



V A A S A N Y L I O P I S T O

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Learning within Projects

*A Qualitative Study of How Learning Contributes
to Knowledge Management in Inter-organizational
Construction Projects*

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Abstract

Haapalainen, Päivi (2007). Learning within Projects: A Qualitative Study of How Learning Contributes to Knowledge Management in Inter-organizational Construction Projects. *Acta Wasaensia* 179, 166 p.

This research investigates learning in inter-organizational projects as a part of the knowledge management of the project. It is typical for these projects that the project team consists of people from different organizations with different education and background. Public construction projects are good examples of inter-organizational projects. It is also typical for these projects that the amount of knowledge required is huge. It is not possible for one person to handle all this knowledge but it is distributed among the project team. The people in the team are required to co-operate: to share and combine their knowledge with others in the team. This is the only way to achieve good end results. However, knowledge sharing is not an easy task when people possess different backgrounds and experiences. For example for an end user (teacher, nurse etc.) of the building that is being renovated, the technical issues presented by an architect or some other designers are often so difficult that learning is needed so that he/she can understand them. If there is no learning, it may cause budget overruns and delays during the project because of late changes in designs and other problems after the project is finished.

Two set of research questions were formulated to gain understanding about the learning in the inter-organizational projects:

1. *How is learning related to knowledge management in the case construction projects? To what kind of issues is learning related in these projects?*
2. *How learning in the case construction project can be facilitated by using facilitated group activities like vision building, activity cards, and mock-up room?*

In order to find answers for these questions two case studies were research. The both cases were public construction projects. The research method in the case one was theme interviews and the aim was to answer research question one. For finding answers to the research question two an action research was organized for testing some methods for facilitating learning. However, material from the each case was also utilized when answering the other question as well.

The both cases show that there is a lot of learning happening in this kind of projects and that it has a strong connection to knowledge management, to e.g. the process of creating new knowledge. It is also clear in the light of the research material that all the parties involved in the project teams need to learn. It is not just the end users that need to understand technical issues but also the technical side of the project has to understand the needs that the end user activities bring for designing. However, the situation is typically such that learning is not very intentional, it just occurs because the circumstances force people to learn. The different methods tested in case two included vision building for the project, mock up room and activity cards. All these methods proved to be useful tools for facilitating learning in the project and thus easing communication and knowledge management in the project.

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Key words: organizational learning, inter-organizational projects, knowledge management, intra-project learning

1 Introduction

The background and the need for this research are presented in the beginning of this chapter. This will be followed by the introduction of the research approach and the objectives of the research. The presentation of the structure of this research report will finish this chapter.

1.1 Background and need for this research

Projects are a very common way of organizing work in today's world, both in public and in private sector, and they are seen as a good organizational form for many purposes. As Pinto (2005: xi) states *“the flexibility, responsiveness, and innovativeness that projects offer modern organizations demonstrate again and again that project-based work is not the latest management fad, but represents a very real sea-change in the manner in which organizations must do business if they are to be successful in a fast-paced, global marketplace”*. Projects mean usually that human resources can be used efficiently when they are needed and after that released for other work. For such work that has a clear temporary nature it is natural to use project as an organizational form, e.g. in the construction business it can be said that all the work is done as projects.

Projects differ from the other organization types in several ways. Projects are temporary organizations: they have more or less clear points of beginning and ending, they are often have relatively short duration so as organizations they are discontinuous (Bresnen, Goussevkaia and Swan 2005a: 27, 30; Hall and Sapsed 2005: 57; Turner and Muller 2003). This means that a project team works together only a restricted period of time. Projects are usually considered to be unique, it is likely that no project before or after are exactly similar either in objectives or processes (Bresnen et al. 2005a: 27; Hall and Sapsed 2005: 57; Turner and Muller 2003). This type of work brings challenges for management practices and especially to knowledge management.

The number of projects is increasing everywhere. Many more or less project-based organizations in different industries like high tech, manufacturing, construction, services, recognize that their competitive advantage is based on their ability to successfully deliver projects. One crucial part of this is managing the knowledge in projects (e.g. Turner 2005: ix–x, Pinto 2005: xi). According to Nonaka and Takeuchi (1995) knowledge management in organizations requires a commitment to processes of creating new knowledge, disseminating it throughout the organization and embodying it in products, services and systems.

However, until fairly recently, comparatively little attention has been directed towards examining the specific problems associated with managing knowledge in project environments (Bresnen, Edelman, Newel, Scarbrough and Swan 2005b: 81). Fong (2005a: 104) states that “*only a limited amount of research has been conducted on KM in the architectural, engineering and construction sectors*”. Love, Huang, Edwards, and Irani (2005: 134) argue that the importance of providing service quality is been acknowledged also in construction business and therefore there is a need to understand how these organizations could become what Senge (1994) calls “The Learning Organization”.

The existing research about projects and knowledge management or projects and learning are mainly concentrated on knowledge management in project-based organizations, especially knowledge transfer or learning between the projects, capturing the “lessons learnt” or learning from failure projects. For example nine articles out of the eleven in the recent book “Management of Knowledge in Project Environments” (edited by Love, Fong and Irani 2005a) represent this perspective. Only two of the articles deal with knowledge management within a project (see Newell and Huang 2005 and Fong 2005b). Also in the book “Knowledge Management in Construction” (edited by Anumba, Egbu and Carrillo 2005) the main emphasis is in the knowledge management in construction companies, however, one chapter is devoted to knowledge sharing in project team.

In Finland, one interesting dissertation (see Ruuska 2005) about knowledge sharing in project-based environments has recently been published. In this work the ideas of the importance of sharing knowledge and experiences and creating shared understanding

are emphasized. Knowledge sharing is based on interaction between people and this interaction happens in semi-formal communities. (Ruuska 2005.) However, the main focus in Ruuska's research is on knowledge sharing between projects, even though she also deals with knowledge management in the projects.

Leonard-Barton (1995: 4–5) and Fong (2005b: 42) state that knowledge-creating skills are particularly important in contexts where new products or processes are being created or the existing ones enhanced. According to Fong (2005b: 42) the development of a constructed facility can be viewed as a new product development with customers or end-users purchasing or using the facility. As Fong (2005b: 42) lists, there are several similarities between new product development projects and construction projects. The existing or new knowledge must be utilized to create the “new product” in a situation where each project is unique at least to some point what comes to both design and construction. The project team also faces several constraints like limited budgets, tight timetables, and increasing project complexity.

In Finland Collin (2005) has researched in her dissertation the design engineers' learning at work as seen by themselves. The focus in this work is on the design engineers and new product developers that work for industrial clients. The main findings are that learning is informal, incidental and very much situated in nature. The learning often happens in interaction with colleagues and within other networks that are connected to work. (Collin 2005.) Even though learning that Collin (2005) describes is sometimes inter-organizational, the inter-discipline focus is missing, the learning environment is mainly based on people with technical education and backgrounds.

In many projects the participants of the project teams are from different departments of one organization or even from different organizations. Usually this is the case when one organization is developing or producing something for clients in another organization, like in product development projects or construction projects. In product development the client and suppliers are often involved in the process as early as possible to assure that the product being developed is what the client wants. In construction or information system delivery projects the basic situation is the same: clients are needed to tell what they want and need.

It is typical for these ‘multidisciplinary’, ‘cross-functional’ or ‘inter-organizational’ projects that the participants in the project teams may have different backgrounds: education, working experience, organizational culture, working procedures etc. It is therefore possible that they do not have “a common language” (see e.g. Koskinen, Pihlanto and Vanharanta 2003: 289). This may cause misunderstandings and may affect to the end results of the project. Cicmil (2005: 159) argues about problem solving in multidisciplinary environments: “*One of the underlying arguments is that all complex problems involve a multiplicity of actors (groups and individuals) and various scientific and technical disciplines. In principle, each sees a problem differently and thus generates a distinct perspective on it. The integration of these, often conflicting, views makes intersubjective understanding, learning and knowledge sharing challenging to achieve or manage*”.

However, bringing the collective knowledge of the team members to bear on serving customers or clients is important because knowledge is a source of competitive advantage (Prahalad and Hamel 1990). Newell and Huang (2005: 22, 36) find that ‘common knowledge’ is important for knowledge integration or creating collective knowledge in projects, though it is not easy to be created. ‘Common’ or ‘shared’ knowledge means knowledge that is uniform across all the members of a team (Hakkarainen, Palonen, Paavola and Lehtinen 2004: 248).

Another typical thing for these projects is the enormous amount of information. There are documents related to project management and documents related to the contents and purposes of the project. It is impossible for each participant of the project to know everything. However, it should be reassured that the right people know the right things at the right time. Thus also knowledge sharing has a great importance in projects. Sometimes the needed knowledge can be found in documents or in databases, sometimes metaknowledge is needed. Metaknowledge means “*knowledge concerning an individual’s, team’s or organization’s knowledge. It involves, for instance, knowledge about who knows what in a team or organizations*” (Hakkarainen et al. 2004: 246).

One typical problem in knowledge sharing is that the knowledge or information is not understood in the right way by the receiver of the message. The more specialized

issue is in the hand, the higher is the risk that the message cannot be interpreted as meant. Sometimes learning is needed in order to the information be understood in the right way. As Fong (2005b: 42) states: “*Project team members have to incorporate new information into their understanding to solve technical challenges they meet. Thus, learning is inherent in the work they do*”. Elkjaer (2003: 50) argues that the future research on organizational learning will emphasize the importance of organizing learning in organizational contexts. That refers e.g. the research on methods that facilitate learning.

It has been identified several types of problems that are caused by lack of information sharing and knowledge management (amongst other reasons) in construction industry: budgets are overrun, timetables are not accurate, needs of the end users are not fulfilled (e.g. Naaranoja and Uden 2007; Love, Irani and Edwards 2004; Anumba, Egbu and Carrillo 2005: ix). Let us take the end user needs as an example. There are two parties that should learn something in order to assure that the end users get what they need and want. For the representative of the end users (e.g. teacher, nurse) this could mean learning the basics of electrical engineering: what is it possible to do with in the limits of budget and timetable. On the other hand the designers have to learn the basics of the work that is done in the building to be built or renovated, only this way he can design such facilities so that they fulfill the end users’ needs.

It has been argued that the early phases (the process and activities before the decision for starting the project has been made and immediately after that) are very important in construction projects, because it influences the performance of the rest of the project. However, there is not much research about this issue. (Kolltveit and Gronhaug 2004: 545.) If the project team communicated effectively at the early phases, the likelihood for changes later during to project decreases (Love et al. 2004: 427). Love at al. (2004: 436) suggests that that the client organizations should employ an independent project facilitator that would be responsible for identifying the client’s strategic needs and managing the design process. This would stimulate and develop the communication between the different parties of the project.

Project team members with diverse skills, knowledge and experiences are required to work together to solve issues or problems encountered in a project (Fong 2005b: 42).

In order this to happen, different parties must be able to discuss different issues. As Newell and Huang (2005: 22) describe in their example of developing a trading system between a technologist and trader, *“it is crucial for the trader to have some basic understanding about the technology, and for the technologist to know something about the trading process”*.

Inter-organizational learning is often seen as something negative: organizations stealing knowledge from each other (see e.g. Larsson, Bengtson, Henriksson and Sparks 1998). Learning in inter-organizational projects, however, can instead be useful, even essential for the success of the project as stated above. An inter-organizational project team should be a group of people learning from each others and together. As Senge (1994) and many others after him considers organizational learning or creating learning organizations to be one of the competitive advantages of companies. *“The most successful corporations of the 1990s will be something called the learning organization. The ability to learn faster than your competitors may be the only sustainable competitive advantage.”* (Senge 1994: 4.)

It can be concluded that projects and project management in particular are important issues in many organizations. The view point of the project research has moved from the focus on developing tools and techniques in the 1970s to the success criteria in the 1990s. The 21st century begins with the focus on the contexts of the projects and the knowledge management in projects (see e.g. Love, Fong and Irani (eds) 2005a). (Turner 2005: ix.)

