts. They also helped to foster relationships with newer workers with established practitioners. Responding more rapidly to customer needs and inquiries was important as communities of practice played a role in quickly transferring the knowledge necessary to address customer issues. Reducing rework and preventing "reinvention of the wheel" was seen as the most valuable contribution. The repository system, organizational memory, served also a

number of important functions. Communities of practice were also discovered to be sources for innovation as they were able to spawn new ideas for product and services. One main reason for innovativeness was the community's ability to create a safe environment where people felt comfortable in sharing challenges This relates to the outcomes on a community level. Building personal relationships, as suggested also by Nahapiet and Ghoshal (1998), promoted innovative ideas. People were willing to share innovative thoughts with those they trusted and they were able to tap their expertise to refine and explore these new ideas (Lesser & Storck, 2001).

Methodologies to study communities

Studies on communities have been dominated by the case study approach, with the methods of interviews and observations. Wenger and Snyder (2000) suggest that non-traditional methods should be used to assess the value of the communities of practice. They argue, that the best way to assess the value is by listening to members' stories, which can clarify the complex relationships among activities, knowledge and performance. However, events can be isolated, so one should not collect just the most compelling stories. A systematic effort captures the diversity and the range of activities that communities are involved in. Also, interviews are often conducted to collect these stories.

One of the main challenges in community research is the detection of invisible communities in organizations. Social network analysis has been used to map and analyze relationships in organizations (e.g. Scott, 1991; Cross et al., 2001). Cross et al. (2001) conducted a study to determine the means of improving employees' ability to create and share knowledge in important social networks. They first assessed the characteristics of relationships that 40 managers relied on for learning and knowledge sharing in important projects. Then they employed social network analysis to map the dimensions of relationships among strategically important networks of people in various organizations. However, one of the criticism against thse social network analysis is that it tells who talks to whom, but provides less understanding of the context and the reasons for communication (Lundkvist, 2004). Social network analysis can be used to detect the relationships and existing communities, however, other methods may be used to complement the shortcomings.

Lundkvist (2004) downloaded and analyzed 185 postings to the Cisco Usernet group somp.dcom.sys.cisco over 18 months to study the interactions among the users. Communication patterns and findings were then used to ignite discussions in three workshops. De Laat and Broer (2004) studied the nature of the discourse in three communities of the Dutch Police. They coded 177 messages that were shared under six months' period to discover how explicit and tacit knowledge is shared to create new corporate knowledge. Communities of practice within the Dutch Police play a role in sustaining and developing their own practice besides being crucial to the learning organization.

Lesser and Storck (2001) studied which communities of practice are acknowledged to be creating value in seven case companies. For each participating company they interviewed between five and ten members of existing communities of practice regarding their perceptions of value at both individual and organizational level. They developed a "mind map", which in turn led to categorization scheme used to review the interview transcripts. From the categories, they abstracted the key sources of individual and organizational value.

One of the problems with the interview-based methods is that the number of respondents remains moderate, as interviews are time-consuming. It may then be difficult to draw wider and generalizable conclusions on larger data. To gather larger volumes of data in order to make comparisons between communities, questionnaires have been used as a data collection method. Andriessen and Verburg (2004) have gathered data on various communities by a research tool "Community assessment tool". The advantages are that it allows data gathering in large amounts in order to get systematic insights into characteristics and performance of communities of practice and thus the opinions of the community members (Andriessen & Verburg, 2004). Interviews were used to gather context-specific data. However, as a shortcoming, it does not allow for the study of communities that are invisible.

The multimethod approach may be used to complement the shortcomings of a specific methodology. In this study, communities are studied by interviewing members and coordinators of communities, as well as some of the stakeholders. Additionally, a questionnaire is used to gather larger amounts of data. However, with these methods only the recognized communities were targeted.

2.5 Knowledge sharing and learning in communities

In most project-based organizations, there is a lack of systematic, institutional learning (Pinto, 1999). Many of the projects would not have failed had there been an opportunity to learn from others' prior mistakes (Pinto, 1999). Pinto further argues that if there is no attempt to document past project activities and results, there is no likelihood that relevant lessons will be learned, passed on, and become guidelines for future efforts. Pinto refers to documenting the past activities rather than sharing them during the projects' run. He encourages project organizations to become "learning organizations" by establishing and enforcing mandatory post-project reviews and by employing these review meetings as a necessary precondition to sign-off on future projects. Project review meetings are in the case of success perfunctory or in the case of failures ignored (Pinto & Rouhiainen, 2001). This emphasizes the explication of lessons learned and transferring them to future projects. However, only the lessons that are easy to explicate are usually focused on. There is also a lot of context dependent knowledge that is shared during the projects' run and cannot be taken out of its context and explicated at the project's end. Best practices involve problems, as they tend to be abstract and principled, and they may produce long lists of practices, which are difficult to realize in practice. The term best also avoids discussion on mistakes and problems (Vartiainen et al., 2003).

Knowledge sharing is especially addressed in multi-project settings. Engwall (2000a) argues that in a homogeneous multi-project environment there are good possibilities to exploit the accumulation of experiences between projects. In heterogeneous environments there are less possibilities based on a strong uncertainty, fuzziness, and exploration characteristics of such an environment. Engwall (2000a) proposes that in a multi-project setting, knowledge transfer between projects is the key management problem on a long-term basis.

2.5.1 Knowledge sharing strategies in organizations

Basically, knowledge sharing in organizations is based on two strategies (Hansen et al., 1999). The codification strategy relies on carefully codifying the knowledge and storing it in archives and databases, where it can be assessed and used over and over again. Examples of codified mechanisms are electrical learning environments to support learning and knowledge support systems, e.g., electronic performance support systems (EPSS) as project memories. Managing project related knowledge has been much referred to as repositories of project data (e.g. Githens, 2002). This strategy faces many difficulties: tacit knowledge and experience are difficult to identify and store, and the storage itself is also time-consuming; in addition, codified knowledge loses its usefulness quite soon if it is not updated.

In the personalization strategy, knowledge is closely tied to the people who developed it (people as repositories) and is shared by personal face-to-face interaction. Examples of personalized mechanisms are learning by joint

reflections and dialogues. People as repositories have faced both advantages and difficulties. Individuals are especially well suited for storing and transferring tacit knowledge, as it is not easily articulated (Polanyi, 1966). Individuals can apply their tacit knowledge in new settings without having to convert it into explicit knowledge (McGrath & Argote, 2001). This strategy also faces some difficulties: it is difficult to explicate tacit knowledge and there are differences in willingness to share own knowledge and it is also vulnerable to membership changes (McGrath & Argote, 2001).

Social processes representing the personalization strategy, as opposed to the use of technology or procedure aimed at the codification of knowledge, has been recognized in project environments (Bresnen et al., 2003). Bresnen et al. (2003) discovered that knowledge in project environments tended to be embodied in members of the network of professionals within the firm. The social dimension was reinforced in the importance attached to personal networks, regular discussion forums and the significance of project engineers moving from one project to another as the main mode of project learning. The relational approach to knowledge sharing puts emphasis on the level of the group (the community, the network), rather than on the individual, and deals with managing knowledge sharing between individuals as they relate to one another in organizations (Huysman & de Wit, 2002).

In the cycle of knowledge creation, the strategies have the same root: knowledge creation starts from individual and collective experiences when solving a problem or meeting a challenging task, and from their reflection and explicit formulation. Subsequently both strategies are possible for knowledge storing and sharing.

O'Dell and Grayson (1998) distinguish three types of infrastructures in knowledge sharing, which resemble the knowledge management strategies of Hansen et al. (1999). The self-directed approach relies on storage and codification of knowledge into repositories and databases. The main function is to capture data and information. Tacit knowledge cannot be represented. This is similar to what Hansen et al. (1999) refer to as the codification strategy. The second approach, knowledge services and networks, provide self-directed components and additionally a variety of knowledge management services and organized networks to assist the transfer process. People come together to share and learn from each other face-to-face and electronically in extensive networks. These networks leverage the collective experiences, skills, and intelligence of the organization. It can also capture tacit knowledge as it stresses personal relationships. This is similar to the personalization strategy. The third approach, facilitated transfer, involves characteristics of the first and the second approaches as well as specific persons who stimulate, assist, and encourage transfer of knowledge and best practices. It aims at providing facilitation and coordination for knowledge sharing at the organizational level and focuses on implementation. O'Dell and Grayson (1998) argue that the approaches are a continuum, and selection is based on the resources, strategy,

and the belief in the importance of knowledge and best practices transfer in the organization. The need for assistance and intervention of knowledge transfer is also considered. Personalization strategy refers to participation in meaningful activities. Codification represents one type of reification. These two strategies should be seen to complment one another, reflecting the processes of participation and reification.

2.5.2 Willingness to share knowledge

The issue of knowledge sharing necessarily involves the question of the willingness to share knowledge. Why would an individual share his or her knowledge with others, particularly in knowledge intensive business, knowledge has been seen to involve issues of power. The knowledgeable expert may have more power than those high in the functional hierarchy.

People are basically willing to share their knowledge, but enablers to support it are required. As an enabler, O'Dell and Grayson (1998) refer to the infrastructure of knowledge sharing. Other enablers are culture, technology, and measures. Culture is critical as sharing knowledge involves social activities, which take place among people. People need to be connected in a meaningful way with a shared purpose. Social networks have been referred to as a person's information environment (Cross et al., 2001). Cross et al. (2001) discovered that critical information for the project's success was obtained mainly from other people, far more often than impersonal sources, such as databases. Relationships are critical for obtaining information, solving problems and learning how to do one's work. To cope with non-canonical practices in work people rely on solutions that are not provided by the formal structure. Informal mechanisms and systems, such as conversation with others, mentoring and storytelling are then used (Brown & Duguid, 1991).

Culture of trust and collaboration may improve knowledge sharing (Sveiby & Simons, 2002). Constant et al. (1994), in their studies of the attitudes about sharing, discovered that people distinguished between tangible information and intangible information embodied as human memory, knowledge, experience, or a skill. Even if they were willing to share both, the motivation for sharing intangible information was lower. They felt that it had, to a great extent, become part of their identity and self-worth. This intangible information was shared more easily if people gained personal benefits from sharing it. This emphasizes the meaning of face-to-face communication (Dixon, 2000). Merely storing information in databases lacks the interaction element of knowledge sharing, as a database gives nothing back. Furthermore, face-to-face interaction increases the sense of safety and promotes virtual interaction as well (e.g. Cross et al., 2001). However, sharing must result in not only organizational outcomes, but personal benefits as well (Wenger, 1998; Dixon, 2000).

2.5.3 Transferability and context-dependency of knowledge and competence

Competence and knowledge may be generic and utilized in other contexts, and some skills may be highly flexible and easily transferable, whereas some may be highly idiosyncratic and lose their value when the situation changes (Tuomi, 1999). The type of knowledge that is not transferable has been referred to as situated (e.g. Lave & Wenger, 1991), which perceives knowledge having meaning only in its context. This reflects back to the discussion of where knowledge is seen to reside and who is it that possesses it.

The cartesian view of knowledge, which involves the duality of mind and body, emphasizes the absolute and context-free nature of knowledge. The rationalistic view of competence perceives competence primarily as independent of context. This means, according to Sandberg (2000), that specific attributes, such as communication skills, are regarded as having a fixed meaning in itself; they are viewed as being independent of context and thus being able to be adopted in a range of work activities.

Nonaka et al. (2000a) argue that the knowledge-creation process is necessarily context-specific in terms of who participates and how they participate. Knowledge is intangible, dynamic and knows no boundaries, and if it is not used at a specific time in a specific place, it is of no value (Nonaka & Konno, 1998). Lave and Wenger (1991, p.33), based on their situated learning theory, argue that there is no activity that is not situated. This means that even so-called general knowledge only has power to relation in specific circumstances. Theories of situated learning have been criticized. If all knowledge is considered situational, how can for example technical innovations be explained, which usually requires high-level knowledge transfer from one situation to another (Tynjälä, 2000). Situated approach tends to connect competence and expertise with culture and neglects the individual perspective (Hakkarainen et al., 2004). The absolute context-bound nature of knowledge argues against human intuition. Development of, for example, scientific knowledge involves generic, universal features of knowledge.

Yet, to a large extent, competence and knowledge depend on their environment: it can be applied only in certain environments. This is especially true of the experiential and social network components of competence (Sveiby, 1997). This means that if a person moves to a new environment, he or she may not be able to apply competence. New situations and contexts require context-specific rules, which are characteristic to that specific context or situation in hand. Collective competence is context dependent and what one knows can only be learned within a specific context and only by joining the collective activity of the group as a whole (Cook & Yanow, 1993). Attributes used in accomplishing work are primarily situational, or context-dependent (Sandberg, 2000). A central feature of the context-dependence of competence is its tacit dimension. A great deal of knowledge is constituted by tacit knowledge, which is hard to share (Polanyi, 1966). If competence is viewed as context-free, the

tacit dimension is overlooked (Brown & Duguid, 1991). Competence and knowledge in this study is viewed as a combination of generic and context-dependent features.

More practically, put into business terms, Dixon (2000, p. 11) defines common knowledge as being knowledge that employees learn from doing the organization's tasks. She uses the term to differentiate it from "book knowledge", which could also be called generic knowledge. Generic knowledge is independent of the context it occurs. Company specific knowledge, according to Dixon, has better chances to give competitive advantage, because it is generated internally, while the more generic knowledge is equally available to competitors. Common knowledge, being context-dependent, is created by employees acting to accomplish the organization's task in new and innovative ways (Dixon, 2000). Cook and Yanow (1993) refer to collective competence, which is similar to what Dixon calls common knowledge, since the knowledge learned at the particular company is applicable to it and if a craftsman moves to another company, retaining is required. Common knowledge has components that are both tacit and explicit. Experience at work creates its own knowledge and as most work is of collective and cooperative nature, most depositional knowledge is intriguingly collective, less held by individuals than shared by work groups (Brown & Duguid, 1991). Dixon (2000, p. 13) links common knowledge, "know how", as opposed to "know what", to action, as it is derived from action and it carries the potential for others to use it to take action.

Stickiness has been defined as difficulty in transferring knowledge (Szulanski, 1995). Tacit knowledge is "sticky" in nature, which refers to the difficulty to explicate, absorb and apply it to new situations (Brown & Duguid, 2000). Internal stickiness connotes the difficulty of transferring knowledge within the organization (Szulanski, 1996). Von Hippel (1998) refers to sticky information as the type that is difficult to transfer, as stickiness refers to the costs of the transfer from one site to another. Szulanski (1996, p. 36) found in his studies that the three main contributors to information stickiness were the lack of absorptive capacity of the recipient, causal ambiguity, and an arduous relationship between the source and the recipient.

Brown and Duguid (1998) argue, that due to the social origins of knowledge, it moves differently within the communities than between them. Within communities knowledge is embedded in practice and circulates easily. Members of a community implicitly share a sense of what practice is and the standards for judgement, which supports the spread of knowledge. In contrast, between communities the practice is not easily shared. Different communities have different standards, different valuations on what is significant, different priorities, and different evaluating criteria. Even though new knowledge is continuously being produced and developed in different communities of practice throughout the organization, the challenge lies in evaluating and moving it (Brown & Duguid, 1998).

The term deliberately used in this study is “share” and not “transfer”, as transfer indicates that knowledge is something that is accumulated and transferred from one entity to another. Dixon (2000) argues that the term “share”, in contrast to mechanistic terms of disseminate or transfer, recognizes the personal nature of knowledge that is gained from work experience. She argues that share has two meanings; it means to give away a part, which is an act of generosity, and it means to hold in common, as in a “shared belief system”. These meanings merge in the context of knowledge management (Dixon, 2000, p. 9). Share may connotate more to social learning theories, as sharing implies reciprocal activities. In turn, transfer is more connected to viewing knowledge as a piece that may be defined, explicated and moved.

2.5.4 Knowledge sharing based on multimembership

Communities of practice cross boundaries in organizations. Their effectiveness requires, besides being an internal issue, connections with other communities and constituencies inside and outside the organization (Wenger, 1998). Andriessen et al. (2002) have distinguished between intra- and inter-organizational communities. As members of intra-organizational communities come from the same organization, inter-organizational ones consist of members from different organizations and cross boundaries between organizations. McDermott (1999a) argues that communities of practice are particularly useful when cross-functional teams are the basic structures of the organization. Communities of practice are a way to knit people back together with peers. The connection between teams and communities of practice, as people are at the same time members in their teams and communities of practice, have also been referred to as a double-knit organization (McDermott, 1999a). Double-knit organization links cross-functional teams together through communities of practice. Communities of practice in project context have been seen as brokering mechanisms in technology development projects (Garrety et al., 2004). Projects benefit from integrating expertise from diverse sources, including the potential users. Wenger (1998, p. 109) refers to brokering as the use of multi-membership to transfer some element of one practice into another. Complex projects need people to act as brokers, transferring and translating knowledge as well as aligning interests and perspectives (Garrety et al., 2004).

Boundaries are critical, as radical new insights and innovations often arise on the boundaries between communities. Interacting across practices forces members to take a new look at their own assumptions, and as a result, boundary processes can be the source of a deep learning (Wenger, 1998). Community members play many roles in their organization. There is a challenge of ensuring that all the necessary knowledge reaches other parts of the organization. Members of the communities and networks often aim at knowledge sharing across organizational units and projects. Communities of practice can be seen to promote the sharing of knowledge and competence between organizational entities. The multi-membership in organizations creates

a learning loop (Wenger et al., 2002) as people move back and forth between communities and project teams and work groups.

Social strategies for promoting the spread of knowledge between communities can be described in terms of translation and brokering (Brown & Duguid, 1998). Translators are individuals who can frame the interests of one community in terms of another community's perspective. Examples are external mediators and consultants. The role of a knowledge broker, in contrast to translators, involves participation rather than mediation. They involve overlapping communities whereas translators work among mutually exclusive ones. Granovetter (1973) noticed in his studies of knowledge diffusion across networks, that in communities with strong internal ties overlaps were difficult to develop, because they precluded external links. Granovetter argued that people with weak ties to several communities were best able to facilitate the flow of knowledge among them. Weak ties were more likely to link members of different small groups than the strong ones, as the strong ties tend to concentrate within particular groups. Brokers are able to make new connections across communities of practice, enable coordination, and open new possibilities for meaning (Wenger, 1998). Also, brokering requires the ability to link practices by facilitating transactions between them, and to cause learning by introducing into a practice elements of another (Wenger, 1998). Brokering requires an ability to manage the co-existence of membership and non-membership, brokers need to yield enough distance to bring different perspectives, but they also need to have enough legitimacy to be listened to (Wenger, 1998). Knowledge brokers are valuable to any organization. They tend to be members with extant networks. These contacts allow them to have power, which is not articulated in any formal chart or description. DeFillippi and Arthur (1998) discovered in their empirical study of film making, that the deepest learning accrued to people who assumed brokering roles at the intersections of communities engaged in projects requiring cooperation among their contributors.

Based on the idea of the sharing of knowledge by participating into communities of practice, learning is much more than acquiring and transferring items of knowledge. Social learning theory views learning as a participation in social processes and practice (Lave & Wenger, 1991; Brown & Duguid, 1991). This moves the focus away from knowledge as merely context-free items that are transferred between various entities. Prevailing literature on project competence and knowledge has mainly focused on project knowledge and competences as separable attributes from the project context and concentrated on the learning of project manager instead of the entire project group. Knowledge sharing in project context requires focusing on participation-based view of knowledge sharing.

This study adopts the personalization strategy on knowledge sharing. Communities as social structures are viewed as means to realize the personalization strategy, as learning in them is based on interaction. The social

nature of learning emphasizes the relationship dimension. Knowledge to a great extent is context-bound. Privileging personalization does not imply that the codification strategy does not have a role in knowledge sharing. The appropriate strategy in project-based environment would be a combination of both strategies. The personalization strategy as the main approach emphasizes the notion of knowledge being distributed in various groups, project groups, communities and such, while the codification strategy allows building of project-based knowledge repositories. Projects produce much explicit and rather generic knowledge that may be utilized in other projects. Viewing knowledge totally situated and context-specific would argue against this notion of codified, explicit knowledge. The next session discusses practice-based learning theories which may be applicable in project contexts.

2.5.5 Practice-based learning in communities

Two different approaches prevail within the theories of organizational learning (Elkjaer, 1999). Learning has been understood both as a cognitive and social activity. Learning as individual cognition sees learning separate from other activities in the organization. Other approaches view learning as a participation in social processes and practices.

Sfard (1998) accordingly refers to two metaphors of learning: learning as acquisition and learning as participation. The acquisition metaphor refers to learning as a process of acquiring knowledge and views the human mind as a container to be filled with certain materials and the learner as becoming an owner of these materials. The participation metaphor, instead, views learning as a process of becoming a member of a certain community. It entails the ability to communicate in the language of this community and to act according to its norms. Learning is a process of becoming a part of a greater whole. The acquisition metaphor emphasizes the individual mind and what goes "into it" while the participation metaphor focuses on the evolving bonds between the individual and others. The acquisition metaphor stresses the inward movement of the object known as knowledge, participation focuses on part-whole relation, as the whole and its parts affect and inform each other. Furthemore, the participation metaphor assumes that the identity of an individual is a function of his or her being a part of the greater entity. Viewing learning as a totally individual activity is misleading, as learning is much more than acquiring and transferring items of knowledge (e.g. Gherardi et al., 1998; Elkjaer, 2003). Individual learning theory has been criticized, as it focuses on learning as inner processes related to acquisition and processing of information and knowledge and leads to the mind being the locus of learning and thereby leading to the separation of the learner and the context (Elkjaer, 2003).

Elkjaer (2003, p. 38) argues that social learning theory encompasses both the epistemology and ontology of learning, whereas individual learning theory delimits itself to the epistemological part of learning. Social learning theory has been described by several names, e.g., situated learning (Lave & Wenger, 1991; Brown & Duguid, 1991; Richter, 1998), practice-based learning

(Gherardi et al., 1998), and collective learning as cultural processes (Cook & Yanow, 1993). Generally social learning theory refers to knowing, being and becoming, and this in particular, according to Elkjaer (2003), shows that it encompasses both the epistemology and ontology of learning. Wenger (1998) refers to social theory of learning, consisting of central components of community, practice, identity and meaning. Components are connected to learning in various ways: Practice refers to learning as doing, community to learning as belonging, meaning as learning as experience, and identity as learning as becoming. However, Elkjaer (2003) refers to the term social learning theory, where the point of departure is the living experience of everyday life. This study refers to the term social learning theory when describing activities and participation in the communities of practice and other types of social structures.

Based on social learning theory, learning is viewed as participation in social processes and practice (Lave & Wenger, 1991; Brown & Duguid, 1991), and to know is to be capable of participating with the requisite competence in complex relationships among people and activities (Gherardi et al., 1998). Situated and social characteristics of learning are emphasized, the central issue in learning is "*becoming* a practitioner, not learning *about* practice" (Brown & Duguid, 1991, p. 48). It refers to becoming part of the social world, being in it, and not a way of coming to know about it (Lave & Wenger, 1991, Brown & Duguid, 1991; Gherardi et al., 1998). Learning about is the accumulation of actual knowledge of "knowing that", while learning to be, is about "knowing how" by application and practice (Brown & Duguid, 2000). This view draws the attention away from abstract knowledge, as learning is situated in communities (Brown & Duguid, 1991) and moves the focus away from the individual. As a member in the community, individuals can learn from other members. Thus the role of the individual as a learner is to be engaged in sensemaking (Weick, 1995).

The theory of Lave and Wenger (1991) has been referred to as a practice-based theory of learning (Brown & Duguid, 1991). Brown and Duguid (1991) refer to learning as situated in social practice and this type of learning is an integral and separable aspect of social practice. Based on Dewey (1916/1966, in Tynjälä, 2000) knowing and doing as processes are not separable. Lave and Wenger (1991, p. 29) suggest that learners participate in communities of practitioners and the mastery of knowledge and skill requires newcomers to move toward full participation in the socio-cultural practice of a community. They refer to legitimate peripheral participation as a process by which newcomers become part of a community of practice, gradually towards full participation. Peripherality implies the degree of engagement: multiple ways of engaging, more- or less-engaged, ways of being located in the fields of participation defined by a community (Lave & Wenger, 1991). Peripheral denotes the existence of a path the newcomers must follow to be recognized as a full member (Gherardi et al., 1998). Legitimate refers to gradual learning that takes place only in connection with the institutionalization of the process, which

reaffirms that the process is social and not merely cognitive (Gherardi et al., 1998). Participation refers to participating in an activity which all members have understanding. Legitimate peripheral participation is seen twofold: on the one hand it refers to the development of knowledgeable skilled identities in practice, and on the other hand the reproduction, and to understand learning makes no differentiation between participation in practice transformation of communities of practice. However, it is not only the newcomers that learn and gradually become full members of the community, the experts also learn from the newcomers and get new insights and ideas (Lave & Wenger, 1991).

Newcomers enter the community and they communicate with experts. This forms an apprenticeship-relation and moving from peripheral to full participation takes place either through formal or informal apprenticeship. Nonaka and Takeuchi (1995) also refer to the apprenticeship-master relation in socialization process in their knowledge creation theory. As apprentices work with their masters they learn craftsmanship through observation, imitation and practice, and not through language. They relate the socialization to the sharing of tacit knowledge requiring some form of shared experience. However, not all forms of apprenticeship facilitate learning, some may even prevent it and actually some studies in apprenticeship literature show that training programs are quite pessimistic about the value of didactic exercises (Lave & Wenger, 1991). Lave and Wenger move away from the traditional connotations of the apprenticeship-master relationship. Instead they refer to participation in a community of practice.

Schön (1987) refers to entering a practicum, as someone becomes an apprentice to senior practitioners. When someone learns a practice, he is initiated into the traditions of a community of practitioners and the practice world inhabited by the practitioners. This involves learning their conventions, constraints, language and appreciative systems, repertoire of exemplars, systematic knowledge as well as patterns knowing-in-action. The idea of reflective practicum involves learning by doing, coaching rather than teaching, and a dialogue of reciprocal reflection-in-action between a coach and a student.

Lave and Wenger (1991) argue that participation in social practice implies a focus on person-in-the world, which refers to a membership in a socio-cultural community and promotes a view of knowing as activity by specific people in specific circumstances. Learning implies being able to be involved in new activities, perform new tasks and functions as well as master new understandings. As learning implies becoming a different person, learning also involves the construction of identities. Development of identity is central to the careers of newcomers in communities of practice and therefore fundamental to the concept of legitimate peripheral participation (Lave & Wenger, 1991). Learning transforms who we are and what we can do and therefore it is an experience of identity (Wenger, 1998). Viewed as an experience of identity, learning entails both a process and a place, and to support learning is not only to support the process of acquiring knowledge, but also to offer a place where

new ways of knowing can be realized in the form of such an identity (Wenger, 1998). Learning and identity are inseparable and aspects of the same phenomenon (Lave & Wenger, 1991), as learning is implicated in acquisition of knowledge, it is also implicated in the acquisition of identity (Brown & Duguid, 2001). Learning involves acquiring identities that reflect both how a learner sees the world and how the world sees the learner (Brown & Duguid, 2001). It involves the ability to act in the world in socially recognized ways. By participating in a community members develop their expertise and professional identity. Moving toward full participation in a community of practice is most significantly an issue of increasing sense of identity as a master practitioner and not just commitment of time, effort and broader responsibilities (Lave & Wenger, 1991). Becoming a better practitioner requires that the learning the learner makes better sense of work, and learning-in-working is an occupational necessity (Brown & Duguid, 1991).

Cook and Yanow (1993) attempt at understanding learning in terms of organizational culture. They (p. 379) define culture in application to organizations as "a set of values, beliefs, and feelings, together with the artefacts of their expression and transmission, that are created, inherited, shared, and transmitted within one group of people and that, in part, distinguish that group from others". Cook and Yanow (1993) argue that human action includes the ability to act in groups. In the course of joint action or practice, a group creates a set of inter-subjective meanings that are expressed in and through their artefacts. As new members enter the group, each acquires a sense of these meanings through the everyday practices in which the organization's artefacts are engaged. Through such "artifactual interactions", shared meanings are continually maintained or modified as they are the acts that create, sustain, or modify the organization's culture (p. 379).

Theories of social learning can be traced back to pragmatism as a philosophy and the foundation for an educational approach, as represented by Dewey (Elkjaer, 1999; 2003). The pragmatist perspective is primarily concerned with "knowing", which is understood as a part of concrete, dynamic human action instead of "knowledge" which is seen as abstract and static (Cook & Brown, 1999).

Social learning theories also have their roots in a socio-cultural approach. L.S. Vygotsky has been considered as the "father" of this approach. Central to Vygotsky's view of learning is the concept of the zone of proximal development. This refers to the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with capable peers (Vygotsky, 1978, p. 86). The dialogical character of learning refers to the instruction a child has from an adult. Learning new things takes place in social interaction between a newcomer and an experienced person. The Vygotskian tradition has largely been seen as collaboration based on the interaction of expert and novice, whereas an expert

helps the novice gradually reach a higher mental level. The zone of proximal development describes this gradual movement. When operating in the zone of proximal development the ideal group involves heterogeneity thus the task requires the collaboration of whole group as no one individual is able to complete the task (Tynjälä, 2000).

Communities of practice can be seen as contexts for knowing and learning (Wenger, 1998). Wenger (1998) refers to communities of practice as social structures where learning takes place both at the collective and individual level and always has both collective and individual characteristics. Learning in communities of practice is not based solely on individual but also on communal experience (Hakkarainen et al., 2004). Social learning theory emphasizes informality, improvisation, collective action, conversation and sense making (Elkjaer, 2003). Learning is seen as an ongoing activity, which cannot be controlled. Only the environment, the organization, can be made to facilitate organizational learning (Elkjaer, 2003). In this study, learning in project groups and communities is seen to take place both collectively and individually. The meaning that the members have of their work is constructed in the participation in the activities of these groups. Other members help each other develop competences, which are needed to perform the required tasks.

2.6 Key concepts of the study

This section provides a summary of the central concepts of the study.

Knowledge and competence in project-based environments are viewed from the point of view of the project group as experienced by the members and seen as both as individual and collective phenomena. Knowledge and competence are collective in the way that they reside in the groups of people. Yet the point of view is extended to involve competences of individual members, as organizational actions are based on human competence, and it is the members of projects who act and communicate in project groups. Collective competence at the group level implies a group's ability to work together towards a common goal (Hansson, 1998; Sandberg & Targama, 1998). The collective competence residing in the groups reflects the social nature of learning and social learning theory (Lave & Wenger, 1991; Brown & Duguid, 1991; Wenger, 1998), which proposes that learning is viewed as a participation process rather than an individual activity. The duality of participation and reification forms the two processes of learning within a community (Wenger, 1998). Finally, in this study, the approach to an organization's knowledge management strategy builds upon the personalization strategy (Hansen et al., 1999).

The term social structure is used to cover social forms that are both emergent and designed in organizations. Social refers to groups of people interacting with each other. A special type of a social structure is a community. A community is defined in this study based on Wenger (1998). As Wenger refers primarily to communities of practice as informal groups, his definition is extended, as the purpose of this study involves a study of communities both as informal and as formalized social structures for knowledge sharing in project-based business environments.

The central elements of communities are defined as the domain of knowledge, community and the shared practice (Wenger, 1998), which are used to distinguish communities from formal work groups and other organizational structures. The central feature of a community in this study is that it is based on a shared interest rather than management initiated goals, although it involves management initiation as well. Practice is referred to as the coordinated activities of individuals and groups in doing their "real work" (Cook & Brown, 1999). Further, target communities are recognized, based on voluntary membership as well as they are work related and cross-organizational. They all share the organizational context of project-based work, as projects are temporary, dispersed and cross-organizational.

Boundary crossing is critical to learning (Wenger, 1998) and the sharing across organizational boundaries takes place through the concept of multimembership (Wenger, 1998), which proposes that people acting in various positions in organizations carry knowledge with them, and knowledge is reconstructed in and between various contexts. The concept of the multimembership complies with to the dispersed project-based environment (Figure 9). Knowledge sharing by multimembership in organizations is based on the idea of the personalization strategy.

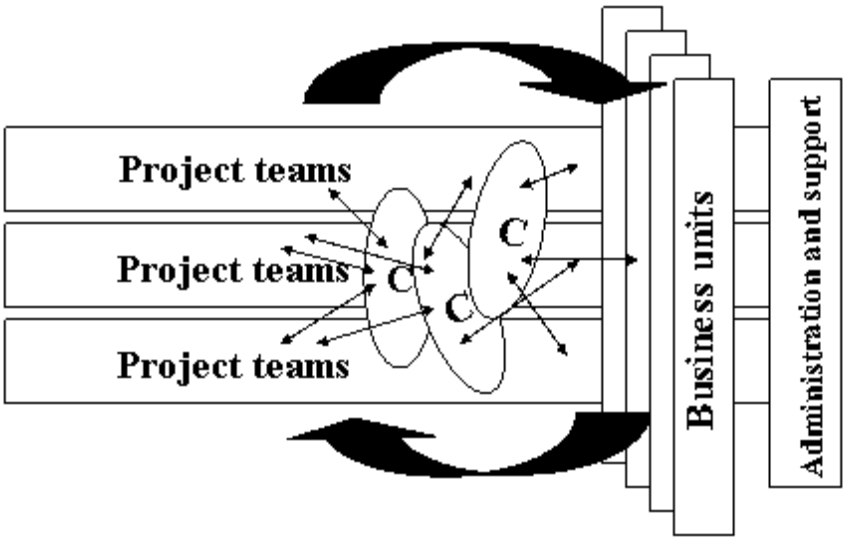

Figure 9 Communities (C) as connecting mechanisms in project-based environments

This study proposes an alternative view of the sharing of project knowledge and competence. It is not suggested to substitute other methods, such as project knowledge bases as based on the codification strategy and project reviews. Instead, it proposes much to complement contemporary methods by focusing on interaction and social knowledge sharing processes. Much knowledge in projects is context-bound. Therefore retrospective reflecting in post-project reviews may not allow for recall of what has been learned. The hypothesis is that in dispersed project-based environments, communities are formed for learning and knowledge sharing of project-related knowledge and competence, as they are based on multimembership and participation. Members act in multiple roles and move between various projects while remaining positioned in their business units as well. Participation supports the notion of context-bound project knowledge. By reifications this knowledge may be put into concrete forms to be shared with those off the context. Many of these communities remain unknown and are based on social interactive networks of people. Yet many communities are formalized and recognized in their host organization. This study aims to recognize the characteristics that promote successful operations and interaction of the multiple types of recognized communities in project-based environments.

3 Empirical study and analysis

The empirical part of this dissertation consists of four interrelated studies (Figure 10). Each study is presented and discussed in individual sections.

The empirical study started with a research project on project knowledge and competences. The aim of the two case studies was to enter into the field of project-based organizations, to study the context of projects as well as the content of knowledge and competence. This involved a loose framework of project competences, which was used as a stimulus for the respondents. The framework was modified based on the responses and analysis, as the research approach throughout the study is abductive (Dubois & Gadde, 2002). The findings showed that project knowledge and competence are not merely individual, but also collective in nature. Lack of communication and interaction created problems. Additionally, project knowledge management was inadequate. The need for mechanisms for collaboration and knowledge sharing emerged from the data. This led on to the formation of research questions for the further study: how to promote interaction, collaboration, and knowledge sharing in a project context? How to share critical knowledge and competences?