Also knowledge management in general and organizational learning have both been popular topics since 1990s when Nonaka and Takeuchi (1995) introduced their concept of ‘knowledge-creating company’ and Senge (1994) his concept of ‘learning organization’. Both of them have been researched from many different viewpoints, even though there has been a lack of consistent terminology and cumulative work, and large projects have been introduced in companies in order to apply these concepts in practice (Vera and Crossan 2003: 122). However, the new century has brought these topics together and got the researchers trying to identify the connection between them (see e.g. Easterby-Smith and Lyles (eds) 2003a).

As shown above, a project team faces the challenges of different knowledge management processes as knowledge creation and sharing. However, Fong (2005b: 42–43) states “*although there is extensive literature covering teams and the benefits they can bring to organizations, a focus on the processes of knowledge creation from a multidisciplinary project team is compelling as research specifically addressing this issue appears to be very limited*”. In the research of learning and projects the focus is usually in transferring the learning from one project to others and not in learning as a part of knowledge management processes.

The aim of this research is to continue the new wave of the research on projects, knowledge management and organizational learning. This research illustrates how participants in inter-organizational project teams see their own learning and what kind of role that learning has in the knowledge management of the projects. In addition to this, the research investigates some techniques that can facilitate knowledge management and learning in construction projects.

1.2 Research approach

1.2.1 Conceptual framework

The research area of this problem field is related to several theoretic disciplines (see Figure 1). This research is clearly dealing with the issues of project management. Within the broad field of projects the focus of this research is in the other hand on construction projects and in the other hand on inter-organizational projects. The problems of project management this research is dealing with are related to knowledge management: how to make sure that the right people in the project know what they need to know at the right time and way and how can the creation of new knowledge be assured. And since the presumption is that sometimes, in order to assure this, people in the projects have to learn something this research is also dealing with organizational learning. Within the organizational learning theories the key theories for this research are social learning theories. The assumption for the research is that “*Learning is thus social and is grounded in the concrete situations in which people participate with others*” (DeFillippi and Ornstein 2003: 27).

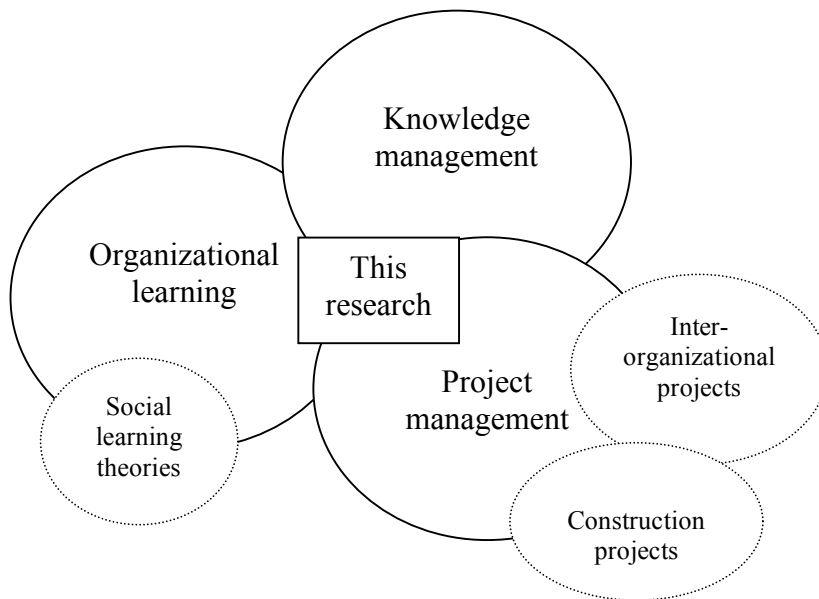


Figure 1. Conceptual framework of this research.

1.2.2 Research objectives

Based on the literature and the knowledge developed early during the research it seemed to be clear that there is at least some learning happening in construction projects. After this, two different sets of research questions arose from this field:

1. *How is learning related to knowledge management in the case construction projects? To what kind of issues is learning related in these projects?*
2. *How learning in the case construction project can be facilitated by using facilitated group activities like vision building, activity cards, and mock-up room?*

The aim of the first set of research questions is to describe and understand how the participants themselves see the learning in projects. How do they learn, why do they learn, what do they learn and is learning somehow supported? In order to answer this research question the connection between knowledge and learning will be dealt with. Most of the earlier research seems to be talking about either one or the other: knowledge management about knowledge creation or knowledge sharing and research on organizational learning about learning. However, many issues are the same they just have a different label on them. It is hard to find an article about learning in project

management journals but looking at the knowledge management issues in the same journals, they seem to be discussing learning.

It seems that learning must happen in these projects in order to fulfill the objectives of the projects. However, learning is not always an easy task. The aim of the second research question is to test a few ways of making learning easier in a construction project and to see if the project and the participants of the core team of the project can benefit from these methods.

The general objective of the research is to gain more knowledge and understanding about learning in inter-organizational projects in general and specially in construction projects: what kind of things do people learn in these projects and how is the learning related to knowledge management of these projects? What is the relationship between knowledge creation and learning as well as between knowledge sharing and learning? Another objective is to provide project managers of construction projects with some tested methods of facilitating learning and thus improving knowledge management in these projects.

1.2.3 Scope of this research

The empirical part of this research is divided into two parts according to the research questions. One case study is done in both parts. Both cases represent public construction projects. Both cases **concentrate mainly on the design phase of a construction project**. The research **subjects of both cases are limited mainly on the participants of the core team** of the design phase. This means that when considering the different parties involved in the construction projects (see Figure 2) the involvement of contractors (or builders) is only very limited in this study and from the end users only those who are closely involved in the design process are involved in the study. The **focus of this research is on learning and knowledge management within the case projects**, transferring learning and knowledge from a project to others is not considered.

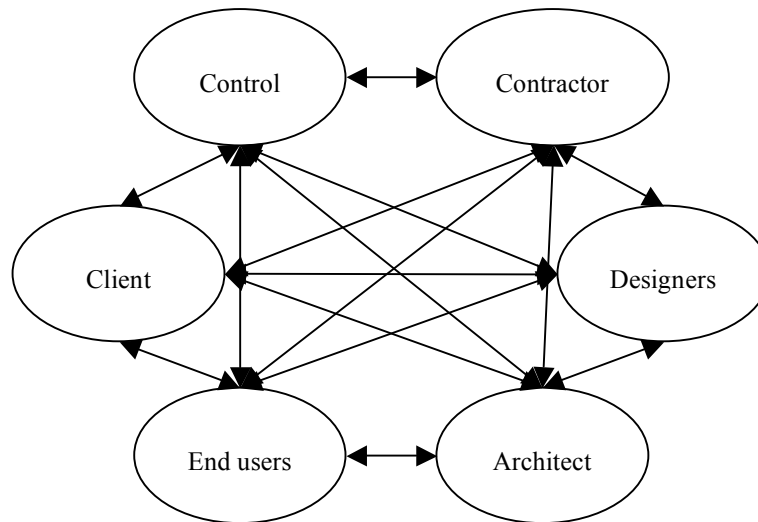


Figure 2. Different parties involved in construction projects.

In this research the clients are the cities or the technical departments of the cities for whom the new or renovated buildings are made for. In the case projects e.g. the project managers represent the client. End users are the people who will be using the buildings when they will be finished. For example if the building is a school, teachers and pupils will be using it. Also the maintenance, including the cleaners, represents the end users. The designers are responsible for drawing the plans for construction. Also the architect is one of the designers. However, the architects are placed in a different group than other designers in this research because they typically have stronger role and ties to other parties than other designers. The contractors are responsible of the actual construction of the building. The role of the control is to ensure the safety of the site, the safety of the building design, and to make sure that the building is following the rules and regulations set by the government or the city. In this research the control is represented by the supervisors employed by the cities that are tightly involved already in the design phase, not outside authorities.

1.2.4 Research strategy and methods

The choice of research strategy and methods should always begin with the purpose and aims of the research. This research has two quite different objectives: the first one is to describe and understand learning as a part of the knowledge management process of projects, the second one is to develop and test methods for facilitating knowledge

management and learning in projects. Thus one part of the research is explorative and the other one is more normative in nature. However, both parts of the research derive from the same philosophical background: hermeneutics. Whereas the other one of the main philosophical research approaches, positivism, aims for explaining issues and their causal relations, hermeneutics aims for understanding them (Olkkonen 1993: 30–31, 38–39).

The research strategy for this research is action-analytical. According to the research philosophy behind action-analytical research strategy, hermeneutics, this strategy aims for understanding the research problem. Typical for this strategy is that there are no external, neutral observations of the research subject that could be measured. The research subject is examined in the light of history, practices and theory (see Figure 3) Also the close connection of the researcher and the subject is typical for this research strategy, though the tightness of connection varies (Olkkonen 1993: 52–53). In this research the role of the researcher is quite different in the two cases. In the first one the connection between the researcher and the informants is loose whereas in the other one the researcher participates in the project work.

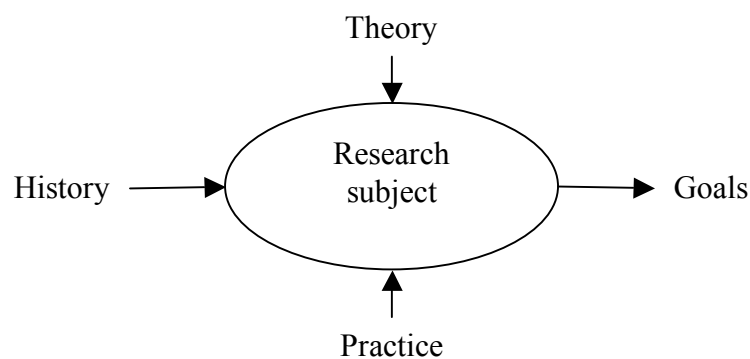


Figure 3. View of the research subject according to action-analytical research strategy (Olkkonen 1993: 56).

Two different research methods are used in this research. Both of them are qualitative. Bogdan and Taylor (1975: ix) wrote about qualitative methods: “*Over the past decade, there has been growing interest in the subjective, in meaning, and in commonsense understanding... The questions that the new approaches raise require methods that are descriptive and holistic. We call these qualitative methods*”. Even

though the qualitative methods are not anymore new, the reasons for using them are still the same.

The research method in the first case is qualitative interview study. According to Weiss (1995: 9–11) there are seven different research aims that could make the qualitative interview study the chosen method: developing detailed descriptions, integrating multiple perspectives, describing the process, developing holistic description, learning how events are interpreted, bridging intersubjectives and identifying variables and framing hypotheses for quantitative research. In this research the aim is to integrate the perspectives of different participants of the project team in order to develop a holistic description of learning in the project. The method for gathering the research material and analyzing it are described in detail in the Chapters 5 and 6.

The research method for the second case is action research. As (Olkkonen 1993: 52–53) states, sometimes the results of action-analytical research are also normative. Action research is such research in which the researcher is trying to affect in one way or another on the research subject, he or she is making an intervention on the used practices. Typically, interventions are made in co-operation with the people participating in the research (Eskola and Suoranta 1998: 128–129). Since the aim of the second part of the research is to develop and test new ways of doing things in projects, this method suits well. Action research as a research method will be discussed deeply in the Chapters 5 and 7.

1.2.5 Structure of this research report

This research report aims for providing both a theoretical view to learning and its connection with knowledge management in inter-organizational projects and some empirical findings from two case studies that are public construction projects in two Finnish cities. One of the projects is used to gain an understanding of learning in these projects and the other one is an action research case in which some practical methods for facilitating learning were tested.

A theoretical framework for this research will be presented in the Chapters two, three and four. Projects, especially inter-organizational and construction, and project management are presented in the Chapter two. Types of knowledge and knowledge management will be introduced in the Chapter three. Individual learning theories and different perspectives to organizational learning will be discussed in the Chapter four. Special emphasize will be given to social construction view of organizational learning.

In the Chapters five, six and seven we will move to the empirical part of the work. A short summary of the main theoretical concepts will begin the Chapter five. Also the methods of material gathering and the basic information about the used case studies will be provided in the Chapter five. The Chapter six will then concentrate on one of the case studies and the Chapter seven in the other one. In these chapters both the analysis methods and results will be presented. The Chapter six will concentrate on the results of the case study 1: What has been found out about learning and its' connection to knowledge management within the core project team in inter-organizational projects? The Chapter seven is dedicated on the action research case: How did the methods used to facilitate learning and improve knowledge management in the action research case work?

Conclusion and contributions of the whole research will be discussed in the beginning of the Chapter eight. After that there will be some discussion of the meaning of the research results to practice. The reliability and the variability of the research will be discussed also in the Chapter eight. And finally, some guidelines for future research will be provided.

2 Projects and project management

As stated in the Chapter 1.2. (see Figure 1) in the background of this research there are several “scientific disciplines”. On the other hand it is important to define what projects are and how they differ from other types of organizations as well as how inter-organizational projects differ from projects within one organization. The presentation of these concepts begins this chapter. For the purpose of understanding the background of this research also the concept of project management will be defined.

2.1 Definition and characteristics of a project

Different definitions for projects are in great deal similar. Same features are usually connected to projects in the definitions by various writers. Söderlund (2004: 184–185) cites one of the early definitions by Gaddis: *“A project is an organization unit dedicated to the attainment of a goal – generally the successful completion of a developmental product on time, within budget, and in conformance with predetermined performance specifications”*. The early definition of Turner (Turner and Muller 2003: 1) is very similar: *“An endeavour in which human, material and financial recourses are organized in a novel way, to undertake a unique scope of work, of given specification, with constraints of cost and time, so as to achieve beneficial change defined by quantitative and qualitative objectives”*.

The Project Management Institute’s “A Guide to the Project Management Body of Knowledge” (United States) (1996:4) defines project as “a temporary endeavor undertaken to create a unique product or service”. Dingle (1997: 4–5) quotes the definition of the project by the British Standard “Guide to Project Management”: *“a unique set of co-ordinated activities, with definite starting and finish points, undertaken by an individual or organisation to meet specific objectives within defined schedule, cost and performance parameters”*. According to Morris and Hough (1997: 3) *“project is an undertaking to achieve a specified objective, defined usually in terms of technical performance, budget and schedule”*.

From these definitions we can find some common issues that are typical for projects. To begin with, projects are unique in contents and objectives and therefore they create temporary organizations (see also Pinto 2005: xi). Another common feature for projects in all the definitions is that projects have clear specific objectives. When objectives are met, the project ends and the project organization stop existing. And the third thing typical for projects is that there are certain limitations within which the objectives have to be met: timetables, budgets, and other recourses. Turner and Muller (2003: 2) argue that many of the traditional definitions of projects are incomplete. They address the nature of projects by considering the following issues: projects are 1) production functions; 2) temporary organizations; and 3) agencies for change, recourse utilization and uncertainty management.

These features bring along some challenges for projects compared to more traditional organizations. As projects are often ‘one-off’ and relatively self-contained, discontinuities are created within the organization that makes it difficult to develop steady-state routines and maximize the flow of knowledge and learning between projects (Bresnen et al. 2005b: 81). The core project team is likely to be dispersed at, or more likely before, the end of the project (Fong 2005a: 105) which may hinder the communication within the project and specially utilizing the things that have been learnt during the project.

2.2 Inter-organizational projects

Project team members are different specialist brought together to form the ‘project team’. They all have their own professional training and knowledge formed from experiences in previous project teams. The expertise of team members may vary a lot, like the case is in construction projects. None of these members alone could take the project successfully to the end. It can be said that the project team members should develop a collective mind. Weick and Roberts (1993) introduce the concept of collective mind to describe the performance of organization in situations where making errors are not acceptable. They (1993: 357) define collective mind as “*a pattern of heedful interrelations of actions in a social system. Actors in the systems construct their actions (contributions), understanding that the system consists of*

connected actions by themselves and within the system (subordination)”. With this collective mind the project team can together reach the objectives of the project by using the individual expertise of different team members. However, it should also be remembered that expertise has always a context. If the other team members do not consider someone as an expert, his or her expertise cannot be fully utilized. (Stein 1997: 181–182.)

More often than not, the project team is an inter-organizational team consisting of multiple individuals from multiple organizations with different professional cultures (Fong 2005a: 105). This is one question that separates projects from each others: is the project within an organization or is there more than one organization involved in it. As Bresnen et al. (2005b: 81) state about construction industry: these problems are compounded by the fragmentation of the project team in to different professional disciplines. Each discipline has its own knowledge base and language. *“Inevitably, such fragmentation of expertise along organizational lines has adverse effects on attempts to develop shared perspectives on innovation, knowledge and learning* (Bresnen et al. 2005b: 83–84).

Also Cicmil (2005: 159) emphasize the fact that both the temporary nature as well as interdisciplinary social interaction may cause problems in projects. She (2005: 159) argues that *“By implication, knowing and learning in such environments involve a degree of interpretation as different groups and individuals focus on different aspects of project reality or create meaning according to their own experience and understanding of the gains, purpose, expectations and the operation of power in the specific context”*.

The potential value of learning in projects is often recognized by the project team members but they do not usually know how to proceed with it. Learning is often needed also in developing the collective mind. The assumption is typically that learning occurs randomly and uninhibited during the project. Sense (2003: 6) however argues that learning in projects is a complex process that has to be managed and facilitated. Sense and Antoni (2003: 490) introduce three ‘central agitators’ that influence learning within projects: 1) individual authority level; 2) project sponsor actions; and 3) the organizational environment influences.

One challenge related to temporary organizations like projects and specially related to inter-organizational projects is lack of trust. Kadefors (2004: 175) argues that trust is one of the critical success factors in partnering projects. Kolltveit and Gronhaug (2004: 545) state about construction projects: *“the various stakeholders have different interests in and ambitions for a project depending on the type of their involvement in the same, and they influence the project according to what role they play in relation to the project”*. Often these interests may be in contradiction, e.g. client wants the best possible building for as little budget as possible, end users want building with many functions and the contractors want to profit from the project. However, the stakeholders should be able to trust to other stakeholders so that a win-win situation could be created and that no-one would deliberately exploit the others.

Usually trust is seen as a history-based, person-based issue. This means that trust is developed over time when the trustor and the trustee interact with each others. According to Meyerson, Weick and Kramer (1996:167) the traditional sources of trust are familiarity, shared experience, reciprocal disclosure, threats and deterrents, fulfilled promises, and demonstrations of nonexploitation of vulnerability. All these sources of trust presuppose either personal contact or common history between the trustor and trustee or both. The problem in project work in general is that people are brought together to do something unique and they probably never have worked earlier or never will work again together. Meyerson et al. (1996: 191) introduce a concept of ‘swift trust’, trust that is based on the role occupied by the trustee even though the person is initially unknown. They suggest that trust in contemporary systems is not so much an interpersonal form as it is a cognitive and action form.

Kadefors (2004) suggest project partnering as a way to facilitate trust building in construction projects. She argues (2004: 181) that team building processes and project-wide communication in the early phases of the project influence the participants’ behaviour so that trust is more likely to be build and maintained. And because problems and misunderstandings often initiate distrust, systems to monitor relations and manage conflicts are good for trust building.

2.3 Construction projects

Huang and Newell (2003: 168) introduce three types of tasks that cross-functional projects are typically used for. The first type of projects is used when creativity and innovations are needed, like in new product development projects. In the second type of projects the aim is to generate consensus through collective input, investigation and negotiation. For example strategic planning projects sometimes are cross-functional. The third type of projects are used for strategic change initiatives. (Huang and Newell 2003: 168.) Construction projects are 'cross-functional' in the deepest meaning of the word, indeed the different functions are usually represented by people from different organizations. When looking at the aims of these projects they have at least the two first types of objectives. The end result of the project is typically a new, unique building that is built to meet the needs of the end users. On the other hand, during the design of the building there are usually a number of negotiations when the needs of the end users are forced to meet the timetables and the budgets of the project as well as technical possibilities.

Bresnen et al. (2005a: 31) argue that *"the construction industry represents one particular type of project environment with its own organizational and institutional features and associated managerial discourse"*. The work in the industry is carried out in projects. Usually the projects involve new product development at least at some level. Both routine and non-routine processes are needed both in design and construction. What brings even more challenges is the complex network of parties involved in projects. Typically the network crosses the boundaries of organizations and professional groups.

Carrillo et al. (2004: 47) provide a simplified depiction of construction project (see Figure 4). In the beginning of the project the need for building a facility or renovating an old one has to be clarified. After that follows a design phase that includes e.g. architectural design and the design of the technical systems in the building. Based on the design drawings the actual construction work can be done. And the final, typically the longest one, phase is the use of the facility.

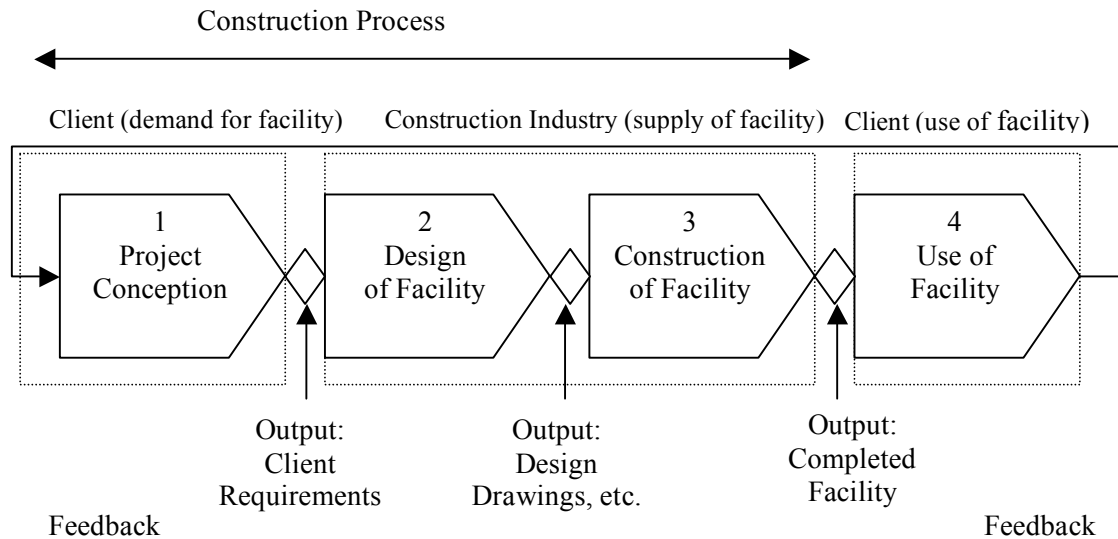


Figure 4. The Simplified Construction Process (Carrillo et al. 2004: 47).

However, it is important to notice that these phases are not so strictly separate and the roles of the client and construction industry are not so strictly concentrated in certain phases. It is impossible that the client requirements from the first phase would be so clear and all realizable that the architect and other designers could do the design work without communication with the client. At the same way, the design drawings are rarely such that no changes or adjustments are needed in construction phase. This means that there should be an actual feedback loop between all the phases and communication between all the parties is important during the whole project.

2.4 Project management

Project management has its origins in the chemical industry just prior to World War II. It was further developed in the 1950s, essentially in the defense and petrochemical industries. It is now a relatively well developed management discipline (Morris and Hough 1997: 3). As Pinto (2005: xi) states: “*project management, by its very nature, represents a unique undertaking, one that is not long-term process driven, but in every sense temporary*”. According to Morris and Hough (1997: 4) project management is the application of a collection of tools and techniques to direct the use of diverse resources towards the accomplishment of a unique, complex, one-time task within time, cost and quality constraints.

Ruuska (2005: 29) says that project management is tasks related to planning, decision making, execution, guidance, coordination, control and leading people. All of these tasks are at least some point related to information and knowledge in the project. Kasvi, Vartiainen and Hailikari (2003: 571) argue that project knowledge is related to the product to be delivered for an internal or external customer or to the production or the use of the product. This knowledge can be technical knowledge concerning the product, procedural knowledge concerning producing and using of the product and acting in a project and organizational knowledge concerning communication and collaboration.