As interaction was emphasized, the study focused on studying the social structures in place in a project-based organization. Again, a loose framework was adopted from the literature, yet the respondents were encouraged to describe their participation in knowledge sharing practices freely. The results showed variety and heterogeneity of social structures in the case company. Among others, community-based structures emerged from the data varying from very informal to formalized ones. Communities were not necessarily recognized and called “communities”. However, the community-based social structures were not defined as part of the formal organization thus they were not integrated into formal management processes, they were mostly semi-formal structures. This led to the formation of the research questions for the next phase of the study: What are the community-based social structures like in project-based environments and what are their characteristics? Eleven groups were studied as communities. Finally, this study was supplemented with a more detailed case study on one of the target communities.

As a result of the empirical study, critical project knowledge and competences are presented. Secondly, characteristics and outcomes of communities are presented and guidelines for developing communities in project-based environments are provided.

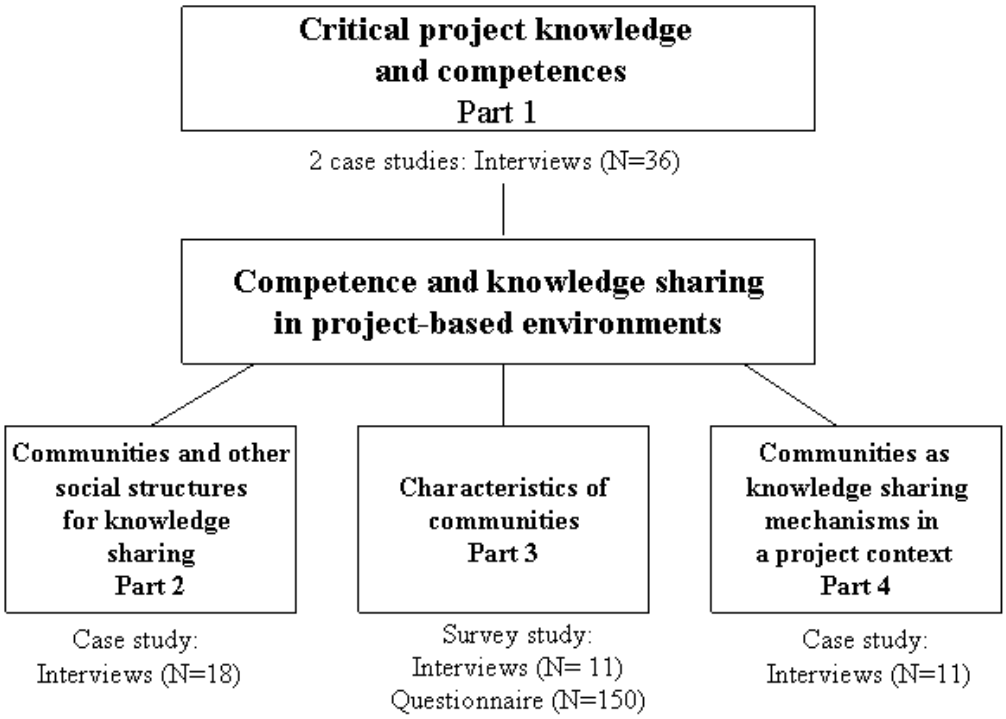

Figure 10 Structure of the empirical research

Structure of the results chapter introduces these studies in the following order:

3.1 Study 1 Knowledge and competences in project contexts

3.2 Study 2 Social structures for knowledge sharing

3.3 Study 3 Characteristics and outcomes of communities

3.4 Study 4 Communities as knowledge sharing mechanisms

3.1 Study 1: Knowledge and competences in project contexts

3.1.1 Introduction

The content of knowledge and competence in project-based environments require further examination as a setting of the stage for studying knowledge and competence sharing mechanisms. This study takes as its starting point the project group level and assesses the competence needs from the point of view of the entire project group. In order to understand competence and knowledge assets, mere identification is not enough, but their understanding in all their complexity is necessary (Leonard-Barton, 1995). This understanding requires focusing on the experience of the target persons.

The study embodies two case studies. The research project of Case A was carried out in cooperation with Helsinki University of Technology and the Federation of Finnish Metal Engineering and Electrotechnical Industries (from now on referred as MET). The objective was to recognize the critical knowledge and competences that are required in project-based work. The objective of Case B was to study the critical competence and knowledge needs of the delivery project from the viewpoint of the participants of the process.

3.1.2 Data and data analysis

Target organizations and projects

Case A

Case A is a technology program managed by MET and consists of many projects. The target projects in the study were two framework projects and one review project. The projects were partly funded by Tekes (The National Technology Agency) and partly by the participating companies.

The technology program involved several organizations including international companies, small and medium sized enterprises, universities, and research institutions. The program involved many projects and sub-projects (Figure 11). The projects that were studied were Rasko, SeaTech and review project Tivli. Rasko aimed at increasing the efficiency of medium and heavy assembly. The total volume of the three-year program was EUR 17.6 million and there were 44 company participants and two research institutions involved. SeaTech aimed at securing the technological competitiveness of Finnish shipbuilding and shipping industry. The total volume of the three-year program was EUR 2.5 million, and all the major Finnish shipyard companies, several shipping companies and public organizations were involved. Tivli was a review project, and it aimed at mapping the preconditions necessary to establish a new framework program in the field of product information in networked businesses. It involved a single research institute that collected information

from a large number of companies operating in a single branch of business. The total budget was 130.000 €.

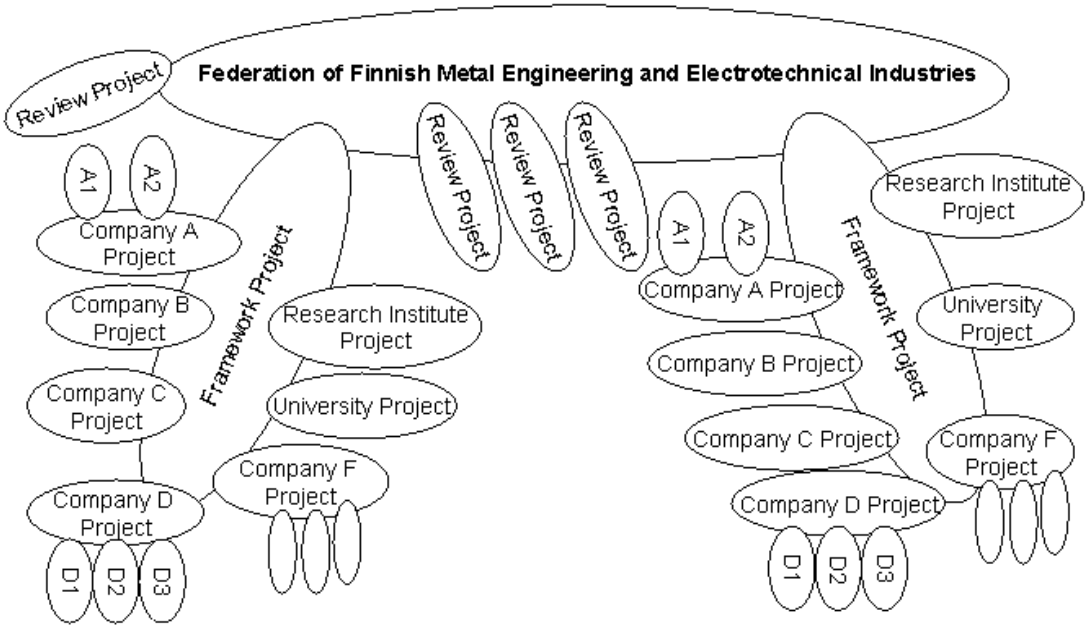

Figure 11 The project framework in Case A

The MET framework program includes five stages:

Ideating process

Program content

Potential participant

Charting of requirements

Ensures interest and possibilities for the ideated program

Start-up

Decision from MET

Actual planning of the program

Project proposals

Carrying out

Executing the program

Calling for project proposals

Completion

Evaluation of the results of the project

Dissemination of the results

Case B

Case B is a publicly listed company operating globally in the engineering industry. There are three types of deliveries. Firstly, the standard delivery processes are handled using a support tool. They are very standardized and cannot be described as projects in the strict sense. Secondly, there are special delivery processes (option delivery), which are based on the standard product, but will be modified according to specific customer needs. The special delivery process combines standard components and pre-designed options. These processes are arranged as projects. Thirdly, there are pure project deliveries, which include new sub-assemblies and components of the designed order. The research focused only on the special delivery processes of standard products, which were organized as projects (referred as "Delivery project").

The delivery project is based on the ordinary operations organized as a process, but each individual delivery process is defined and managed as a delivery project and the persons participating in a project vary in each delivery. Delivery projects are repetitive, but consist of unique features each time. Projects are performed simultaneously (Figure 12). The delivery project includes many participants, who work as a network during the project delivery. Participants are both within the company, such as salesmen and designers, and outside the company, such as subcontractors. When the deal is made, the technical support unit addresses the participants for that project. The product as a result of the delivery process will be referred to as "Product".

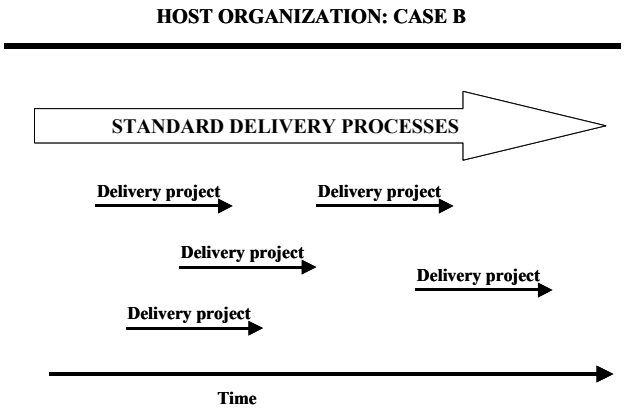

Figure 12 Delivery projects in Case B

The delivery process contains many parallel sub-processes and participants (Figure 13). The network structure makes it challenging to manage and coordinate.

Prior to the order of the product, many operations take place, such as marketing and inquiries. In special deliveries, the process usually starts by an inquiry from a customer. If the product order is made the project will start.

The product support team (technical support) has a central role, sometimes through the entire delivery project, in supporting the salesmen and designers.

They will assign the project team for the delivery. In bigger deals a kick off meeting for the representatives of central participants, such as sales, design and production, is supposed to take place. Those responsible for ordering and the product designers, who are part of the support team, are located between sales and production. They are responsible for the final specification of the product.

The order is forwarded to the person who handles it and supports the field salesmen by answering all sorts of technical inquiries and questions.

Production control is responsible for designing the production so that the manufacturing of the products in question can take place. Besides the product designer, there are also mechanic designers who design components, as well as electricity designers. There is also a person, a buyer, who is responsible for buying components from subcontractors as an ongoing activity.

The production in the factory is responsible for manufacturing of a certain part of the final product and for the management of the production material. In addition, there are both internal and external suppliers.

Delivery takes care of all the material leaving the factory and organizes details concerned with transportation. The assemblage of the final product will take place in a subcontractor's factory. All the material and components coming from different locations will be put together there. Finally, the installation group is responsible for the delivery of the product to the customer.

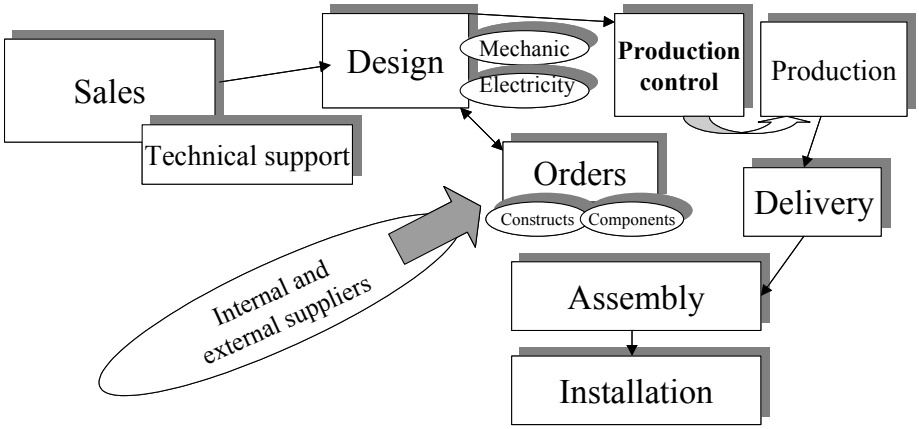

Figure 13 Participants in the delivery projects in Case B

Data collection

In Case A the projects had either ended or were about to end in the near future. The interviewees were project coordinators of MET, representatives of TEKES, representatives from the companies as well as representatives from Helsinki University of Technology and VTT Technical Research Center of Finland. Interviewees were selected to cover as many different participants and viewpoints as possible. However, it was not possible to review all participating members. The number of interviewees was 24. Interviews were conducted in 2000 – 2001.

In Case B twelve participants of the delivery project were interviewed during the fall of 2001. The interviewees were selected to represent all groups within the delivery project. This allowed the researcher to analyze the delivery project from multiple participants' perspectives and acquire a holistic view of the entire process.

The projects were analysed retrospectively. Material on projects was collected by means of documents, and interviews were then conducted. A stimulated recall method (Bloom, 1953; Jokinen & Pelkonen, 1996) was used in the interviews. In retrospective studies, there is a problem that the memories of the interviewee can be altered due to the time interval. The purpose of the stimulated interview is to provide the interviewee with as many stimuli as possible from the original situation. With the help of the stimuli it is easier to recall the original situation and thus increase the reliability of the data (Jokinen & Pelkonen, 1996). In these cases, a set of images was presented during interviews. One showed a project timeline with some key events and documents identified from the project documents. The other showed a picture presenting seven major areas of project competences identified from the literature (e.g. Crawford, 2000): Project management, leadership, communication and interaction, knowledge management, interest groups, technology, and processes and procedures. An interpretative approach to studying knowledge and competence requirements was sought, instead of merely listing the required attributes (Sandberg, 1994). The focus in this study is in the competences experienced by the respondents, even though a loose framework was used to stimulate the memories of the respondents. Finally, to study communication and interaction between participants, maps of the project participants were used. A retrospective analysis was made based on the interviews.

The interview themes (Appendix 1) were constructed to give answers to the research questions. The required competences were studied with semi-structured questions such as "What has been critical to the projects' success?" and "What kinds of problems appeared in the project?"

Analysis of data

The data were analysed by using a text-analysis program, Atlas.ti. Data was classified into classes related to themes based on the defined codes (Appendix 2, 3). The material providing answers to the research questions was gone through and analysed. Comments that produced simplifications to answers were added.

Classes were grouped, classes on critical knowledge or competence needs were gathered into one group. Inside these groups answers were further classified according to comments. This resulted in a description of all critical knowledge and competence areas that came up in interviews. Finally, areas were also quantified by counting the number of responses referring to various areas.

3.1.3 Results

This chapter introduces the results of the research and intends to answer the research question of the critical project knowledge and competence requirements in project contexts. Firstly, Cases A and B are presented individually, featuring both their critical competence and knowledge, the major sources of problems and cross-case conclusions are drawn.

Critical competences and knowledge in Case A

Project management was the most discussed competence area. Sixteen respondents mentioned the theme of organizing, administration and management as the most important area. These included areas such as the general management of the project, organizing, coordination and defining the ways of action and keeping the project together to the very end.

Communication and interaction (n=14) was considered critical for the success of the project. Project participants must be able to express themselves orally and literally. They are also required to act with different people in different situations. Project work is teamwork, in which cooperation and communication skills are emphasized. Additionally, external communication was mentioned (n=4).

Goals and objectives of the project were coded under *processes and procedures*, which include ways of action and ways of doing things in projects. Distinct from this area, project management in this study includes more technical management of the project, which is closer to conventional views of managing projects. Defining the content and the goals of the project, as well as the vision, was considered essential (n=12). Additionally, one respondent emphasized the realism and relevancy of the goals. Management of the whole entity (seeing the project as a whole, "the big picture") was important (n=11). Ways of action, which include project discipline and rules, were mentioned (n=4).

Interest groups and networking (n=9) was considered a key in a networked project context.

Management of the *technology* and the substance knowledge of the area in question were considered critical (n=12). Additionally, information technology (n=4) was mentioned.

Knowledge management was not considered very critical by the respondents. Issues of knowledge management were divided under three groups: knowledge management in MET (n=2), in projects (n=3) and in subprojects (n=3).

Leadership competence was not emphasized strongly in this case. Six respondents considered enhancing commitment and motivation important. Leadership style and leadership arrangements (n=4) were mentioned as well. One respondent mentioned executive group working.

Critical knowledge and competence areas are presented in figure 14.

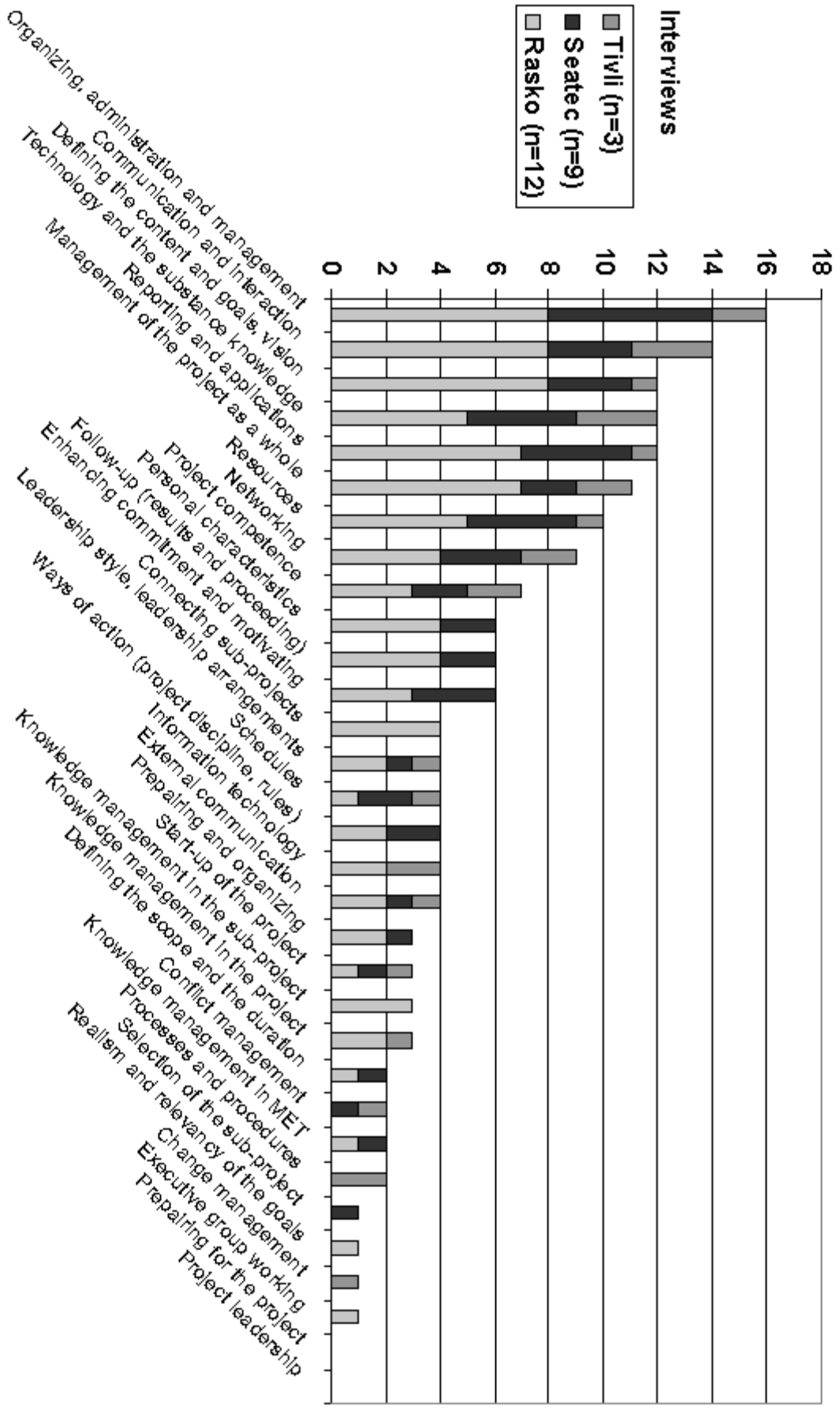

Figure 14 Critical project knowledge and competence areas in Case A

Problems and challenges in Case A

An alternative approach to analyzing project knowledge and competence was done by examining the challenges and problems that have occurred in the project work (Figure 15).

The main challenge was *knowledge management* in projects (n=19), even though only few respondents mentioned it as a critical knowledge area in the project context. Management of resources was also considered problematic (n=18). Projects had in most cases already started with scarce resources. Therefore working for projects was extended beyond the original project time line in order to achieve the original goals. Most of the personnel in projects were doing project work in addition to their own work, as there were no permanent project personnel. Therefore schedules were exceeded and persons were exhausted. This is closely related to defining the content and the goals, which were also considered challenging (n=12). There were many other challenges in the field of *project management*: Start-up of the project included, besides starting the actual project, the sub-projects as well. Start-up phase was considered problematic (n=12). All the sub-projects did not start simultaneously, which caused problems and resulted in difficulties integrating them into the overall project at a later date. *Organizing, administration and management* were considered critical knowledge areas, yet they involved development challenges (n=11). Change management of the project includes persons and the environment and was considered critical only by one respondent, yet eleven had encountered problems with it. Keeping up with schedules (n=10) was also an issue for development, since schedules were considered problematic. Reporting and applications were an essential part of the technology programs. Yet eight respondents considered that there were challenges and development needs in these. Development needs in other issues mentioned were lower, such as preparing and organizing (n=4) and choosing the sub-projects (n=4).

Problems in the area of *processes and procedures*, in defining the content and the goals, were recognized (n=12). Additionally, realism and relevancy of the goals were mentioned (n=4). Otherwise there were no major challenges in this area. Connecting the sub-projects to each other required some development (n=6), but otherwise management of the entity was not seen as problematic, since only one respondent mentioned it. The ways of action (project discipline and rules) (n=4) were not a major problem.

The biggest challenges in the *leadership* field were in enhancing commitment and motivating project group members (n=9). There were also needs in developing leadership style and leadership arrangements in general (n=5). Four respondents considered that the working of the steering group should be developed.

Networking with *interest groups* was considered critical and twelve respondents saw it involving challenges as well.

Management of the *technology and the substance knowledge* in question were critical, but they seemed to be managed well, since only four respondents considered them as challenges. Management of information technology was mentioned by seven respondents.

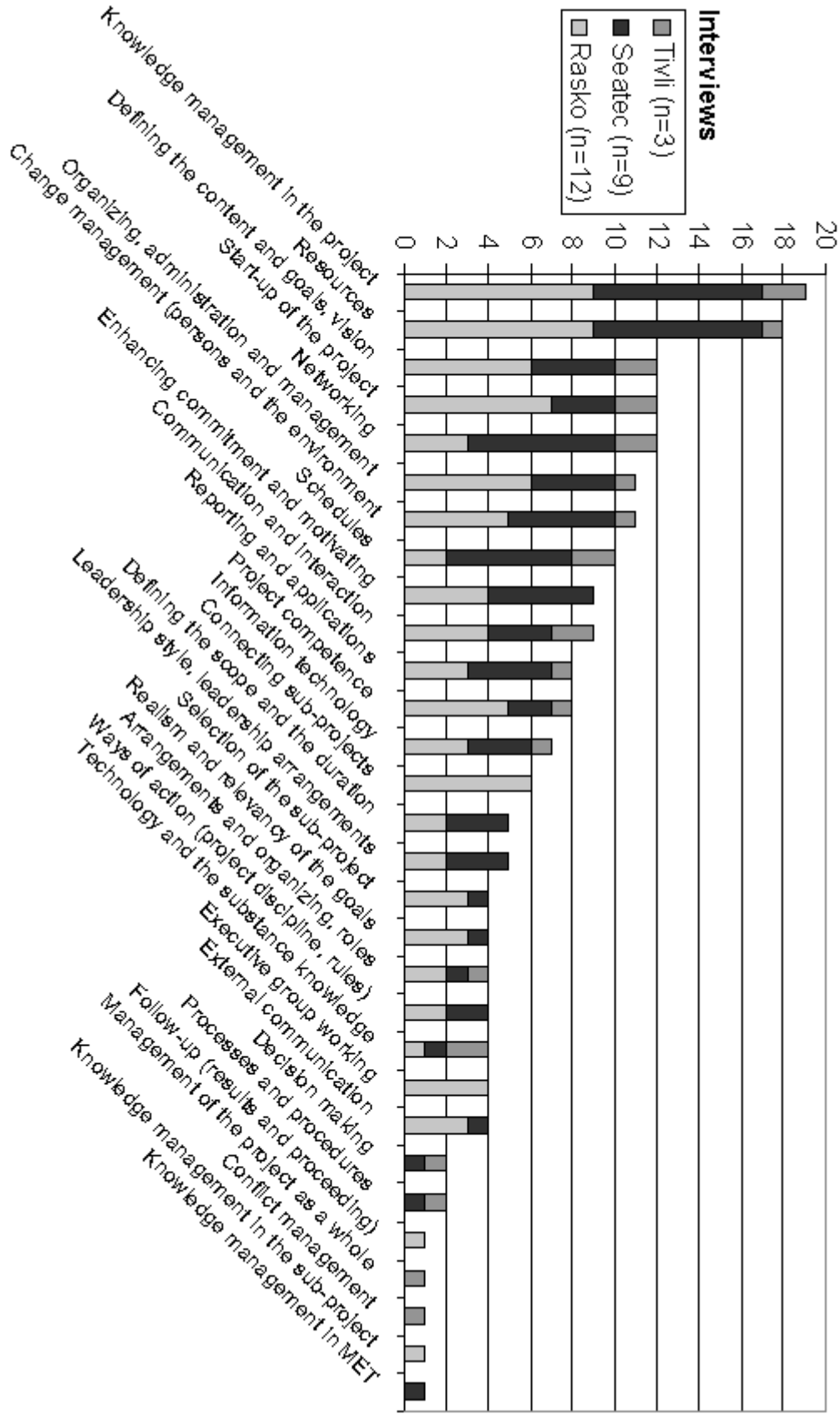

Figure 15 Problems and challenges in the case projects in Case A

Critical competences and knowledge in Case B

Mastering the product related *technical competence* was seen as the basis for a successful delivery (n=12). At the organizational level, this required world-class mastery of the product and systems related to it. Technical expertise was required at every phase of the process. In the beginning, negotiations with customers and an ability to handle the sales process required high technical competences from the sales personnel and support functions. Requirements differed somewhat in each phase and competence was very context-specific. Also, the depth of the required competence varied. Some participant groups, like designers, had to master the product as a whole while some had to master only slices. Support functions, like delivery, were only required to know the very basics.

Management and understanding of the entire process was emphasized (n=10). As organizing of the process was considered important under project management, this area included understanding of the *process and the procedures*. These responses included:

> Understanding of the process from the beginning to the end
>
> Understanding relationships between participants
>
> Understanding one's own place in the whole
>
> Understanding other participants' needs
>
> Understanding one's own work

"Seeing the big picture" included also the whole company, not just one's own business unit. Additionally, it had to do with knowing the company and its different parts and how they function (n=2). Also objectives (n=2) and rules (n=1) were mentioned.

In the area of project management competence, *organizing of the project* (n=10) included such areas as effective realization of the process, management of participants, clear distribution of responsibilities, methodicalness, and controllability. These all dealt with the traditional project management tasks. Additionally, the management of capacity (n=1) was related to this area: the load has to be levelled and resources managed.

As the delivery process consists of many participants and many boundaries, continuous *communication* and cooperation (n=7) were necessary for success. These included, at the project level, organizing and enabling cooperation by the organization. This included possibilities for divergent interaction, construction of the community spirit and feeling of belonging. Handling the boundaries was critical and there were often changes along the way, which had to be communicated to all parties. Dialogue between the participants helped to keep the product together throughout the long process.

The delivery project had both internal and external participants. Subcontractors and suppliers were essential participants, yet not belonging to the company's organization, so the project crossed organizational boundaries. Therefore, communication with suppliers and subcontractors was essential to success. There were many different *interest groups* and each internal participant had contact with different groups.

Organizing cooperation and enabling communication with different interest groups (n=6) was perceived as the most relevant area in managing interest groups. The more communication, the better internal participants get to know the interest groups. The need for information sharing was continuous, since all parties were working on tight schedules and delivery times.

Knowledge management competences were divided into four main categories: acquiring knowledge (n=7), storing knowledge (n=4), utilizing existing knowledge (n=2), and disseminating knowledge (n=2). Successful delivery was based, in the first place, on an ability to acquire the necessary knowledge from the customer and from the various participants of the process, both internal and external. This included codified as well as personalized knowledge. Storing the knowledge required getting the knowledge into explicit form, as well as common routines, programs and systems. Utilizing existing information was relevant, since delivery projects more or less repeated themselves, and it was necessary to know what has been going on in previous projects and also to transfer the lessons learned. Utilizing included knowing where to find the necessary knowledge as well as separating relevant knowledge from irrelevant knowledge. Enabling the knowledge sharing between participants was required since the process was long and the sharing of previous knowledge was critical to the next phase.

Competences related to a *customer* emerged as a special competence area in comparison to Case A. Case B was a delivery project aimed to design and produce a product a customer had ordered. Therefore, customers were an inseparable part of the project. Marketing and management of the sales process were emphasized in the beginning of the process and even before the take off. Defining new leads from the customers concerned the sales personnel, but also the assemblers, who worked in customers' facilities. Therefore, they were also in the a position with their direct relation to the customer. They might notice further needs while they were assembling the product and had a chance to discuss them with the customer and then deliver the needs to sales. Customer relationship management (n=6) required taking the lead in the relationship with the customer. Delivery project was an excellent source of up-to-date customer information.

Time management (n=4) was mentioned separately from the overall organizing of the project. Such critical requirements, as the management of the schedules, were mentioned. This led to punctuality in the delivery. Managing time and especially delivery times required equal distribution of tasks and adherence to the rules.

Change management (n=4) was related to the whole project. There were constant changes in the delivery project and therefore these were critical.

Common language (n=3) helped in communication and created the feeling of togetherness. It also enhanced the preciseness in communication. It included both the terminology (technical features) and common concepts. Also, everyday concepts had to be understood collectively, such as what does “in the morning” mean.

Results in *leadership* were very brief since the respondents did not comment much on leadership issues. Seven respondents mentioned some area of leadership competences. These answers included leadership in general, feedback, motivation, fairness, teaching and coaching. Knowing people and making full use of human resources (n=2) were also mentioned. This was connected to knowing the entire organization. The responses reflected the importance of leadership skills in project work, but further conclusions cannot be made.

Figure 16 presents a summary of the critical knowledge and competences.

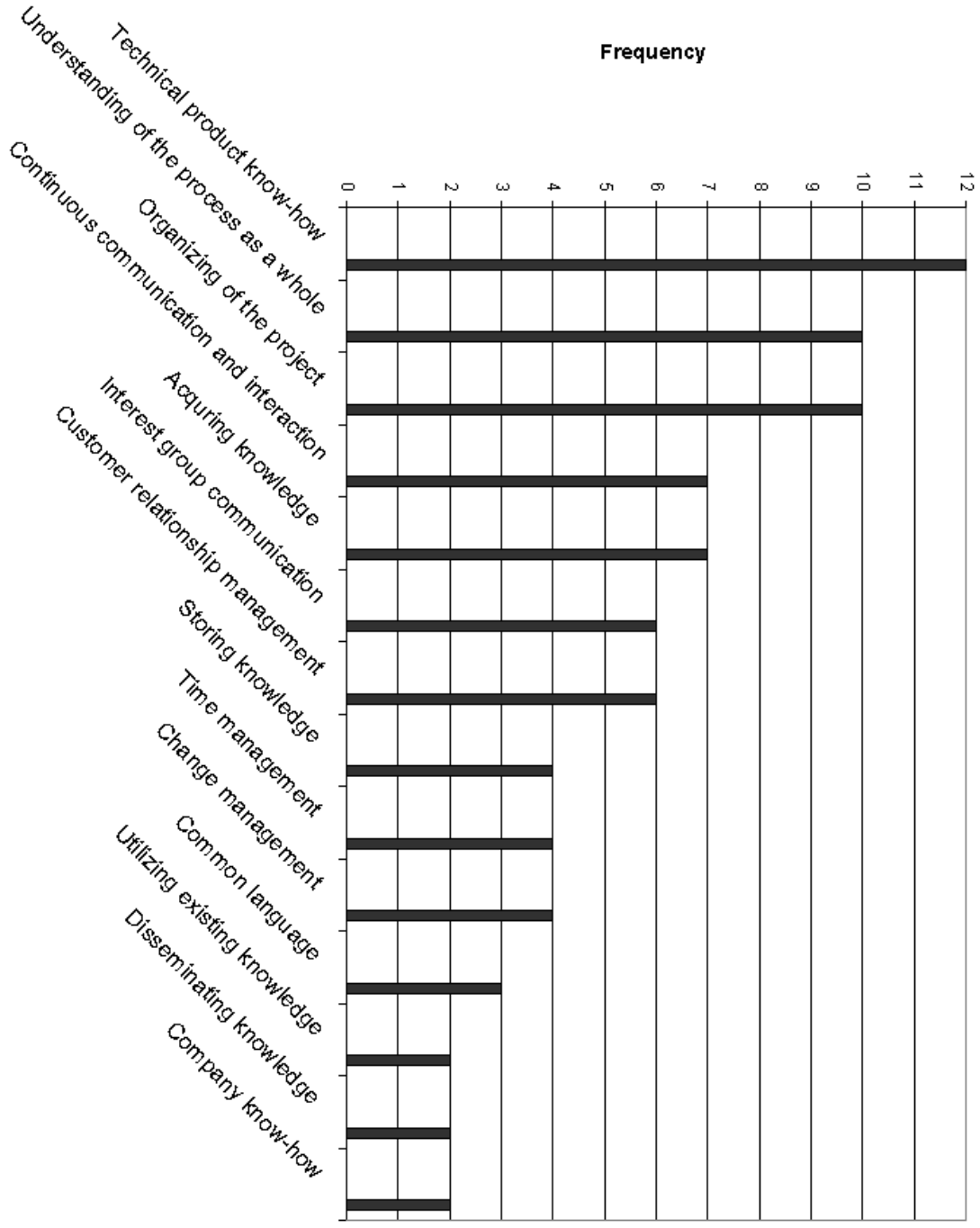

Figure 16 Critical project knowledge and competences areas in Case B (N=12)

Problems and challenges in Case B

Interviewees were asked to describe the problems and challenges they had encountered during the life span of the project.

The main problems were in the area of *project management*, e.g., time management, as every respondent mentioned the existence of these kinds of problems. They were mostly related to delivery times, but also to the capability to organize overall time management properly. This was affected by too small "bumbers", but also production would start despite difficulties in receiving components in time. Delivery times were confirmed unrealistic, which caused problems for the whole delivery.

The main problems with *technical competence* were errors (n=12), which were due to the lack of expertise on the field. They were mostly design errors. These were dependent on insufficient preparation and assurance. People were presuming many things and were not being precise. A special type of problem was also inadequacy of the initial data on orders (n=9), which took place in the beginning of the project. Problems with the systems (n=5) included inoperability and programs were outdated.

There were problems in *communication and interaction*. Almost all the respondents (n=10) perceived problems in knowledge sharing and communication. These included problems that were caused as the changes were not communicated. The long chain caused knowledge sharing problems, everyone was not aware of what had been agreed to. Additionally, there were problems in cooperation (n=2), which were realized through accusing other participants, "pointing with fingers", for mistakes. It was looking for the scapegoat rather than constructive problem solving.