Söderlund (2004: 185) argues that project management has been researched within two main theoretical traditions. The first one is based on engineering science and applied mathematics and its main emphasis is on planning techniques and methods of project management. The other tradition is interested in organizational and behavioral aspects of projects and has its roots in the social sciences. The tasks of the project manager reflect these traditions. Typically the role of project manager has involved tasks like planning, administration, supervision and reporting. However, e.g. Turner and Muller (2003: 5-6) argue that “*the project manager should learn to delegate the planning and reporting*”. Instead, the new role of the project manager involves more guiding than doing, it is about the non-rational, motivational, and emotional aspects of goal setting.

Cicmil (2005: 166) introduces a well covering multiple perspective framework for project management (see Figure 5). She states that all these perspectives have their own influence in knowledge, learning and collaborative interaction in project environments. These perspectives, however, cannot, often be separated or examined as single units because they are related.

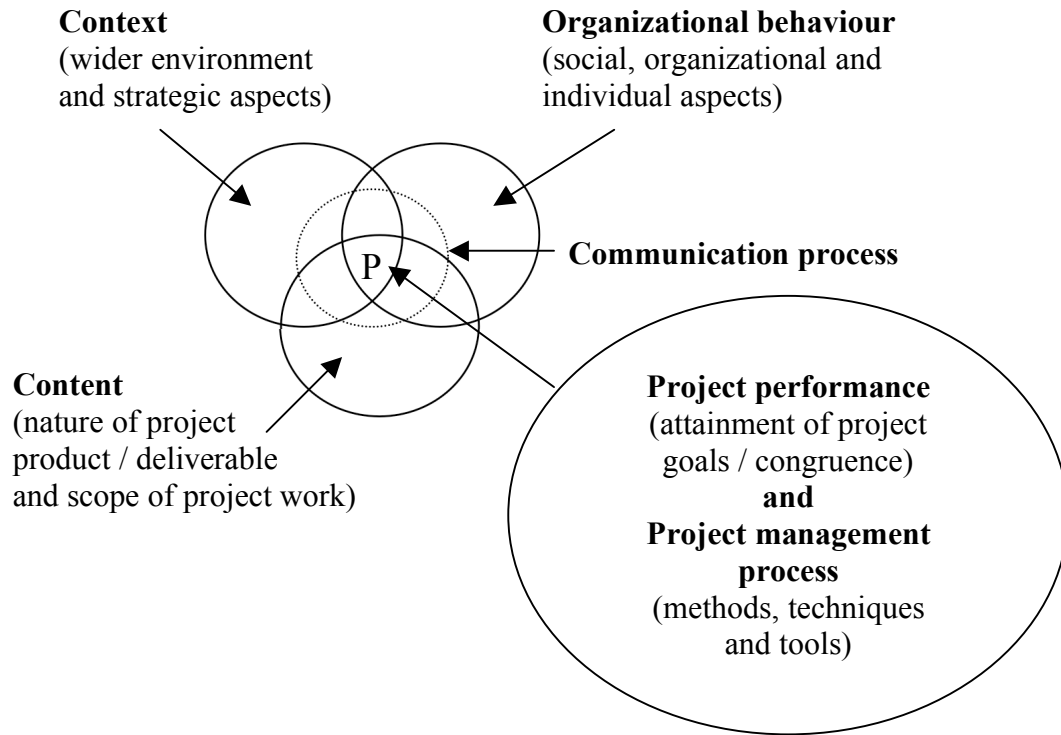


Figure 5. The project management multiple perspective framework (Cicmil 2005: 166).

3 Knowledge management

Different definitions for concepts of data, information and knowledge will be introduced in this chapter. Also knowledge management and its processes will be explored.

3.1 Data, information and knowledge

It is often said that a firm's competitive advantage depends more than anything on its knowledge (see e.g. Prusak 1997: ix). It is true that knowledge plays an important role also in projects. It is, however, difficult to find one specific definition for knowledge. One of the most quoted definitions of knowledge is by Nonaka (1994: 15): *knowledge is justified true belief*. This definition is based on the approach of the Western philosophy. For the purpose of this research this definition seems to bring along more questions than answers. Term 'belief' points that someone has to believe in it. Is knowledge only knowledge for those who believe in it? How and by whom is it defined that the belief is 'true'? And what makes it 'justified'?

Berger and Luckmann (1966) on the other hand see knowledge as a set of shared beliefs that are constructed through social interactions and embedded within the social contexts in which knowledge is created. This definition emphasizes the social dimension of knowledge: knowledge is created by people interacting and it always has a context. The work of Berger and Luckmann thus represents the social construction view to knowledge and knowledge creation.

There is often done a separation between data, information, and knowledge. Davenport and Prusak (1998: 5) see knowledge as something individual "*it originates and is applied in the minds of knowers*" but say also that "*it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices and norms*". According to them (1998: 2–5) "*data is a set of discrete, objective facts about events*", information is a message with a sender and a receiver and it is meant to have an impact on the judgment and behavior of the receiver. Finally, they define knowledge as "*a fluid mix of frame experiences, values,*

contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information”.

Also Liebowitz (2005) makes a separation between data, information, and knowledge in his knowledge framework (see Figure 6). He (2005: 3) says that data are discerned elements and they are turned into information when they are processed and patterned in some way. When information turns actionable, it is transformed into knowledge. Liebowitz also (2005: 3–5) emphasizes the importance of the context of data, information, and knowledge and the learning process that happens when knowledge is being utilized.

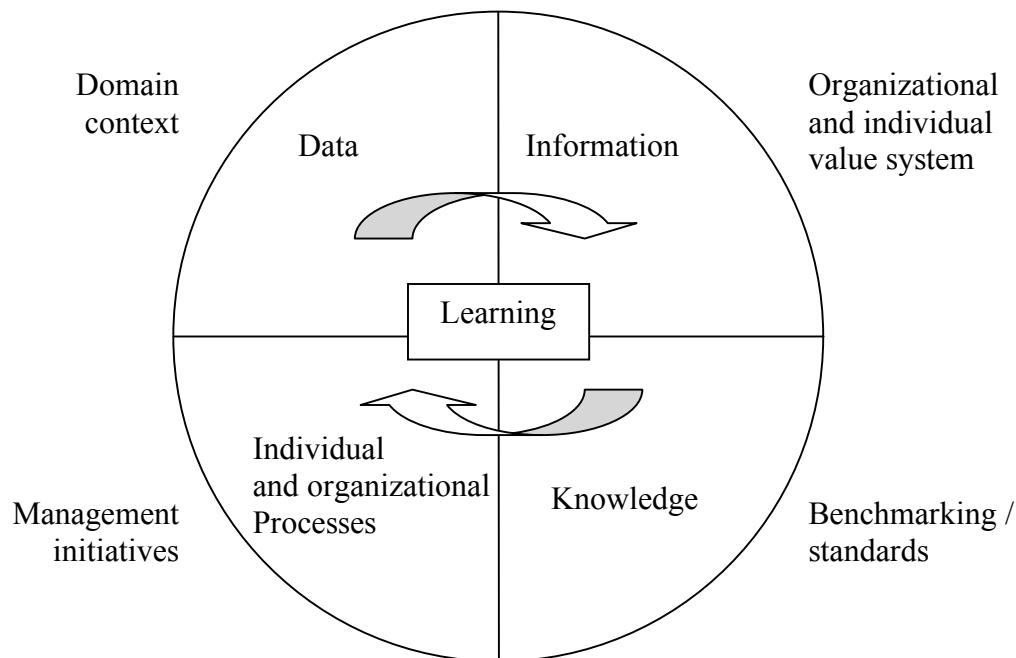


Figure 6. Conceptual views of the knowledge framework (Liebowitz 2005: 3).

Bhatt (2001: 69) defines knowledge to be meaningful information. Knowledge is derived from information. What makes difference between data and information is their organization and what makes difference between information and knowledge is the interpretation (Bhatt 2001: 69). Nonaka and Takeuchi (1995: 57–58) state that the difference between knowledge and information lies in three things: “*First, knowledge, unlike information, is about beliefs and commitment. Second, knowledge, unlike information, is about action. And thirds, knowledge, unlike information, is about meaning*”. The first thing means that knowledge is related to a certain perspective or

intention of a person. The second thing means that knowledge is related to a specific action which, like the third thing, emphasizes the idea that knowledge is context-specific. Also according to Nonaka and Takeuchi knowledge is built on information.

Kogut and Zander (1992: 386), however, connect knowledge and information in totally another way. They define knowledge as both information and know-how. According to them “*know-how is the accumulated practical skill or expertise that allows one to do something smoothly and efficiently*”. Information on the other hand “*implies knowing what something means*”.

Another issue often connected to knowledge is understanding. Chakravarthy, McEvily, Doz and Rau (2003: 306) state that knowledge is defined by most authors “*as a type or degree of understanding that exists at a point of time*”. Chong and Pandya (2003) define knowledge as understanding that one gains through experience, reasoning, intuition, and learning. We expand our knowledge when others share their knowledge. New knowledge is born when we combine our knowledge with knowledge of the others.

Yet another way of defining knowledge is to look at how it is used or processed. E.g. Perkins (1993) represents this view. His perspective is called the access framework. Access characteristics are divided into four categories. Knowledge concerns what kind of knowledge is available: procedural knowledge, facts, strategies, and routines. Representation concerns how the knowledge is represented. Retrieval concerns how and how effectively knowledge can be found. And finally, construction concerns the system’s capacity to assemble the new knowledge structures from the pieces of knowledge. More about knowledge related processes in an organization will be discussed later in this chapter.

3.2 Different types of knowledge

A common way of categorizing knowledge is to divide it into explicit and tacit knowledge. This division is based on the book by Michael Polanyi (1966): “The Tacit Dimension” (for a good review to Polanyi’s work see also Tsoukas 2003). In this

book Polanyi discusses the nature of tacit knowledge from the point that “we know more than we can tell” (Polanyi 1997:136). He describes the two types of knowledge by “knowing what” (explicit knowledge) and “knowing how” (tacit knowledge) (Polanyi 1997:137).

It was, however, Nonaka and Takeuchi (1995) who made the concepts of explicit and tacit knowledge famous in their book “The Knowledge-Creating Company”. They argue that explicit knowledge is objective whereas tacit knowledge is subjective. Explicit knowledge is knowledge of rationality and mind and it is sequential. Tacit knowledge is knowledge of experience and it is simultaneous, it is hard to be taken away from the time and the place. Tacit knowledge also is more related to practice than explicit knowledge that is more related to theory. (Nonaka and Takeuchi 1995: 61.)

Tacit knowledge is hard to be expressed in the words and even more difficult to be expressed in written form. It is a part of human values, attitudes, motivation etc. It is mostly created through experience and practice. This all means that tacit knowledge is difficult to share. (See e.g. Nonaka and Takeuchi 1995: 62–70; Koskinen 2004: 15; Järvinen, Koivisto and Poikela 2002: 72–73.) Often people do not even realize all the tacit knowledge they possess. During the raising a human child learns a moral system that guides what is good and what is bad. Sometimes it can be very difficult for a person to express this system of values even though it can be easy for her to say if something is right or wrong. People also possess many practical skills, for example work related, that can be extremely difficult to be put into words and explained to others. According to Koskinen et al. (2003) the significance of tacit knowledge in projects has probably not yet been sufficiently understood.

Explicit knowledge is, however, closer to what can be understood by information. It can easily be embodied in language or another code system. Therefore it is also easier to transfer explicit knowledge than tacit knowledge. (See e.g. Nonaka and Takeuchi 1995: 62–70; Koskinen 2004: 15.) Explicit knowledge can be e.g. factual statements about company budget or mathematical equations about the phenomena of physics.

Järvinen et al. (2002: 135–143) introduce five different types of knowledge:

- Embrained knowledge
- Embodied knowledge
- Encultured knowledge
- Embedded knowledge
- Encoded knowledge.

Järvinen et al. (2002) also define what kind of forms these different types of knowledge get in organizations (see Table 1).

Table 1. Types of knowledge and resources (Järvinen et al. 2002).

	Embrained knowledge	Embodied knowledge	Encultured knowledge	Embedded knowledge	Encoded knowledge
Long-lasting physical resources				Product, prototypes, process technology	
Human resources (individual)	Facts, concepts, principles etc.	Know-how, tacit knowledge	Behavioral models, values		
Human resources (community)	Collective beliefs	Co-operation and communication procedures	Values, goals, ideologies etc.	Roles, routines, rituals	
Knowledge and information base resources					Web-pages, databases, manual etc.

Embrained knowledge is facts, concepts, principles and collective beliefs (Järvinen et al. 2002: 138). In construction projects embrained knowledge can be found e.g. in procedures how projects are proceeding: how to get different permissions, how to handle the bidding process or how the write a project plan. Also different collective beliefs, like the belief of the designers that the end users always have grandiose wishes that can't come through, represent embrained knowledge.

Embodied knowledge is know-how and tacit knowledge and co-operation and communication procedures (Järvinen et al. 2002: 138). All the participants of construction projects possess a lot of embodied knowledge, e.g. architect or electrical designer have a lot of know-how about how to design a building or an electrical system for a building. Also their problem solving methods represent embodied knowledge. There are also many procedures related to organizing co-operation and communication in construction projects: how the information is shared between the designers or how the design meetings are organized. During the last years the procedures for co-operation and communication have changed a lot also in construction industry as the new information and communication media have been taking into use. When the procedures change, also the knowledge related to these procedures change.

Behavioral models, values, goals and ideologies represent encultured knowledge (Järvinen et al. 2002: 138). In an old industry like construction industry there is a lot of encultured knowledge imbedded in every project. It is typical for encultured knowledge that it has been created during decades and centuries, not over night. It can be said that the encultured knowledge is a foundation for all the action in construction projects: it guides the different parties to behave and act “in the correct way”, acting as a map and a compass leading to end results.

The adaptation of encultured knowledge begins already during the education, no matter whether it is architectural studies or training of carpenter and it continues when a student moves into the real construction projects. The professional jargon containing a lot of specialist terminology is one of the forms of manifestation of encultured knowledge. For a person with no education or experience of construction industry it may be difficult to follow such language. Changing encultured knowledge is a very slow process and therefore it is difficult to launch new holistic procedures for construction projects because the professionals have a certain behavioral model saying that “it’s always been done like this so it should be done like this also in the future”.

Products, prototypes and process technologies as well as roles, routines, and rituals represent all embedded knowledge (Järvinen et al. 2002: 138). In construction

projects the products are massive and visible to everybody: buildings. We all have every day something to do with these products, they are a necessity in a most climates of the world where shelter from e.g. cold, heat, and rain is needed. Roles also have a strong meaning for the different parties of a construction project: it is important that everyone in the team acts according to the guidelines of his / her role, an individual acting in a different way will probably feel a strong collective pressure or at least causes uneasy feelings for the others. Also these comprehensions of different roles begin to form during the education.

Encoded knowledge can be found in web-pages, databases, manual etc. It usually takes a written form (Järvinen et al. 2002: 138). In the organizations of construction industry for example the drawings and other documents related to projects represent encoded knowledge. There are also collections of instructions for the whole industry that are coded knowledge. In Finland this kind of data collection is called “Rakennustietokortisto” and all the participants of the projects are supposed to be familiar with its contents.

Two different categorization of knowledge has been introduced above. What is the connection between them? Encoded knowledge is quite clearly explicit knowledge, it's written in manual and data bases and can be easily shared. However, none of the other categories represent clearly either explicit or tacit knowledge. Embedded knowledge is partly explicit knowledge (e.g. products) and partly tacit (e.g. roles). Encultured and embodied knowledge is typically explicit knowledge: people have their values, behavioral models and know-how but for example goals or different rules for co-operation may also be stated in such form that they are explicit knowledge. Embrained knowledge can be seen as tacit knowledge that has been turned into explicit knowledge but the degree of how explicit it is depends on the conceptual and cognitive skill of a person (Jarvinen et al. 2002: 136). The summary is been presented in the Table 2.

Table 2. Connection between the different ways of categorizing knowledge (based on the work of Nonaka and Takeuchi (1995) and Järvinen et al. (2002)).

Explicit knowledge	Tacit knowledge
	Embrained knowledge
Embodied knowledge	(Embodied knowledge)
Encultured knowledge	(Encultured knowledge)
Embedded knowledge	Embedded knowledge
Encoded knowledge	

3.3 Knowledge management

Easterby-Smith and Lyles (2003b: 12) claim that the idea of knowledge management is fairly new (see also Schreiber, Akkermans, Anjewirden, de Hoog, Shadbolt, Van de Velde and Wielinga 2000: 1). In spite of this, just like the concept ‘knowledge’, knowledge management has several different definitions. One way to define knowledge management seems to be to see it through its connection to resources and environment and another way is to define it through the processes related to it.

Liebowitz (2005: 1) sees knowledge management as a value creation process: *“knowledge management is the process of creating value from an organization’s intangible assets”*. According to him knowledge management includes sharing and leveraging knowledge both internally and externally. Schreiber et al. (2000:1) state that knowledge management deals with leveraging knowledge as a key asset and resource in an organization. Knowledge management *“takes knowledge as a central subject for organizational decision-making in its own right, and attempts to deal with the management control issues regarding leveraging knowledge”* (Schreiber et al. 2000: 69).

Knowledge management is according to Brelade and Harman (2001: 30) obtaining and using resources to create an environment in which individuals have an access to information and in which individuals obtain, share, and use this information to raise the level of their knowledge. In addition to this individuals are encouraged and enabled to obtain new information for organization. According to Nonaka and

Takeuchi (1995) knowledge management requires a commitment to create new knowledge, disseminate it throughout the organization and embody it in products, services, and systems.

Earl (1997: 9–13) suggests that the knowledge management in an organization consists of at least four components: knowledge systems, networks, knowledge workers, and learning organizations. Knowledge systems refer to databases and information systems that can capture information and help decision making. Networks that can be local, corporate or external are important for knowledge capture, knowledge building and dissemination. Knowledge workers are the core asset for an organization, people with crucial skills for knowledge processing. And finally, the organization must be developed into a learning organization, because *“knowledge is only maximized if the organization can learn”*.

Chakravarthy et al. (2003: 306–316) state that knowledge management has to include three processes in order to an organization to gain a competitive advantage. These processes are to accumulate, protect and leverage knowledge. They suggest that *“knowledge is accumulated when units within the firm or the organization as a whole gain new knowledge”*. The knowledge must be protected so that the competitors do not get the company’s competitive advantage. The tacitness, complexity and specificity of an organization’s knowledge base help the organization to defend its competitive advantage. Leveraging is using of existing knowledge for commercial purposes.

According to Love, Fong and Irani (2005b: xiv) knowledge management is the process for acquiring, refining, storing, and sharing knowledge in an organization. Marshall, Prusak and Shpilberg (1997: 230) say that there are at least seven things that can be done with knowledge in an organization. New knowledge can be created within the organization. Knowledge can be accessed or transferred either formally or informally. It can be represented enabling easier access or it can be embedded in processes. It can be utilized. And finally, these different knowledge processes can be facilitated by development of culture that values, shares, and uses knowledge.

3.4 Knowledge management processes

As it has earlier been seen that knowledge and knowledge management can be defined in different ways, also knowledge management processes can be categorized in several ways. Koskinen (2004: 16–17) defines two types of knowledge management processes that can be utilized in projects. One is codification in which the process often centers computers. The knowledge is first codified and stored in databases from which it can be then utilized. The other type is personalization in which the process centers an individual. The knowledge is tied to people and shared in person-to-person contacts. In many cases, however, both of these knowledge management processes are used together.

Scheiber et al. (2000: 71) introduce one knowledge management cycle. It consists of seven phases: identify, plan, acquire / develop, distribute, foster / use, maintain / control quality, and dispose (see Figure 7).

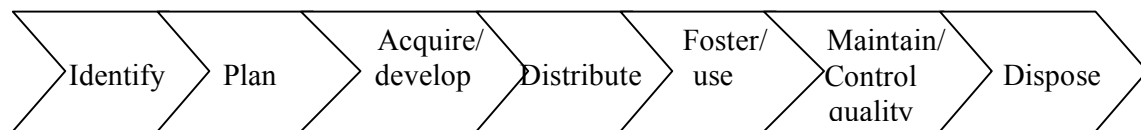


Figure 7. Activities in knowledge management and the associated knowledge-value chain (Scheiber et al. 2000: 71).

In identifying phase the existing knowledge within and outside of the organization is recognized. In the next phase it is planned what knowledge will be needed in the future. After this the needed new knowledge is either developed within the organization or acquired from the outside and distributed wherever it is needed. In the following phase the knowledge is applied in business processes. While being used, the knowledge must be maintained and its quality controlled. Finally, at some point when the knowledge is no longer needed, it has to be disposed. (Scheiber et al. 2000: 71–72.)

According to Turner (2005: x) the knowledge management in traditional organizations consists of three steps: variation, selection, and retention. New ideas are

created within the function, the best of the ideas are utilized and then the knowledge is stored in the function where it can easily be reused. In project environment, the new ideas are created in temporary projects that cannot select or retain new ideas. Also storing the knowledge is an open question. Since the project organization stops existing when the project ends, where is the knowledge stored and who may use it?

Nonaka and Takeuchi have introduced in 1995 (62-70) their famous model of knowledge creation (SECI model) that is based on the interaction between tacit and explicit knowledge. The four processes included in the model are socialization, externalization, combination, and internalization (see Table 3).

Table 3. Four modes of knowledge conversion (Nonaka and Takeuchi 1995: 62).

	Tacit knowledge	To	Explicit knowledge
Tacit knowledge	Socialization		Externalization
From			
Explicit knowledge	Internalization		Combination

In the socialization process tacit knowledge is turned into tacit knowledge possessed by others by sharing experiences. Knowledge transferred in this process is typically either skills, the apprentice learning from the master in practice, or mental models, for example a new-comer learning the culture of the organization. According to Nonaka and Takeuchi (1995: 64) socialization occurs also between product developers and customers: *“interactions with customers before product development and after market introduction are, in fact, a never-ending process of sharing tacit knowledge and creating ideas for improvement”*.

Externalization is a process in which tacit knowledge is turned into explicit knowledge. This helps sharing the knowledge with others. However, turning tacit knowledge into adequate and consistent concepts is not an easy task. Therefore metaphors and analogies are used. According to Nonaka and Takeuchi (1995: 66)

externalization is the key process for creating new knowledge because it creates new explicit concepts from tacit knowledge.

In combination process parts of existing explicit knowledge are combined in new ways. It is a process of systemizing concepts into knowledge system. Reconfiguration of explicit knowledge in documents, databases etc. can be done by sorting, adding, combining, and categorizing. The combination process can lead to new knowledge. (Nonaka and Takeuchi 1995: 67–69.)

In internalization process tacit knowledge is attached into a part of a person's mental models which means that it is turned into tacit knowledge. When such a mental model is shared by most members in the organization, it becomes a part of the organizational culture. According to Nonaka and Takeuchi (1995: 69–70) this process is closely related to 'learning by doing' but it does not necessarily include a person actually experiencing or doing something, it can also be done by listening or reading stories and experiences of other people. However, it helps the process if the knowledge is verbalized or diagrammed into documents, manuals or stories.

In each of the four processes new knowledge can be created though the nature of the processes and the created knowledge are different. In socialization process sympathized knowledge is created, externalization leads to conceptual knowledge, combination creates systemic knowledge and internalization gives rise to operational knowledge. Nonaka and Takeuchi (1995: 70–73) describe the relationship between the four processes as a spiral. After the tacit knowledge has been shared in socialization process, it should be turned into explicit knowledge in externalization process. This explicit knowledge can then be combined into new explicit knowledge. After this the new knowledge is again turned into tacit knowledge in internalization process and in order it to be shared through the organization, socialization process is needed. And the cycle begins again.

Liebowitz (2005: 6) introduces the knowledge management cycle consisting of four major stages (see Figure 8): knowledge identification and capture, knowledge sharing, knowledge application, and knowledge creation. Existing knowledge is first identified and captured. After that it can be shared throughout the organization and applied in

combination with the old knowledge. New knowledge can then be created based on the used one and captured again and the cycle goes on.