Understanding of the process as a whole was also mentioned as a major cause for problems with *processes and procedures* (n=7). It appeared in many ways and linked to the communication between different participants. People tended very often to only take care of their immediate tasks and not consider how their own doings could affect others. In general, they did not have an understanding of other participants' work. Insufficient understanding on the corporation (n=2) was also mentioned. The department's customer always viewed the corporation as a whole and one part's mistakes are conceived as the mistakes of the whole corporation regardless of the unit in question.

Organizing of the process was seen as problematic by six respondents. Three of them mentioned that lack of the kick off -meeting was causing problems in complex deliveries. Delivery problems (n=6) included both unrealistic time confirmations, as well as delays in the delivery, which were often due to early confirmations.

Responsibilities and tasks were considered somewhat unclear (n=4). It was not clear whether someone was actually responsible for the whole project since there were no appointed project managers. This was mentioned as a problem

(n=4) and was also reflected in the problem of no one seeing the big picture of the entire project. This also reflected the problematic relationship between the standard delivery processes and the special delivery processes (n=3). Three respondents mentioned scarce resources. As no one was responsible for the whole project, the entity seemed to fall apart, as everyone just took care of their own duties.

Changes in the process were seen as problematic (n=3), as well as the lack of technical support (n=2).

Lack of common language (n=3) resulted in misunderstandings.

The biggest problems in *knowledge management* were related to insufficient tools for managing knowledge. These included groupware-tools, a customer management system and a proper customer register. Additionally, the production control system was used poorly and relevant information was not stored in it. Problems with knowledge management were closely related to problems with project management and proper organizing of the project. Groupware-tool was needed to enhance the overall management of the process as a whole and to help participants to view the state of the delivery at all phases. Knowledge was tightly engaged in people possessing it (n=2) and was not stored or shared in a sufficient manner. This was related to communication and interaction between participants, one has to know who has participated in previous projects in order to find out the required information.

The main problems with *interest groups* concerned the delivery times exceeded by subcontractors (n=3). These included the situations where suppliers were unable to deliver on time. The more intensive the communication with the suppliers was, the faster the internal participants would know about the delay.

As recognizing customer needs was considered important, there were also problems with customer related competence. Sometimes the customer was unable to explicate the needs (n=4), which most often was due to the fact that there were matters that were not yet fixed. Sometimes the customer had changed his mind about some detail (n=3). Only one respondent considered that the problems with the customers were due to insufficient knowledge of the customer.

3.1.4 Conclusions

The level of analysis in the two cases concerned projects. Knowledge and competence were described as experienced by the participants. Complementary views were collected about by the difficulties in projects. The analysis of answers was reversed in a way: what kind of competence and knowledge would have been necessary to avoid the experienced problems. This section involves cross-case conclusions of both cases. Firstly, there were similarities and differences concerning the projects.

Similarities and differences of projects in the cases

There were both similarities and differences concerning the projects. They were both part of larger networks. In Case A, participants were both from within and outside the target organization. External partners included research institutes, investors, and participating companies from the industry. In Case B, external partners were mainly sub-contactors and suppliers. The product was based on the cooperation of many producers. Customers could be considered as part of the network in both cases. Also, projects were technology driven.

There were many differences as well. Even though the projects were technology driven and usually involved a product, the project in Case A was more based on expertise sharing between the participating partners. In Case B, the goal of the project and the final outcome was always a concrete product: the product a customer had ordered from the company. The aim of the project was to design, produce, and deliver the final product to the customer. In this type of production based company, technical knowledge is the most critical knowledge (Vartiainen et al., 2003). Projects in Case B were more customer-driven than in Case A. The project was knowledge intensive, as the product required high technical expertise, but the new knowledge was not the main objective of the project. In Case A, creation and dissemination of new knowledge as such played a more important role than in Case B.

The organization of Case A was aimed at operating as a project-based organization. In Case B, organization was not designed as a traditional project organization, but as ordinary operations, the delivery processes, which were organized as projects. The timeline in Case A was longer than in Case B. In Case B, the project's duration was rather short varying from two weeks to some months. In Case A the roles were typical project roles and projects were temporary in a way that personnel had dual roles, as they worked partly in projects and partly in their home base units. In Case B, the personnel worked in stable functions and projects were organized around their permanent tasks as persons participating in each delivery were nominated. In the delivery project each person performed his or her permanent job. More attention to project management had been paid in Case A than in Case B.

Knowledge and competences in two cases

Organizing and project management were seen critical in both cases. In Case B, there were more problems in project management competence, since delivery projects were organized as ordinary operations rather than as projects with a nominated project manager and views on the responsibility were divergent. In Case A, there were assigned project managers. Yet, there were challenges as well, such as time management, overall organizing, and, especially, the organizing of the start-up phase. These problems indicated that projects were not an easy way to work, since many parts had to be interrelated and projects required much organizational work, which was additional to fulfilling the ordinary tasks.

Managing and understanding the project as an entity involved all participants of the project. Divided tasks resulted in a poor understanding of the project as an entity and what it was all about and resulted in weak understanding of the goals. Understanding of the entity came up especially strongly in Case B, where the project was divided into pieces and everyone was expected merely to take care of one's own tasks and duties. In Case A, there were problems in connecting sub-projects to each other.

Projects are composed of people working together towards a common goal. The need for communication and interaction within and between projects and with the environment was strongly emphasized in both cases, as they were structured as networks involving many participants, and the need for knowing people and cooperation across boundaries became obvious.

Projects are complex working systems involving many participants. Projects are organized as networks and this required in both cases, besides good communication, management of various contacts involved.

Technology forms the main domain of knowledge and the content of the project. Both cases were expertise- and knowledge- intensive, and technology driven, so high- level expertise in technology was required. In Case B, all the respondents mentioned technical product knowledge as the basis for the successful functioning of the project.

Knowledge management proved to be somewhat problematic. Even though projects in Case A were knowledge intensive, this was not considered very critical and received only some quotations. In Case B, there were also problems in the area of knowledge management, yet the respondents considered it critical, even though it was seen more from a codification viewpoint, as involving the improvement of tools and systems.

Leadership was not deeply discussed in the responses. Generally, leadership tended to be underestimated in project work.

Despite the differences in project settings there were many common characteristics in critical competence in the two cases. The frequencies of quotations in both cases are presented in table 4.

Table 4 Frequencies of quotations on competence needs in both cases

Competence	Case A	Case B
Organizing and project management	16 / 24	10 / 12
Communication and interaction	14 / 24	10 / 12
Technical know-how and technology	12 / 24	12 /12
Managing and understanding the entity	11 / 24	12 / 12
Interest groups and networking	9 / 24	6 / 12
Leadership	6 / 24	7 / 12

Additionally, in Case A, such areas as reporting and applications were emphasized. This describes the nature of the technology program, which involves participants from many sides, including investors. Case B was more customer-focused and involved commercial aspects.

Knowledge and competences in project-based environments

Organizing and project management generally were emphasized, as supported by the extensive project literature on this subject (e.g. Frame, 1995; Crawford, 2002). Project management tasks and competence areas are also described in detail in many standards (e.g. PMBOK, 1996). Project management competences have been widely discussed and recognized and the importance was also shown in this study. These areas relate more or less to the rationalistic views; competences and knowledge as attributes (Sandberg, 1994). Secondly, communication and interaction was considered critical in this study. Third, knowledge management came up in this study, although it is not widely discussed in the project literature. There is a considerable amount of literature on knowledge management, as well as on project management, but such a concept as "project knowledge management" is lacking (Kasvi et al., 2003). Kasvi et al. argue that systematic project knowledge management is required, if a project organization intends to become a learning organization, and if it wants to be able to apply the results and lessons learned from one project to another. Knowledge repositories and especially practices that facilitate the use of this repository are required, since organizations will not be able to rely on individual memory as people forget, as well as come and go.

The emergence of collective competence requirements was interesting. They were not specifically asked in the research questions, but they emerged from the data, e.g., in the form of the shared understanding of the project as a whole. Generally, project management has not strongly emphasized competence at the collective level of a project team or a network. But, as Sandberg and Targama (1998) argue, shared understanding is the basis for collective competence. In

this study, the management and understanding of the project as a whole was emphasized and seen as being a major source of difficulties in projects. This was stronger in Case B, which was a network of participants in which the projects were carried out as ordinary operations in the company. The goal of the work was to fulfil the needs of the customers. Recognizing and knowing the customer at all levels was perceived as critical, even for people not in direct customer contact. Mutual understanding of the goals of the project was emphasized in both cases. Goals guide the work throughout the project and keep participants on the same track. Project plan aims at creating the big picture (Frame, 1995). In the networked projects individuals and various groups must be able to integrate their competences. This integration of competences calls for the concept of collective competence.

Interpersonal and practical aspects constitute collective competence (Hansson, 1998). Interpersonal competence includes not just skills of individuals, but a group's ability to work together with different individuals. This kind of competence is collective in nature and context-dependent. Each interaction situation is unique with different individuals and different actions. Practical competence, according to Hansson, includes both an ability to solve problems and to handle the assigned task. Individuals must be able to find ways to solve emerging problems together and by finding ways to solve them fulfil the given task. This ability develops only by working together and is context-dependent as well.

Project participants are supposed to form a mutual agreement on what the project is all about and how the goals are achieved. The project plan serves as an explicit description of the domain of the project. A shared understanding of the domain is required in communities of practice (Wenger, 1998) and the same may apply to project groups as well. Projects, even though they are formal team structures in contrast to communities of practice, are joint enterprises, in which members should have a shared understanding of what the project is all about.

Target projects had many problems, and many of them were repeated. This may be partly a sign of context-dependency, each project is unique and operates in its own context. However, many mistakes were repeated that could be avoided as they are based on poor management of processes and procedures. Unclear definition and goal setting lead to problems during the project's run. Other causes for failure were changes made during the project, as well as unrealistic schedules, knowledge sharing and feedback.

As competence and knowledge management literature has mainly focused on either strategic competences creating competitive advantage or on individual level descriptions mainly resulting in attribute lists, the dimension of collective competence has been underestimated as critical competence and requires further research. It shifts the focus from the individual to the groups and their ability to fulfil the task together (Hansson, 1998). The field of collective competence has not been studied extensively, especially in the project contexts.

Yet more understanding on the work of individuals is required as well, since organizational actions are based on human competence (Sandberg, 2000).

Participants in the delivery process acted as individuals and each had their individual tasks and they saw very little unity with the other actors. This poses a challenge when learning is seen as a process that takes place in a participation framework (Lave & Wenger, 1991). Traditionally learning has been seen to take place in the individual mind. This paradigm may be prevailing in organizing the delivery process as well. It leaves the actors independent from others. Acting is inseparable from the whole and actors are not able to connect with each other and are all individual parts in a whole that is meant to be a participation framework. They are not able to construct shared understanding and meanings. However, activities, tasks, functions, and understandings do not exist in isolation; they are part of broader systems of relations in which they have meanings (Lave & Wenger, 1991, p. 53).

But as Sandberg (2000) argues, the rationalistic approach focuses on attribute skill lists. In fact this is how individual level competence management is started in many companies. In practice, competence management has primarily focused on modelling individual skills needed. This work has generated sometimes long attribute lists, which have proved hard to maintain and update. However, as Virkkunen (2002) argues, transformation is going on towards such competence management, which focuses on a collective level of competences and on creation of new competence and knowledge in cooperation with many parties.

Competences need to be viewed in a broader context rather than just single projects, since they are always part of the organizations around them. Projects are usually part of larger networks and therefore people participating in them need to cross various boundaries. It is important also to evaluate project competence on a broader scale not solely from the perspective of individual competences. Individuals tend to come and go and take their competence with them, so building the organization's project competence management on evaluation of individual competences creates an unsustainable foundation. The focus should be placed on the projects and their contexts as a whole.

3.2 Study 2: Social structures for knowledge sharing in project-based organizations

3.2.1 Introduction

The second study of the dissertation reports the results of the study on social structures that are used for knowledge and competence sharing in a project-based company. Personalization (Hansen et al., 1999) was chosen as a strategy that was followed.

The objective of this case study is to identify the social structures for knowledge sharing in the case company. The research aims at understanding how people share knowledge in their everyday work in a project-based company. Based on the results, a typology of communities and other social structures is presented.

3.2.2 Data and data analysis

The case company

The case company is an Internet Consultancy company that operated in four countries at the time of the research. The head office is in Helsinki, Finland, with 1 sub-office outside Helsinki. There were also offices in Amsterdam, Düsseldorf and Stockholm. However, the Düsseldorf and Stockholm offices were closed down after the research in 2003. The company was founded in 1997, and at the time of the research 280 people in total were employed in the four countries.

The company was organized based on four Competence Centres: Design, Technology, Consulting, and Project Management. The company was a project organization as all its activities were based on working in customer projects, and the main structure for organizing work was project teams. Project teams were directed to deliver client projects. Project work included the project team and a project manager. Project managers were organized as the competence centre of "Project management" and were professional project managers. Project members came from different competence centres. The projects had regular, formal meetings.

Data collection

Research methods included documents and interviews. Eighteen people were interviewed. They were selected to represent all offices, competence centres and included people from various positions and tasks to represent multiple viewpoints and perspectives. One interview with the representative from the Stockholm office, was a telephone interview.

There was a basic theoretical framework of communities and other social structures for knowledge sharing. Interview themes (Appendix 4) were based on these concepts. They involved issues on intra- and inter-group relations and cooperation, communication, knowledge sharing and collaboration, and

networks and communities. They were formed to find answers to the research questions. All interviewees were basically asked the same questions in order to be able to make reasonable and valid comparisons across informants, yet they were encouraged to describe their activities and participation freely.

The transcribed interviews produced the main empirical data for the case. Respondents described in the interviews the ways they cooperated and communicated with others within and outside the organization and how they shared their knowledge with others. The also considered the value they have generated to the work of others and the ways others have contributed to their work. Networks and communities and social relationships with others were discussed. Besides describing their activities they provided stories and examples.

Analysis of data

After the transcription, the interviews were analysed using a text-analysis program Atlas.ti. Data was coded into classes (Appendix 5) based on the themes of the interview, which, in turn, were based on finding answers to the research questions. Knowledge sharing forums, cooperation, and relationships were further classified for each respondent. Common features and anomalies were analysed and a typology of social structures for knowledge sharing was made.

The five dimensions were further subdivided into three categories respectively and formed the base of the analysis.

Formality

1. *Formal*: e.g. regular meetings with an agenda, a nominated leader and clear goals.
2. *Semi-formal*: ongoing interaction, but with more occasional meetings.
3. *Informal*: based on loose relationships, not necessarily visible to non members.

Boundaries

1. *Intra-organizational*: Involves members only from the case company, strictly internal.
2. *Both*: Involves members from the case company, but may also have one or two external connections.
3. *Inter-organizational*: Involves members from the case company and from other organizations.

Competence diversity

1. *High*: Involves members from all competence areas.
2. *Medium*: Involves members mainly from one competence area, but there may also be members from one or two other competence areas.
3. *Low*: Involves members from one area only.

Space

1. *Physical*: All members share the same physical location, e.g. an office.
2. *Both*: Most members share the same physical location: members are from the same office, but one or two members may come from other locations.
3. *Dispersed*: Members do not share the same physical location at all: all the members are from different offices or organizations.

Interaction

1. *Face-to-face*: All communication takes place face-to-face.
2. *Both*: Communication takes place both face-to-face and virtually.
3. *Virtual*: All communication takes place virtually.

3.2.3 Results

Communication

This study focused on social structures that were used for knowledge sharing in the case company. Besides the ones analysed in this study, the case company had formal steering system that involved knowledge sharing. This chapter describes the empirical data.

Communication in the case company took place both face-to-face and virtually. Face-to-face communication was considered more relevant than virtual. Table 5 summarizes the differences of the face-to-face and virtual communication, as the respondents (n=18) decribed them in the interviews.

Table 5 The perceived differences of face-to-face and virtual communication described in the interviews

Face-to-face	Virtual
Required in the beginning of the relationship, thereafter both are possible	
Helps to understand the process	Document shows the result
More suitable for idea generation	Suitable for throwing out an idea and seeing how others respond
Important decision making	Routine issues
Allows immediate feedback and explanation, gestures, one needs to respond	Lacks immediate feedback and reactions, can be neglected
Two-way communication	One-way communication
Precise, one can always explain	Possibility for misunderstandings
Suitable for sharing tacit knowledge	Suitable for sharing explicit knowledge
Does not leave a document	Leaves a document to get back to

Face-to-face communication primarily took place within organizational structures, e.g., within offices, competence centres, and project teams. Project teams were major connecting structures between competence centres, as members represented various competence areas. Projects were generally within offices, yet there were some cross-office ones as well.

Knowledge sharing practices

There were several formalized knowledge sharing practices in the case company. Various groups met on a regular basis, such as team meetings and management group meetings, which were integrated into management processes. These were related to the formal organizational structures. They were not analysed in this research, as the target was communities and other social structures, which were not integrated into formal management processes.

There were several structures that connected professionals. In all, sixteen different formal, semi-formal and informal social structures or spaces for knowledge sharing in the company were recognized. They were categorized as Intra- or inter-organizational structures, and further within intra / organizational structures distinguished between competence based / cross-competence structures, work-related / non-work structures, and spaces as contexts for knowledge sharing.

Intra-organizational social structures for knowledge sharing

1 Competence-based groups: Professionals representing same competence

Members in professional groups, competence-based communities and peer groups share a similar competence background.

Professional groups

Professional groups were connected members from the same professional positions, such as client managers. Their purpose was to share knowledge between the professionals and discuss issues of common interests. They were intra-organizational. They were formal and work related and based on a person's professional position in the organization. Members were mainly from the same competence centre. They usually shared the same physical space and communication took place both face-to-face and virtually.

Competence-based communities

Competence-based communities involved members from the same competence area, such as consulting, design, project management and technology. Their purpose was to connect people within competences, share advice and experiences. They were only fairly formalized. Members usually shared the same physical space and communication took place mainly face-to-face, but also virtually. They were more loosely and informally connected than formal professional groups, which had nominated leaders, strict agendas, and regular meetings. The distinction between these two was primarily in the degree of formalization.

Peer groups

Peer groups appeared at various levels. They were informal and emergent, in contrast to professional groups. A person may have a peer group that shares the immediate physical space, e.g., colleagues sitting in the same room. Relationships were very informal and ongoing. Peer groups were mostly within competence centres. Communication took place both face-to-face and virtually.

2 Cross-competence groups

Members in internal development groups, strategic communities, cross competence-communities, interest groups, and personal networks usually consisted of members with various competence areas. What keeps these structures together was the shared goal or shared interest.

Internal development groups

Internal development groups were temporary and had a recognized status in the organization. Their purpose was to develop concepts that were not directly related to any ongoing customer project. They were formalized and involved a leader and allocated time for developing a new idea or a concept. They were intra-organizational involving members from different competence centres. Members working in the development group usually shared the same physical space, but communication could take place both face-to-face and virtually.

Strategic communities

Strategic communities were related to the company's strategy. Their purpose was to create new business potential and new client solutions, connect competences, and concentrate on strategically important issues. A Digital marketing communication community was one example. They were fairly formalized and had organizational support. Members may share the same physical space, but were also members from other offices. Communication took place both face-to-face and virtually.

Cross-competence communities

Cross-competence communities connected people from different competence areas and different competence backgrounds. Their purpose was to connect people with shared interests in a certain domain. Examples were Mobile network and SIG community on Flash-programme. They were only fairly formalized and were intra- organizational. Communication took place both face-to-face and virtually. In addition, there were inter-organizational and dispersed cross-competence communities.

Interest groups

Interest groups were loosely connected and very informal. Their purpose was to share ideas and experiences on a certain common area of interest. Examples of intra-organizational interest groups were: Games development and eLearning. Members represented different competence areas. They did not mostly share the same physical space. Communication took place both face-to-face and virtually.

Personal networks

Personal networks were emergent and usually invisible to others. They were informal. Examples of these were: advice (to whom to turn to for advice), idea generation (to whom to turn to get new ideas, develop one's ideas), problem

solving (to whom to turn to in the event of a problem), and cooperation networks (with whom to work with across boundaries). They were based on social relationships between people and are usually formed based on experiences of former work relationships. They involved members from one or more competence areas. They were intra-organizational, although some of them crossed company boundaries. Communication took place both face-to-face and virtually.

3 Meeting spaces as contexts for knowledge sharing

Physical face-to-face forums, virtual meeting forums, and ad hoc spaces for interaction were based on dimensions of physical or virtual proximity.

Knowledge sharing forums

Knowledge sharing forums were physical or virtual. Their purpose was to share knowledge and experiences with others. They were intra-organizational. Physical ones were fairly formalized and followed a pre-designed concept. Examples of these were: Friday Infos, Fast breaks, and Company Opens. They involved members from all competence centres. Members shared the same physical space, and communication was always face-to-face. Virtual meeting places involved discussion folders in Outlook, and communication was virtual. Some of them were accessible only to certain groups, while some were open for everyone. Some were accessible to all offices. However, these were not frequently used. Additionally, one smaller office had an active Intranet discussion space, which was rather informal.

Meeting spaces

Meeting spaces were for ad hoc discussions on matters of mutual interest and knowledge sharing, and for discussions on problems and ideas. Physical meeting spaces were: hallways and corners, coffee machines, special meeting rooms, and a cafeteria. In the main office, the cafeteria was an important space for people to connect and form relationships. Spaces were informal and intra-organizational. They involved members from one or more competence areas.

4 Non-work social networks

Additionally, there were social networks that were not related to work issues, but took place within the context of the company. They served in getting to know other people in the company thus enhancing communication and interaction.

Designed social networks

Social networks involved activities outside work. There was a fairly formalized core group, 'Body and Soul' that was responsible for organizing social events. It was intra-organizational and involved members from different competence areas. Their target group was the whole personnel, though the activities took place in the main office. Members shared the same physical space and communication took place mainly face-to-face.

Emergent social networks

Besides the formalized network, there were emergent social networks, which involved people from various competence areas. Activities involved sports and bands. Communication was face-to-face.

5 Inter-organizational structures

Professional associations

Professional associations were inter-organizational and formal. Members did not share the same physical space and communication took place primarily on a virtual basis, but face-to-face meetings were held occasionally depending on association.

Partner networks

Partner networks involved partners who were working for the same client or worked as sub-contractors in the case. Examples of members in the partner networks were: advertising companies and technology consultants. Networks were inter-organizational and formal. Members did not share the same physical space. Communication took place both face-to-face and virtually

Inter-organizational networks

Inter-organizational networks involved members from various organizations. They were dispersed and communication took place mainly on a virtual basis. They shared an interest in a certain domain, such as mobile issues, or shared the same background, such as Alumni group. The Alumni meetings took place irregularly and consisted of members of present and former workers of the company. They were often referred to as inter-organizational peer groups or interest groups. A special interest group on Computer human interactions (SIGCHI) was an example of an inter-organizational network.

Dimensions of social structures

All the sixteen formal, semi-formal and informal social structures were analysed by using five dimensions and their three categories (Table 6).

Table 6 Dimensions of social structures and spaces for knowledge sharing in the case company

	Formality	*Boundaries*	*Competence diversity*	*Space*	*Interaction*
Professional group	Formal	Intra-organizational	Low	Same physical space	Face-to-face + virtual
Competence-based community	Semi-formal	Intra-organizational	Low	Same physical space	Face-to-face + virtual
Peer group	Informal	Intra-organizational	Medium	Same physical space/dispersed	Face-to-face + virtual
Internal development group	Formal	Intra-organizational	Medium	Same physical space	Face-to-face + virtual
Strategic community	Semi-formal	Intra-organizational	High	Same physical space/ dispersed	Face-to-face + virtual
Cross-competence community	Semi-formal	Intra-organizational	Medium	Same physical space/ dispersed	Face-to-face + virtual
Interest group	Informal	Intra-organizational	High	Same physical space/ dispersed	Face-to-face + virtual
Personal network	Informal	Intra-organizational	High	Same physical space/ dispersed	Face-to-face + virtual
Physical knowledge sharing forum	Formal	Intra-organizational	High	Same physical space	Face-to-face
Virtual knowledge sharing forum	Formal	Intra-organizational	High	Dispersed	Virtual
Meeting space	Informal	Intra-organizational	High	Same physical space	Face-to-face
Intentional social network	Semi-formal	Intra-organizational	High	Same physical space	Mainly Face-to-face
Emergent social network	Informal	Intra-organizational	High	Same physical space	Mainly Face-to-face
Professional association	Formal	Inter-organizational	Low	Dispersed	Mainly virtual
Partner network	Formal	Inter-organizational	High	Dispersed	Face-to-face + virtual
Inter-organizational network	Semi-formal	Inter-organizational	Medium	Dispersed	Mainly virtual

Table 7 shows that social structures were mostly semi-formal or informal, members were mostly from the company, though there were also members from other organizations, they involved members from more than one competence areas, most members came from the same physical location (office) and shared the same physical space, and communication took place both face-to-face and virtually.

Table 7 The characterization of social structures and spaces for knowledge sharing in the case company

Dimension	Level	Frequency (total N=16)	Conclusion
Formality	Formal	6	
	Semi-formal	5	Mostly semi-formal or informal
	Informal	5	
Organizational boundaries	Intra	13	Mainly intra-organizational
	Both	-	
	Inter	3	
Competence diversity	High	9	
	Medium	4	Mostly diversity of competences
	Low	3	
Space	Physical	7	Most members share the same physical location (e.g. office)
	Both	5	
	Virtual	4	
Interaction	Face-to-face	4	
	Both	11	Communication both face-to-face and virtual
	Virtual	1	

3.2.4 Conclusions

The study shows the great variety of formal, semi-formal, and informal social structures that were used for knowledge sharing in the case company. In fact, the number of formal structures was smaller than the number of less formal ones. Their analysis on five dimensions shows their great heterogeneity as well.

Knowledge management in the case company was based primarily on the personalization strategy (Hansen et al., 1999). Formal knowledge-sharing practices were based on face-to-face communication. In informal communication the personalization strategy and face-to-face communication

were valued more than virtual communication via ICT tools. The level of activity in the use of the Intranet and Outlook folders varied, but generally was not very high. In one small office, where people were physically close to each other, which promoted informal and spontaneous communication, the internal Intranet was also more actively used than in the other offices.

Communities of practice are referred to as informal, voluntary, and self-managed. They share a domain and practice and a sense of a community (Lave & Wenger, 1991; Wenger, 1998). They may also be more invisible to others than those who participate (Brown & Duguid, 1991). Social structures that correspond to the concept of community of practice were detected in the case company. The type that corresponded most closely to the concept is the cross-competence SIG community. It was self-managed, with a coordinator, and membership was voluntary and based on the members' passion for developing the shared domain and practice. Additionally, there were potential communities and networks of people communicating in shared domains. These network communities were emergent and very informal. One possible explanation for the great variety is that the communities are in different phases of their life cycles. A group may start with a loose structure but the level of formalization may increase with time.

Botkin (1999) and Storck and Hill (2000) refer to more formalized groups that focus on strategic issues. Strategic communities were intentionally created at the case company. They have the potential for being supported, institutionalized communities that enhance knowledge sharing in strategically critical competence and knowledge. They also have characteristics that correspond to the concepts of Wenger (1998) and Wenger et al. (2002), such as the shared domain and practice.

The types of communities defined by Andriessen et al. (2002) can also be recognized at the case company. Formal expert communities correspond to competence-based communities, such as Project manager communities, who do not work together on a daily basis, but share the same expertise and are dispersed. Daily practice communities were not emphasized in the case company. Peer groups working in physical proximity with mainly face-to-face communication correspond most closely to these. In most cases peer groups exhibited loose relationships. Large problem-solving communities were not found at the case company. Problem-solving was based more on personal networks, which were not recognized or visible to others, but the respondents referred to them when asked how they solved problems, tested their ideas and so forth. Email lists for problem-solving were mentioned by some respondents, but they were not organized, functioning rather on an ad hoc basis. Problem-solving, idea generation, and advice were based on personal relationships and experience of who knows what. These relationships correspond to what Krackhardt and Hanson (1993) found in their studies. A common feature of personal networks was that they were based on informal relationships that were not based on formal organizational boundaries but rather on previous working

and project relationships. Yet there was a shared interest. In this way, they are similar to communities, but they are more like sets of relationships (Wenger et al., 2002), and they are loosely connected. The boundaries of these networks are also constantly evolving.

There was a great deal of informal communication at the case company. Even though there were various formal meetings, people still had the need to connect with others informally. Nonaka and Konno (1998) refer to physical, virtual, and mental spaces, or ba. Mental spaces were not studied, but both physical and virtual spaces exist at the case company. Physical spaces can be referred to as "enabling communication spaces". In particular, the lunchroom in the main office was the space where relationships and potential emergent communities were built. The coffee machine in the cafeteria was referred to as "a physical hub" by one respondent. Davenport and Prusak (1998) refer to conversations at the water cooler as occasions for knowledge sharing. In one foreign office, there was a special meeting room for informal communication. As work at the case company is creative, a lot of informal communication seemed to take place in "hallways and corners". Learning was present in all sorts of activities (Lave & Wenger, 1991) and not just in formal training. Informal learning took place all the time, so facilitating learning by providing space and opportunities to meet other people are vital.

All in all, there were social structures that had the potential to develop into communities (Figure 17). Informal communities as social structures emerge from those social networks that exist in an organization or between them (Wenger et al., 2002). Enabling communication spaces and social interactive networks could be considered potential communities. However, not all social structures need to develop into communities. Rather, the great variety of social structures serves various purposes in organizations. The case study showed the need to provide multiple forums and channels to support knowledge sharing in the project-based company.

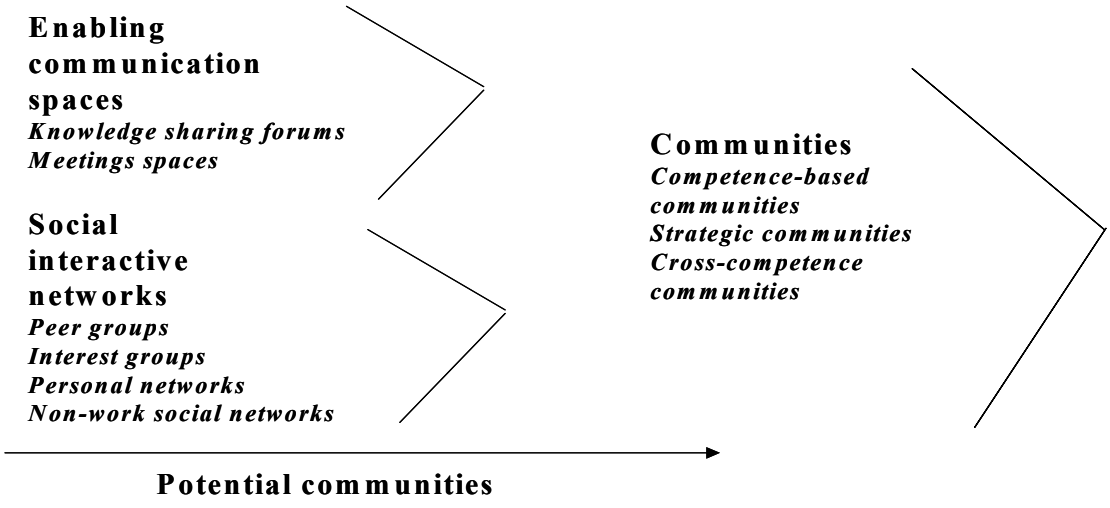

Figure 17 The spectrum of social structures in the case company

Finally, it must be stated though, that the challenge with the research of social structures remains. The ones that are detected are the ones that become visible for the researcher. Yet there are many that remain unknown and invisible. They are thus constantly evolving. Social structures and processes are continuously being produced and reproduced, interpreted and reinterpreted, so the thought of completely reifying them may be impossible (Elkjear, 1999). By the time they are made explicit and visible connections between people may have already altered (Huysman & de Wit, 2002).

3.3 Study 3: Characteristics and outcomes of communities

3.3.1 Introduction

The study was carried out as a co-study with the Technical University of Delft, where the questionnaire was designed for the assessment of communities. It is based on the Dynamic Group Interaction Model (Andriessen et al., 2001; Andriessen, 2003). The items of the questionnaire deal with the following topics: context features of the community, e.g., composition of the group; individual goals; activities of the group, e.g., contents of meetings; group facilitation, e.g., activities of the coordinator and use of ICT tools; as well as personal, group and organizational outcomes.

The objective is to identify and model social structures and their characteristics and some of their processes for knowledge sharing.

3.3.2 Data and data analysis

Target organizations and communities

Eleven groups in six organizations were studied as communities. They were selected to represent different types of groups. They were not all called "communities" in their organizations, and some were referred to as networks, groups, or teams. They had variance in their formality and organizational status. However, they were all focused on knowledge sharing, even though they might additionally have had other objectives. Target communities operated within the organizational boundaries and were all intra-organizational. The size of the community varied from 6 – 250 members. However, 52% of the communities had less than 22 members.

45 % of the communities had practiced less than a year. 52 % of members had been members in their community less than a year and 59 % of the communities had high turnover in the stability of membership. 65 % of the communities had both expert and junior members, whereas 35 % involved only experts.

41 % of the respondents were females, 59 % males. The average age was 30 – 40 years. 43 % of the respondents described their level of expertise as an "expert"[3]. The respondents had worked in the field of the community on average 4 – 5 years. The respondents had worked in the company on average 4 – 6 years. Duration of membership in the target community was on average 6 – 12 months.

[3] Response scale: 1=beginner, 2=somewhat experienced, 3=experienced, 4=expert, 5=highly experienced

Table 8 presents the companies and the communities and their dimensions, based on the typology of dimensions of study two. Target communities were both competence based and cross-competence communities.

Table 8 Target organizations and communities and their dimensions

Organization	Employees (2003)	Target group	(N)	Formality	Boundaries	Competence diversity	Space	Interaction
Internet consultancy	280	Digital marketing communication	10	Semi-formal	Intra-organizational	Cross-competence	Same	Face-to-face and virtual
Internet consultancy	280	Visual design	20	Semi-formal	Intra-organizational	Competence based	Same	Face-to-face and virtual
Internet consultancy	280	Project management	30	Semi-formal	Intra-organizational	Competence based	Same	Face-to-face and virtual
Telecommunication company	7368	Business Intelligence	13	Informal	Intra-organizational	Cross-competence	Dispersed	Face-to-face and virtual
Network service company	380	Project management and implementation	21	Formal	Intra-organizational	Cross-competence	Dispersed	Face-to-face and virtual
Network service company	380	DVBT Receivers (Development group 1)	7	Semi-formal	Intra-organizational	Competence based	Dispersed	Face-to-face and virtual
Network service company	380	DVBT Network management (Development group 2)	7	Semi-formal	Intra-organizational	Competence based	Dispersed	Face-to-face and virtual
Network service company	380	DVBT Distribution (Development group 3)	6	Semi-formal	Intra-organizational	Competence based	Dispersed	Face-to-face and virtual
Messaging and logistics service company	22.544	Project manager network	65	Semi-formal	Intra-organizational	Competence based	Dispersed	Face-to-face and virtual
Banking group	9038	Long term savings and life	16	Formal	Intra-organizational	Cross-competence	Dispersed	Face-to-face and virtual
Research institution	3000	Environment research	250	Semi-formal	Intra-organizational	Competence based	Dispersed	Mainly virtual

The target groups were expected to fulfil the basic elements of communities, following Wenger (1998): a shared domain of knowledge, community, and a practice. Additionally, they were recognized in their organization, which means that they are visible also to others than the members. However, this does not necessarily indicate recognition on behalf of management. Furthermore, they were based on voluntary membership, work related, and cross-functional in the way that members came mainly from various organizational units.