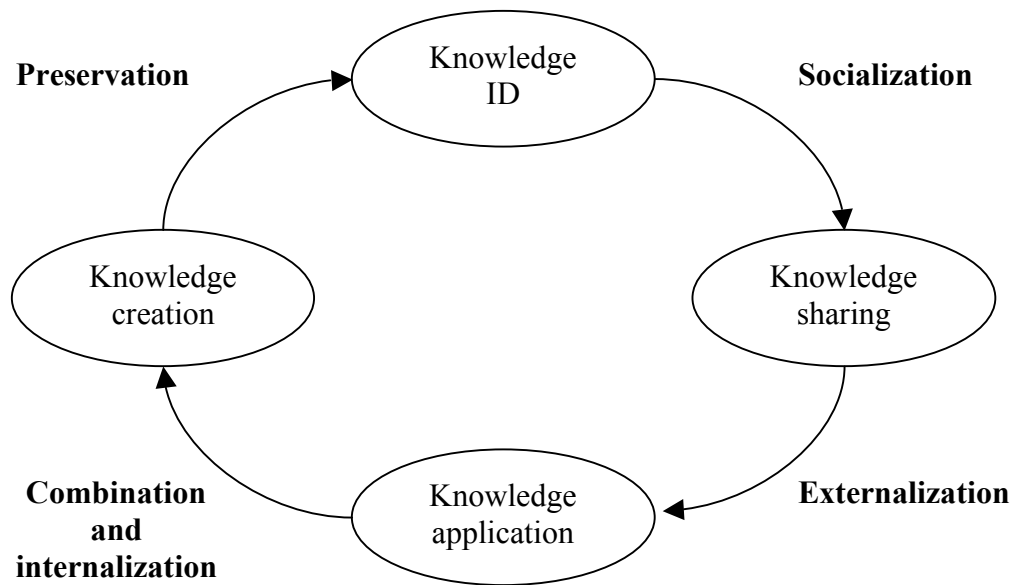


Figure 8. The knowledge management cycle (Liebowitz 2005: 6).

Liebowitz (2005: 6) also combines these stages with the SECI-model of Nonaka and Takeuchi (1995). Once the knowledge is captured and codified in some way in the first place socialization happens and results knowledge sharing. After this process knowledge becomes externalized and can be applied. The next phase is combining the knowledge with other knowledge and also internalization of the knowledge. This should create new knowledge that needs to be preserved and can be captured and the cycle begins again.

Fong (2005b: 46) suggests that the social construction perspective of knowledge as a set of shared beliefs constructed through social interaction should be added to the model of Nonaka and Takeuchi (1995). This means that both individual and social levels should be taken into account. According to Fong (2005b: 46–47) if the elements of social construction and communication are added into the model of Nonaka and Takeuchi, three modes of knowledge creation can be distinguished: knowledge sharing, knowledge integration, and collective project learning.

Knowledge sharing process can happen either directly without language (socialization) or with language (externalization). Knowledge integration is needed to combine different knowledge both existing within the project as well as outside of the project. Learning is related to internalization process, usually there is a strong emphasis on converting tacit knowledge into explicit but internalizing the new knowledge is not supported. In his model of knowledge creation in multidisciplinary projects (see Figure 9) Fong (2005b: 52) introduces two more processes that are related to knowledge creation: boundary crossing and knowledge generation.

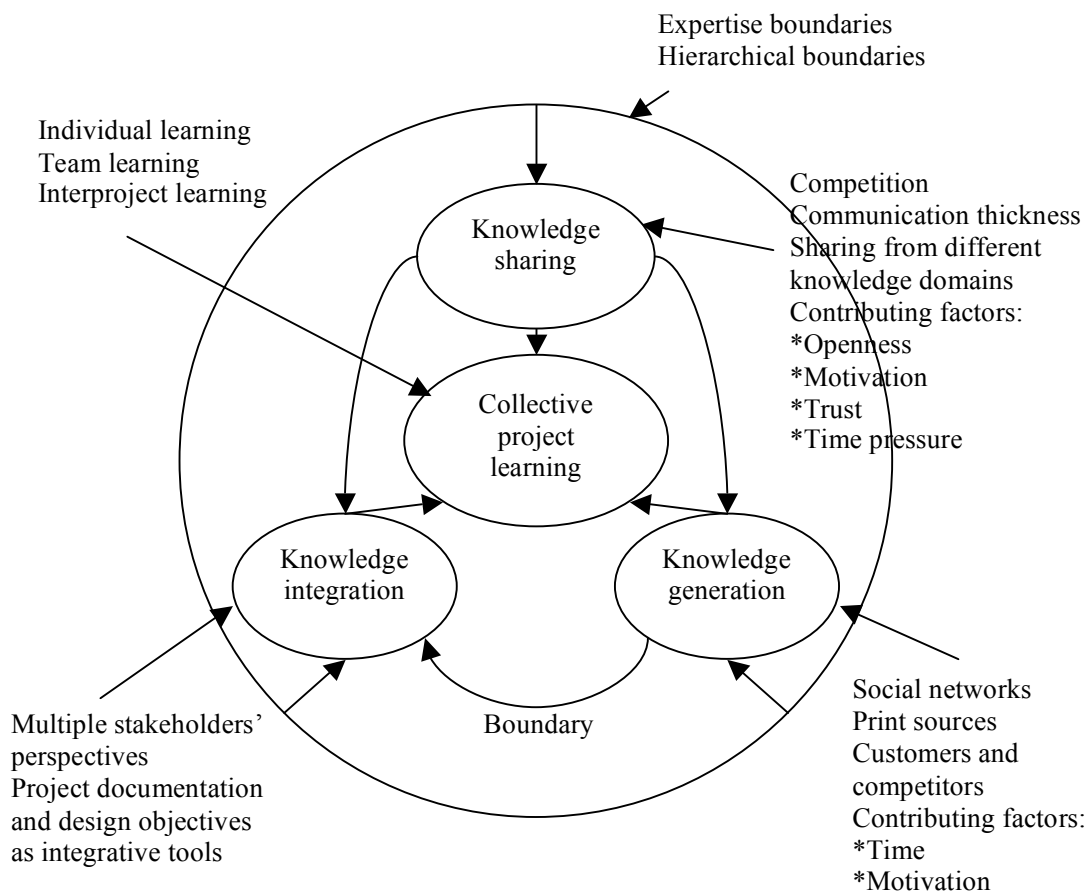


Figure 9. The interrelationships between multidisciplinary knowledge-creation processes (Fong 2005b: 52).

The first process of knowledge creation is boundary crossing. In his research Fong (2005b: 49) identified two types of boundaries: one between team members of different disciplines and another one between clients, consultants, and contractors.

Team members should be able to cross these boundaries in order to be able to exchange and combine knowledge with other team members.

The next process is knowledge sharing. According to Fong (2005b: 49) project team members that possess different knowledge are more likely to discuss it than those with similar knowledge bases. He also states that “*the type of communication appeared more influential in the transfer of tacit knowledge than in that of explicit knowledge. For tacit knowledge to be effectively transmitted, interpersonal communication seemed of the utmost importance*”. The third process happening is knowledge generation in which teams create knowledge by generating new or ‘emergent’ knowledge through interaction and communication. (Fong 2005b: 49–50.)

The fourth process is knowledge integration. In this process different views from several stakeholders are considered when making decisions. And finally, the last process is collective project learning. In this phase experts learn from the projects they are engaged to. Project team members have constantly new things to learn. This learning can be utilized later in the same project or in other projects. (Fong 2005b: 50–51.)

4 Individual and organizational learning

In this chapter the concepts of individual learning and organizational learning will be introduced and different perspectives to both will be explored. Also the connections between learning and organizational learning will be briefly presented. Special attention will be paid to social construction perspective to organizational learning.

4.1 Individual learning theories

There are several theoretical learning perspectives that are utilized as numerous practices in different contexts even today. These perspectives include the following: behaviorism, social learning theories, cognitive perspective, experimentalism, and humanism. None of these perspectives consists of one united theory, but they are rather more or less “umbrella concepts” for several theories that have similar background and / or features. It is also important to note that drawing the line between different theories is not always easy and the terminology often varies from one writer to another.

4.1.1 Behaviorism

Behaviorism is based on psychological learning perspective that seeks to explain human behavior by examining how humans learn. The basis for behaviorism is that the purpose of any living organism is to adapt to the environment in which it is living. An organism meets stimuli and responds to them. This is happening again and again and perhaps different responds are carried out. When the result is positive to the organism, it learns that this certain response is useful and when the result is negative to the organism, it learns to avoid that way of reacting. Thorndike (1931: 101) formulated this in ‘law of effect’ based on the observations that animals tend to repeat those actions that lead to satisfactory results for them. (See also e.g. Järvinen, Koivisto and Poikela 2002: 81–84; DeFilippi and Ornstein 2003: 21.)

It was typical also for the other early representatives of behaviorism, e.g. John B. Watson and B.F. Skinner to base their findings on the work with animals (see e.g. O'Donohue and Fergusson 2001 for more about Skinner and his 'radical behaviorism'). It was important that the research concentrated only on the performance that could be objectively observed, because behaviorism assumes that it is not possible to acquire objective information about what is happening in a person's (or an animal's) mind. (Tynjälä 2002: 29.) As Ivan Pavlov, one of the early behaviorists, wrote (1928: 329): "*...but though the right of existence of human psychology be granted, there is no reason why we should not question the necessity of animal psychology. Indeed, what means have we to enter into the inner world of the animal!*"

Pavlov's experiments with dogs are well-known examples of behaviorism, classical conditioning specially. In classical conditioning an unconditioned stimulus and its correspondent response are paired with a conditioned stimulus that comes to cause a similar response. In operant conditioning behaviors are supported or reduced by giving prizes or punishments. (See e.g. Babkin 1974 for more about Pavlov's work.) A great deal of teaching at schools is based on these principles, when a student memorizes the right things and writes them down in an exam, she gets praises and good marks, which guides her to learn exactly that information and skills that she is wanted to learn.

4.1.2 Cognitive learning perspective

Cognitive learning perspective is based on the cognitive psychology that tries to explain humans by understanding their thinking, reasoning, and memory, their mental models, that is: their cognitions. Learning is seen as building one's cognitions. (DeFilippi and Ornstein 2003: 22.) One of the early models of cognitive development of a human is done by Jean Piaget. According to her (see e.g. Piaget and Inhelder 1977) a child goes through four stages when her cognitions are been developed. These stages are representational thinking, increased use of symbols and language, concrete understandings of the physical world and abstract understandings of ideas and reasoning.

Radical constructivism is one example of cognitive learning perspective. Sometimes also the name cognitive constructivism or strong constructivism is used (see e.g. Derry 1996). The basic assumption that is behind radical constructivism (and therefore the ‘radical’ in the name) is the epistemological idea that knowledge does not represent reality in an objective way, within knowledge there is always a subjective interpretation (Confrey 1995: 194).

People have cognitive maps, schemes, that represent their knowledge and understanding about the world around them and about possibilities that they themselves have in that environment at a certain moment. This means that different people have different cognitive maps and that the same person’s map changes during the time as a result of learning. The quality of the map affects on what kind of information the person is looking for and what is she ready to learn. (Confrey 1995: 196-198; Derry 1996: 165). Besides scheme, two other important concepts for radical constructivism are assimilation and accommodation. Assimilation means adding a new piece of information to an existing scheme. Accommodation is needed when the new experience is in contradiction with the existing scheme. In this kind of situation the existing scheme has to be altered. (Derry 1996: 165.)

4.1.3 Social learning theories

Social learning theories have features from both psychological learning perspective and cognitive psychology. Whereas behaviorism implies that human has to experience personally the consequences of her behavior, social learning theories broaden the view by suggesting that one can also learn by observing how others behave and what the consequences of their behavior are. (DeFilippi and Ornstein 2003: 21–22.) On the other hand, whereas cognitive learning perspective concentrates on an individual learner and her cognition social learning theories state that the social interaction and giving meanings that is embedded in it are essential for learning (Wertsch and Toma 1995: 159; Marshall 1996: 237). Bauersfelt (1995: 140) sees a change in many disciplines and cites Resnick (1989): “*First, learning is a process of knowledge construction, not of knowledge recording or absorption. Second, learning is*

knowledge-dependent; people use current knowledge to construct new knowledge. Third, learning is highly tuned to the situation in which it takes place”.

Sociocultural approaches form one subcategory of social learning theories. These approaches emphasize the role of cultural, historical and institutional contexts in learning. Particular emphasis is on speech, ‘mediation’. Sociocultural approaches lie heavily on the research by Russian Vygotsky. (Wertsch and Toma 1995: 160; Daniels 2004: 1.) One of the Vygotsky’s central themes is that *“a defining feature of human mental functioning is that it is mediated by tools and signs”* (Wertsch and Toma 1995: 163). This mediation happens both in intermental (referring to social dimension of consciousness) and intramental (referring to the individual dimension of consciousness) planes. Vygotsky believed that higher mental functioning has its origins in social processes and therefore the social dimension of consciousness is primary. (Wertsch and Toma 1995: 161–163; see Daniels 2004: 13–20 for more about mediation.)

Prawat (1996: 117) argues that the work of Vygotsky is today interpreted in different ways by different groups of researchers. One group focuses on dyadic interaction where *“a more knowledgeable “other” structures the learning experience in a way that allows the novice to overcome whatever limitations in skill might impede his or her attainment of desired goal”*. There is also another group that concentrates on the basic assumption that knowledge is a social construct, a collective entity.

Another subcategory of social learning theories is social constructionism (sometimes also used social constructivism). However, social constructionism can also be placed under the cognitive learning perspective. Like sociocultural approaches, also social constructionism emphasizes the social aspect of learning, both emphasize the interaction and dialogue in learning. The main difference between the social constructionism and Vygotskian theory is that for Vygotsky the psychological processes are the most important thing whereas social constructionism concentrates on social interactions. (Tynjälä 2002: 57.) Social constructionism is often related to work of Berger and Luckmann (Gergen 1995: 27). According to Berger and Luckmann (1972) the reality is a social construct that is been created and modified in the interactions between humans. *“Everything is wrapped up in language. Individuals*

as well as objects and events in the world exist within a cocoon of language” (Prawat 1996: 222).

4.1.4 Experimentalism and humanism

Experimentalism explains learning as a result of concrete experience – observations / reflection – abstract conceptualization / generalization – action / testing -cycle. One early developer of experimental learning theory is David Kolb. According to him (1984) all begins when a human experiences something concrete (concrete experience). After this she starts to reflect her experience, to think about what it means (reflective observation). The following step is understanding which may lead either to generalization or abstract conceptualization. After this the learner will actively test, apply in practice her ideas (active experimentation). Finally this leads to learning experience (see more about Kolb’s work in the Chapter 4.2.2.3). One practical example of experimental learning is problem-based learning that is utilized e.g. in medical training (Järvinen et al. 1991: 88–91).

Humanist learning perspective was born to revoke behaviorist view to learning. The basic idea was that a human is not an animal that behaves under the same conditioning laws as animals do. Humans have consciousness and intellectual, linguistic, and moral needs that make their learning totally different than what behaviorists claim. The core of the humanism is, however, dialogue and interaction between the teacher and the students or between the facilitator and the group. Also the learning needs of the students and their self-direction are core issues of humanism. (See e.g. Järvinen et al. 1991: 91–93.)

4.2 Organizational learning

Organizational learning, just like learning, does not constitute a one clear coherent theory but several different perspectives can be found within the organizational learning theory. These perspectives vary in several characteristics, e.g. who is considered to be the learner, what is the learning process like, is it e.g. a cognitive or a social process etc. Two ways to try to capture the essence of organizational learning

will be introduced here. Firstly, Huysman's (2000) research about biases in the organizational learning literature will be reviewed because it introduces quite well the different characteristics of organizational learning. Secondly, different perspectives of organizational learning according to DeFillippi and Ornstein (2003) will be explored with several examples in order to gain understanding about the nature of organizational learning.

4.2.1 Characteristics of the organizational learning

One way to look at organizational learning is to examine what kinds of issues are addressed in the literature dealing with it and how these issues are covered. Huysman (2000) provides a framework of four learning biases within the organizational learning literature (see Table 4). These biases can be defined by the following questions related to learning: who is learning, how, when and why.

Table 4. Learning biases (Huysman 2000).

Who learns?	Individual learning bias	Individual Organization ←Y-----X-----→
How do they learn?	Active agency bias	Voluntarism Determinism ←Y-----X-----→
When do they learn?	Purposeful learning bias	Purposeful Accidental ←Y-----X-----→
Why do they learn?	Improvement bias	Improvement Decline ←Y-----X-----→

Y = Org. learning literature in general
X = 'balanced perspective'

The individual learning bias (who) defines whether the learning is done by an individual or by an organization. According to Huysman (2000: 83–85) the learner in the literature is usually an individual. The perspective is either that an individual acts

and learns within the organizational framework or that organizational learning is a metaphor and individual learning is used as a model for understanding some collective activities. However, some authors look at organizational learning as a cultural process and they concentrate more on practices of groups than individuals.

The active agency bias (how) explains if learning is voluntary or at some way determined. According to Huysman (2000: 85) the tendency in the literature is “*to see learning as an activity in which a single learner learns from the environment and who is more-or-less free to choose how to learn, what to learn and from whom to learn*”. Huysman claims that there are at least three things that complicate the picture. The first thing is that learning is greatly influenced by the past. The second one is that there are usually some powerful dominant coalitions in organizations that act as gatekeepers deciding what knowledge is considered to be useful organizational knowledge. And the third thing is the influence of institutional forces that may affect the learner. (Huysman 2000: 85–86.)

Purposeful learning bias (when) handles the issue whether the learning is purposeful or accidental. Huysman (2000: 86) states that learning is often seen “*as an activity that deliberately takes place and thus can be planned for*”. However, she reminds that the future cannot be engineered and that organizations often face unexpected internal and external events that may have an effect also on learning. In addition to planned learning processes there are also unplanned and even unnoticed learning processes happening in organizations. (Huysman 2000: 87.)

Improvement bias (why) determines if the results of learning are considered to be good for the organization. According to Huysman (2000: 87–88) learning is usually seen in the literature in a way that it will improve the future performance of the organization. Already one of the first contributions to organizational learning, the learning curve theory, assumed that learning means improvement in organizational processes. However, it is possible that learning will end up also in zero or even negative results.

4.2.2 Different perspectives to organizational learning

Another way to review organizational learning is to build categories that represent different perspectives to learning. DeFillippi and Ornstein (2003: 23-31) have categorized organizational learning based on a review of over 70 articles from the last 15 years. The categorization is based on the extent to which the authors of the articles cross-reference one another, shared assumptions about organizational learning in the articles and suggestions of other scholars. The result was the following four categories of organizational learning:

1. information processing,
2. behavioral / evolutionary,
3. applied learning, and
4. social construction.

All of these categories consist of several different views that are based on different psychological perspectives, however, there are some certain elements that brings these views together into these categories. Each of the categories will be introduced next. Within in each category, several different issues are discussed. The three first mentioned categories will be introduced briefly based on some examples. The social construction perspective will be explored more deeply because it presents the main theoretical background of this research.

4.2.2.1 Information processing

Information processing views to organizational learning see organizations as systems of information. Their primary task is to improve organizational processes that mimic the processes of computation. There are two basic assumptions about learning underlying these views. The first assumption is that information, knowledge, and learning are stored in collective memory that is based on the cumulative experiences of the individuals in the organization. The second one is that there are shared mental models of interpretation that are used when giving meaning to information. (DeFilippi and Ornstein 2003: 24.)

Organizational learning theories in the information processing category have connections to both behaviorism and cognitive learning perspective. Like behaviorism

also information processing suggests that learning is the result of an adaptation process in which an individual learns from experience. However, another important assumption in information processing is sense making, the interpretation process of the information and that connects this category to the cognitive learning perspective.

Learning from experience, organizational memory and interpretation of experience

There is a strong sense of the same basic assumptions as in information processing perspective usually also in the work of Levitt and March (1988). Organizational learning is based on the experiences of individuals and it is accumulated during the time. *“The experiential lessons of history are captured by routines... they are recorded in a collective memory”* (Levitt and March 1988: 320). These lessons are later interpreted by the help of certain models, paradigms, that are shared in the organization.

Organizational learning is viewed as routine-based, history-dependent, and target oriented (Levitt and March (1988:319–320)). Generally most of things done in organizations are based on “this is the way that things have been done and also will be done” – thinking and so is learning. If e.g. new knowledge for problem solving is usually done by sending some managers to a course, this will probably be the way to do it also in the future instead of for example trying to learn from the experiences of the workers. The history-dependence means that *“routines are based on interpretations of the past more than anticipation of the future”* (Levitt and March 1988: 320). Also learning is meant to match the needs of yesterday rather than challenges of tomorrow. All organizations, both companies and non-profit organizations, have some targets they try to meet. Whether learning is trying to capture the lessons learnt from experiences or trying to gain some new knowledge via courses, it is typically somehow related to the targets of the organization.

Organizational learning depends and is based on individual memories, but there is also organizational memory. It is needed to make sure that what is learnt will stay in the organization also when individuals change. Therefore learning from individual experiences is *“recorded in documents, accounts, files, standard operating procedures, and rule books; in the social and physical geography of organizational structures and relationships; in standards of good professional practice; in the*

culture of organizational stories; and in shared perceptions of the way things are done around here” (Levitt and March 1988: 327).

The information and knowledge recorded in individual and organizational memory needs to be interpreted also after the original experiences are already forgotten and when new individuals come to the organization. In every organization there are stories, paradigms and frames that guide interpreting both existing and new information. However, these structures can change and it is possible that different groups in the organization favor different frames. (Levitt and March 1988: 323–324.)

Exploration and exploitation

March (1991) writes later about exploration and exploitation in organizational learning. Exploration refers to developing and seeking for new knowledge: “*search, variation, risk taking, experimentation, play, flexibility, discovery, innovation*” as March (1991: 71) states. Exploitation has more to do with utilizing the existing knowledge: “*refinement, choice, production, efficiency, selection, implementation, execution*” (March 1991: 71). Because of the limited resources companies are forced to make choices between exploration and exploitation. The question is that what would be the ideal balance between these two types of organizational learning.

One of the basic assumptions in March’s (1991) work is that there’s a mutual learning relationship between the organization and the individuals in it. Organizations store their knowledge in procedures, culture, norms etc. They learn this knowledge from the individuals within the organization. However, also the individuals learn from the organization when they are socialized to these features. This assumption clearly connects March’s work to information processing category.

Absorptive capacity

Cohen and Levinthal (see e.g. 2000: 39–67) have introduced a concept of ‘absorptive capacity’. They begin by the idea that ability to acquire and utilize new information is critical for the organization’s innovative capabilities. This “*ability to recognize the value of new information, assimilate it, and apply it to commercial ends*” is called ‘absorptive capacity’ (Cohen and Levinthal 2000: 40).

According to Cohen and Levinthal (2000: 39) absorptive capacity is “*a function of the firm’s level of prior related knowledge*”. This could be simplified by saying that the more knowledge of the issue in hand the organization already has, the more likely it will understand the value of the new information and be able to utilize it. This idea is supported by the cognitive and behavioral learning perspective studies. Research on memory development suggest that new things are easily stored, recalled and used when there exists prior related knowledge because this makes it possible to associate the new information to the existing one. As Cohen and Levinthal (2000: 43) state: “*learning is cumulative, and learning performance is greatest when the object of the learning is related to what is already known*”.

There are two kinds of absorptive capacity: individual and organizational. An organization’s absorptive capacity depends on the absorptive capacities of the individuals in the organization but it is not simply a sum of them. According to Cohen and Levinthal (2000: 43–47) other issues that affect to an organization’s absorptive capacity are the structure of communication between the organization and its external environment, the communication structure within the organization, and the character and distribution of expertise in the organization. The communication structures define how well the new information is found and spread across the organization. The nature of knowledge possessed by the individuals in the organization affects both to the transfer of the information as well as to ability to utilize it. There should be some overlap of the knowledge across the individuals to ensure the internal communication but “*the interactions across the individuals who each possess diverse and different knowledge structures will augment the organization’s capacity for making novel linkages and associations beyond what any individual can achieve*” (Cohen and Levinthal 2000: 45).