Target communities

1. Internet Consultancy company

Digital marketing communication community (DMC)

The purpose of the community is to develop knowledge and a shared approach on the domain of digital marketing communication. The community was established in September 2002 and members are both experienced and newcomers.

Visual designers (VD)

The purpose of the community is professional development, learning and knowledge sharing in the domain of visual design. It was established in the fall of 2002 and members are all rather experienced.

Project managers (PM)

The purpose of the community is knowledge sharing within project managers in the domain of project management. It was established in the fall of 2001 and members are both experts and newcomers.

2. Telecommunication company

Business intelligence network (BIN)

The purpose of the Business intelligence network is to gather, analyze and share market information related to the strategy process of the corporation. It was established in the fall of 2001 and members are all experts in their own fields.

3. Network Service company

Project implementation group (PIG)

The purpose of the Project implementation group is to coordinate projects in the company and share project related knowledge. It was founded in the spring of 2002. Members represent different competences so all of them are not experts as project managers.

Three Development groups: Development group 1, DVBT receivers (DG1), Development group 2, DVBT network management (DG2), Development group 3, DVBT distribution (DG3).

The purpose of the three Development groups is to collect, develop and share knowledge on the domains of DVBT receivers, DVBT network management and DVBT distribution. They were all established in the spring of 2001. All members are experts.

4. Messaging and Logistics company

Project manager network (PP-Network)

The purpose of the PP-Network is to connect the project professionals in the company and support their professional development. It also aims at supporting the project culture and project competence in the organization and share knowledge in the domain of project management. It was established in October 2002. 20 – 30 of the 65 members are active. Members are both experts and newcomers.

5. Banking group

Long term savings and life group (LTS)

The purpose of the community is to develop elements to support banks in one of the strategic competence areas: long term savings and life, as well as to share knowledge in the domain. It was established in 2002. Members are both experts and newcomers.

6. Research Institution

Environment portal (EP)

The purpose of the Environment portal in environment research is to connect professionals and share knowledge in the domain of environment research. It was established in November 2001. 1/3 of the 250 members are active. There are also sub-communities. Members are both experts and newcomers.

Data collection

The coordinator of each community (N=11) was interviewed. Data on the characteristics of the communities was collected by an online questionnaire (N=150). Coordinators were interviewed before delivering the questionnaire to the community members. Interviews were designed to receive information on the organizational context and the background of the community, such as establishment, coordination, members, and organizational support. Interviews were semi-structured (for interview themes, see Appendix 6).

The analysis of communities is based on the Dynamic Group Interaction Model (Andriessen et al., 2001; Andriessen, 2003). The characteristics of target communities under scrutiny in this study are: the structure of the community, purpose and goals, activities, coordination, organizational support, and outcomes at personal, community, and organizational levels. For the examples of the items in the questionnaire, see appendix 7. The model is discussed in more detail in chapter 2.3.

The original questionnaire is in English. The English version was used in three communities (DMC, Visual designers, and Project managers) in the Internet Consultancy, because the official language of the company is English. A Finnish translation was used in eight communities in the other five companies. The questionnaire was translated from English to Finnish by the researcher and her instructor. The translated version was then compared with the original English version in order to ensure the congruency. The translated version was further tested by two persons outside the research team.

Scale constructions

A measure describing the degree of the formality was composed based on the interview data. This measure is first presented and is followed by the scale constructions from the questionnaire data.

The degree of formality

The degree of formality and the differences between communities were analysed. This analysis was based on the interview data. The qualitative data was quantified in the following way in order to construct comparisons between communities.

The concept of the formality is twofold. Firstly, it refers to the formality that comes from the organization and reflects the community's relation to the host organization, e.g., how the community is supported in the organization. Secondly, the formality that comes from the community reflects the community's tendency to structure its work, e.g., by the formation of roles.

The degree of formality consists of three categories, which are used to illustrate the various dimensions of formality.

Top-down vs. bottom-up management dimension has three components. It describes whether the membership is obligatory (or voluntary), boundaries are closed (or open for anyone in the organization to join), and whether the community has been formed by the management (or by the members). If only one component appears, the community is viewed as managed "bottom-up". If two components appear, the community is viewed as "semi-bottom-up". If all three conditions appear, the community is viewed as managed "top-down".

Role formation has three components. It describes the variance of coordination roles in the community: whether there are coordinator, secretary or other roles. If there is only one role, the community is viewed as "fairly-coordinated". If there are two roles, the community is viewed as "semi-coordinated". If there are more than two roles, the community is viewed as "strongly coordinated".

Finally, *organizational support* also has three components. It describes whether the management supports the community, whether time is allocated for participation, and whether there is a sponsor for the community in the organization. If only one of the three components appears, the community is viewed as "fairly supported". If two components appear, the community is

viewed as "semi-supported". If all components appear, the community is viewed as "strongly supported".

All variables together indicate the degree of formality.

The communities can be divided into "formal" (7 – 9 attributes), "semi-formal" (4 – 6 attributes), "informal" (1 – 3) communities.

Sum scale variables and single items

Both sum scale variables and single items are used in the analysis (Appendix 8). Sum scales were constructed by using explorative factor analysis. Scales and items were organized under the themes used to describe the characteristics of communities: purpose and goals, activities, coordination, organizational support, and outcomes.

Purpose and goals involve the scale of "learning goals" (five items, $\alpha = .71$). It describes the individual goals that are related to the learning of the members, such as hearing about new knowledge and experience from others, improving the level of expertise, keeping up to date in the field, saving time in finding information, and solving problems at work.

Activities involve two sum scales and two single items. The scale of "practice-based activities" (five items, $\alpha = .80$) describes the activities the members perform together in the community, such as writing reports or other publications, doing internal company projects, preparing for new projects for customers, writing project proposals, and exchanging emails to find solutions for problems. The scale of "participation in the community" (two items, $\alpha = .70$) describes the level of participation by the members of the community, such as how actively members participate in the community and how many hours they spend for the community per month. The single item variable "willingness to participate" describes the willingness of the members to participate more in the community, if they had more time for it. The single item variable "willingness to share knowledge" describes the willingness of the members of the community to share their knowledge with the community.

Facilitation and coordination involves one single item variable and one sum scale that indicate the roles of the coordinator. The single item variable of "organizer" describes the level of activity of the coordinator as an organizer of community meetings. The scale of "contact maker" (four items, $\alpha = .69$) describes the level of activity of the community coordinator in encouraging contact making, such as making external contacts, connecting community members with each other, promoting the community towards management, and alerting members to interesting external activities.

Organizational support involves one single item variable. The variable of "encouragement" describes the degree of which the members feel encouraged by their organization to participate in the community.

Outcomes are divided into the sub-themes of personal, community and organizational level outcomes.

Personal outcomes involve two sum scales and one single item variable. The scale of "learning outcomes" (six items, α = .91) describes the personal learning outcomes of the members, such as how much they have learned from the subject area, how well they have been able to solve problems in their work, have they been better able to find all kinds of information, have they been able to work more efficiently, have they been able to keep up to date in their field, have they been able to transfer what they heard in the community to their project or department. The scale of "benefit outcomes" (three items, α = .85) describes the benefits that the members have achieved by being a member in the community, such as new projects / customers, improved career prospects or better reputation and visibility in the organization. The single item variable of "contacts" describes the amount of new useful contacts acquired by being a member of the community.

Community outcomes involve the scale of "sense of community" (four items, α = .86) describes the depth of the sense of community that has been achieved in the community. This involves issues of trust, feelings of a sense of loyalty to the community, good common understanding, and a feeling of a sense of belonging to the community.

The single item variable "general satisfaction" describes the extent of enthusiasm and motivation of members to participate in the community.

Organizational outcomes involve two sum scales and one single item variable. The scale of "effectiveness" (two items, α = .76) describes the extent of cost savings and contribution to effectiveness the community has earned. The scale of "innovation" (two items, α = .82) describes the extent of new ideas and methods and approaches the community has contributed for the organization. The single item variable of "documentation" describes the extent of documentation of information the community has contributed.

For correlations, see appendix 9.

Analysis of data

Interview data was analysed by grouping the responses thematically and finding common features and anomalies and summarizing them.The answers concerning the degree of formality were analysed by quantifying them in order to make comparisons between communities under the categories of top down/bottom up management, role formalization, and organizational support, as described earlier.

Questionnaire data was analysed by using SPSS statistics program. Descriptive analysis is presented by using means and frequencies. Missing data was replaced by means after constructing the scales. The response scale varies from 1 to 5, one being the lowest and 5 the highest (1= not at all important, 5 = very

important). Relations between scales and single item variables were studied by using the standard multiple regression (Tabachnick & Fidell, 1996).

Results were organized under the following topics: Description of the community, respondents and background information, structure, purpose and goals, activities, communication, coordination, organizational support, and outcomes.

Procedures

A pilot study was conducted in April 2002 (Ruuska et al., 2002). The first version of the questionnaire was tested in an inter-organizational community, which fuses human resource development (HRD) professionals within an ICT corporation. The researcher participated at the community's meeting and delivered the questionnaire to participants. The filled forms were later posted to the researcher. 16 questionnaires were given out and 14 were returned. However, one questionnaire was dismissed, because the respondent had not assessed the target community, and therefore the number of analyzed questionnaires was 13. The data was analyzed quantitatively by using an Excel program. The researcher presented the results at a community meeting, which was used to validate the results and gain feedback on the questionnaire and its usability as a community assessment tool.

The main aim of the pre-study was to test the questionnaire and its usability as a method to assess communities. There were certain limits to the questionnaire became obvious in the research. Some of the questions seemed to be confusing. The questions of ICT technology and the frequency of use were not understood similarly, since the answers were quite contradictory and involved variance. There were also questions on rules. Only half of the respondents answered these questions. This could either indicate that there are not very many rules in the community or the questions were not clear enough. The questionnaire, however, proved useful in describing the main characteristics of communities and providing mainly descriptive data on the communities.

Originally, the questionnaire was tested by the researchers, who developed it, in the study (N=271) of seven communities (Andriessen & Verburg, 2004).

The www-link of the questionnaire was sent to 256 respondents in eleven communities. A total of 150 usable responses were received, and the effective response rate was 59 %. Response rates of individual communities are presented in table 9.

Table 9 Response rates

Community	N (%)
1. Digital marketing communication	90
2. Visual designers	55
3. Project managers	43
4. Business intelligence	92
5. Project implementation group	52
6. Development group 1	86
7. Development group 2	86
8. Development group 3	100
9. PP-Network	52
10. Long term savings and life	100
11. Environment portal	41
All communities	59

3.3.3 Results

The results of all data (N=150) collected by the questionnaire are presented in this chapter. However, the data on the degree of formality (table 10) was collected by the interviews.

The characteristics of communities are described under six themes: structure, purpose and goals, activities, coordination, organizational support, and outcomes. Outcomes are further analysed as personal, community and organizational outcomes.

Characteristics of communities

Structure: the degree of formality

Most of the communities were semi-formal (Table 10). Communities were mostly (59%) managed bottom-up, 23% were managed semi-bottom-up, and 19 % were managed top down. Communities were mostly semi-coordinated (61%), while 17 % were only fairly coordinated and 23 % were strongly coordinated. 54 % of the communities were strongly supported in the organization, while 38 % were semi-supported and 8 % only fairly supported.

These three categories, top down/bottom up management, the degree of coordination and the amount of organizational support together describe the degree of formality. Based on these categories, 8 % of the communities were informal, 73 % semi-formal, and 19 % formal.

Table 10 The degree of formality in target communities

The degree of formality	Communities	N (%)
Informal	Business intelligence network	8
Semi-formal	Digital marketing communication community Visual designers Project managers Development group 1 Development group 2 Development group 3 Environment portal PP-Network	73
Formal	Project implementation group Long term savings and life group	19

Purpose and goals

All the target communities were focused on knowledge sharing. Table 11 shows that the goals related to learning were considered important. Members were seeking to hear about new knowledge and share experiences, keeping up to date in their field as well as improving their expertise. Additionally, getting help for members' work was also central, as over half of the respondents aimed at solving concrete problems and saving time in finding information. The explicated purpose of each community is presented in chapter 3.3.2.

Table 11 The most important learning goals perceived by the respondents

How important are the following goals to you personally?	(Very) important %
Hearing about new knowledge and experience	95
Keeping up to date	87
Improving members' level of experience	83
Solving concrete problems	66
Saving time in finding information	62

Activities

Talks about experiences and presentations by members took place most often (Figure 18) as well as meetings with discussions. Activities that took place less often were team building activities, brainstorming, presentations by non-members, and workshops. All activities were valued more than their frequency. The most frequent activities in the target communities were based on face-to-face interaction. In 80 % of the communities communication took place only face-to-face.

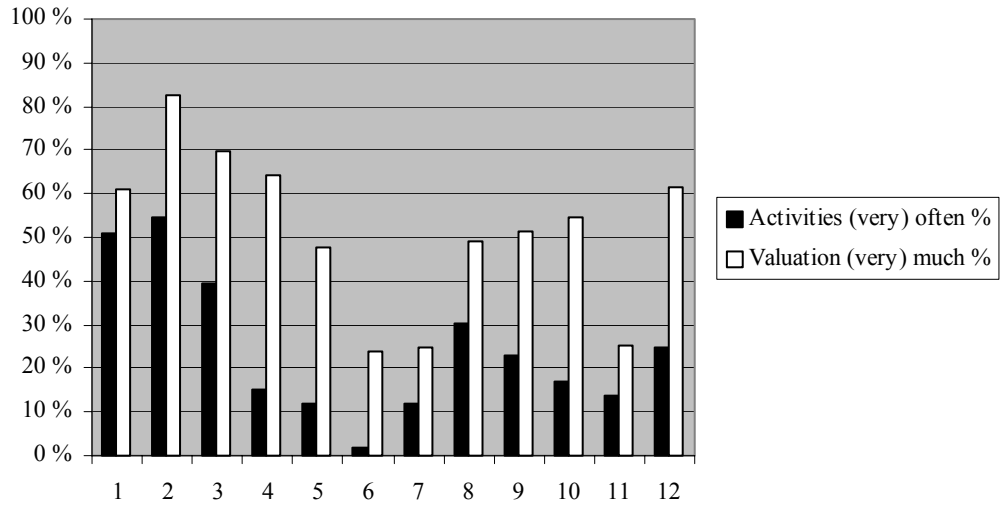

Figure 18 Comparison of means of the frequency of activities and valuation of activities 1. Meetings with discussions, 2. Talks about experiences, 3. Presentations by members, 4. Presentations by non-members, 5. Workshops, 6. Team building activities, 7. Members writing reports or other publications together, 8. Doing internal company projects, 9. Preparing for new projects for customers, 10. Brainstorming, 11. Writing project proposals, 12. Exchanging emails to find solutions to problems.

The scale of "practice-based activities" includes activities that are based on working together on project work (Table 12). The actual doing took place less often than meetings and discussions.

Table 12 The frequency of practice-based activities perceived by respondents

How often do the following activities happen in your community?	(Very) often %
Doing internal company projects	30
Exchanging emails to find solutions to problems	25
Preparing for new projects for customers	23
Writing project proposals	14
Members writing reports or other publications together	12

The level of participation of members (Figure 19) varied within communities. Communities had mostly (77 %) both active and less active members. However, only 11 % of the respondents participated very actively, and they could be considered as core members. 68 % participated quite or somewhat actively, and they could be called active members, while 21 % said that they do not participate actively at all, and they could be named peripheral members.

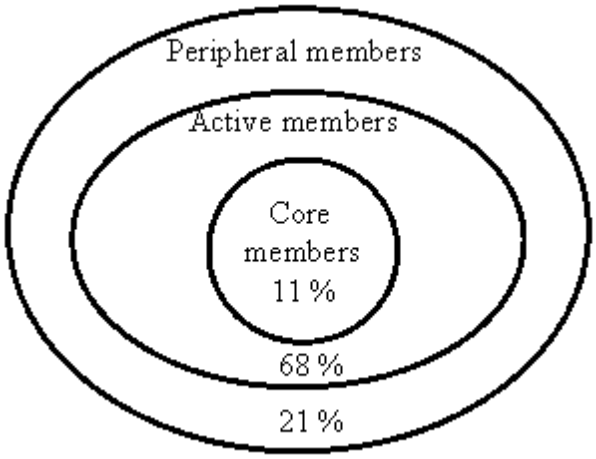

Figure 19 The level of activity in target communities

Participation in the community includes the level of participation and time spent for the community. Hours spent for the community varied. Most members (73 %) spent less than a day per month for the community.

40 % of the respondents participated in the community sometimes or often in their spare time. 54 % of the respondents would like to have face-to-face meetings with members more often, while 35 % did not consider it to be necessary. Apart from community meetings the respondents often had face-to-face meetings with other members of the community, and only seldom had virtual meetings.

37 % of the respondents would like to participate more if they had more time, 50 % would like to participate somewhat more.

Respondents were, for the most part, willing to share their knowledge with the community (91 %). Only 9 % were only somewhat willing to share their knowledge. On the other hand, the respondents perceived that only 8 % of the members were reluctant to share their knowledge. Mean of willingness to share knowledge is 4.3.

Facilitation and coordination

Communities were mostly semi-coordinated (61 %), while 17 % were only fairly coordinated and 23 % were strongly coordinated.

There are at least two roles which the coordinators perform: as organizer and contact maker. The role of organizer involves organizing meetings. Coordinators were the most active in organizing meetings.

The role of the contact maker (table 13) involves issues of promoting the community towards management, making external contacts, alerting members to interesting external activities (e.g. conferences, and connecting community members with each other).

Table 13 The activity of the coordinator as a contact maker perceived by the respondents

How active is your coordinator in the following activities?	(Very) much %
Promoting the community towards management	56
Making external contacts	32
Alerting members to interesting activities	31
Connecting community members with each other	27

In addition, coordinators were seen as active in stimulating members to participate in the community (57 %=(very) active) Respondents were rather satisfied with the coordinator (mean 3.6). Members could influence topics and issues discussed in the community (mean 3.8).

Organizational support

Based on the coordinators' interviews, 54 % of the communities were strongly supported in the organization, while 38 % were semi-supported and 8 % only fairly supported.

Respondents were asked how encouraged they feel by their organization to participate actively in the community. 43 % felt encouraged or very encouraged, 32 % felt somewhat encouraged, while 26 % felt "not very or not at all encouraged". This is in line with the interview data. The mean of the perceived organizational support is 3.2.

Outcomes

Outcomes are assessed on three levels: personal, community and organizational level.

Personal outcomes involve learning, benefits, and contacts (Table 14). Contacts and learning were the most important outcomes, as almost half of the respondents felt they had achieved them "much" or "very much". Benefit outcomes were perceived rather low.

Table 14 Personal outcomes perceived by the respondents

Learning outcomes	**(Very) much %**
Have you learned a lot about your subject area?	42
Have you been able to keep up to date in your field?	40
Have you been better able to find all kinds of information?	34
Have you been able to transfer what you heard in the community to your project or department?	34
Have you been able to solve problems in your work?	30
Have you been able to work more efficiently?	26
Benefit outcomes	
Did you find new projects / customers?	14
Has your reputation and visibility in the organization improved?	14
Have your career prospects improved?	13
Contacts	
Have you made useful new contacts?	43

The target community was not perceived as the most important way to find new information (mean 3.4). The most important source was individual colleagues (mean 4.3) and experts (4.1). Also Internet (mean 3.8) and publications (3.6) were considered more important than the community. Database consulting (mean 3.3) was considered a little less important.

Sense of community was approached by trust, sense of loyalty, common understanding and sense of belonging. Sense of community was developed (Table 15).

Table 15 Sense of community perceived by the respondents

Members of the community:	**(Very) much %**
Trust each other	61
Have a good common understanding	57
Feel a sense of loyalty to the community	55
Feel a sense of belonging to the community	37

43 % of the respondents were generally very enthusiastic and motivated to participate to the community and 48 % were moderately enthusiastic and motivated, while 9 % were not very enthusiastic or motivated to participate. The mean of the general satisfaction is 3.6. 72 % of the respondents liked being part of the community (mean 3.9).

Organizational outcomes were considered smaller than the personal ones (Table 16). Organizational outcomes were related to developing new methods and approaches for the community. Organizational outcomes were generally low.

Table 16 Organizational outcomes perceived by the respondents

Effectiveness	**(Very) much %**
The community has made a real contribution to the effectiveness of the organization	25
The community has contributed to cost savings for the organization	12
Innovation	
The community has contributed to developing new methods or approaches for the organization	42
The community has contributed to new ideas for the organization	31
Documentation	
The community has contributed to the documentation of information (e.g. knowledge systems, manuals, training instructions, best practices)	27

Differences between communities

Means of the central scales and single item variables are presented in table 17. It shows that Long term savings and life group is strong with all means. In contrast, Environment portal generally receives low scores. Long term savings and life group seems to emerge from the data more than other communities. Within 14 scales or single item variables, it received the highest mean in 11. On the other hand, Environment portal emerges most often as receiving the lowest means (within 14 scales or single item variables in 7). In personal

outcomes Long term savings and life group and Visual designers seem to be strong. In organizational outcomes, again Long term savings and life group received high means, but also Project implementation group. Innovation is strong in Long term savings and life group and DMC. Sense of community and general satisfaction were strong both in Long term savings and life group and Project implementation group.

Table 17 Summary of the scale means

Variable	Community											
	DMC	VD	PM	BIN	PIG	Dev 1	Dev 2	Dev 3	PP-Netw	LTS	EP	All
Learning goals	4.1	4.2	4.0	3.6	4.3	4.1	4.3	4.3	4.2	4.5	3.7	4.1
Practice	2.8	2.5	2.7	2.2	2.7	1.7	2.7	2.5	2.1	3.7	2.5	2.6
Participation	2.2	2.5	2.8	3.8	2.7	2.5	2.9	2.8	2.4	4.2	2.3	2.8
Willingness to participate	3.8	3.0	3.0	3.0	3.1	3.3	3.3	3.2	3.6	3.6	3.2	3.3
Willingness to share knowledge	4.3	4.2	4.2	4.4	4.5	4.5	4.5	4.0	4.3	4.7	4.0	4.3
Coordinator: Organizer	3.3	3.5	3.9	4.7	4.5	4.0	4.0	3.7	4.1	4.1	3.7	4.0
Coordinator: Contact maker	3.4	3.2	3.1	3.2	3.1	3.1	3.2	2.7	3.0	3.7	3.2	3.2
Organizational support	3.4	3.4	3.5	3.0	3.5	3.0	3.3	3.0	2.8	3.8	2.9	3.2
Learning outcomes	3.2	3.6	3.2	3.0	3.4	2.9	3.4	2.9	2.8	3.9	2.1	3.1
Benefit outcomes	2.7	3.0	2.4	2.2	2.2	1.5	2.2	2.3	1.9	3.8	1.5	2.3
Contacts	3.2	3.8	3.4	3.7	3.2	3.0	3.0	3.0	3.3	4.4	2.7	3.3
Sense of community	3.4	3.7	3.6	3.3	4.0	3.5	3.9	3.7	3.3	3.9	3.0	3.6
Effectiveness	2.8	3.1	3.3	2.4	3.5	2.3	3.2	2.3	2.4	3.6	1.9	2.8
Innovation	3.7	3.6	3.4	2.8	3.5	2.4	3.5	2.4	3.2	4.2	2.6	3.2
Documentation	3.1	2.8	3.0	2.2	3.4	2.8	3.0	2.8	2.8	4.1	2.0	2.9
General satisfaction	3.2	3.5	3.2	3.3	3.8	3.3	3.3	3.3	3.3	3.8	3.0	3.4

Because the data was gathered from eleven separate communities, mean comparisons were computed to check whether the communities differed from each other: no differences were found.

Factors related to beneficial outcomes

The outcomes of communities were further studied by standard multiple regression to find out what variables explain them.

The community outcomes (dependent variable) are explained by using theoretically selected scales and single item variables. Learning has been seen as central to communities (Lave & Wenger, 1991; Brown & Duguid, 1991; Wenger, 1998). Communities form around knowledge needs and practice

(Wenger et al. 2002). The concept of practice implies doing real work (Cook & Brown, 1999). Leadership in the community is distributed and diverse, and the tasks may be divided (Wenger et al. 2002). The coordinator's tasks include planning and facilitating events, linking members informally and crossing boundaries, fostering the development of the community, and managing the boundary between the community and the formal organization. The primary role is to link people (Wenger et al. 2002). Wenger (2000b) argues that the level of external management and support is critical in two ways: on the one hand communities require recognition and support, but on the other hand the voluntary and informal aspect might lose its value by too much interference. Communities may be made visible by formalizing them (Botkin, 1999). Communities may differ in their set-up: they may be top-down formally initiated, with centrally selected members, or be informal, spontaneous, and bottom-up initiated (Andriessen et al., 2001). They may also be referred to as formal, semi-formal, or informal (Ruuska & Vartiainen, 2003).

The scales of learning goals, practice-based activities, contact maker and single item variables of encouragement and formality were selected. Community outcomes consist of the personal, community and organizational level outcomes (Figure 20).

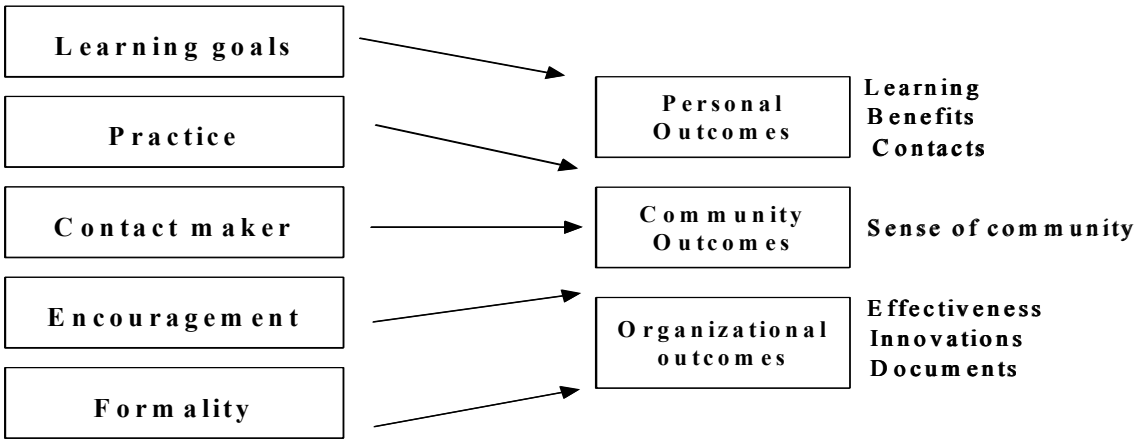

Figure 20 Model of the characteristics of a community used in the standard multiple regression

Outcomes on personal, community, and organizational levels were studied individually. First an index on personal outcomes (learning outcomes, benefits and contacts) was made. Then each was studied individually. Community outcomes (the sense of community) were also studied individually. Finally, an index of the organizational outcomes (effectiveness, innovations, and documentation) was made and then each was studied individually. Scales and single item variables (learning goals, practice-based activities, contact maker, encouragement, and formality) were used as independent variables.

Personal outcomes are explained by learning goals, practice-based activities, contact maker, and encouragement. The equation with formality gained no

significant effect. An examination of the individual outcomes shows that learning outcomes are not explained significantly by formality either. Benefits are explained only by learning goals and practice-based activities, and not by contact maker, encouragement, or formality. Contacts are explained only by learning goals and encouragement, and not by practice-based activities and formality. However, equation between contact maker and contact gained no significant effect.

Community outcomes (sense of community) are significantly explained by learning goals, contact maker, encouragement, and formality. Equation with practice-based activities gained no significant effect. The scale of practice-based activities involves concrete working together, such as doing internal company projects, writing reports and other documents, preparing for new projects and writing project proposals as well as exchanging emails to find solutions to problems.

Organizational outcomes are significantly explained by all the variables. Closer examination on individual items shows that effectiveness as well as innovations are also explained by all the variables. Documentation, however, is explained significantly by learning goals, contact maker and formality. Equation with practice-based activities and encouragement gained no significant effect.

In brief, equation with learning goals gained the most significant effect (table 18). Practice-based activities are significant for personal outcomes except contacts and organizational outcomes except documentation. It failed to gain significant effect on community outcomes. Contact maker role is significant, it explains all the other effects than benefits and contacts. Encouragement explains all other effects apart from benefits and documentation. Formality explains significantly community and organizational outcomes, but not the personal ones.

Table 18 The regression table for outcomes variables

	Personal	Learning	Benefits	Contacts	**Community**	**Organizational**	Effectiveness	Innovation	Documentation
	β	β	β	β	β	β	β	β	β
Learning goals	.35***	.44***	.20**	.31***	.33***	.29***	.25***	.26***	.24**
Practice	.23**	.17*	.37***	.09	-.04	.20**	.21**	.17*	.15
Contact maker	.16*	.16*	.10	.15	.21**	.24***	.16*	.28***	.19*
Encouragement	.18*	.19**	.11	.18*	.24**	.14*	.17*	.14*	.07
Formality	.04	.03	.08	-.01	.17*	.25***	.19**	.17*	.29***
R^2	.45***	.49***	.39***	.26***	.37***	.56***	.45***	.47***	.40***
Adjusted R^2	.43***	.47***	.37***	.24***	.34***	.54***	.43***	.45***	.38***

****p<.001; **p<.01; *p<.05*

3.3.4 Conclusions

Learning in communities of practice entails both a process and a place (Wenger, 1998). This study views a community as a place and context for learning. Learning takes place by participating in the community's activities (Lave & Wenger, 1991). The communities studied were especially mental and social 'bas' (Nonaka et al., 2000a) meeting mostly face-to-face in the same physical place and the target communities were mostly semi-formal.

Learning goals were emphasized. Members were primarily directed and motivated to learning and not performing a task. This distinguishes communities from other structures, e.g. teams, as teams are usually directed to achievespecific performance goals (e.g. Katzenbach & Smith, 1993). Placing a great emphasis on the learning goals has many characteristics of the learning projects (Poell & Van der Krogt, 2003), yet communities are not considered as learning programs in the way learning projects are. Communities are about practice and supporting work, and are of indefinite duration, while learning projects have defined duration. Yet learning projects are not ordinary projects, as the members of projects are the customers themselves, in their capacity as learners (Poell & Van der Krogt, 2003).

Most frequent and valued activities were based on face-to-face meetings and experience sharing. The core group was small, yet most members were somewhat active. In addition, there was a periphery, which involved one fifth of the members. Activities in the communities were based mainly on discussion and experience sharing. Conversations and experience sharing are important, as learning is supported by conversations and stories about problematic and difficult cases (Lave & Wenger, 1991). However, the concept of practice implies doing real work (Cook & Brown, 1999), yet these kinds of practice-based activities were not very strong in the communities. Results indicate that practice-based activities are central in achieving outcomes on personal and organizational levels. Weak practice-based activities in target communities may have an effect on the perceived values in the target communities. Discussions and experience sharing as the main content of activities do not seem to provide enough concrete values, even though they involve developing the practice, as they are about discussing work related issues and finding solutions to problems at work. The discussions concerned project work as well. One reason for the small amount of project related activities may be the diversity of the projects the members represent.

The results indicate that the coordinator is an organizer, but also a contact maker who helps members to participate and achieve results. The role of the coordinator is to maintain relationships and develop the practice (Wenger et al., 2002). However, the coordinators of the target communities seem to have taken more of the traditional role of an organizer rather than a contact maker. Yet they were active in encouraging members to participate, which keeps the community alive and going. The coordination of communities is not a typical leadership task as the leadership may be distributed and diverse and can even

be given to sub-groups. The results indicate that the contact maker role is significant in communities. Organizations also benefit from the execution of that role, as it is related to the degree that communities contribute to developing new methods and approaches, and creating new ideas for the organization. Communities are based on participation and continuous interaction (Lave & Wenger, 1991; Wenger, 1998), and relationships are central, therefore the coordinator's role in connecting members is vital.

Communities were supported by their organizations by allocating time for participation, yet this time was considered too little, and less than half of the members felt generally encouraged to participate. The degree of organizational support should be mirrored against the purpose of the community. The degree of support may vary during the life cycle of a community. Organizational support includes, besides recognition, allocation of time and legitimation of participation. Communities benefit from cultivation (Wenger et al. 2002) and are made visible by recognizing them (Botkin, 1999). Results indicate that encouragement on behalf of the host organization is significant. However, there seems to be more willingness to participate than is enabled by the organization. As communities are bound together by shared interest (Wenger, 1998) and not integrated into management process and achievement of organizational goals, their importance may not be realized. The lack of a common language around communities as learning and knowledge sharing structures may also reduce organizational support. Common language of communities has been recognized as vital (e.g. Wenger, 1998), as it helps organizations to focus on supporting and facilitating communities thus helping members to discuss and recognize the participation and value in various communities (Wenger, 2000b). The target organizations lacked a common language and concepts on communities and their status remained ambiguous.

In the target communities, personal outcomes, especially the learning outcomes, were perceived as higher than organizational outcomes. This is supported by previous research (Ruuska et al., 2002). Communities have a strong focus on learning and developing members' professional competence. Concerning organizational outcomes, Wenger and Snyder (2000) argue the values of the community are difficult to realize, and the results may be delayed. Results may also appear in the work of teams, projects, and business units and not in the communities themselves and are therefore hard to detect and assess. Most personal outcomes bring value to the organization as well. In this study, innovativeness as an organizational outcome was achieved more than effectiveness, which may be explained by the focus on learning and the lack of performance goals. Communities are not aimed to directly increasing effectiveness, but rather to support learning and knowledge sharing. Therefore, communities function well as learning forums, but the organizational benefits are challenging. Huysman (2002) argues that even though communities of practice are well suited to support learning within organizations, they have a tendency to obstruct learning by organizations, their contribution in supporting learning at the organizational level is much more complicated.

Based on the multiple regression analysis, outcomes of the communities were explained by the independent variables of learning goals, practice-based activities, contact maker, encouragement, and formality. Learning goals in particular, but also practice-based activities, contact maker and encouragement were related to personal outcomes. However, the equation between contact maker and contact gained no significant effect. "Contacts" is a single item variable of the amount of useful contacts one has gained through being a member in the community. Wording may be too general as it refers to contacts and does not explain them in more detail. Formality did not explain personal or community outcomes, only the organizational ones.

Community outcomes were explained by learning goals, contact maker, encouragement and formality, but not by practice-based activities. The scale of practice-based activities involves concrete working together, such as doing internal company projects, writing reports and other documents, preparing for new projects and writing project proposals as well as exchanging emails to find solutions to problems. Working together would be expected to have effect on the sense of community. However, in the target communities respondents did not feel that way. These types of tasks and working together performed less than having meetings with discussions and sharing of experiences. Practice-based activities in the questionnaire may not reflect the communities' activities. Additionally, it may also reflect an individualistic culture, as working for new projects are perceived to bring value for individuals, and not seen as bringing collective value. This may be connected to individual based performance appraisal.

Organizational outcomes were explained by all variables. Formality had its place in explaining organizational outcomes, especially in documentation of information such as manuals, training instructions and best practices.

In the analysis various levels of membership were not mirrored against the perceived values. Stuckey and Smith (2004) discovered that members in various positions perceive the community differently. Those in the periphery may view it as looser sets of relationships than those in the core. The same may apply to perceptions of value of the community. Those active might be the ones who get the most value. Yet the needs of those in the periphery might correspond to their activity level. However, this poses an interesting research question for future research.

Target communities had three elements introduced by Wenger (1998): the domain, the community and the practice. Domain of knowledge gives the members a sense of joint enterprise and brings them together. Target communities were mostly focusing on knowledge sharing and learning and the learning goals were high. Also, the explicated purpose of each community was much related to the sharing of knowledge in the dispersed project context. The sense of community was developed and members were interacting on an ongoing basis. Practice involves members working together and produces a shared repertoire, such as documents, manuals, standards, and ideas (Wenger,

1998). Practice is therefore essentially related to outcomes. It also involves development of expertise. The development of practice in the communities was more discussion based rather than activity based, as activities were mostly based on face-to-face meetings with discussions and experience sharing rather than working together in concrete projects or tasks. Concrete project related work may be so project-specific that it may be hard to accomplish in a community of people from various projects. Concentrating on conversations help to build the professional expertise and therefore development of practice may not be considered merely as concrete tasks.

In brief, critical elements of communities as learning environments were: formality (structure), learning goals, practice-based activities, coordination as enabling and enhancing contacts between members and the environment, organizational encouragement and focus on outcomes on personal, community, and organizational levels. Learning goals create the sense of what the community is all about and help members to create a joint enterprise.

Communities have the potential to become forums for professional development of, e.g., project manager expertise. Project managers can, by participating in the community, gradually learn to become more competent, as the community includes both experienced and newcomers (Lave & Wenger, 1991). Communities concentrate, according to Wenger (1998), on the learning that takes place through working in practice. However, target communities were generally were still in the beginning of their development path.

3.4 Study 4: Communities as knowledge sharing mechanisms

3.4.1 Introduction

This study has approached communities from varius viewpoints. However, this final case study studies in more detail one of the eleven target communities, the Digital marketing communication community (DMC) in the Internet Consultancy. Therefore this case study represents a specific type of community. A semi-formal community strongly supported in the host organization was selected for further study. In section 3.2 DMC was categorized as a strategic community. Strategic communities in the case company were cross-competence structures composed of people with an interest in strategically relevant areas. In chapter 3.3 DMC was further categorized as being semi-formal based on the following attributes:

Top down / bottom up management

Membership was voluntary and based on interest in the domain.

Boundaries were open in the way that new members were accepted, even though the community has to approve new members.

DMC had been formed by management initiative.

The community was managed semi-bottom-up.

Role formalization

There were a coordinator and a secretary

The community was semi-coordinated.

Organizational support

Management supported the community

Time was allocated for participation

There was a sponsor in the organization

The community was strongly supported.

The objective is to research in more detail the target community and its knowledge sharing practices. The community is studied in its historical context and viewed through its development, as a community is always a reification of its past and embodies the history and knowledge generated over time. The research target is described in figure 21.

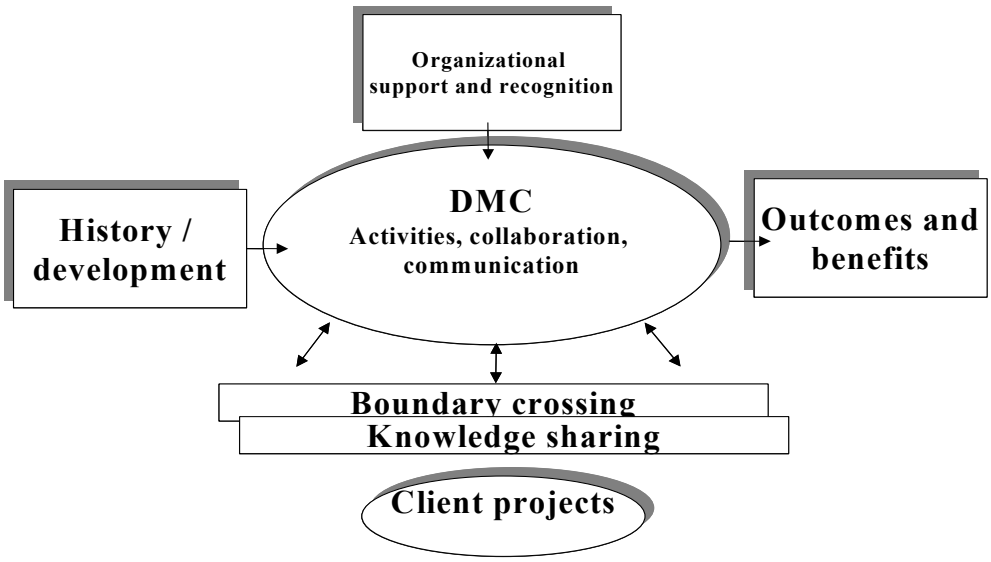

Figure 21 The research target

3.4.2 Data and data analysis

The case company

The case company is the Internet Consultancy company and is described in more detail in chapter 3.2.2. The target community, consisting originally of ten members, had five core members at the time of the research.

Data collection

The interviewees included management (n=2), community members (n=5), and members of the client projects (n=4). Interviewees were chosen to represent various viewpoints, both members and stakeholders of the community. Interviews were semi-structured (for the themes, see Appendix 10). The interview themes were constructed to give answers to research questions and included questions on the domain, community, and practice, the role of the respondent in the company and in the community, communication and knowledge sharing, and benefits of the community. The stimulated recall method (Jokinen & Pelkonen, 1996) was used to refresh the memories of the respondents concerning the development of the community. Respondents were asked to place critical, both positive and negative incidents and important milestones of the community in a time line.

Additionally, data collected during previous research was used to analyse the history, development, and the characteristics of the community and is referred to as "questionnaire data". However, respondents (N=9) of the questionnaire and in the interviews (n=5) were only partly identical as there had been turnover in membership.

Analysis of data

Data was analysed using text analysis program Atlas.ti. Interview data was analysed by grouping the responses thematically and finding common features and anomalies and summarizing them (Appendix 11). Comments that produced simplifications on answers were added. Items were further classified within the themes and compared to transcripts.

3.4.3 Results

Transformation of the community

Different phases were traced on the development of the DMC community. However, they are parallel and may not necessarily be defined sequentially, yet they help to understand the community.

Potential phase

Various activities and networking have taken place around digital marketing communication over the years. An informal network existed before establishment of the DMC. It involved people working on digital marketing communication issues. There still are networks beside the formalized DMC. However, the informal network provided the basis for the establishment of DMC, which in a way emerged from that network. As one respondent put it: "DMC was not founded in 2002, it was then when the management recognized us". This phase could be named as the potential phase for the emergence of DMC community.

Establishment

Digital marketing communication has been one of the core areas in the company. The need for growth brought forth new forms of organizing the creation of new knowledge on client offerings. The form chosen was a cross-organizational structure, which was not a team in a traditional sense (as defined, e.g., by Katzenbach and Smith, 1993), but more like a community of people with shared interest to develop new concepts for the company. Digital marketing communication was chosen as one of the key areas for offering development. It was a matter of recognition and formalization of the work of the informal network. A coordinator, "an owner", was nominated, who became accountable for the establishment and development. Establishment took place in August 2002.

Formation

The group searched its form for the first half a year period. In the fall of 2002 many activities were involved. The first versions of the approach of the digital marketing communication were ready in December 2002 and that was considered as the first main milestone. February 2003 was also a major milestone as the explicated approach was made public and presented in a seminar organized by an advertisement magazine. The coordinator of the

community made a presentation in the seminar and it was considered as a major break through and recognition for the community and its work, as well as for the company. Another major activity was the co-research, which involved development of measures related to digital marketing communication.

Decline

The community faced a dramatic decline and exhaustion in activities after achieving the achieved milestones. Meetings were held and requests from client projects were received, but less than during the first activity period. Boundaries with organizational units were to some extent lost. There was a turnover of members during the summer of 2003.

Re-formulation and new activity period

The loss of certain core members was considered critical. The composition of the group was restructured. The core group was downsized. Many people remained in the periphery, more as outsiders. The role of the coordinator was renegotiated. The original coordinator became more like a sponsor and a new coordinator was chosen. Her role became critical as a knowledge broker. Roles within the community were based on competences and tasks were refocused. Needs were also redefined.

Re-formulation was also related to the new growth vision of the company. Officially the role of DMC became more formal, but it still maintained its position outside the formal organization and kept its cross-organizational development focus. Management support and interest were emphasized. Reporting was intensified, as the sponsor of DMC became part of the "Management for growth –group" and she also reported he progress to the CEO of the company.

In the fall of 2003 an active period was restarted. The new coordinator had discussions with client managers to find out the business needs. Cooperation with the other Finnish office was also intensified. New focus and key areas were discussed. Activities were based on doing and working in practice rather than merely discussing. Boundaries of the community were somewhat blurred. It was difficult to separate community and other work, as they were based on participation on many levels. Despite the formalization by the management, the informal communication and practice were maintained, partly as a counterforce to the formalization. The members set their own agendas and boundaries. They emphasized their personal interest and commitment. However, the formalization gave the required structure to achieve concrete outputs.

Purpose of the community

The purpose of the community was to provide an approach to digital marketing communication, as well as to support the work of client projects in the area.

Members belonged to the community based on their personal interest in the domain and they wished to enhance their competence. Knowledge creation, knowledge sharing and idea generation for the success of the company were also mentioned. Variance in members' tasks and competences motivated people, as it gave them a chance to learn new things and see them from new viewpoints.

What kept the community together was the shared interest in the domain and the desire to learn more about it by working and communicating with other members. Digital marketing was considered as a hot topic. It was interesting for the company, yet the personal interest of members was the driving force. Management also recognized the importance of personal motivation.

Based on the questionnaire data the most important personal goals in DMC were related to learning (Table 19):

Table 19 Personal learning goals of the respondents based on questionnaire data

How important are the following goals to you personally?	(Very) important %
Hearing about new knowledge and experiences	100
Keeping up to date	100
Saving time in finding information	67
Solving concrete problems	50
Improving members' level of expertise	33

Formality

Status of the community

DMC community was recognized and formalized in the organization. Originally, the community was one of the main client offerings. The importance of digital marketing communication was emphasized in the growth vision of the company. The development of each area was organized as a cross-organizational strategic community. The sponsor of the community reported the progress to the CEO. She was also part of the formal group "Management for Growth". Yet the community remained informal in the way that it was not an official business unit, but rather accountable for the development of the domain. It was part of the business development of the company.

Structure

The primary logic was to have members from all client teams to represent various client projects. This ensured the sharing of knowledge and focusing on client needs. Also, various competence areas were present. Finally, it was fundamental that the same people worked in client projects while developing key areas. The core group was kept small to ensure the functionality and achievement of results.

Roles in the community were mainly competence based. Members were working with the issues discussed in the community in their actual project work.

Activities: participation and reifications

The community had regular meetings on average once or twice a month. Meetings were planned and had certain routines, developed over time, that were followed. The coordinator made notes and collected action points for further work. Sometimes non-members had presentations, but mostly it was the members who participated. Actual work took place in between the meetings. As the work was based on client work, it was often intertwined with community work and members found it difficult to separate what was community work and what was client work. Certain members worked together outside the community as well. Relationships in the community were based on knowing each other well.

Based on the questionnaire data, all the respondents thought that face-to-face meetings were useful and 67 % considered that they would like to have them more often. 67 % would have liked to participate more often if they had time.

Informal communication between members was very active. Outside meetings they met in hallways and the cafeteria and discussed different topics. Emails also "flew" between the members. Communication was not only based on digital marketing communication, but also on other matters, so there was no clear boundary here either. Members described working for the community more like "ad hoc" work and was not so formal. Communication took place mostly at work, as there were very few happenings outside work.

Relationships were very informal and friendly between the members and the spirit of the community was good. In general, communication was considered informal in the entire company. The formality was considered to be in good balance, as the community was not too formal, yet not too informal either. If the community was very informal, it would not provide enough benefits for the company, as intended. All the members had an equal opportunity to bring subjects into discussion and everyone's opinion was respected. However, most felt that there was no such thing as "DMC-identity", even though they felt a sense of belonging to the group. They emphasized that the relationships would exist without the formalization of the DMC community and references to shared identity of this group could be identified. *Based on the questionnaire*

data, 88 % of the respondents considered that people act informally in the community and all thought that people are easy going.

Learning in the community took place through working in practice and participating into both community and project work and producing outputs.

Based on the questionnaire data (Figure 22) the most frequent activities were talks about experiences and exchanging emails to find solutions to problems. Peer-to-peer experience sharing and problemsolving were highly valued. Preparing for new projects for customers and brainstorming were also highly valued although they did not take place as often.

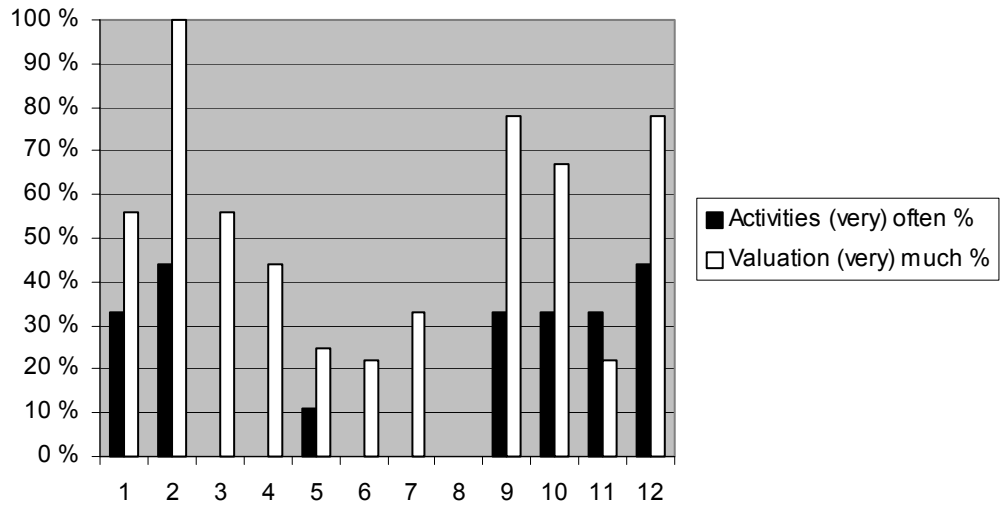

Figure 22 Frequency of activities and their valuation based on the questionnaire data 1. Meetings with discussions, 2. Talks about experiences, 3. Presentations by members, 4. Presentations by non-members, 5. Workshops, 6. Team building activities, 7. Members writing reports or other publications together, 8. Doing internal company projects, 9. Preparing for new projects for customers, 10. Brainstorming, 11. Writing project proposals, 12. Exchanging emails to find solutions to problems.

Besides participating in the community work, members produced artefacts. Members shared common language, even though they were not so explicitly aware of it and found it difficult to name it. Abbreviations were shared and the abbreviation of "DMC" standing for the Digital marketing communication was well established. Some members told "inside stories" and advertising agency gossip was shared.

Some routines were developed. Meetings were performed with certain routines and procedures, and produced action points and next steps.

Concrete outputs included power point presentations, a DMC road map, templates, DMC Newsletter, case collections, materials, documents, and reports. Additionally, two members wrote articles. DMC had also participated in organizing various events, such as Fast breaks, M&M Seminar, training program lectures, and presentations in companies. Additionally, there was a co-project with a research company on measures.

Knowledge sharing practices

The purpose of the community was based on the idea of knowledge sharing in the project-based organization. Knowledge sharing could be divided into 6 sub-themes.

Firstly, *formal reporting* was the responsibility of the sponsor and the coordinator of the community. The sponsor represented business management in the community. She reported the development of the community to the CEO and to the management team of the growth areas. The coordinator wrote an electronic newsletter "DMC-Flash", which was distributed in the organization.

Secondly, *formal forums* were used for knowledge sharing. "Fast Breaks" took place on average twice a year and were meant for everyone in the company. Additionally, topics of DMC had been part of the training programs in the company, e.g., Training program for consultative selling.

Main knowledge sharing took place with the *client teams and projects*. Membership was based on the idea of multimembership, members were both accountable for project work and participating in the community. There were representatives from the main client teams in the community. Members were expected to take care of the boundaries with their client teams. The coordinator visited the teams regularly to find out the needs and hot topics. Knowledge was also shared in management groups. Communication and cooperation between the community and client teams was two-way. On the one hand DMC members provided material for projects, and on the other hand client managers had requests, but also support and information for DMC. Cooperation consisted of providing material and background help, not so much working directly with clients. DMC related knowledge was critical to the projects. Additionally, international marketing trends, product knowledge, overall offering of the company and measures were central. Knowledge sources, besides DMC, were mainly personal contacts and networks, but also included clients and electronic sources. The amount and depth of working with client projects was considered too low.

Electronic knowledge sharing took place mainly by email. Members disseminated DMC related knowledge through their personal networks. People also tended to approach the coordinator in particular with the requests for information. Virtual spaces to share knowledge were public folders with access to anyone in the company. They were not used very much. However, email communication was considered active also in the questionnaire.

Informal knowledge sharing was very active. People asked for advice in hallways, there was lot of informal, ad hoc hallway discussions going on. At this point as well members did not solely represent DMC as their roles were intertwined.

Finally, there were *boundaries* outside the company. However, these boundaries were considered too few. There were some occasions where DMC was presented. There was also successful research cooperation.

Members were active as knowledge brokers in the company.

Based on the questionnaire, DMC was valued as a knowledge source for the respondents. Generally person-to-person communication and knowledge sharing is used more than publications or databases (Table 20).

Table 20 Importance of various knowledge sources based on the questionnaire data

How important are tha following ways for you to find new information?	(Very) important %
Through individual colleagues	100
Through the community	88
Via the internet	88
Asking an expert	88
Reading publications	57
Through database consulting	38

Coordination and facilitation

The first coordinator had been chosen by the management. The original coordinator had been the major developer of the community since its establishment. However, there had been a shift in coordination, and at the moment of the research the original coordinator acted more like a sponsor and there was a new coordinator. The new coordinator had a key role in the community. She was described as the backbone of the community, while other members were the bones. Her role was very operational.

Based on the questionnaire the coordinator was the most active in promoting the community towards management (Table 21).

Table 21 The activity of the coordinator as a contact maker based on the interview data

How active do you evaluate your coordinator is in the following activities?	(Very) much %
Promoting the community towards management	78
Alerting members to interesting activities	44
Connecting community members with each other	33
Making external contacts	33

Organizational support

Time was allocated for participation by giving the community the development status in the company. It allowed members to have lower billability in client projects. However, it was admitted that client work is prioritized. Time spent for the community depended on the projects members performing. However, project work and community work overlapped to some extent.

The community had management support. The formal status and the strong management interest indicated the support. However, knowledge management systems were inadequate and this was seen as a sign of lack of support in knowledge sharing.

Based on the questionnaire 78 % thought that the organization allocates time for participation, but only 57 % considered these sufficient for community work. Only 38 % felt encouraged to participate in the community by the organization.

Outcomes of the community

Development of the digital marketing communication related competence was critical, as it was one of the key areas in business. DMC community was seen as a forum for the development of new concepts. Recognition and conceptualization had brought added value to the company. Management saw the development of the concept as such as transferable in the company. It had systematized the development work. Direct business benefits were difficult to show. However, DMC community was believed to produce indirect business benefits, e.g., by increased client revenue, although the reporting system had only started to recognize the work of DMC. For clients the work of DMC had opened new possibilities and in a way had opened their eyes to see new ways in digital marketing. DMC development could be used as a reference for clients. Creation of new knowledge was required for differentiation in the market. It was seen though that if the company's general message in the area were clearer, DMC community would be more beneficial.

Personal benefits involved an increase in one's competence. Working in the cross-functional community allowed members to get acquainted with areas that

they had not been so familiar with. The technology focus was particularly mentioned. Other members as knowledge sources were valued as it helps to find information that would otherwise be hard or even impossible to discover. Also, DMC community had provided a new viewpoint of the company and had helped to connect different topics. Competence was seen to be constructed at various boundaries. The formal status gave a justification to working with the issues. Members also valued the chance to communicate with other like-minded people who had the same interest for digital marketing communication and felt a sense of community with other people as a benefit.

Based on the questionnaire (Table 22), most personal benefits included learning and keeping up to date in the field. However, only one third had been able to transfer what they have heard in the community to their projects.

Table 22 Personal outcomes based on the questionnaire data

Learning outcomes	**(Very) much %**
Have you learned a lot about your subject area?	57
Have you been able to keep up to date in your field?	57
Have you been able to solve problems in your work?	29
Have you been better able to find all kinds of information?	29
Have you been able to transfer what you heard in the community to your project or department?	29
Have you been able to work more efficiently?	0
Benefit outcomes	
Did you find new projects / customers?	14
Has your reputation and visibility in the organization improved?	14
Have your career prospects improved?	0
Contacts	
Have you made useful new contacts?	29

Sense of community was partly developed. 71 % of the respondents felt they had a good common understanding in the community. However, one third felt loyalty or sense of belonging to the community (Table 23).

Table 23 Sense of community based on the questionnaire data

Members of the community	(Very) much %
Have a good common understanding	71
Trust each other	57
Feel a sense of loyalty to the community	29
Feel a sense of belonging to the community	29

Organizational outcomes were minor. However, innovations and new ideas were contributed, as intended (Table 24).

Table 24 Organizational outcomes based on the questionnaire data

Effectiveness	(Very) much %
The community has made a real contribution to the effectiveness of the organization	29
The community has contributed to cost savings for the organization	0
Innovation	
The community has contributed to new ideas for the organization	86
The community has contributed to developing new methods or approaches for the organization	70
Documentation	
The community has contributed to the documentation of information (e.g. knowledge systems, manuals, training instructions, best practices)	33

3.4.4 Conclusions

DMC was based on a social network that was recognized and formalized. The community was organized around a common domain and it was the shared interest that bound the members together. Even though there was rather strong formalization by the management, members felt connected more by personal relationships and shared interests. What kept the community together was not the formal structure or the management initiative. Boundaries were set by the members, and to some extent they rejected formalization. Crucial parameters for identifying and defining the community are the social dimensions used by the members themselves for recognizing one another (Van Maanen & Barley, 1984), and the life of a community of practice is produced by its members through their mutual engagement (Wenger, 1998). This raises the question of how to keep management intervention at the appropriate level. The community was not directly integrated into management process, but the reporting of the development reflected a strong emphasis on controlling the community. As a "knowledge group", as one respondent named it, DMC had two sides and two

lives: one was the formal structure reporting to management and the other the informal community, which connected interested people and was not entirely visible to others. This would most likely stay alive even though there were changes in the formal status. Members tended to refer to this informal part very much. Members had succeeded in preserving informal communication and relations despite strong attempts to formalize the community. This was partly due to the origin of relationships and to cooperation of members outside the community.

The position of the community was in between the management and the client teams (Figure 23). Its purpose was to create new knowledge and solutions for clients. This was achieved by communicating reciprocally with client project teams, which had direct contacts with the clients. Client teams provided the community with the information of the client needs. Link with the management was built to ensure the strategic relevance of the actions taken. Outcomes were also reported to the management team. Management provided the community with the insights of the strategy process.

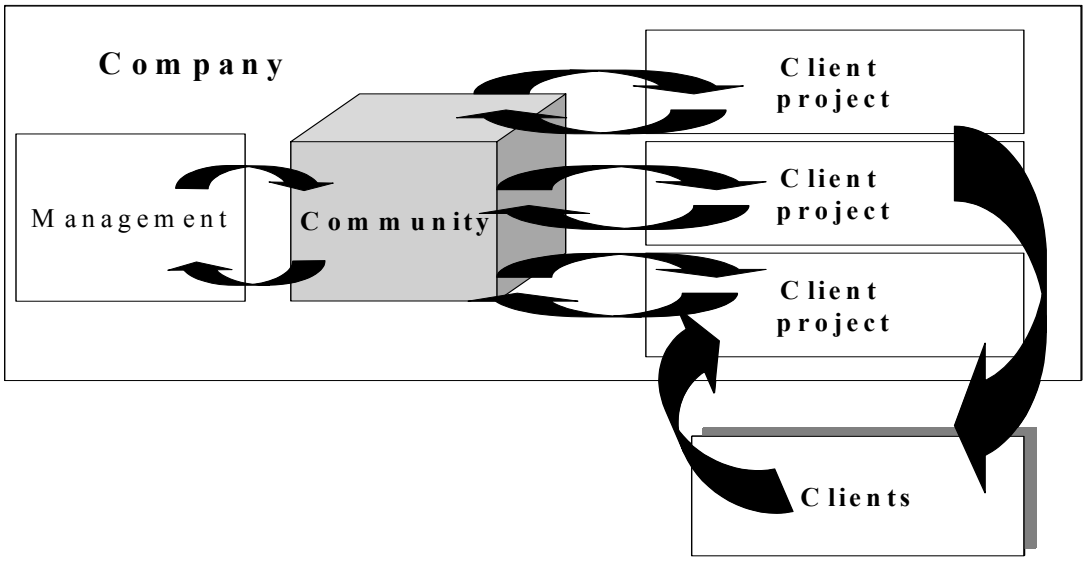

Figure 23 DMC community's position in between management and client projects

The value of the formality of the community was seen in providing structure and push for the work, as it sets milestones and forces members to achieve results. Formalization gave structure, recognition, and legitimation. If the community is expected to provide innovations, the formalization should not be too strong and the personal motivation and connection with other members is critical. Otherwise DMC might lose its value as a community and become a parallel function in the formal organization, which does not add to innovation but builds another formal structure. DMC was very much based on the passion of its members in the domain. Members were not seeking to improve their careers or gain other such benefits, but desiring to learn more, creating innovative solutions, and connecting with peers.

Some of the respondents stated that they are not certain whether there is any DMC identity as such, but they do have a sense of belonging to the community. Yet there seemed to be a strong connection between the members. The identity they had created may not explicitly be referred to the formal group, but to the informal connectedness of members. Members formed together an informal community, they tended to refer to this informal one more than to the formalized DMC. Members used a common language and shared concepts, even if they were not so explicitly aware of that either.

Roles in the community varied and were diverse. Some members acted more as knowledge brokers, while some had specific expertise in technology. Existence of multiple expertise, partly parallel, was beneficial for idea generation and learning, as also found in studies of Häkkinen and Arjava (1999). Members of DMC were "cross-organizational individuals" who are needed in all innovative organizations. If a company wants to increase the capability for innovation, cross-organizational individuals as knowledge brokers need to be recognized and motivated.

Formal reporting as knowledge sharing was articulated. Otherwise knowledge sharing was not explicitly expressed or planned. Knowledge was mainly shared through multimembership (Wenger, 1998). As the number of members is small, this type of knowledge sharing remains minor. Learning and sharing of knowledge take place as a participation process in activities (Lave & Wenger, 1991). Boundary crossing is critical in learning (Wenger, 1998). Boundaries of DMC were few. DMC interacted with peers, projects, client managers intra-organizationally, but at the same time they should be more intensively connected with similar communities and groups elsewhere, such as digital marketing experts and professional associations. Boundary crossing would enhance sharing of knowledge and would give new insights. The local community needs to build connections with others to learn from other locations (Wenger, 1998). The duality of participation and reification (Wenger, 1998) allowed DMC produce learning and outputs in the organization. The personalized knowledge was explicated by the process of participation and reified to codified knowledge. Tacit and explicit, or personalized and codified knowledge, are present in the processes of participation and reification (Wenger, 1998).

Organizational outcomes are difficult to show and may even be impossible to define in a financial manner. Organizational outcomes were mostly new ideas and approaches. This was supported by the questionnaire data as well. Personal outcomes involved learning and enhancement of competence. New insights and combinations of competence are also created.

In business where performance is based on billable work, recognition and legitimation of the community work are critical as the work for the community is not shown in financial results. In this case it was taken care of by giving the community a formal development status. This requires, however, that allocation of time is realistic and realizable.

The group was in many ways like a community of practice (Wenger, 1998; Wenger et al., 2002). They had a shared domain of knowledge, which they felt accountable for. The community of people was based on informal and ongoing relationships. The shared practice was based on doing real work and negotiating the meaning of the shared domain. In addition to the core group there were looser relationships at the periphery. Even though DMC was originally called a team, it had more characteristics that are more common to communities than teams. Teams have been defined by Katzenbach and Smith (1993, p. 45) as: "a small group of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable". Commitment to performance challenge and performance goals separate teams from communities. However, the duality of formalized and informal community as a feature of the community was crucial. It shows that certain amount of formality is needed in the business context, yet the community is based on informal relationships. This duality enables it to combine the passion of the informality with the structure and formality needed to relate to organizational aims. DMC had also a role in developing strategic competence of the company. Strategically critical competence hardly resides in one function or unit, therefore the development requires cross-organizational structures. Formalized communities enable a company to realize its competence strategy in accordance with the business strategy.

4 Discussion

This final chapter discusses the contributions of the study and provides answers to the research questions of the dissertation, as presented in chapter 1.2.1. The research process is also evaluated. Managerial implications on project knowledge and competences as well as communities in project-based organizations are further presented. Finally, future challenges in the research of communities in organizations are discussed.

Project-based environment poses special challenges for knowledge sharing and learning. The temporary nature of projects allows much learning to be lost when the project dissolves. Also, many problems that occur during the project's run are context-specific, and it may be difficult to reflect on them after the completion of the project. Many issues and problems arise in action, in the practice of the project. They call for discussion and reflection as they emerge, during the process of the project. In the first research, project participants found it difficult to reflect on the problems retrospectively. The dispersed and cross-organizational nature of projects distributes people to work in multiple locations. The project team in many cases is an abstraction. Thus as people move from one project to another, they easily lose contact with their peers. Professional development requires communication and interaction with members of the same profession. Project managers work in their projects lacking contact with other project managers. Other professional groups, such as Visual designers, remain an abstraction, unless there is a forum or a mechanism where they can feel a sense of belonging to the larger community of visual designers. People in dispersed projects face similar problems, work solutions, and they benefit from interaction. The challenges addressed in the introduction were recognized in the target organizations. Attempts to solve them in organizations were diverse. This study focuses only on the interactive groups of people as mechanisms to overcome the challenges.

4.1 Main contributions of the study

Firstly, this study contributes to the body of knowledge of project knowledge and competence by studying their content. Secondly, this study contributes to the body of knowledge of community literature viewing communities as personalized mechanisms for sharing of knowledge in the project-based environments. Much of the community research is theoretical. More empirical studies in business contexts are needed. This study provides empirical evidence on communities as social structures in project-based business environments. Communities and other social structures have not been widely studied specifically in project organizations.

According to the community-based theories, knowledge and knowing are embedded in communities and groups of people, instead in the minds of individuals, and they study communities as main social structures for sharing of knowledge and competence. These ideas are represented by scholars like Lave and Wenger (1991), Brown and Duguid (1991; 1998), Wenger (1998), and Gherardi et al. (1998). In this study the main theoretical ideas are derived from that discussion. Therefore this study adopts the epistemology of practice, which perceives knowing as taking place in action (Cook & Brown, 1999). Human action includes the ability to act in groups (Cook & Yanow, 1993). The ability of a group is referred to as collective competence. However, privileging groups over individuals does not mean the rejection of the individual.

4.1.1 Project contexts require collective competences

The competence study served as a setting of the stage and as a study of the context and aimed at exploring the needs and challenges related to knowledge and competence in project-based environments. The level of analysis was the project group level. The results indicate that project group needs competence and knowledge that involves shared understanding and is collective in nature. The management of the entity was challenging and indicated the lack of collective level knowledge and competence. The concept of collective competence implies a group's ability to work together towards a common goal at the group level (Sandberg & Targama, 1998; Hansson, 1998). It is congruent with the view of social learning theories learning taking place through participation of in social processes and practice rather than residing in an individual head. The findings on knowledge and competence support the main conceptual framework of the study. The results contribute to the body of knowledge on project knowledge and competence, as previous research and literature has mainly been based on the rationalistic assumptions (see Sandberg, 1994), viewing knowledge and competence mainly from the individual point of view composed of pre-defined attributes. Generally, project management literature has not strongly emphasized competence at the collective level of a project team or a larger network. But, as Sandberg and Targama (1998) argue, shared understanding is the basis for collective competence. In this study, the management and understanding of the project as a whole was emphasized and seen as being a major source of difficulties in projects. Collective perspective

does not separate individuals from their working environments. Individuals in groups are involved in meaning making. This study bases on the experience of the individual and is more interpretative than rational in nature.

The target projects had also encountered problems with managing the project related knowledge. Both codified and personalized knowledge management were inadequate. The lack of tools and mechanisms was the major problem source within knowledge management. As Kasvi et al. (2003) argue, there is a need for a concept of ”project knowledge management”. There are extensive streams of literature on project management as well as on knowledge management, but the issue of integrating the two concepts is less discussed. This study contributes to the concept of project knowledge management, viewing communities and other social structures as part of a project organization’s knowledge management strategy. This type of strategy is based on personalization (Hansen et al., 1999).

Competences are critical success factors for projects. This study argues that the traditional project management competences, even though they are perceived as being critical, are not in themselves sufficient. A shared understanding of the project as a whole and knowing and understanding the goals are critical. Communication between the members is critical. Communication involves, besides the actual project team, the entire network involved in the project. The competences required are more or less combinations of various competences, i.e., collective competences.

As said, emphasizing collective competences does not imply the rejection of the individual. Project groups are composed of individual members. They each need to be competent and knowledgeable in their work. Thus they need to be able to work as a collective towards a common goal. Discussion on collective competence tends to neglect the individual. This study argues, however, that the emphasis on a collective level does not reject the existence of competence and knowledge as an individual phenomenon. Studying competence and knowledge in the project contexts calls for seeing the phenomena both as individual and collective. However, as argued before, the focus needs to be more on the collective level, as opposed to the present prevailing literature on project knowledge and competence requirements.

Solving complex problems that emerge in projects may require cross-organizational communication across projects’ boundaries, since the solution may be dependent on an interest group outside the project. Therefore, the project group must be able to manage multiple connections within and outside the organization. Existence of informal networks and communities were not yet studied in this research, but such forms of knowledge structures could be useful in project contexts as well (Wenger et al., 2002).

Emphasis on collective competence calls for viewing learning, social and collective. Learning in communities is social in nature and is based on participation in a community’s meaningful activities (Wenger, 1998).

Communities were chosen as social structures for studying the sharing of project knowledge and competence. The other studies of this dissertation concentrate on these communities.

4.1.2 Social structures as semi-formal communities in project-based environments

The overlap of formal, semi-formal and informal organizational structures

The main challenge in organizations is that much of the work is done outside the formal organization. The formal organization is consciously designed to maximize efficiency and contribute to the achievement of organizational goals (Huczynski & Buchanan, 2001). The informal organization refers to the sets of relationships between organizational members (Krackhardt & Hanson, 1993), which emerge crossing formal boundaries and are characterized by spontaneity and volunteerism (Lillrank, 1988). The dichotomy of the formal and informal organizational structures presents a limited view on organizations. This study proposes that between and overlapping with the formal and informal structures there is a layer, which is referred to as a semi-formal organizational structure (Figure 24). In the project-based environments there was a semi-formal knowledge layer of communities involving both formal and informal characteristics. These communities focused on knowledge sharing and learning. Members were primarily bound together by a shared interest in the domain.

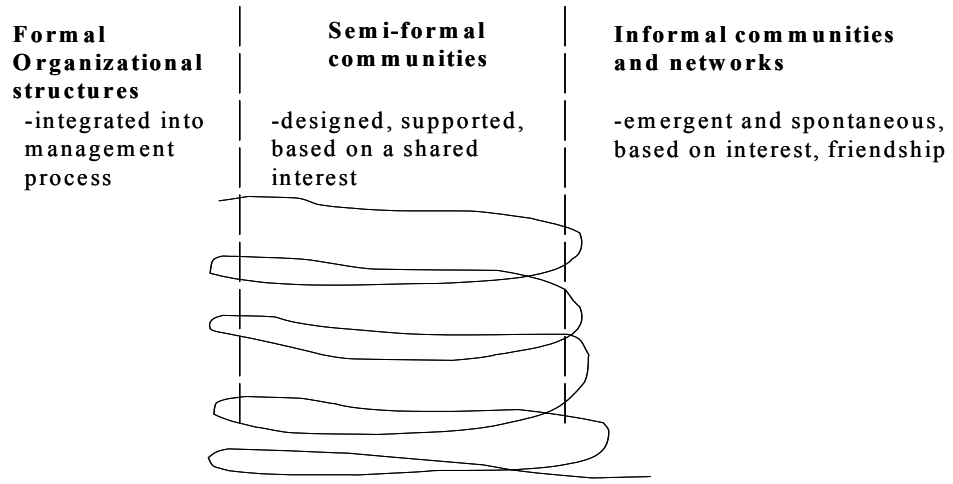

Figure 24 The overlap of formal, semi-formal and informal organizational structures

The knowledge base layer in the hypertext organization (Nonaka & Takeuchi, 1995) refers to a layer where organizational knowledge is generated and which forms a connecting layer between the other two layers. It is embedded in corporate vision, organizational culture, or technology. However, it does not exist as an actual organizational entity. Tuomi (1999) has reinterpretated the hypertext organization model by conceptualizing the knowledge-base layer as a set of communities of practice, and not as a repository of documents,

technologies, or corporate culture, as originally suggested by Nonaka and Takeuchi (1995). Community of practice is a focal unit of collective knowledge development. Tuomi (1999) proposes the concept of an organizational community to combine a traditional community of practice and a team. Yet these concepts do not consider the dimensions of the formal and the informal.

The definitions of distinguishing between the formal and the informal organization meet some difficulty. The line between the formal and the informal is fuzzy. It may even be doubted whether it is possible to talk about these two as separate. The starting point of this study was to study social structures that are not part of the "formal organization", even though they would be deliberately designed. What these structures lack is a direct connection to the management process and financial goals. The first encounter with the empirical study indicated that the social structures are diverse and vary in their degree of formality. This resulted in defining them as formal, semi-formal, and informal (Ruuska & Vartiainen, 2003). This typology was used in further studies on communities and it is referred to as the degree of formality. Further study indicated that social structures aiming at knowledge creation and sharing vary in their internal degree of formality. It indicated that the separation between the formal and informal as such is not relevant, as the features of the social structures were not clear and may have features from both definitions. Furthermore, this study defines the organizational structures as formal, semi-formal and informal and views the lines between the designed and emergent as being blurred.

The changing demands of business change the image of the structures. As the figure 24 presents the concepts of formal, semi-formal and informal organizational structures, it may also depict the development process of these structures. Often social structures may start as loose, informal sets of relationships of people who have similar interests. They may, although not necessarily, develop into semi-formal structures and be recognized by others in the organization and by the management. Some of these semi-formal communities may develop into new formal organizational structures and loose their character as a community of people and transform as integrated into formal management processes.

Conceptualization of a community in a project-based environment

Communities have been viewed as voluntary, interest-based social structures, which allow them to be distinguished from other organizational structures. Communities as unbounded entities differ from formal work groups (as defined, e.g., by Hackman, 1990 or Guzzo & Dickson, 1996), which are bounded and involve strong management initiative. Communities, even initiated by management, are self-managed. Brown and Duguid (1991) argue that group literature in general refers to groups as canonical, bounded entities.

Community literature instead refers to communities as voluntary, unbounded groups (e.g Wenger, 1998; Tuomi, 1999).

Table 25 presents the differences between the characteristics of formal work groups based on literature (e.g. Hackman, 1990; Guzzo & Dickson, 1996) compared to the findings in this study.

Table 25 Differences between formal work groups and communities in the study

	Formal work group	Community
Bond	Completion of the task	Shared interest in a domain of knowledge, desire to learn and share knowledge and experiences
Goals	Performance goals	Learning goals
Affiliation to the host organization	Integrated into management process	Not integrated into management process, yet may involve management intervention
Origin	Management initiative	Management or member initiative
Internal formality	Formal	Formal, semi-formal or informal
Boundaries	Closed, bounded entity	Open, unbounded entity Shifting, blurred Set by the members
Leadership	Appointed leader	Leader more of a coordinator or a facilitator
Role of the leader	Formal authority	Organizer and contact maker, no formal authority
Membership	Appointed	Voluntary

Communities have been to a large extent studied as occupationally and professionally defined groups, e.g., midwifes (Lave & Wenger, 1991), flutemakers (Cook & Yanow, 1993), service technicians (Orr, 1996), and claims processors (Wenger, 1998). Lave and Wenger's (1991) theory was originally applied to maintaining traditions and transferring them into new generations, as well as a framework for developing apprentices to masters by gradual learning by legitimate peripheral participation into community of practice. Wenger (1998) extended the concept of the community of practice to involve multiple settings. Communities of practice have also been referred to as pointing to a specific place, such as a classroom (e.g. Hodkinson & Hodkinson, 2003) or office (e.g. Orr, 1996; Wenger, 1998). An occupational community (van Maanen & Barley, 1984) consists of people who consider themselves to be engaged in the same sort of work, share a social identity and values. Their primary reference group is the occupational community.

Occupational communities emerge and the boundaries are set and seen by the members. They involve rather stable patterns and emphasize stability rather than change.

Hakkarainen et al. (2003) criticize the conception of communities of practice as defined by Lave and Wenger (1991) arguing that communities of practice have traditionally focused on preserving existing traditions and competence without sufficiently focusing on the creation of new knowledge. They also argue that typical research on communities of practice has studied how knowledge is transferred from one generation to a new one without deliberate or fundamental cultural conversion. They see communities of practice, as conceptualized by Lave and Wenger (1991) and Wenger (1998), conservative in this sense. This criticism is partly in place, however, the development of theory (e.g. Wenger, 1998) has moved further from the master-apprenticeship relation focusing on more a variety of communities of practice in work organizations. Thus, in work organizations there is a multiplicity of social structures for various purposes, which each reflect the needs of the context in which they exist. Generally research has tended to focus on specific structures as superior over others. Based on this study, the complexity of project context leads to the need for multiple social structures, which have different purposes and goals. Some were focused on generating new knowledge, while some aimed at learning and creating the prevailing practice. The main social structure studied in this study is a community, which is focused on knowledge sharing in the project context.

Theoretically important in the conceptualizations of communities of practice is that they are primarily about learning, and not, about achieving organizational goals, as Wenger (1998) argues that learning is intrinsic in communities of practice and involved in everything we do. In this study I apply the framework of communities of practice into multiple types of social structures, which are not part of the formal management process of the formal organization, and study to what extend they may be considered as communities. These structures may be diverse, yet they all involve focus on learning and knowledge sharing and applicability of the concept of a community seems suitable. Due to the lack of language around communities, they were not specifically called “communities”, but, development groups or networks.

Based on the study, communities in project-based environments are defined as cross-organizational groups with a shared interest in a certain domain of knowledge, interacting on an ongoing basis with learning goals. Members do not work together on a daily basis and do not necessarily share a profession. They represent different organizational units or project teams. Major types of communities in this study are identified as strategic and professional communities.

Strategic communities are focused on strategically relevant knowledge. They may contribute to the strategy process and related projects by providing necessary knowledge. The results indicate that these strategic communities vary from formal to informal. The formal strategic community, Long term

savings and life group, resembled a cross-organizational matrix organization structure. Yet it had a strong focus on learning and developing the strategically relevant competence area of the company. This knowledge focus enables it to be viewed as a formalized organizational community. However, as its boundaries were fluid, it nevertheless involved strong management intervention, its status in the organization was somewhat problematic. The semi-formal strategic community, Digital marketing communication community, was formalized as well, yet member initiative was strong and the members set the boundaries themselves and referred to themselves as "a social knowledge group". Their domain of knowledge was the strategic focus area in the company. The informal strategic community, Business intelligence network, was the loosest of the three strategic communities, and cultivated market information for the strategy process of the company. It differed from the two other communities, as it did not aim to develop a certain area, but rather provided knowledge support for the strategy process and the related projects by collecting and cultivating market knowledge. This knowledge was dispersed in the organization, so a cross-organizational community structure was used to fuse the experts together. Yet this community had strong learning goals, so learning and knowledge sharing were valued as personal goals besides promoting the strategy process.

Strategic communities involve developing the domain of strategically important competences. Strategic competences reside in various parts of the organization. The distinctive structure of competence applies to a combination of competences (Turner & Crawford, 1994). Strategic community of Digital marketing communication had a twofold role in the organization. It developed knowledge and concepts to the client projects in digital marketing communication. Additionally, it was responsible for developing the strategic competence of the domain. Strategic community of Long term savings and life group involved experts from various areas of this strategic competence. Invention of new solutions to the customer requires integration of multiple competences, which reside in expert departments as well as on the field. By interacting on an ongoing basis, members of the community contribute to the development of the company strategy as well as to the development of the integrated competence area and produce support for customer work.

Botkin (1999) relates knowledge communities to tangible business purposes. Strategic communities (Storck & Hill, 2000) are created by management to address strategic objectives. They are not integrated into management process as the corporate invention is rather minimal. Yet they are management initiated. Strategic communities in this study involve characteristics of both concepts, yet they are more deliberately focused on learning and knowledge sharing and the creation of new knowledge. The focus in communities in this study is in learning goals promoting organizational success. While delivering value to the organization, learning is intrinsic in strategic communities. Both aspects are integrated.

The strategic community of Long-term savings and life group was highly institutionalized. It could be viewed as an organizational community which combines the strategic competence areas of the company. Tuomi (1999) suggests that to organize knowledge creation various types of organizational communities based on strategic needs could be combined. Moreover, organizational communities like Long term savings and life group, could be viewed as a means to develop strategic competence of a company and part of a company's competence strategy.

Professional communities involve professionals from a coherent field. The primary purpose of these communities is the development of professional competence, practice and identity. Members share a profession, such as was the case in the two communities of Project managers and Visual designers, or a domain of knowledge, as was the case in the three Development groups and in the Environment portal. In all communities the bond was professional practice and knowledge. The Project implementation group was organized as a community, involving core and peripheral members, and characteristics of communities were present. Yet it came close to a project portfolio group, because of the strong intervention of management and the focus on coordination of projects, so it is on the borderline between a community and a professional group (Ruuska & Vartiainen, 2003). It was not a business unit, as it was not integrated into management process in the way business units are and did not have any financial goals. Yet distinct from project portfolio groups in general, the strong involvement of learning goals, brings it close to a community. It could be defined as a social structure that has characteristics of communities, yet combined with the characteristics of a professional groups, such as project portfolio groups. Tuomi (1999) proposes to solve the trade-off between communities and teams by defining an organizational unit that combines the characteristics of teams and communities of practice. He suggests that this could be done, e.g., by including a periphery that is not responsible for the goals of the team, and by extending the concept of community of practice so that teams can be community members. He refers to these structures as organizational communities. Communities of practice may be institutionalized as different types of coordinating mechanisms, such as steering groups and forums (Tuomi, 1999). The Project implementation group could be viewed as an institutionalized organizational community, project portfolio coordination mechanism.

Referring to Tuomi's (1999) distinction of homogeneous and heterogeneous communities, strategic communities may be considered as heterogeneous, as they comprise different types of expertise, but the connecting bond is the domain of knowledge. Professional communities, instead, are considered homogeneous, as they are differentiated based on their levels of expertise. They are connected by the same profession.

Communities play an important role in project-based environments, as they help to weave the dispersed project organization around competences.

Furthermore, at the organizational level, constellations of communities may develop into a broader competence strategy, integrating various areas. The concept of the core competence (Hamel & Prahalad, 1990; 1994) views competences as cross-organizational representing an integration of individual skills. Distinctive competences are combinations of competences (Turner & Crawford, 1994). Organizational competences are viewed from the resource-based view of firms, as organizational assets. Integrating the practice-based view to develop these ideas competences may be seen to reside in various strategic competences that overlap and are interactive. They comprise strategically relevant competence areas of the company. This study proposes viewing the company's competence strategy as overlapping strategic communities, integrating the creation and development of the strategic, organizational competences (or put differently, core or distinctive competences) into the strategy practices.

4.1.3 Communities as contexts for workplace learning and knowledge sharing

All the target communities in the study were focused on knowledge and competences. Event though they might have specific organizational purposes, they all involved strong learning goals, which emphasize their role as learning forums. Wenger (1998) argues that learning is intrinsic in communities and can be used to characterize their special nature as social structures. This was indicated in the empirical evidence of this study. Communities aim at learning, and they require explication of the learning goals. Learning may be viewed as intrinsic in structures that are not deliberately directed at learning. The rationale for existence may be coordination, as was the case with the Project implementation group. Yet the members had strong learning goals and integrated learning into this group. The desire for learning may be intrinsic in all we do, and in the various groups we participate. The problem with conventional organizational structures is the lack of focus on learning, as they are result driven. Communities lack the financial, result driven goals and are formed around a knowledge domain. The strong emphasis on learning goals proposes that communities are viewed as contexts for workplace learning.

Communities of professional practitioners foster learning. The purpose of the Visual designer community was to become a better designer and learn about the practice of design. Schön (1987) argues that skilful designing is a kind of knowing-in-action, which cannot be taught, but requires coaching and learning. Thus designing is a creative activity, and a holistic skill. It requires reflection-in-action. Communities may work as contexts for professional development. This study argues that communities in project-based environments are in particular contexts for professional development. The strong emphasis on learning goals contributed to the beneficial outcomes on personal, community and organizational levels. This means an agreement of the learning focus in the group. Members explicitly aim at learning, also at the personal level. They are enthusiastic about improving their competence. The explicit willingness seems

to indicate the achievement of beneficial outcomes at many levels. In the target communities in general, personal learning outcomes were mainly achieved. However, learning outcomes may contribute more widely in the organization, as the members act as knowledge brokers and belong to multiple communities. Attainment of beneficial outcomes presumes personal interest, which cultivates the commitment to the community. Learning as participation (Lave & Wenger, 1991; Brown & Duguid, 1991; Wenger, 1998; Gherardi et al., 1998) implies the focus on social learning that takes place in a community. Learning as a process is becoming a member in a certain community (Sfard, 1998). Members learn by interacting and developing their practice.

Face-to-face communication was generally valued more than the use of ICT tools. Activities were mainly face-to-face involving discussion and experience sharing. Yet the results indicate that they should involve more actual project work and develop project related practice. Communities are based on participation in various activities. Conversations and experience sharing are important, as learning is supported by conversations and stories about problematic and difficult cases (Lave & Wenger, 1991). Discussion and experience sharing were valued in target communities. Discussions allowed members to reflect on their experiences and by telling stories these experiences were explicated and made visible. Discussion enables members to build a collective knowledge base, as chat continuously adjusts a group's collective knowledge and individual member's awareness of each other (Brown & Duguid, 2000). Stories pass knowledge from old-timers to newcomers and allow people to learn from each other (Brown & Duguid, 2000). Additionally, the concept of practice refers to doing real work (Cook & Brown, 1999). Practice is relevant as it creates a shared understanding of what the community does (Brown & Dugud, 1998).

The coordination of a community is vital for the community. Coordinators act as knowledge brokers. Besides connecting members of the community together, they act as brokers between other social structures. The coordinator's work involves at least two roles: the organizer and the contact maker. The contact maker role was indicated as important to achieve outcomes. This role encompasses connecting members with each other as well as with others in the organization. It also involves promoting the community towards management. The coordinators of the target communities acted primarily as organizers.

The question of organizational support is somewhat problematic and twofold. As Wenger et al. (2002) argue, communities benefit from intentional cultivation. Yet they have to a large degree been viewed as informal, invisible social structures (e.g. Brown & Duguid, 1991). Organizational support is sensitive in nature: the line between encouragement and over interfering is delicate. This study concentrates on communities, which are recognized also by others than the members. This in fact was a prerequisite. The results indicate that recognition, encouragement and realistic allocation of time are crucial parameters for beneficial outcomes. Fictitious support causes ambivalence to

the members, as they need to justify their participation. Results indicate that the work for the community is assumed to take second place in priorities, if something else comes up. Short term goals focus on immediate results, and this is problematic with the issue of learning (Wenger, 1998).

The novelty of communities as intentional knowledge sharing structures did not allow members to talk about their communities. Language on communities promotes the activity of communities, as they may be distinguished from present dominant structures, such as teams. Language on communities helps members to discuss and recognize the participation and value in various communities in the organization (Wenger, 2000b). The issue of language is twofold. Firstly, language may help us to define and characterize, to notice, communities as social structures. Additionally, it helps the members to speak about their communities. One of the aims of this study is to provide language and vocabulary to recognize communities in project-based organizations, which allows people to speak about them. As management tends to focus on formal structures and goals, language on informal and semi-formal social phenomena is needed.

A certain degree of formality was required in project-based environments. The nature of the project-based environment involves focusing on the achievement of the goals of the projects, therefore communities as knowledge sharing mechanisms needed structure to enhance knowledge sharing. The concept of the source of the formality is twofold (Figure 25). Firstly, it refers to the formality that comes from the organization. This involves organizational processes and the interference of management. Secondly, we can talk about the formality that comes from the community. Communities tend to generate explicit agreements about their internal structuring process, e.g., how to arrange meetings and the formation of roles. A structuring process is required to organize the work in communities. Regular meetings, agendas for the meetings, and role formation allowed communities to focus on their active participation in the community and promote the outcomes. Formality as internal is referred to as a specific type of structuring process in a community. However, despite the formality from the organization, boundaries in the last case study were set by the members. Members tended to identify themselves with the informal social relationships and referred to this informal group rather than to the formalized structure. They rejected the formalization that came from the organization, as management attempted to tie them into the management process. What they did not reject was the formality that came from the community. This formality was based on their own structuring and the community remained self-managed in this sense. They referred to the structure of a community as an enabler of achieving results.

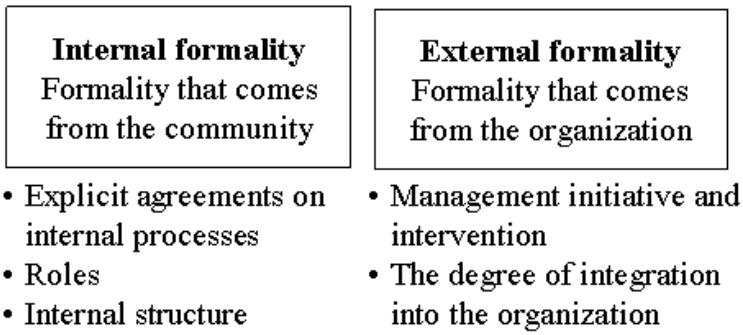

Figure 25 Sources of formality in communities

4.1.4 Communities are defined and bound together by social relationships

Crucial parameters for identifying and defining the community are the social dimensions used by the members themselves for recognizing one another (Van Maanen & Barley, 1984), and the life of a community of practice is produced by its members through their mutual engagement (Wenger, 1998). Based on the results of this study, the idea of engagement and self-setting of boundaries is involved even in the formalized and recognized communities. The fact that management recognizes and institutionalizes these communities, does not change the notion that they are defined and bound together by social relationships, which distinguishes them from formal organizational structures, such as teams. Formality may be a structural dimension, yet the social relationships are defined by members. As an example, Digital marketing communication community was established in 2002. It had started as an informal network, which was recognized and formalized. Despite the strong attempts to formalize the community, members set the boundaries by identifying themselves as an informal community of people they felt a part of. They rejected the formalization and strong management initiative (the formality that comes from the organization) by defining their boundaries through their social relationships instead of formal descriptions of the community. The periphery of the community was living and fluid, the actual social network of people bound together by interest in the digital marketing communication was broader than those of the core members and known by the management. All the core members were involved in multiple social networks, even crossing boundaries of the company. The formalized community served merely as a structure for achieving goals, yet the social relationships and the bond between members was informal and based on shared interest in the domain of digital marketing communication, which members felt passionate about. These relations have existed even if the semi-formal community had been dissolved. Formalized communities may form a duality of the formalized community and the social community as lived by the members (Figure 26). The boundaries are extended by multiple social networks. Brown and Duguid (1998) argue that communities of practice are not designed but emerge. In this study communities involve conscious design. Yet an informal community of

practice may live parallel to the institutionalized structure, as members referred to the social bonds between members rather than a structure that was institutionalized.

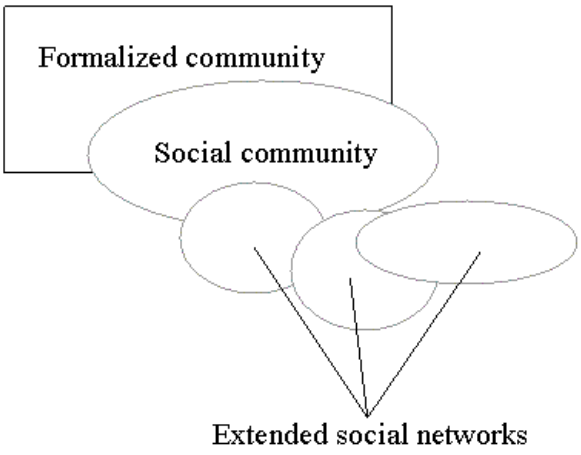

Figure 26 The duality of formalized and social communities

Evidence of phase changes in the trajectory of the community of Digital marketing communication was detected. As the community was based on the informal network of people around the domain, evolvement and development was also dependent on changes on that network. The change of some members was considered critical, and caused reorganizing of the community. Secondly, reifications caused phase changes, as they were considered important milestones. The development of a community could not have been viewed as sequential (as suggested by Tuckman & Jensen, 1977), but rather as parallelism of various phases.

Members of the knowledge sharing communities often act as knowledge brokers. Wenger (1998) refers to brokering as the use of multimembership to transfer some element of one practice into another. Brokers are able to make new connections among communities and enable coordination (Wenger, 1998). Members in the Digital marketing communication community were central knowledge brokers in the organization. They were crossing boundaries and acting in multiple roles. Some of the actions were deliberately planned yet most of them were emergent and took place in social interaction with others. Community and other work overlapped. The core group worked together in different ways. Not only the members worked within the community and with its meetings, but also at other times throughout the day they met in hallways and for lunch and traded stories back and forth, as also described by Brown and Duguid (1991). Communication was both formal and informal. Some of them also worked in the same projects. The domain was connected to members' work and therefore the work done for the community could not always be separated from the actual work tasks members did for their client teams. Learning was inseparable from working. The insight accumulated was, as suggested by Brown and Duguid (1991), socially constructed and distributed.

4.1.5 Community-based view on organizations

This study adopts the community-based view on project-based organizations, whose dominant structures are projects and communities that connect various projects together and thus act as brokering mechanisms. The parallelism and overlap of organizational structures promotes success in the project-based environment. Strategic communities promote the development of strategically relevant competence. Additionally, they enable development of professional competence. Professional communities promote the development of professional competence, practice and identity. Communities in project-based environments are contexts for learning and knowledge sharing, based on multimembership (Wenger, 1998). In addition to dominant forms of strategic and professional communities, variety of social structures emerges in project-based environments. The multiplicity of structures calls for various needs and purposes. Some focus on short term sharing of ideas or problem solving, some provide context for community building.

A community-based view on organizations is conceptualized as viewing organizations as constellations of various communities (Wenger, 1998; Tuomi, 1999) or hybrid groups of overlapping and independent communities (Brown & Duguid, 1998). Practice gives life to the formal organization and is often a response to the designed organization (Wenger, 1998). Interaction of the designed and emergent organization describes the organization (Wenger, 1998). Organizations as complex systems have multiple units of analysis (Tuomi, 1999).

Semi-formal communities in project-based environments may enhance learning of the members, the development of their professional competence as well as contribute to new ideas, approaches, and methods for projects, as discovered in this study. Therefore these knowledge sharing communities help project organizations focus on learning and knowledge sharing as well as connect peers with each other and help to overcome the challenges posed by the temporal and dispersed nature of a project organization. However, communities required more focusing on the practice, coordination and organizational support to be able to achieve outcomes. In some target communities, these features remained on an average level and inhibited beneficial outcomes to realize their full potential.

Viewing communities as dominant structures for knowledge sharing and learning in project-based environments changes the perspective of the learning architecture of project-based organizations. They emphasize the interaction of project members across boundaries and involve personalization strategy (Hansen et al., 1999). Personalized and codified knowledge both have a role in this view. Personalized knowledge is based on participation in the communities' meaningful activities (compare Wenger, 1998), and by reification (Wenger, 1998) it may be codified in knowledge bases of communities and projects.

4.2 Managerial implications

The issues of competence and knowledge and their sharing by communities in organizations involve great practical relevance. Good research should, besides involving theoretical and empirical contributions, contribute to the reality of organizations. Theory may be tested in practice, which proves its practical applicability. Research subjects in organization science reflect the reality of organizations and companies. This section discusses the managerial and practical implications of the research findings.

4.2.1 Practical implications of the knowledge and competence study

The study on project knowledge and competence shows that practical implications should be focused especially on collective aspects. The present focus has been primarily on individual aspects. Project competence has been approached much from the point of view of the project manager and individual members. Project management qualifications have produced lists of attributes related to preferable behavior and competences. What is often missing is the wholeness of the project group. Projects tend to be complex involving multiple aspect to be integrated. This requires us to focus on project groups as entities instead of merely individuals.

Practical implications of knowledge and competence required in project organizations include the following recommendations:

Project management

- Set realistic goals for the project.
- Resources allocation and schedules according to goals.
- Define clear distribution of responsibilities.
- Proper time allocation for persons participating in projects, so that projects would not be executed as the last priority.
- Shared project schedules, so that everyone can check how the project is proceeding.

Developing the understanding of the entire project

- Clear goals communicated to everyone.
- Provide a description of the project process including the entity, different phases, participants and networks, and the time line. This includes also interest groups and external networks of the project. Communicating the process to everyone.
- If the participants are dispersed, but the project involves a concrete outcome, e.g., make a video of the whole process to concretize it or create possibilities to visit other sites.
- Provide an introduction to project work in general, training project basics to all participating in projects, preferably together with the entire project group.
- Provide an introduction to the work of the target project.
- Use mentoring to share experiences and creating understanding on a broader context.
- Enhance the knowledge on the customer. This is especially important if the project involves many parties and only some of them are in direct contact with the actual customer.
- Chance to visit the customer, e.g., with the salesmen.

Enhancing communication between participants

- Networks and communities within and between projects.
- Include agreed ways of communication in project plans.
- Frequent get-togethers.
- Regular meetings, such as start-ups.
- Getting to know people better: home pages and picture galleries.

Promoting learning and knowledge sharing

- Project models
- Create networks and communities of practice between projects.
    - Project manager networks meeting once a month. Project managers bring information from their projects to the community, where it is discussed. On the other hand they take knowledge back to their projects. This creates a learning spiral between projects.
    - Problem solving communities of practice or networks.
    - Virtual communities and networks, which communicate via information technology.
- Regular meetings
- Assess project experiences, transferring lessons learned in project meetings.
- Enhance the project's external communication, focusing on the boundaries of the project.
- Take at least one junior to every project. This ensures that the best people will not become overloaded and new generations are nurtured.
- Introduction to all newcomers. Assigning tutors for newcomers.

Emphasizing project knowledge management

- Create project knowledge management practices, using both personalization and codification strategies.
- Create and use project tools and ensure participants manage them.
- Rules for knowledge management, reporting and documentation
- Databases including information on who knows what instead of coding all the data.

The next section proposes that communities in dispersed project-based environments would serve as knowledge sharing mechanisms. They could be named as the organizational glue. Recommendations on sustaining these types of communities are provided next.

4.2.2 Practical implications of the community study

Organizations include formal, semi-formal and informal structures, which overlap. Many of the social structures are invisible to others than those participating, which management is not often aware of. Communities as potential social structures for sharing of knowledge and development of competence are not generally recognized in organizations. This is partly due to the lack of language on communities. This study shows that they should be managed as a tool for learning and knowledge sharing, as well as promoting the success of an organization. But their management is a tricky issue. Over-management may kill the spontaneous nature of communities, which, in most cases, is their most valuable advantage. Voluntariness guarantees the passion and commitment involved in communities. The study shows that the existence and explication of the learning goals promotes beneficial outcomes at all levels.

Learning may be integrated into multiple social structures in organizations, even ones that are not primarily designed for learning. Supporting learning in organizations calls for new ways of viewing where learning takes place. Communities as primary contexts for workplace learning offer an integration of doing real work while learning. The content of learning involves real issues, problem solving, and getting help from others. Multimembership enhances knowledge brokering as people act in multiple positions and roles in organizations. But participation in multiple communities requires support and encouragement. It also requires legitimation of membership.

Based on the results of this study, practical implications of managing communities include the following recommendations:

Structure

Communities are not teams. They are self-managed and based on voluntary membership. Yet they require, in order to promote the success of the organization, certain degree of formality. Most communities viewed as knowledge sharing mechanisms were semi-formal. Structure helps to attain outcomes. Formality may refer to the internal formality coming from the community, such as structure and roles, or external community coming from the organization, such as the degree of management intervention and integration of the organization.

Purpose and goals

Communities focus on knowledge and competence. Learning goals are primary. Communities as knowledge structures do not involve financial goals. They may, however, support the achievement of the financial goals.

Communities may be viewed as learning forums, which involve doing real work and creating practice, while enhancing learning.

Activities

Communities are based on ongoing interaction of members within and across the boundaries of the community. Discussion and experience sharing are valued, yet communities are based on practice, which implies doing real work. The practice of a community is related to members' work. Conversations and telling of stories helps to create the practice by having members reflecting on their work and making it explicit.

Coordination and facilitation

The coordinator may be denominated by management, yet the leadership task in communities does not involve hierarchical authority. Coordination involves practicing two roles: organizer and contact maker. The organizer role involves traditional organizing, yet the contact maker role is more critical, as the main task is to advance relationships, connect members with each other and with other communities and the host organization. It also involves promoting the community towards management. The coordinator needs to share her own experience as well with the members of the community.

Organizational support

Communities require recognition and legitimation of participation. Allocation of time must be realistic thus members should not have to justify their participation in the community.

Outcomes

Outcomes may be perceived at personal, community and organizational levels. Primary personal outcomes involve learning, benefits, such as new projects / customers, improved career prospects or better reputation and visibility in the organization, and new contacts. Communities are particularly suitable for supporting learning. Community level outcomes involve the sense of community, which includes trust, the feeling of a sense of loyalty to the community, good common understanding, and the feeling of a sense of belonging to the community. Organizational level outcomes are challenging, if not impossible, to measure. Both personal and community level outcomes may be seen to promote organizational outcomes though. It should be realized that the organizational outcomes may land elsewhere than in the community. Work in the community may help to solve problems that occur in projects, yet it is difficult to detect the source. Communities promote innovativeness rather than effectiveness.

Central elements of knowledge sharing communities are presented in figure 27.

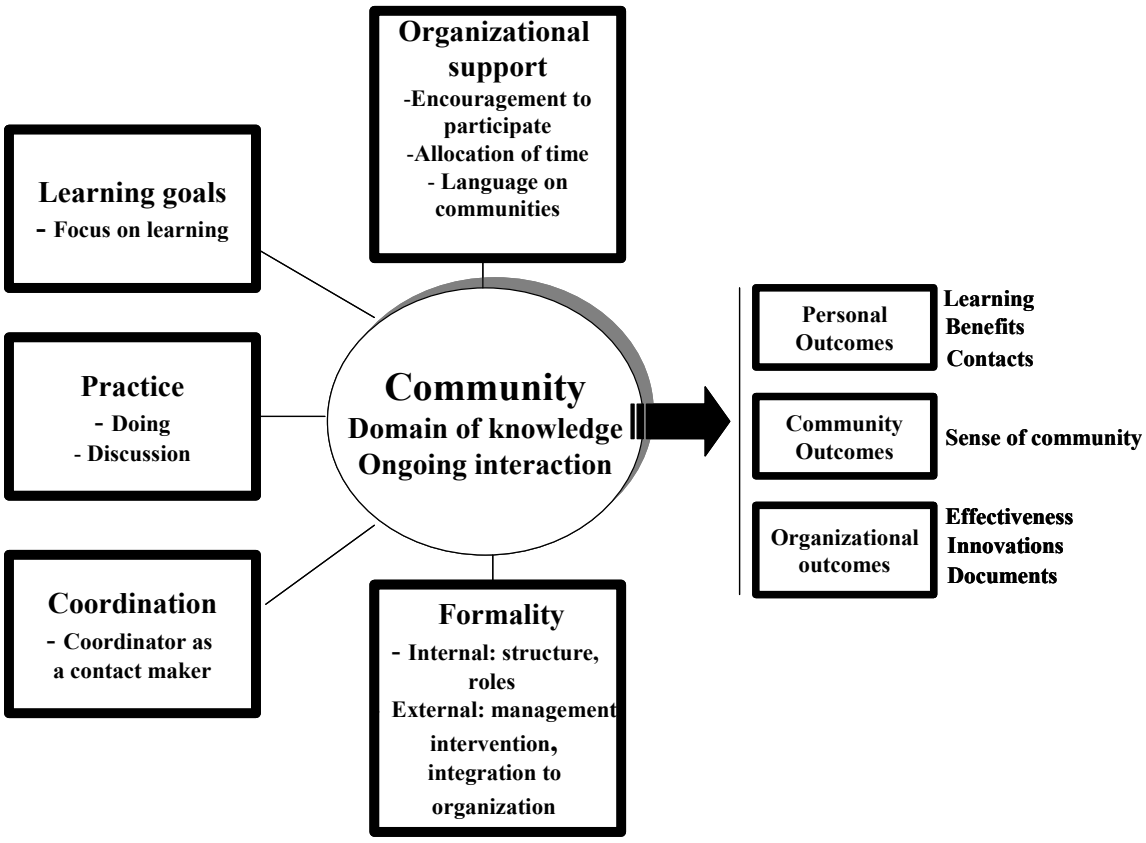

Figure 27 Model of the central characteristics of communities in project-based environments

A community perspective has implications on the training of project managers. Traditional training is based primarily on certifications and project standards. Participating in the community of project managers is one kind of on-the-job training. Participation allows project managers to engage in project management practice in wider contexts, and learn from other project managers. Certifications are based on assuming explicit knowledge, participation in the community of practice allows project managers to learn about practice thus become better practitioners.

4.3 Evaluation of the research

Methodological issues are addressed to evaluate the research process and the findings.

The research process was abductive (Dubois & Gadde, 2002), which allowed a dialogue between theoretical assumptions and empirical evidence. It is positioned in relation to induction and deduction, but it is closer to an inductive than deductive approach, yet the continuous interaction of theory is stressed more heavily than in the grounded theory. Systematic combining builds on the developing of existing theories rather than generating them. Findings shaped the understanding of the social structures and further cases were designed based on theory, but also on empirical findings. The abductive approach was chosen to be able to recognize and define emergent concepts. Allowing empirical data to modify the prefixed theoretical concepts enabled emergent themes to be included. The abductive approach proved useful in the study of the concepts of knowledge and competence. The emergence of collective competence was evident and the loose framework allowed emergent concepts. Going back to the theoretical discussion on collective competence allowed the concept to be recognized and applied in project contexts, thus allowed for the development of existing theories on project competence. In the study of communities the dialogue between the theory and empirical data was useful, as the discussion on communities is to a great extent conceptual and theory based. Empirical findings of the study allowed this theory to be approved and reconceptualizations to be made. The abductive approach allowed rigor in the analysis.

The study was based primarily on qualitative methods. However, quantitative methods were also used. Bloor (1997) argues that qualitative research has various alternatives for checking the validity of the results. Triangulation was used to compare the data from different sources and to collect data by multiple methods. Data collection from many sources enabled cross-checking of data and the validation of the interpretation (Bryman, 1992). Divergence was used to enrich the explanation (Jick, 1979). Triangulation was used for validating the results. The effectiveness of triangulation rests on the premise that the weakness in each single method will be compensated by the counter-balancing strengths of another (Jick, 1979). In this study, the main sources of data were interviews. They are justified by the nature of the research subject, which involves social structures with people as meaning makers. The research is based on the way the respondents have experienced life in the targets and how it is reflected in their stories. The emphasis was put to the experiences of the respondents, as the social organization as seen by insiders is typically quite different from that seen by outsiders (Van Maanen & Barley, 1984). Yet the problem with the qualitative research is that it is time consuming and allows for a limited number of respondents. Therefore the use of quantitative data mainly for exploratory purposes was justified in terms of being able to receive a greater amount of data on the research subject.

Careful data collection plan and selection guidelines were made in order to avoid sampling errors in the use of interviews. However, it is still not possible to observe all situations. Therefore the data represents a limited view of reality in that sense. Data was collected intensively within each study and within a defined time period to avoid temporal sampling errors. Interviewees were selected to represent as many viewpoints as possible to overcome the distortion of the findings because of the selectivity of respondents (see Patton, 1990). The number had to be limited though, as it was not possible to interview all the participants in projects. Retrospective research has also shortcomings in the way that people tend to forget past events or memories might be altered. A stimulated recall method (Jokinen & Pelkonen, 1996) was used to overcome this problem in studies one and four. Data analysis was done systematically with a help of the computer assisted analysis program. Interview data involves long stories of respondents, which may be lost during data analysis. The program was used to overcome the problem of the overload of data. Still, as data is divided into separate codes, there is a danger of losing its sense (Coffey & Atkinson, 1996). Rules for analysing data (Eskola & Suoranta, 2001) and codes and descriptions of what is included under each code were drawn carefully. After the first coding of each data, it was re-read and double-checked to ensure that relevant parts of responses had been included.

This study is based on the case study. Generally accepted criteria to evaluate a case study do not seem to exist (Eisenhardt, 1989). Case study approach has been criticized as it provides little basis for scientific generalization: do the results apply to other cases and to other industries? (Yin, 1994) As the strength of the case study approach, Yin (1994) argues that it is possible to get into details and create hypothesis for further research. As the research questions involved getting into details and providing descriptions of various elements, the case study seemed useful for those purposes (Yin, 1994). Each previous study provided research questions to be answered in the following step. Additionally, case study approach was used, as it allows the researcher to view the data in many divergent ways (Eisenhardt, 1989). Similarities and differences between the cases were analyzed. This was done by choosing some dimensions on the results, as Eisenhardt (1989) suggests. Cases were collected from several companies. This and the use of many data collection methods were used to increase the validity of the research. Many sources of data provided a number of benefits: the collection of data on matters which cannot be directly observed, cross-checking of information from different sources and the validation of researcher's interpretation of her subjective perspectives (Bryman, 1992).

Methods developed to assess reliability and validity in quantitative research cannot be applied directly to qualitative research (King, 1994). Analysis and evaluation of data in qualitative research cannot be distinguished as sharply as in quantitative research (Eskola & Suoranta, 2001). In qualitative research the researcher needs to make an ongoing evaluation of the decisions made. However, four criteria for evaluating the validity and reliability are generally presented: reliability, construct, internal as well as external validity. These are

next discussed from the viewpoint of the case study research. Reliability and validity of the quantitative study in study three are presented in chapter 3.3.

Reliability calls for the demonstration that the operations of the study, e.g., data collection procedures, can be repeated with the same results (Yin, 1994). In qualitative study this is difficult to demonstrate, as the research situations are unique conversations between the researcher and the respondent thus the situation and the research target have changed and evolved as time goes by. Qualitative research in seeking to describe and understand how people make sense of their world, does not require the researcher to seek objectivity and distance themselves from the respondents (King, 1994). However, to enhance the reliability of the research, a systematic approach was used. Patton (1990) argues that the qualitative researcher has an obligation to be methodological in reporting the details of data collection and the analysis process. To increase the reliability I have described data collection and analysis in association with each study in chapter 3. Data collection and analysis involved detailed guidelines, which were followed in a similar manner in each individual study. General research design is described in chapter 1. To enhance the reliability of the research process as a whole, the abductive process is described in chapter 1. I have also intended to write this dissertation in such form that the findings can be traced back to the data collection and to the objectives and the research questions.

Construct validity concerns the establishment of correct operational measures for the studied concepts (Yin, 1994). In quantitative research a valid instrument is the one, which actually measures what it claims to measure. Also, in qualitative research, a study may be considered valid if it truly examines the topic, which it claims to have examined (King, 1994). Basically, the concept is similar in both, yet in quantitative research the notions of validity centers on the methods while in qualitative research it is concerned for the validity of interpretations. Techniques for ensuring validity are multiple.

To increase the construct validity, multiple sources of data and data collection methods were used, as triangulation of different methods may be used to increase validity (King, 1994). Interviews and documents as well as a questionnaire complemented with coordinator interviews were used to gather data. The findings of this study are based on various sources as highly complementary and the use of qualitative and quantitative data are synergistic. Both are used to understand communities. Merely using qualitative data would have lacked the higher number of respondents and research targets, which allowed getting a broader picture of communities. Also, merely quantitative data would not have been proper, as the study of communities requires understanding the dynamics and meaning involved. This may be difficult to achieve merely with quantitative data. Questionnaire data was complemented and validated by the coordinator interviews, which allowed the research targets to be better understood in their contexts. The final case study on one of the communities was also used to validate the findings of the questionnaire.

However, both the interviews and the questionnaire data presented the respondents' subjective perceptions of the phenomena.

Validation of the results can be done by describing why the choices have been made and why some alternatives were not used (Kvale, 1996). The research process and the analysis have been described in detail in this study in order to clarify the choices that have been made.

Respondent validation was used, whereby the researcher provided subjects with an account of their findings for assessment, even though the subjects might not be able to validate the inferences drawn for the researcher's academic forum (Bryman, 1992). To validate the results the respondents were allowed to check the interpretations made by the researcher (Janesick, 1994).

Study 1, in Case A, a two-day seminar for the representatives of the target organization was arranged. Even though it did not involve all the interviewees, the participants of the organization were given a chance to evaluate the results and their validity. In Case B, representatives of the organization were used to comment upon the results.

Study 2, results were sent for comments from all the respondents. Additionally, a feedback session for the respondents was organized.

Study 3, a report of the results was sent to the coordinators to be distributed to the members of communities for comments. Additionally, in one community a face-to-face feedback session was organized.

Study 4, the results were sent to all the respondents for comments.

The use of the questionnaire is also evaluated. One of the problems of the questionnaire was its length. It involved multiple questions, so answering was time consuming. Additional problems arose with the technology. The Surveyor program did not allow the respondents to save the answers while replying. If they were interrupted and were not able to finish the questionnaire at once, they could not return to previous answers, but had to start all over again. This may have had an effect on the percentage of completed questionnaires, which was indicated by the number of unfinished questionnaires. However, these were not included in the research material. Another problem arose with the questions concerning the tools for communication and interaction. Many respondents had left them unanswered. They were grouped into three sets of questions, which involved overlap. These questions are not part of this study, as they were delimited from this dissertation. But generally the questionnaire provided rich data for analysing communities and answering the research questions. As an advantage of an online questionnaire, the responses were immediately seen by the researcher. The response rate of communities varied from 41 to 100 %. The effective response rate was 59 %, which could be considered sufficient for online questionnaires.

Internal validity refers to the causal relationship, where certain conditions are proven to lead to other conditions. Internal validity is not applicable for descriptive or exploratory case research (Yin, 1994). It is typical however, for explanatory research. This study involved a small-scale explanatory study. Validity of that study is presented in chapter 3.3 in association with the results.

External validity refers to generalizability of findings to other domains. It concerns whether the findings can be generalized beyond the case studies. External validity of the case study may be extended by the use of multiple cases over a single case (Eisenhardt, 1989; Yin, 1994). Studies one and three involved multiple cases, studies two and four were single-case studies. Patton (1990) suggests that instead of generalizing the research findings, extrapolation may be used to speculate on the likely applicability of findings to other similar, but not identical, conditions.

Concerning the questionnaire, Andriessen and Verburg (2004) collected data in various target organizations. In their studies, the questionnaire proved to provide valid data on different types of communities.

Finally, some thoughts after the process, as ontological and epistemological conclusions. This study reflects the constructivist paradigm, which conceives knowledge as a human construction, and not as an ultimate truth (Guba, 1990). Knowledge was constructed by respondents and their experiences were taken as the basis for the interpretation, as they were asked to relate their experiences with their work and activities. Constructivist, interpretive approach aims at understanding human action (Schwandt, 2000). Schwandt argues that to understand a particular social action, the inquirer must grasp the meaning of that action (p.191). Morgan and Smircich (1980, p. 492) propose viewing different approaches of ontological and epistemological assumptions on a continuum. Core ontological assumption at the other end views reality as a projection of human imagination, while the other extreme sees it as a concrete structure. The basic epistemological stance refers either to obtaining phenomenological insight or revelation, or to constructing a positivist science.

This study may not be viewed strictly as representing either poles, but to be positioned somewhere in the middle. A major part of the study involves interpretations of respondents to their reality. Interpretations during the data analysis were also made by the researcher. However, this study involves a part that relies on the notion of causality, following more the positivist approach. That reflects the notion of objective format of knowledge.

Limitations of the research

This study focuses on the communities that are visible to others and not merely to members and recognized in the organization. This may be seen as a limitation of the study. Invisible communities may involve different dynamics and characteristics than the recognized ones. One might criticize the research for not using a social network analysis to detect the social structures. Social network analysis is useful in detecting informal relationships, which are not

seen by outsiders. The focus was on various types of structures aiming at knowledge sharing. Therefore interviews of key persons in the organization were chosen as a research method. It is true though that a social network analysis would have provided more information of the most informal social structures in the organization, which, in many cases, are very important for knowledge sharing. They are always the hardest to recognize. Now as a shortcoming, the lack of these most informal social structures is present in the study.

The shortcomings of the questionnaire were discussed in the previous section.

In general, methods used in the study were appropriate and the use of multiple methods allowed the research target to be approached from multiple viewpoints. Observation was not systematically used, which could be considered as a limitation of the study. The limitation of the questionnaire is also its applicability only to identifiable communities in organizations. Yet the richness of information provided by the questionnaire is substantial. It is suitable for use with qualitative interviews.

4.4 Suggestions for the future research

Research and writing a dissertation is always a learning process. In the end you think you would have done something differently. New knowledge gained during the research process builds on understanding of the concepts and phenomena. The abductive approach allows learning, as it takes place in the interplay between search and discovery (Dubois & Gadde, 2002). As the contribution of the study, communities as social structures in project-based environments have been made more visible and have been provided lacking empirical evidence to the theoretical discussion. At this point it feels that this only sets the stage. Further interesting questions arise in the study of social processes and mechanisms involved in the knowledge sharing. How does this knowledge sharing take place? What are the crucial parameters? This research setting did not allow these questions to be answered adequately, as the focus was more on the structure than the processes. As a next step, action research would be a suitable research method to be able to be deeper involved in the communities. More detailed case studies on communities, as was done in the last study, would provide rich data.

Another stream of research involves the organizational level study of strategic communities. Communities have a role in the company's strategy. Strategic communities involve practices that intend to promote the strategy process and the development of strategic competences. As Virkkunen (2002) has proposed, second generation knowledge management involves communities and collective forms of learning. The community-based view on organizations proposes that communities are dominant structures in organizations. Strategic communities are formed around strategically relevant domains. Strategic communities in the target organizations were occasional and not based on deliberate strategy to view communities as main vehicles for developing and implementing competence strategy. Viewing organizations as constellations of communities of practice (Brown & Duguid, 1991; Wenger, 1998) allows competence strategy to be approached from community-based view. Therefore research on the study of strategic communities would be most interesting to carry out.

5 References

Ahonen, H., Engeström, Y. & Virkkunen, J. (2000) Knowledge Management – The Second Generation: Creating Competencies Within and Between Work Communities in the Competence Laboratory. In: Malhotra, Y. (Ed.) Knowledge Management and Virtual Organizations, pp. 282 – 305. Hershey, PA: Idea Group Publishing.

Andriessen, J.H.E. (2003) Working with groupware. Understanding and Evaluating Collaboration Technology. London: Springer.

Andriessen, J.H.E., Soekijad, M., Huis in't Veld, M. & Poot, J. (2001) Communities of Practice: between control and creativity. Contribution to the Symposium: Knowledge management and organizational learning: a focus on social processes. The Tenth European Congress on Work and Organizational Psychology, Praha, Czech Republic, 16 – 19 May 2001.

Andriessen, J.H.E., Soekijad, M. & Keasberry, H.J. (2002) Support for knowledge sharing in communities: an introduction. In: Andriessen, J.H.E., Soekijad, M. & Keasberry, H.J. (Eds.) Support for knowledge sharing in communities, pp. 1 – 10. Delft: Delft University Press.

Andriessen, J.H.E. & Verburg, R. (2004) The Development and Application of the Community Assessment Toolkit. Proceedings of 5th European Conference on Organziational Knowledge, Learning and Capabilitis, 2 – 3 April 2004, Innsbruck, Austria (CD-Rom).

Argyris, C. & Schön, D.A. (1978) Organizational Learning: A Theory of Action Perspective. Massachusetts: Addision-Wesley Publishing Company.

Artto, K. A. (2001) Management of Project-Oriented Organization – Conceptual Analysis. In: Artto, K.A., Martinsuo, M. & Aalto, T. (Eds.) Project Portfolio Management. Strategic Management through Projects, pp. 5 – 22. Helsinki: Project Management Association Finland, PMA Finland.

Ayas, K. & Zeniuk, N. (2001) Project-based Learning: Building Communities of Reflective Practitioners. Management Learning, Vol. 32, No. 1, pp. 61 – 76.

Barnard, C.I. (1954) The Functions of the Executive. Cambridge, Massachusetts: Harvard University Press.

Battistelli, A. & Picci, P. (2003) To experience innovation: Creation and development of group innovative learning. Proceedings of 3rd International Conference of Researching Work and Learning, July 25th – 27th 2003, Tampere, Finland, Book III, pp. 12 – 21.

Bloom, B.S. (1953), Thought-processes in lecture and discussions, Journal of General Education, Vol. 7, pp. 55-71.

Boland, R.J. & Tenkasi, R.V. (1995) Perspective Making and Perspective Taking in Communities of Knowing. Organization Science, Vol. 6, No. 4, pp. 350 – 372.

Botkin, J. (1999) Smart Business. How Knowledge communities Can Revolutionize Your Company. New York, NY: The Free Press.

Boud, D. (1999) Situating academic development in professional work: Using peer learning. International Journal of Academic Development, Vol. 4, No. 1, pp. 3 – 10.

Boud, D. & Middleton, H. (2003) Learning from others at work: communities of practice and informal learning. Journal of Workplace Learning, Vol. 15, No. 5, pp. 194 – 202.

Bresnen, M., Edelman, L., Newell, S., Scarbrough H. & Swan, J. (2003) Social practices and the management of knowledge in project environments. International Journal of Project Management, Vol. 21, No. 3, pp. 157 – 166.

Brown, J.S. & Duguid, P. (1991) Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation. Organization Science, Vol. 2, No. 1, February 1991, pp. 40 –57.

Brown, J.S. & Duguid, P. (1998) Organizing Knowledge. California Management Review, Vol. 40, No. 3, Spring 1998, pp. 90 – 111.

Brown, J.S. & Duguid, P. (2000) The Social Life of Information. Boston, Mass.: Harvard Business School Press.

Brown, J.S. & Duguid, P. (2001) Knowledge and Organization: A Social-Practice Perspective. Organization Science, Vol. 12, No. 2, March – April 2001, pp. 198 – 213.

Brown, R. (1988) Group Processes. Dynamics within and between Groups. Oxford: Blackwell Publishers.

Bryman, A. (1992) Research methods and organizational studies. New York: Routledge.

Chisholm, D. (1989) Coordination without hierarchy. Informal structures in multiorganizational systems. Berkeley: University of California Press.

Coffey, A. & Atkinson, P. (1996) Making sense of qualitative data: complementary research strategies. Thousand Oaks, CA: SAGE.

Collis, D.J. & Montgomery, C.A. (1995) Competing on Resources: Strategy in the 1990's. Harvard Business Review, July – August 1995, pp. 118 – 128.

Constant, D., Kiesler, S. & Sproull, L. (1994) What's Mine Is Ours, or Is It? A Study of Attitudes About Information Sharing. Information Systems Research, Vol. 5, No. 4, pp. 400 – 421.

Cook, S.D.N. & Brown, J.S. (1999) Bridging Epistemologies: The Generative Dance Between Organizational Knowledge and Knowing. Organization Science, Vol. 10, No. 4, July – August 1999, pp. 381 – 400.

Cook, S. D.N. & Yanow, D. (1993) Culture and Organizational Learning. Journal of Management Inquiry, Vol. 2, No. 4, December 1993, pp. 373 – 390.

Crawford, L. (1999) PM Competence: People and Organisations. In: Artto, K., Kähkönen, K. & Koskinen, K. (Eds.) Managing Business by Projects, Vol. 2, pp. 672 – 689. Helsinki: Project Management Association Finland and NORDNET.

Crawford, L. (2000) Profiling the Competent Project Manager. Proceedings of PMI Research Conference 2000, pp. 3 – 15.

Crawford, J.K. (2002) Project Management Maturity Model. Providing a Proven Path to Project Management Excellence. New York: Dekker.

Creswell, J. W. (1994) Research design: qualitative and quantitative approaches. Thousand Oaks, CA: SAGE.

Cross, R., Parker, A., Prusak, L. & Borgatti, S.P. (2001) Knowing What We Know: Supporting Knowledge Creation and Sharing in Social Networks. Organizational Dynamics, Vol. 30, No. 2, pp. 100 – 120.

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

Day, G.S. (1994) The Capabilities of Market-Driven Organizations. Journal of Marketing, Vol. 58, (October 1994), pp. 37 – 52.

De Board, R. (1988) The Psychoanalysis of Organizations. A psychoanalytical approach to behavour in groups and organizations. Cambridge: University Press.

DeFillippi, R.J. & Arthur, M.B. (1998) Paradox in Project-Based Enterprise: The Case of Film Making. California Management Review, Winter 1998, Vol. 40, No. 2, pp. 125 – 139.

De Geus, A. (1997) The Living Company. Habits for survival in a turbulent business environment. Boston, MA: Harvard Business School Press.

De Laat, M. & Broer, W. (2004) CoPs for CoPs: Managing and Creating Knowledge through Networked Expertise. In: Hildreth, P. & Kimble, C. (Eds.) Knowledge Networks. Innovation Through Communities of Practice, pp. 58 – 69. Hershey, PA: Idea Group Publishing.

Denzin, N. K. (1978) The Research Act, 2nd ed. New York: McGraw-Hill.

Dixon, N.M. (1997) The Hallways of Learning. Organizational Dynamics, Spring 1997, pp. 23 – 34.

Dixon, N.M. (2000) Common Knowledge. How Companies Thrive by Sharing What They Know. Boston, MA: Harvard Business School Press.

Dubois, A. & Gadde, L.E. (2002) Systematic Combining: An abductive approach to case research. Journal of Business Research, Vol. 55, pp. 553 – 560.

Duncan, R. (1979) What is the right organization structure?: decision tree analysis provides the answer. Organizational Dynamics, Vol. 7, No. 3, pp. 59 – 80.

Edum-Fotwe, F.T. & McCaffer, R. (2000) Developing project management competency: perspectives from the construction industry. International Journal of Project Management, Vol. 18, pp. 111 – 124.

Edvinsson, L. & Malone, M.S. (1997) Intellectual Capital. Realizing Your Company's True Value by Finding its Hidden Roots. New York: HarperBusiness.

Eisenhardt, K. M. (1989) Building Theories From Case Study Research. Academy of Management Review, Vol. 14, No. 4, pp. 532 – 550.

Elkjaer, B. (1999) In search of a social learning theory. In: Easterby-Smith, M., Burgoyne, J. & Araujo, L. (Eds.) Organizational Learning and the Learning Organization, pp. 75 – 91. London: Sage Publications.

Elkjaer, B. (2003) Social Learning Theory: Learning as Participation in Social Processes. In: Easterby-Smith, M. & Lyles, M.A. (Eds.) The Blackwell Handbook of Organizational Learning and Knowledge Management, pp. 38 – 53. MA, USA: Blackwell Publishing.

El-Sabaa, S. (2001) The skills and career path of an effective project manager. International Journal of Project Management, Vol. 19, pp. 1 – 7.

Engwall, M. (2000a) Moving Out of Plato's cave: Toward a Multi-Project Perspective on Project Organizing. Working Paper. Fenix WP 2001:8. Stockholm, November 2000. Retrieved June 4, 2002 from the World Wide Web: http://www.fenix.chalmers.se.

Engwall, M. (2000b) Multiproject Management: Effects, Issues and Propositions for Future Research. Working Paper. Fenix WP 2001:6. Stockholm, November 2000. Retrieved June 4, 2002 from the World Wide Web: http://www.fenix.chalmers.se.

Engwall, M. & Sjögren Källqvist, A. (2000) Dynamics of a Multiproject Matrix: Conflicts and Coordination. Working Paper. Fenix WP 2001:7. Stockholm, November, 2000. Retrieved June 4, 2002 from the World Wide Web: http://www.fenix.chalmers.se.

Enkel, E. (2002) Knowledge Networks – an integrated approach to managing explicit and implicit knowledge. The Third European Conference on Organizational Knowledge, Learning, and Capabilities, April 2002, Athens.

Eskola, J. & Suoranta, J. (2001) Johdatus laadulliseen tutkimukseen. Tampere: Osuuskunta Vastapaino.

Frame, D. J. (1994) The New Project Management. Tools for an Age of Rapid Change, Corporate Reengineering, and Other Business Realities. San Francisco: Jossey-Bass Publishers.

Frame, D. J. (1995) Managing Projects in Organizations. How to Make the Best Use of Time, Techniques, and People. San Francisco: Jossey-Bass Publishers.

Frame, D.J. (1999) Project Management Competence. Building Key Skills for Individuals, Teams, and Organizations. San Francisco: Jossey-Bass Publishers.

Gareis, R. (2000) Competences in the Project-Oriented Organization. Proceedings of PMI Research Conference 2000, Paris, France.

Garrety, K., Robertson, P.L. & Badham, R. (2004) Integrating communities of practice in technology development projects. International Journal of Project Management, Vol. 22, No. 5, pp. 351 – 358.

Gherardi, S. (2001) From organizational learning to practice-based knowing. Human Relations, Vol. 54, No. 1, pp. 131 – 139.

Gherardi, S., Nicolini, D. & Odella, F. (1998) Toward a Social Understanding of How People Learn in Organizations. The Notion of Situated Curriculum. Management Learning, Vol. 29, No. 3, pp. 273 – 297.

Githens, G.D. (2002) Programs, Portfolios, and Pipelines: How to Anticipate Executives' Strategic Questions. In: Pennypecker, J.S. & Dye, L.D. (Eds.) Managing Multiple Projects. Planning, Scheduling, and Allocating Resources for Competitive Advantage, pp. 83 – 90. New York: Marcel Dekker, Inc.

Granovetter, M. (1973) The Strength of Weak Ties. American Journal of Sociology, Vol. 78, No. 6, May 1973, pp. 1360 – 1380.

Graves, L.N. (1994) Creating a Community Context for Cooperative Learning. In: Sharan, S. (Ed.) Handbook of Cooperative Learning Methods, pp. 283 – 299. Westport, Connecticut: Greenwood Press.

Guba, E.G. (1990) The Paradigm Dialog. London: Sage Publications.

Guzzo, R.A. (1996) Fundamental Considerations about Work Groups. In: West, M.A. (Ed.) Handbook of Work Group Psychology, pp. 3 – 21. Chichester: John Wiley & Sons.

Guzzo, R.A. & Dickson, M.W. (1996) Teams in Organizations – Recent Research on Performance. Annual Review of Psychology, Vol. 47, pp. 307 – 338.

Hackman, J.R. (1990) Groups That Work (and Those That Don't). San Francisco: Jossey-Mass Publishers.

Hakkarainen, K., Paavola, S. & Lipponen, L. (2003) Käytäntöyhteisöistä innovatiivisiin tietoyhteisöihin. Aikuiskasvatus, Vol. 23, pp. 4 – 13.

Hakkarainen, K., Lonka, K. & Lipponen, L. (2004) Tutkiva oppiminen. Järki, tunteet ja kulttuuri oppimisen sytyttäjinä. Porvoo: WSOY.

Hall, R. (1992) The Strategic Analysis of Intangible Resources. Strategic Management Journal, Vol. 13, pp. 135 – 144.

Hamel, G. (1994) The Concept of Core Competence. In: Hamel, G. & Heene, A. (Eds.) Competence-based Competition, pp. 11 – 33. West Sussex: John Wiley and Sons Ltd.

Hamel, G. & Prahalad, C.K. (1994) Competing for the Future. Boston, MA: Harvard Business School Press.

Hansen, M.T., Nohria, N. & Tierney, T. (1999) What's your strategy for managing knowledge. Harvard Business Review, March – April 1999, pp. 106 – 116.

Hansson, H. (1998) Kollektiv kompetens. Göteborg: BAS.

Helledoid, D. & Simonin, B. (1994) Organizational Learning and a Firm's Core Competence. In: Hamel, G. & Heene, A. (Eds.) Competence-based Competition, pp. 213 – 239. West Sussex: John Wiley and Sons Ltd.

Hildreth, P., Kimble, C. & Wright, P. (2000) Communities of practice in the distributed international environment. Journal of Knowledge Management, Vol. 4, No. 1, pp. 27 – 38.

Hodkinson, H. & Hodkinson, P. (2003) Rethinking communities of practice: A case study of schoolteachers' workplace learning. Proceedings of 3rd International Conference of Researching Work and Learning, July 25th – 27th 2003, Tampere, Finland, Book III, pp. 50 – 59.

Hogg, M.A. (2001) Social Categorization, Depersonalization, and Group Behavior. In: Hogg, M.A. & Tindale, R.S. (Eds.) Blackwell Handbook of Social Psychology: Group Processes, pp. 56 – 85. Malden, Massachussetts: Blackwell Publishers Inc.

Holstein, J.A. & Gubrium, J.F. (1995) The Active Interview. Thousand Oaks, CA: Sage.

Huczynski, A. & Buchanan, D. (2001) Organizational Behaviour. An introductory text. Harlow: Prentice Hall.

Huysman, M. (2002) Organizational Learning and Communities of Practice; A social constructivist perspective. The Third European Conference on Organizational Knowledge, Learning, and Capabilities, April 2002, Athens.

Huysman, M. & de Wit, D. (2002) Knowledge Sharing in Practice. Dordrecht: Kluwer Academic Publishers.

Häkkinen, P. & Arjava, M. (1999) Kollaboratiivinen oppiminen teknologiaympäristössä. In: Eteläpelto, A. & Tynjälä, P. (Eds.) Oppiminen ja asiantuntijuus, pp. 206 – 221. Juva: WSOY.

Isaacs, W. (2001) Dialogi ja yhdessä ajattelemisen taito (Dialogue and the Art of Thinking Together). Helsinki: Kauppakaari.

Janesick, V.J. (1994) The Dance of Qualitative Research Design. Metaphor, Methodology, and Meaning. In: Denzin, N.K. & Lincoln, Y.S. (Eds.) Strategies of Qualitative Inquiry, pp. 35 – 55. London: Sage.

Jarvenpaa, S.L. & Tanriverdi, H. (2003) Leading Virtual Knowledge Networks. Organizational Dynamics, Vol. 31, No. 4, pp. 403 – 412.

Javidan, M. (1998) Core Competence: What Does it Mean in Practice? Long Range Planning, Vol. 31, No. 1, pp. 60 – 71.

Jick, T.D. (1979) Mixing Qualitative and Quantitative Methods: Triangulation in Action. Administrative Science Quarterly, Vol. 24, December 1979, pp. 602 – 611.

Johnson, C.H. (2001) A survey of current research on online communities of practice. Internet and Higher Education, Vol. 4, pp. 45 – 60.

Johnson, D.W. & Johnson, R.T. (1994) Learning Together. In: Sharan, S. (Ed.) Handbook of Cooperative Learning Methods, pp. 51 – 65. Westport, Connecticut: Greenwood Press.

Johnson, J.C. & Weller, S.C. (2002) Elicitating Techniques for Interviewing. In: Gubrium, J.F. & Holstein, J.A. (Eds.) Handbook of Interview Research. Context and Method, pp. 491 – 514. Thousand Oaks, CA: Sage Publications.

Jokinen, P. & Pelkonen, M. (1996) Virikkeitä antava haastattelu – menetelmä käsitysten, kokemusten ja ajattelun tutkimiseen hoitotieteessä (Stimulated recall interview – a data gathering method for studying perceptions and experiences in nursing). Hoitotiede, Vol. 8, No 3/96, pp. 134 – 141.

Järvinen, P.J. (1999) The Significant Quality Makers of One-of-a-kind Product Projects. In: Artto, K., Kähkönen, K. & Koskinen, K. (Eds.) Managing Business by Projects, Vol. 2, pp. 699 – 724. Helsinki: Project Management Association Finland and NORDNET.

Järvenpää, E. & Immonen, S. (1999) Verkostojen johtaminen ja hallinta. In: Ollus, M., Ranta, J. & Ylä-Anttila, P. (Eds.) Yritysverkostot – kilpailua tiedolla, nopeudella ja joustavuudella, pp. 61 – 89. Vantaa: Taloustieto Oy.

Kasvi J.J.J., Vartiainen M. & Hailikari M. (2003) Managing knowledge and knowledge competences in projects and project organisations. International Journal of Project Management, Vol. 21, pp. 571 – 582.

Katzenbach, J.R. & Smith, D.K.. (1993) The wisdom of teams. New York: Harper Business.

King, N. (1994) The qualitative research interview. In: Cassell, C. & Symon, G. (Eds.) Qualitative methods in organizational research. A practical guide, pp. 14 – 36. London: Sage.

Kirjavainen, P. & Laakso-Manninen, R. (2000) Strategisen osaamisen johtaminen. Helsinki: Edita.

Kogut, B. & Zander, U. (1997) Knowledge of the Firm. Combinative Capabilities, and the Replication of Technology. In: Prusak, L. (Ed.) Knowledge in Organizations, pp. 17 – 35. Boston: Butterworth-Heinemann.

Kolbotn, R. (2004) Communities of Practice in the Royal National Lifeboat Institution. In: Hildreth, P. & Kimble, C. (Eds.) Knowledge Networks. Innovation Through Communities of Practice, pp. 70 – 76. Hershey, PA: Idea Group Publishing.

Krackhardt, D. & Hanson, J.R. (1993) Informal Networks: The Company Behind the Chart. Harvard Business Review, July – August 1993, pp. 104 – 111.

Kujala, J.Y. & Artto K.A. (2000) Criteria for Project Performance in Business Context. Project Management, Vol. 6, No. 1, pp. 46-53.

Kvale, S. (1996) InterViews: An Introduction to Qualitative Research Interviewing. Thousand Oaks, CA: Sage.

Lampel, J. (2001) The core competencies of effective project execution: the challenge of diversity. International Journal of Project Management, Vol. 19, No. 8, pp. 471 – 483.

Langley, D. (2002) Sociability and the outcomes of Communities of Practice. In: Andriessen, J.H.E., Soekijad, M. & Keasberry, H.J. (Eds.) Support for knowledge sharing in communities, pp. 91 – 117. Delft: Delft University Press.

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

Leonard-Barton, D. (1995) Wellsprings of Knowledge. Building and Sustaining The Sources of Innovation. Boston, MA: Harvard Business School Press.

Lesser, E.L. & Storck, J. (2001) Communities of Practice and Organizational performance. IBM Systems Journal, Vol. 40, No. 40, pp. 831 – 841.

Lewin, K. (1948) Resolving Social Conflicts. New York: Harper and Brothers Publishers.

Liedtka, J. (1999) Linking Competitive Advantage With Communities of Practice. Journal of Management Inquiry, Vol. 8, No. 1, March 1999, pp. 5 – 16.

Lillrank, P. M. (1988) Organization for Continuous Improvement. Quality Control Circle Activities in Japanese Industry. Dissertation. University of Helsinki.

Lundkvist, A. (2004) User Networks as Sources of Innovation. In: Hildreth, P. & Kimble, C. (Eds.) Knowledge Networks. Innovation Through Communities of Practice, pp. 96 – 105. Hershey, PA: Idea Group Publishing.

Maurer, F. (1996) Computer Support in Project Coordination. Proceedings of the Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises (WET ICE 96), IEEE Computer Society Press, pp. 200 – 205.

McDermott, R. (1999a) Learning across teams. How to build communities of practice in team organizations. Knowledge Management Review, Vol. 8, May/June 1999, pp. 32 – 36.

McDermott, R. (1999b) Nurturing Three Dimensional Communities of Practice: How to get the most out of human networks. Knowledge Management Review, Vol. 11, November/December 1999, pp. 26 – 29.

McDermott, R. (2000) How Learning Communities Steward Knowledge: Shell Oil Company. In: Harkins, P., Carter, L.L. & Timmins, A.J. (Eds.) Linkage, Inc's best Practices in Knowledge Management & Organizational Learning Handbook, pp. 194 - 226. Lexington, Massachusetts: Linkage Incorporated.

McGrath, J.E. (1984) Groups: Interaction and Performance. Englewood Cliffs: New Jersey.

McGrath, J.E. (1991) Time, Interaction, and Performance (TIP). A Theory of Groups. Small Group Research, Vol. 22, No. 2, May 1991, pp. 147 – 174.

McGrath, J.E. & Argote, L. (2001) Group Processes in Organizational Contexts. In: Hogg, M.A. & Tindale, R.S. (Eds.) Blackwell Handbook of Social Psychology: Group Processes, pp. 603 – 627. Malden, Massachussetts: Blackwell Publishers Inc.

Mishler, E.G. (1986) Research Interviewing. Context and Narrative. Cambridge, Massachusetts: Harvard University Press.

Mohrman, S.A., **Cohen, S.G. & Mohrman, Jr., A.M.** (1995) Designing Team-Based Organizations. New Forms of Knowledge Work. San Francisco: Jossey-Bass Publishers.

Monge, P.R. & Contractor, N.S. (2000) Emergence of Communication Networks. In: Jablin, F.M & Putnam L.J. (Eds.). The New Handbook of Organizational Communication Advances in Theory, Research, and Methods, pp. 440 – 520. Thousand Oaks, California: Sage.

Morgan, G. & Smircich, L. (1980) The Case for Qualitative Research. Academy of Management Review, Vol. 5, No. 4, pp. 491 – 500.

Nahapiet, J. & Ghoshal, S. (1998) Social capital, intellectual capital, and the organizational advantage. The Academy of Management Review, Vol. 23, No. 2, April 1998, pp. 242 – 266.

Nardi, B., Whittaker, S. & Schwarz, H. (2000) It's Not What You Know, It's Who You Know: Work in the Information Age. First Monday, Vol. 5, No. 5. Available online. URL: http://firstmonday.org/issues/issue5_5/nardi/index.html.

Niemistö, R. (1999) Ryhmän luovuus ja kehitysehdot. Helsingin yliopiston Lahden tutkimus- ja koulutuskeskus. Tampere: Tammer-Paino.

Niiniluoto, I. (1989) Informaatio, tieto ja yhteiskunta. Filosofinen käsiteanalyysi. Helsinki: Valtion Painatuskeskus.

Nonaka, I. & Konno, N. (1998) The Concept of "Ba": Building a Foundation for Knowledge Creation. California Management Review, Vol. 40, No. 3, Spring 1998, pp. 40 – 54.

Nonaka, I., Konno, N. & Toyama, R. (2001) Emergence of "Ba": A Conceptual Framework for the Continuous and Self-transcending Process of Knowledge-Creation. In: Nonaka, I. & Nishiguchi, T. (Eds.) Knowledge Emergence: Social, Technical, and Evolutionary Dimensions of Knowledge-Creation, pp. 13 – 29. Oxford: Oxford University Press.

Nonaka, I. & Takeuchi, H. (1995) The Knowledge-Creating Company. Oxford: Oxford University Press.

Nonaka, I., Toyama, R. & Konno, N. (2000a) SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation. Long Range Planning, Vol. 33, pp. 5 – 34.

Nonaka, I., Toyama, R. & Nagata, A. (2000b) A Firm as a Knowledge-creating Entity: A New Perspective on the Theory of the Firm. Industrial and Corporate Change, March 2000, Vol. 9, No. 1, pp. 1 – 20.

Norris, N. (1991) The Trouble with Competence. Cambridge Journal of Education, Vol. 21, No. 3, pp. 331 – 341.

O'Dell, C. & Grayson, Jr., C.J. (1998) If Only We Knew What We Know. The Transfer of Internal Knowledge and Best Practice. New York: The Free Press.

Orr, J.E. (1996) Talking about Machines. An Ethnography of a Modern Job. Ithaca: Cornell University Press.

Palloff, R.M. & Pratt, K. (1999) Building Learning Communities in Cyberspace. Effective Strategies for the Online Classroom. San Francisco: Jossey-Bass Publishers.

Patton, M. (1990) Qualitative evaluation and research methods. Second edition. Newbury Park: Sage.

Pinto, J.K. (1999) Managing information systems projects: Regaining control of a runaway train. In: Artto, K. A., Kähkönen, K. & Koskinen, K. (Eds.) Managing Business by Projects, Volume 1, pp. 31 – 43. Helsinki: Project Management Association Finland and NORDNET.

Pinto, J. & Rouhiainen, P. (2001) Building Customer-Based Project Organizations. New York: Wiley.

PMBOK (1996) A Guide to the Project Management Body of Knowledge. PMI Standards Committee. Upper Darby, PA: Project Management Institute.

Poell, R.F. & Van der Krogt, F.J. (2003) Project-based learning in organizations: towards a methodology for learning in groups. Journal of Workplace Learning, Vol. 15, No. 5, pp. 217 – 228.

Poland, B.D. (2002) Transcription Quality. In: Gubrium, J.F. & Holstein, J.A. (Eds.) Handbook of Interview Research. Context and Method, pp. 629 – 649. Thousand Oaks, CA: Sage Publications.

Polanyi, M. (1966) The Tacit Dimension. New York: Doubleday.

Prahalad, C.K. & Hamel, G. (1990) The Core Competence of the Corporation. Harvard Business Review, May-June 1990, pp. 79 – 91.

Prencipe, A. & Tell, F. (2001) Inter-project learning: processes and outcomes of knowledge codification in project-based firms. Research Policy, Vol. 30, pp. 1373 – 1394.

Rheingold, H. (1993). The virtual community: homesteading on the electronical frontier. USA: Harper.

Richter, I. (1998) Individual and Organizational Learning at the Executive Level. Towards a Research Agenda. Management Learning, Vol. 29, No. 3, pp. 299 – 316.

Roethlisberger, F.J. & Dickson, W.J. (1939) Management and the worker. Cambridge, Massachusetts: Harvard University Press.

Rolstadås, A. & Kolltveit, B. (1999) Competence Development in a Project Environment. In: Artto, K., Kähkönen, K. & Koskinen, K. (Eds.) Managing Business by Projects, Vol. 2, pp. 689 – 698. Helsinki: Project Management Association Finland and NORDNET.

Ruuska, I., Simola, A. & Vartiainen, M. (2002) Communities of practice in inter-organizational knowledge sharing - a case study of a community in ICT corporation. Proceedings of the 4th CINet Conference, September 15. – 18.2002, Espoo, Finland, pp. 593 – 604.

Ruuska, I., Vartiainen, M. (2003) Communities and other social structures for knowledge sharing – A case study in an Internet Consultancy Company. In: Huysman, M., Wenger, E. & Wulf, W. (Eds.) Communities and Technologies, pp. 163 – 183. Amsterdam: Kluwer Academic Publishers.

Sandberg, J. (1994) Human Competence at Work. An interpretative approach. Göteborg: BAS.

Sandberg, J. (2000) Understanding Human Competence at Work. An Interpretative Approach. Academy of Management Journal, Vol. 43, No. 1, pp. 9 – 25.

Sandberg, J. & Targama, A. (1998) Ledning och förståelse. Lund: Studentlitteratur.

Schein, E. H. (1995) Dialogue and Learning. Executive Excellence, April 1995, pp. 3 – 4.

Schindler, M. & Eppler, M.J. (2003) Harvesting project knowledge: a review of project learning methods and success factors. International Journal of Project Management, Vol. 21, pp. 219 – 228.

Schwandt, T.A. (2000) Three Epistemological Stances for Qualitative Inquiry. In: Denzin, K. & Lincoln, Y.S. (Eds.) Handbook of Qualitative Reseach, pp. 189 – 213.Thousand Oaks, CA: Sage.

Schön, D. A. (1987) Educating the Reflective Practitioner. Toward a New Design for Teaching and Learning in Professions. San Francisco: Jossey-Bass Publishers.

Scott, J. (1991) Social network analysis: a handbook. London: Sage.

Selznick, P. (1957) Leadership in administration: a sociological interpretation. New York, NY: Harper and Row.

Senge, P. M. (1990) The Fifth Discipline. The Art and Practice of the Learning Organization. London: Century Business.

Sense, A.J. (2003) Learning Generators: Project Teams Re-conceptualized. Project Management Journal, Vol. 34, No. 3, pp. 4 – 12.

Sfard, A. (1998) On two metaphors for learning and the dangers of choosing just one. Educational Researcher, Vol. 27, No. 2, pp. 4 – 13.

Sherif, M. & Sherif, C.W. (1969) Social Psychology. New York: Harper and Row.

Snow, C.C. & Hrebiniak, L.G. (1980) Strategy, distinctive competence, and organizational performance. Administration Science Quarterly, Vol. 25, No. 2, pp. 317 –336.

Snyder, W.M. (1997) Communities of Practice: Combining Organizational Learning and Strategy Insights to Create a Bridge to the 21st Century. Retrieved February 9, 2001 from the World Wide Web: http://www.co-I-l.com/coil/knowledge-garden/cop/cols.shtml

Stalk, G., Evans, P. & Shulman, L.E. (1992) Competing on Capabilities: The New Rules of Corporate Strategy. Harvard Business Review, March-April, pp. 57 – 69.

Stewart, T. A. (1999) Intellectual capital: the new wealth of organizations. New York: Doubleday.

Storck, J. & Hill, P.A. (2000) Knowledge Diffusion through "Strategic Communities". In: Lesser, E.L., Fontaine, M.A. & Slusher, J.A. (Eds.) Knowledge and Communities, pp. 65 – 83. Boston: Butterworth-Heineman.

Stuckey, B. & Smith, J.D. (2004) Building Sustainable Communities of Practice. In: Hildreth, P. & Kimble, C. (Eds.) Knowledge Networks. Innovation Through Communities of Practice, pp. 150 – 164. Hershey, PA: Idea Group Publishing.

Sveiby, K.E. (1997) The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets. San Francisco: Bennet-Koehler Publishers, Inc.

Sveiby, K.E. & Simons, R. (2002) Collaborative climate and effectiveness of knowledge work – an empirical study. Journal of Knowledge Management, Vol. 6, No. 5, pp. 420 – 433.

Szulanski, G. (1995) Unpacking Stickiness: An Empirical Investigation of the Barriers to Transfer Best Practices inside the Firm. Academy of Management Journal, Special Issue: Best Papers Proceedings 1995, pp. 437 – 441.

Szulanski, G. (1996) Exploring Internal Stickiness: Impediments to the Transfer of Best Practice Within the Firm. Strategic Management Journal, Vol. 17, Winter Special Issue, pp. 27 – 43.

Tabachnick, B.G. & Fidell, L.S. (1996) Using Multivariate Statistics. 3rd ed., USA: HarperCollins College Publishers.

Teigland, R. & McLure Wasko, M. (2004) Extending Richness with Reach: Participation and Knowledge Exchange in Electronic Networks of Practice. In: Hildreth, P. & Kimble, C. (Eds.) Knowledge Networks. Innovation Through Communities of Practice, pp. 230 – 242. Hershey, PA: Idea Group Publishing.

Tuckman, B. & Jensen, N. (1977) Stages of small group development revisited. Group and Organizational Studies, Vol. 2, pp. 419 – 427.

Tuomi, I. (1999) Corporate Knowledge. Theory and Practice of Intelligent Organizations. Helsinki: Metaxis.

Turner, J.R. (1999) The handbook of project-based management: improving the processes for achieving strategic objectives. London: McGraw-Hill.

Turner, D. & Crawford, M. (1994) Managing Current and Future Competitive Performance: The Role of Competence. In: Hamel, G. & Heene, A. (Eds.) Competence-based Competition, pp. 241 – 263. West Sussex: John Wiley and Sons Ltd.

Turner, J. & Keegan, A. (1999) The Management of Operations in the Project-Based Organization. In: Artto, K.A., Kähkönen, K. & Koskinen, K. (Eds.) Managing Business by Projects, Volume 1, pp. 57 – 85. Helsinki: Project Management Association Finland and NORDNET.

Tynjälä, P. (2000) Oppiminen tiedon rakentamisena. Konstruktivistisen oppimiskäsityksen perusteita. Tampere: Tammerpaino Oy.

Ulrich, D. (1998) Intellectual Capital = Competence x Commitment. Sloan Management Review, Winter 1998, Vol. 39, No. 2, pp. 15 – 26.

Ulrich, D. & Lake, D. (1990) Corporate Capability and Competing from the Inside Out. New York: John Wiley & Sons.

Vaast, E. (2004) The use of Intranets: The Missing Link Between Communities of Practice and Networks of Practice? In: Hildreth, P. & Kimble, C. (Eds.) Knowledge Networks. Innovation Through Communities of Practice, pp. 216 – 228. Hershey, PA: Idea Group Publishing.

Van Maanen, J. & Barley, S.R. (1984) Occupational Communities: Culture and Control in Organizations. In: Staw, B.M. & Cummings, L.L. (Eds.) Research in Organizational Behavior. An Annual Series of Analytical Essays and Critical Reviews, Volume 6, pp. 287 – 365. Greenwich, Connecticut: JAI Press Inc.

Vartiainen, M., Ruuska, I. & Kasvi, J.J.J. (2003) Projektiosaaminen – dynaamisen organisaation voimavara. Helsinki: Teknologiateollisuus ry.

Vartiainen, M., **Kokko, N. & Hakonen, M.** (2004) Hallitse hajautettu organisaatio. Paikan, ajan, moninaisuuden ja viestinnän johtaminen. Helsinki: Talentum.

Virkkunen, J. (2002) Konseptien kehittäminen osaamisen johtamisen haasteena. In: Virkkunen, J. (Ed.) Osaamisen johtaminen murroksessa. Ideoita ja kokemuksia toisen sukupolven knowledge managementin kehittelystä, pp. 11 – 49. Raportteja 20. Työelämän kehittämisohjelma. Helsinki.

Von Bertalanffy, L. (1971) The Theory of Open Systems in Physics and Biology, In: Emery, F.E. (Ed.) Systems Thinking. Selected Readings, pp. 70 – 85. Baltimore, Md: Penguin Books.

Von Hippel, E. (1998) Economics of Product Development by Users: The Impact of ”Sticky” Local Information. Management Science, Vol. 44, No. 5, May 1998, pp. 629 – 644.

Von Krogh, C. (1998) Care in knowledge creation. California Management Review, Vol. 40, No. 1, pp. 73 – 90.

Vygotsky, L. S. (1978) Mind in society. Cambridge, Mass.: Harvard University Press.

Warren, C.A.B. (2002) Qualitative Interviewing. In: Gubrium, J.F. & Holstein, J.A. (Eds.) Handbook of Interview Research. Context and Method, pp. 83 - 101. Thousand Oaks, CA: Sage Publications.

Webb, S. & Vielvoije, R. (1999) Identifying Potential Project Managers: Assessing for Essential Skills. In: Artto, K., Kähkönen, K. & Koskinen, K. (Eds.) Managing Business by Projects, Volume 2, pp. 772 – 785. Helsinki: Project Management Association Finland and NORDNET.

Weick, K. (1995) Sensemaking in Organizations. London: Sage.

Wenger, E. (1998) Communities of Practice. Learning, Meaning, and Identity. Cambridge: Cambridge University Press.

Wenger, E. (2000a) Communities of Practice: The Key to Knowledge Strategy. In: Lesser, E.L., Fontaine, M.A. & Slusher, J.A (Eds.) Knowledge and Communities, pp. 3 – 20. Boston: Butterworth Heineman.

Wenger, E. (2000b) Communities of Practice: The Structure of Knowledge Stewarding. In: Depres, C. & Chauvel, D. (Eds.) Knowledge Horizons: The Present and the Promise of Knowledge, pp. 205 – 225. Boston: Butter-Heinemann.

Wenger, E. C. & Snyder, W.M. (2000) Communities of Practice: The Organizational Frontier. Harvard Business Review, January - February 2000, pp. 139 – 145.

Wenger, E., McDermott, R.A. & Snyder, W. (2002) Cultivating of Communities of Practice. Boston, MA: Harvard Business School Press.

White, D. & Fortune, J. (2002) Current practice in project management – an empirical study. International Journal of Project Management, Vol. 20, pp. 1 – 11.

Wilson, A.T.M., **Trist, E. & Curle, A.** (1990) Transitional Communities and Social Reconnection. In: Trist, E. & Murray, H. (Eds.) The Social Engagement of Social Science. A Tavistock Anthology. Volume I: The Socio-Psychological Perspective, pp. 88 – 111. Philadelphia, USA: The University of Pennsylvania Press.

Yin, R.K. (1994) Case Study Research: Design and Methods. Thousand Oaks, CA: Sage Publications.

Zimmerer, T.W. & Yasin, M.M. (1998) A Leadership Profile of American Project Managers. Project Management Journal, Vol. 29, No. 1, March 1998, pp. 31 – 38.

6 Appendices

1. Study 1: Interview outline / Cases A and B
2. Study 1: Main codes / Case A
3. Study 1: Main codes / Case B
4. Study 2: Interview outline
5. Study 2: Main codes
6. Study 3: Interview outline
7. Study 3: Sample items from on-line questionnaire for the members of communities
8. Study 3: Scale constructions
9. Study 3: Correlations
10. Study 4: Interview outline
11. Study 4: Main codes

Appendix 1. Study 1 – Interview outline / Cases A and B

1. Background of the interviewee

- Name and position within the organization. What are your tasks within the organisation?
- How would you describe your employer?
- What kind of experience do you have of similar projects to date? Have you been involved in similar projects previously?
- How have you acquired your knowledge/competence of project work?

2. Background information on the project

- What is your opinion of the project? What was it about?
- What were the goals of the project?
- Were the goals changed during the project?
- How well were the goals achieved?
- Who participated in the project? What were your/your company's tasks? Why was your company involved?
- What benefits did you expect to achieve from your participation?
- What were the tasks and roles of the other participants?
- What went especially well in the project?
- What, if anything, was problematic during the different phases of the project?

3. Job description and competence requirements in the delivery process

- What (concrete) tasks were included in your work?
- What knowledge or competence do you believe was required in fulfilling these tasks?
- Try to remember the starting phase of the project. What were your primary tasks?
- What knowledge or competence was required to fulfil these tasks?
- What was problematic in fulfilling each task?
- What aspect of your expertise was needed to carry out your duties in the project?
- What mistakes, if any, were made at the beginning of the project, which may have affected the end result?
- (If not…) What could have been a mistake at the beginning, which could have affected the success of the process?
- The process of propelling the project forward. Were the tasks different during the progress of the project than in the beginning? Did your tasks change in the different phases?
- What critical factors or possible mistakes occurred during the progress of the project that could have affected the results of the project?

- What was critical at the end of the project? What critical factors or possible mistakes existed that could have affected the results of the project?
- During the process, were there surprises or issues that you hadn't taken into account? If so how did you act/react?
- Did you have to avail of external help, subcontractors/consultants, during the process?
- How could the competence of the participants have been developed so that the project could have attained a better result/outcome?
- In which areas, based on this project, would it be deemed necessary to develop, in particular, competence related to project management?
- Which adjectives would use to describe a good project manager? Which adjectives would you use to describe other participants of the project?

4 Knowledge management and knowledge transfer

- What new knowledge did the project produce?
  - Did your project produce some knowledge, e.g. internal reports of www-pages?
  - What was the best idea that emerged during the project? How did you come up with it?
- What sources of information were used in the project (e.g. reports, databases, handbooks or experts)?
- Were there some sources that were not always used in the project?
- Was some knowledge especially crucial to the success of the project?
- How were experiences and other material gathered and stored by participants during the life of the project?
- Did the other participants have information that you needed, but didn't receive?
- Who was, if applicable, responsible for collecting the knowledge?
- How was knowledge from the project gathered and stored?
- What mechanisms were used?
- Who was, if applicable, responsible for collecting the knowledge?
- Who had access to these repositories of the project?
- Is this knowledge still available for use?
- How has the knowledge produced in the project been used in your company/ research centre?
- Has some part remained unused? If applicable please motivate why?
- Is knowledge management in your opinion effective? Was some aspect of this management very successful or very poor?

5 Interaction and information sharing

- How was the flow of information during the project? Were there problems?
- What kind of information was shared in the project between the participants?
- How was the cooperation between participants organized in practice?
- Was element of information sharing or cooperation changed during the project? How?
- How well do you know other persons who participated?
- Who were you mostly in contact with during the project?
- In what kind of situations did you formally and informally interact with each other?
- What tools did you use, e.g. www-pages?
- How often did the participants interact with each other?
- Were members reluctant to share their knowledge with other participants?

6 Development proposals

- What future challenges exist in projects concerning competence and knowledge management?
- What would you do differently if you were to start the project again? Why?
- What is the best way to disseminate knowledge to various participants?
- If you were to starting a new similar project and you could organize training for the participants before the take off, what issues would the training cover?

Appendix 2. Study 1 – Main codes / Case A

1A Background information
1D Sources of competence
2A Contacts and the goal of the project
2D Participants of the project
2E The task and the role of one's own organization
2F The motive of one's own organization
2H The roles and tasks of other participants
2I Success in the project
2J Problems
2J Competence areas
2K External factors
2L The role of MET
2N The need for additional support (MET)
2O The content and the goal of the sub-project
3A The tasks of the interviewee in the project
3C Required competence of the interviewee
3D Critical issues
3L Surprises
3M External support
3N Needs for competence development
3O Good project manager
4A Knowledge, new
4B Documents
4C Documents, responsibility
4D Internal documents, sub-projects
4E Knowledge to other sub-projects
4F Insights
4F Emergence of ideas
4G Knowledge sources of project
4H Knowledge sources of sub-project
4J Critical knowledge of project
4K Knowledge from other participants
4L Knowledge gathering of sub-projects
4M Tools for knowledge gathering of sub-project
4N Responsibility for knowledge gathering of sub-project
4O Knowledge gathering
4O Storing of knowledge
4P Tools for knowledge gathering
4Q Responsibility for knowledge gathering
4R Access to subproject's knowledge
4R Access to project's knowledge
4T Utilizing the knowledge
4V Efficiency of knowledge management

5A Knowledge flow between sub-projects
5B Knowledge flow between sub-projects, content
5C Organizing of the cooperation of sub-project
5D Knowledge flow between sub-projects, changes
5E Interaction, knowing of persons
5F Interaction, social network
5G Occasions for interaction
5H Tools for interaction
5I Density of interaction
5J Reluctance to share knowledge between sub-projects
6 Development proposals
6A Development proposals, competence
6B Training for the participants
6D Development proposals, knowledge sharing
6E Development proposals, tools

Schedule
Success evaluation
Learning in the project
Sub-projects for the sub-projects
Project management
Conflicts between sub-project and main project
Conflicts in project
Knowledge sharing to newcomers
Accuracy of information

Appendix 3. Study 1 – Main codes / Case B

Background

- Experience
- Own tasks
- Tasks of the department
- Location in the delivery project

The delivery project

- Phases of the delivery project
- Responsibility of the delivery project as a whole
- Changes during the delivery project
- What went well
- Problems in the delivery project
  - Leadership
  - Project management
  - Communication and interaction
  - Knowledge management
  - Interest groups
  - Technical competence
  - Projects and procedures
  - Customer
- External factors affecting the delivery project
- Need for extra support

Competence requirements in the delivery project

- Leadership
- Project management
- Communication and interaction
- Knowledge management
- Interest groups
- Technical competence
- Projects and procedures
- Customer
- Competence required in different phases

Competence requirements of the individuals

- Leadership
- Project management
- Communication and interaction
- Knowledge management
- Interest groups
- Technical competence

Projects and procedures
Customer
Competence required in different phases

Knowledge needs

New knowledge created during the delivery project
Documents in the delivery project
Knowledge sources in the delivery project
Critical knowledge in the delivery project
Knowledge management in the delivery project
Collecting and storing of the knowledge
Knowledge sharing between the participants

Communication

Knowledge flow between the participants
Cooperation in the delivery project
- Contacts
- Density of cooperation
- Modes of cooperation

Personal features

Development proposals

- Future challenges
- Training needs
- Development proposals

Other

Leadership
Project management
Communication and interaction
Knowledge management
Interest groups
Technical competence
Projects and procedures
Customer

Appendix 4. Study 2 – Interview outline

1 Intra- and inter-group relations and cooperation

- With whom do you cooperate? How does it work?
- Whose work contributes most to your own work?
- To whose work does your work contribute the most?
- Who is depending on the results of your work?
- The work of which group, that you collaborate with, affects most the success of your work?

2 Communication

- How do you communicate with each other within and between your site / your competence center / in your team?
- What kind of communication practices/rules have you agreed upon in your company?
- The use of communication and information sharing tools (ask the interviewee to fulfil)
- Compare the meaning, importance and differences of face-to-face meetings with e.g. e-mails and videoconferencing?
- How would you improve communication in your company?

3 Knowledge sharing and collaboration

- What ways are used to share knowledge within and between sites/projects/competence areas in your company?
- How do you share your own knowledge with others?
- What kinds of issues are the most problematic and you need help from other people? What do you do then?
- How do you get your best ideas? / from whom?
- With whom do you test your ideas?

4 Networks and communities

- Whom do you know best in your site / competence area / in your company?
- What common interests do you have? Are they related to work or something else?
- Do you meet outside work?
- Are there formal / informal networks (communities) that you know of / that you belong to? (personal relationships / many persons involved)
    - Internal
    - External
- What functions do you think that “Offerings” have? For what purposes were “Offerings”created?

Appendix 5. Study 2 – Main codes

1 Cooperation
2 Generation of value
- 2.1 Others' work to respondent's own work
- 2.2 Respondent's work to others' work

3 Modes of communication and knowledge sharing
- 3.1 Formal
  - 3.1.1 Formal face-to-face
  - 3.1.2 Formal electronical
- 3.2 Informal
  - 3.2.1 Informal face-to-face
  - 3.2.2 Informal electronical

4 Communication practices and rules
5 Communication tools
6 Relation and importance: face-to-face vs. virtual communication
7 Functionality of communication
- 7.1 What works
- 7.2 Barriers
- 7.3 Suggestions for improvement

8 Ideas
- 8.1 Generation of ideas
- 8.2 Getting help from others with ideas

9 Problem solving
10 Networks and communities
- 10.1 Formal and intra-organizational
- 10.2 Informal and intra-organizational
- 10.3 Formal and inter-organizational
- 10.4 Informal and inter-organizational

11 Offering teams
- 11.1 Formation
- 11.2 Goals
- 11.3 Activities
- 11.4 Benefits
- 11.5 Status
- 11.6 Other

12 Other

Appendix 6. Study 3 – Interview outline / community coordinators

1. What is the name of the community?
2. What is the domain or competence area? What issues are discussed?
3. What are the purpose and goals? Why has the community been formed / emerged?
4. How has the community been formed? Is it spontaneous or deliberately formed? By whose initiative was it formed?
5. When was the community formed, how many months has it existed?
6. How many members do you have?
7. What is the turnover of the members?
8. How does the activity of the members vary? Do you have active members and less active members?
9. Are all the members from the same organization? If not, how many organizations do they come from?
10. Are all the members experts, newcomers or both, on the domain of the community?
11. Can anyone join the community, or are there any restrictions?
12. How are the members appointed?
13. Is membership voluntary or compulsory?
14. What are the tasks and the role of the coordinator?
15. How was the coordinator selected?
16. Has the coordinator been trained for the job? If so, how?
17. What are the roles and the structure of the community?
18. Does the group meet face-to-face?
19. How many times has the group met face-to-face?
20. What kinds of communication tools does the community have?
21. Is there a sponsor or an official support person in the organization?
22. Is the senior management aware of the community? Does it support the community?
23. Is time allocated for participation in the organization? If so, how much?
24. What type of organizational support is there?
25. Is the participation in the community part of the members' performance appraisal?
26. Are the members geographically dispersed?
27. How many nationalities are there in the community?
28. Do the members speak the same language as their mother tongue? If not, what is the common language in the community?

Appendix 7. Study 3 – Sample items from on-line questionnaire for the members of communities

How important are the following goals for you personally as a member of the community (Scale 1 – 5)

Hearing about new knowledge

To advance in my career

Etc.

On average, how many hours do you spend on the community per month?

How useful do you think the following means of communication are (or would be) particularly for your community's work?

Email

Video connection

Etc.

To what extent do you think the members of the community… (Scale 1 – 5)

Have a good common understanding

Trust each other

Etc.

To what extent do you think the community has… (Scale 1 – 5)

Contributed to cost savings for the organization

Etc.

Appendix 8. Study 3 – Scale constructions

Purpose and goals

1 Learning goals (Five items)
α .71
Scale in the questionnaire:
1= Not at all important
2= Not very important
3= Somewhat important
4= Important
5= Very important

Activities

2 Practice (Five items)
α .80
Scale in the questionnaire:
1= Never
2= Seldom
3= Sometimes
4= Often
5= Very often

3 Participation in the community (Two items)
α .70
Scale in the questionnaire:
1= Never
2= Seldom
3= Sometimes
4= Often
5= Very often

4 Willingness to participate
Single item variable
Scale in the questionnaire:
1= Not at all
2= Hardly
3= Somewhat
4= Much
5= Very much

5 Willingness to share knowledge
Single item variable
Scale in the questionnaire:

1= Not at all willing
2= Not very willing
3= Somewhat willing
4= Willing
5= Very willing

Coordination

Coordinator's roles:
6 Organizer
Single item variable

7 Contact maker (Four items)
α .69
Scale in the questionnaire:
1= Not at all
2= Hardly
3= Moderately
4= Much
5= Very much

Organizational support

8 Encouragement
Single item variable
Scale in the questionnaire:
1= Not at all encouraged
2= Not very encouraged
3= Somewhat encouraged
4= Encouraged
5= Very encouraged

Outcomes

9 Learning outcomes (Six items)
α .91

10 Benefit outcomes (Three items)
α .85

11 Contacts
Single item variable

12 Sense of community (Four items)
α .86

13 Effectiveness (Two items)
α .76

14 Innovation (Two items)
α .82

15 Documentation
Single item variable

Scale in the questionnaire (outcomes):
1= Not at all
2= Not very much
3= Moderately
4= Much
5= Very much

16 General satisfaction
Single item variable
Scale in the questionnaire:
1= Not at all
2= Not very much
3= Moderately
4= Much
5= Very much

Appendix 9. Study 3 – Correlations

	Mean	St.Dev.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Learning goals	4.12	.56															
2 Practice	2.53	.82	.37**														
3 Participation in the community	2.76	.98	.28**	.45**													
4 Willingness to participate	3.32	.76	.25**	.05	-.01												
5 Willingness to share knowledge	4.29	.62	.34**	.03	.26**	.11											
6 Organizer	3.97	.82	.06	-.00	.19*	.06	.20*										
7 Contact maker	3.18	.59	.24**	.40**	.34**	.02	.22**	.25**									
8 Perceived support	3.16	.93	.23**	.45**	.39**	.00	.10	.18*	.34**								
9 Learning outcomes	3.13	.81	.59**	.49**	.50**	.04	.26**	.16*	.40**	.43**							
10 Benefit outcomes	2.58	.91	.41**	.56**	.47**	.04	.18*	.03	.35**	.37**	.71**						
11 Contacts	3.32	.94	.41**	.33**	.44**	.06	.24**	.18*	.32**	.34**	.66**	.66**					
12 Sense of community	3.57	.64	.46**	.33**	.34**	.04	.38**	.35**	.38**	.40**	.57**	.42**	.39**				
13 Effectiveness	2.80	.86	.46**	.53**	.35**	-.06	.29**	.16	.39**	.43**	.70**	.58**	.45**	.57**			
14 Innovation	3.20	.83	.47**	.51**	.32**	.05	.32**	.14	.49**	.41**	.67**	.61**	.57**	.50**	.76**		
15 Documentation	2.91	1.04	.43**	.46**	.28**	.06	.31**	.20*	.37**	.33**	.57**	.53**	.40**	.50**	.57**	.65**	
16 General satisfaction	3.35	.68	.37**	.31**	.31**	-.04	.25**	.29**	.32**	.28**	.46**	.44**	.36**	.60**	.51**	.47**	.47**

****p<.001; **p<.01; *p<.05*

Appendix 10. Study 4 – Interview outline

1 Coordinator

- How many members does DMC have at the moment?
- What has happened in the DMC after the formation (critical positive and negative incidents – place them in the timeline)
    - Turnover of members
    - Goals and tasks
    - Status, relationship to the host organization
    - Outcomes
- What roles are there in DMC?
- What is the role of the coordinator?
- How would you describe the activity of the members?
- How often do you meet?

2 Members (including the coordinator)

Members' role in DMC

- How many are you in DMC?
    - How well do you know the other members?
- How long have you been a member?
- How would you describe your role?
    - What do the other members do, what are their roles?
- How would you describe your expertise on the domain?
- Why do you belong to DMC?
- How active do you participate?
    - How do you feel, are you an insider or an outsider? Has this changed during your membership?
- Are you a member in any DMC related projects or client teams?
- Are you a member in any other such groups?

Domain

- What are the most critical/hottest issues in DMC?
- What issues are critical to business?
- What issues are important and interesting to you personally?

Community

- Who maintain or enhance the relationships between the members?
    - How?
- How do you interact with each other?

- What do you do together?
    - Related to work
    - Outside work
- Do all the members have the same right and possibility to influence the activities of DMC and present their ideas?
- How do new members come along?
    - Have you had any new members lately?
- How would you describe the spirit in DMC?

Practice

- How have the tasks and projects of DMC changed after the formation?
- What has happened after the formation (critical positive and negative incidents – place them in the timeline)
- Do you have any stories, slogans, jokes or other shared language within DMC?
- Do you have some routines?
- What benefits have you gained from being a member in DMC?
- How has your participation in DMC affected your own competence?
- What concrete outcomes have you produced (e.g. tools, best practices, methods, manuals, documents, client knowledge, standards etc.)?
- Has DMC produced financial benefits to the organization?
- What added value has DMC produced in the short or long term for the company / the clients?

Knowledge sharing

- What knowledge do you share / should share within DMC?
- What knowledge do you share / should share outside DMC?
- How do you share what you have produced in DMC to the organization?
- Do you have physical or virtual knowledge sharing spaces? What are they?
- Does anyone have special responsibility to share knowledge or keep in touch with some client teams or projects? Has anyone taken such responsibility?
- How do you cooperate with client teams and projects?
    - Do you have shared databases, meetings, documents, programs etc.?
- How do you personally share what you have learned in DMC to others in the organization?

3 Members of the projects / client teams

- How would you describe your work?

- Which project / client team do you represent?
- What are the goals and tasks in your project?
- What are the most important knowledge sources in your project team?
- What kind of knowledge on digital marketing communication is the most critical to your project team?
- Do you know what is the purpose of DMC?
- Do you know who belongs to DMC?
    - With whom have you cooperated?
- What knowledge or outcomes has DMC produced for you?
- Has DMC given you concrete help in your client cases?
- Has anyone from DMC participated in your client cases or come along when visiting the client?
- Do you have any members from DMC in your project / client team?
    - If so, how do they share what they have learned in DMC to others?
- What benefits has DMC produced to your project team?
- What benefits has DMC produced to your clients?
- What benefits has DMC produced to the organization?
- How is DMC supported in the organization?
- What has happened in DMC after the formation (critical positive and negative incidents – place them in the timeline)?
- What develop needs do you think that DMC has?

4 Management

- What are the purpose and goals of DMC?
- Who belongs to DMC and what do they do?
- What is the status of DMC in the company?
- How has DMC been integrated into the company strategy and strategy process?
- How does the management support DMC?
- Is time allocated for participation?
- What has happened in DMC after the formation (critical positive and negative incidents – place them in the timeline)?
- What concrete benefits and outcomes has DMC produced?
- How have the outcomes been communicated to the organization / client teams and projects?
    - How is knowledge sharing supported in the organization?
- What added value does DMC produce to the company?
    - Is it expected to produce value in the short and/or long term? How?

Appendix 11. Study 4 – Main codes

1. **Background information**
   - 1.1 Background (work, projects)
   - 1.2 Purpose of DMC
   - 1.3 Duration of membership
   - 1.4 The level of one's expertise
   - 1.5 Personal motivation
   - 1.6 Organizational support
   - 1.7 Status
   - 1.8 Structure

2. **Development cycle**
   - 2.1 Critical incidents and changes

3. **Activities**
   - 3.1 Roles
   - 3.2 Activities (meetings, other doing together)
   - 3.3 Interaction (relationships, contacts, boundaries)
   - 3.4 Modes of action (shared language, routines, sayings etc.)
   - 3.5 The degree of formality
   - 3.6 Activity of the members
   - 3.7 New members
   - 3.8 The spirit and identity of DMC
   - 3.9 Development needs (problems)

4. **Knowledge and knowledge sharing**
   - 4.1 The most critical issues (company)
   - 4.2 The most critical issues (members personally)
   - 4.3 Critical DMC related knowledge to projects
   - 4.4 Knowledge sharing with others
   - 4.5 Spaces
   - 4.6 Cooperation with client projects
   - 4.7 Other knowledge sources of the projects

5. **Outcomes**
   - 5.1 Concrete outcomes
   - 5.2 Benefits for the organization (incl. financial benefits and added value)
   - 5.3 Personal benefits
   - 5.4 Benefits to the clients

6. **Other**