After the original work of Cohen and Levinthal there has been quite a lot of work done researching absorptive capacity (for a review see Van Den Bosch, Van Wijk and Volberda 2003). The concept has been researched in individual, intermediate (e.g. team or business unit), and company level as well as in inter-organizational level. New dimensions like efficiency, scope, and flexibility of absorptive capacity have been introduced. Also new views to antecedents and organizational outcomes of absorptive capacity have been stated. (Van Den Bosch et al. 2000: 284–290.)

However, even there has been extensions drawn to original concept of absorptive capacity the basic connection between information processing perspective to organizational learning and the research of absorptive capacity still exists: the basic assumption that the new information is stored in the collective memory that is based on the experiences of the individuals and the use of it depends on the existence of related knowledge.

Organizational forgetting

De Holan and Philips (2003) discuss a matter that is not so much dealt with in the organizational learning literature: organizational forgetting. They argue that organizational forgetting is another side of organizational learning. It can sometimes be positive: organizations need to forget some things, and sometimes it is negative: organizations forget things that they should not forget. (De Holan and Philips 2003: 393-394, 397-398.) Also in the work of De Holan and Philips (2003: 396) there is a strong sense of information processing perspective: “*organizational learning produces organizational knowledge that is in turn stored in organizational memory*”.

According to De Holan and Philips (2003) there are three different modes of organizational forgetting: the inability to integrate new knowledge, the deterioration of stored knowledge, and forgetting as knowledge management. The basic idea is that knowledge can be lost before it is stored to the organization’s memory or lost from the memory, either by accident or by purpose (see Figure 10). (De Holan and Philips 2003: 398, 401–404.)

In the first mode the storing the new knowledge in the memory fails. The new knowledge is either transferred to the organization from outside or it is created in the organization, so that it actually is available in the organization for some time, but for some reason it is not stored to the memory. According to De Holan and Philips (2003) it is easy to transfer new knowledge or create it but storing it in the memory is a difficult task and the result are often imperfect. (De Holan and Philips 2003: 401–402.)

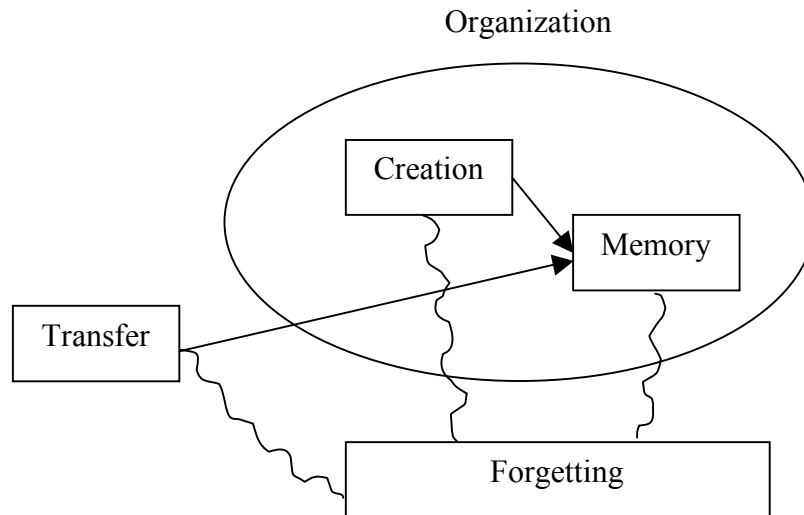


Figure 10. Modes of organizational forgetting (De Holan and Philips 2003: 396).

The second mode deals with the situation after the new knowledge is stored into the memory. Many researchers view learning as linear and cumulative process: once something is learnt, it will stay in the memory and new learning is based on the existing knowledge. However, De Holan and Philips (2003) suggest based on their observations that after a while knowledge actually degrades. They state that in order to keep the knowledge, it has to be “maintained”. (De Holan and Philips 2003: 402–403.)

The third dimension of forgetting deals with cases of “*voluntary forgetting, that is, forgetting that is actively desired by the organization, although not always achieved*” (De Holan and Philips 2003: 403). This kind of forgetting can be found for example in situations when old, “bad” habits should be forgotten so that new, better ones can be applied. De Holan and Philips (2003: 404) suggest that when organizational learning is wanted, there should be organizational forgetting presence because organizational learning often requires that old routines are replaced by new ones.

4.2.2.2 Behavioral / evolutionary theories

Behavioral theories focus typically on how organizational routines and systems behave and change as a respond to the organization’s own experience and to the experience of other organizations (DeFillippi et al. 2003: 26). It is typical for this view to organizational learning that learning is truly seen to happen on organizational

level, organizations learn from what is happening within the organizations or outside of the organizations and this knowledge is encoded into organizational routines. This learning is strongly affected by historical events and it is independent of individuals in the organization. Consequences is the factor that most affects learning.

Behavioral organizational learning theories have connections to individual behavioral theory, they both see learning as some kind of adaptation process: something happens in the environment and learning happens as a result of the individual / organization trying to survive. However, behavioral approach to organizational learning has also connections to cognitive learning perspective, in both cases e.g. the future learning is build on the cumulative learning that has happened in the past. This way the past is shaping the future learning.

Chains of behavior and their performance consequences

Herriot, Levinthal and March (1985) present a set of models for examining the evolving chains of behavior and their performance consequences by computer simulations. They see learning as an incremental experiential process that results from adaptive behavior. There are certain rules in organizations that help decision making. However, these rules are not stable but they are modified according to successful and not successful decisions.

There are a few assumptions in the models of Herriot et al. (1985) that clearly connect their work to behavioral organizational learning category. The first one is that the outcome of a current choice is somehow dependent to the history of choices. Another assumption is that the current goal relies on the past goals and the past performance. That is, the consequences of the past actions affect on what will be done in the future. However, learning is not a result of only the own actions of the organization but they can also learn from the experience of others. The others influence the behavior of the organization also by presenting competition, co-operation etc. (Herriot et al. 1985: 299–300.)

As results Herriot et al. (1985) state that in some cases this kind of learning process actually leads to optimal choices for the organization. However, there are some cases in which the results are not so good. It also seems to be true that the initial decisions

and competences have a great effect to the end results as the assumption was. It was also found out that increasing the degree in which the future decisions were based on the past success and failure didn't have much of a positive effect on the performance. (Herriot et al. 1985: 302.)

Evolution of dynamic capabilities

Zollo and Winter (2002) discuss the evolution of dynamic capabilities in organizations. According to them, there are two kinds of activities in organizations: operational routines and dynamic capabilities. Operational routines are the day-to-day functions of the organization, both staff and line activities. The dynamic capabilities, however, aim for improving the operational routines: "*A dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness*" (Zollo and Winter 2002: 340). In stable environment that changes slowly, the key to the success of an organization is typically effective line activities. The importance of dynamic capabilities emphasizes in environment where changes are rapid because they help reacting those changes.

Zollo and Winter (2002: 340) claim that these dynamic capabilities are a product of three learning mechanisms: experience accumulation, knowledge articulation and knowledge codification. Organizational routines are shaped both straight by these learning mechanisms and by the dynamic capabilities that these learning mechanisms create (see Figure 11).

Experience accumulation means the traditional way of 'trial and error' –learning in which organizations react to some stimulus and learn by notifying whether the result is positive or negative. Knowledge that is meant when talking about experience accumulation is tacit and the process is usually not very conscious. The knowledge is then stored into organizational routines. (Zollo and Winter 2002: 340–341.) This part of the research by Zollo and Winter (2002) is clearly related to behavioral learning theories.

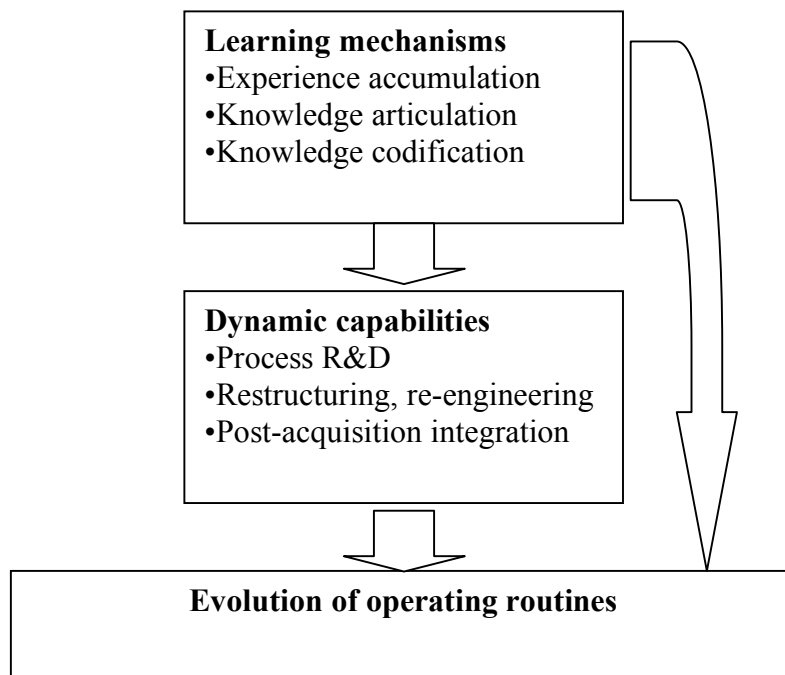


Figure 11. Learning, dynamic capabilities, and operating routines (Zollo and Winter 2002: 340).

However, Zollo and Winter (2002: 341) argue that another important side of learning in organizations is often not appreciated enough: “*the deliberative process through which individual and groups figure out what works and what does not in the execution of a certain organizational task*”. Knowledge articulation refers to this process, it means those collective discussions, lessons learnt capturing sessions etc. in which individual share their experiences, articulate their implicit knowledge and gain new understanding about different issues. While knowledge articulation requires higher level cognitive efforts than what is typical in behavioral learning theories, this part of the work by Zollo and Winter (2002) relies on cognitive tradition.

Also the third learning mechanism, knowledge codification, requires higher level cognitive efforts. The codification process is the next step of knowledge articulation: in codification process results of knowledge articulation are written down in manuals, databases, decision support systems and other tools to guide future actions. Clearly, not all issues of knowledge articulation will be codified, because of the huge amount of recourses that codification requires. (Zollo and Winter 2002: 342–343.)

Zollo and Winter (2002: 349) suggest that the knowledge codification process is the key mechanism for accumulating expertise also in those tasks that are heterogenic and not frequent. It seems natural that for example production planning that is done constantly and always by same basic principles, codification of this process is useful in spite of the recourses required, because it can make the process more effective. However, according to Zollo and Winter (2002: 349) organizations should also codify processes like acquiring new production capacity by building a new production line or a factory even though these activities are not likely to happen many times. The reason for this is that though the output of the codification process may not justify the codification cost, the learning benefits of the codification process itself might do that. *“Codification efforts force the drawing of explicit conclusions of experience, something that articulation alone (much less experience alone) does not do”* (Zollo and Winter 2002: 349).

Critique to behavioral theories

Weick (1991) claims that applying the traditional definition of learning, according to which learning is a changing response to a stimulus that remains the same, that is learning to use a new response, to organizational learning leads to problems. The reason for this is that the condition of the same stimulus – different response is rare in organizations, which means either that the organizations do not learn or that they learn in some other ways. The environments of the organizations are often unstable so the stimuli often change. And if the stimuli remain the same, it is typical for the organizations to create routines and patterns that keep also the responses the same. It is also possible that even if the response for the same stimulus changes the reason is other than learning, for example turn-over of the personnel or simply forgetting which response was used earlier. (Weick 1991: 116–119.)

According to Weick (1991) there are two ways to overcome these problems. In the first strategy the definition of learning is kept the same and it is acknowledged that learning in organizations is rare. It is also possible to try to find certain types of organizations that support this kind of learning. The other strategy leads to change the definition of learning. Weick (1991) proposes e.g. the definition of learning as a process in which knowledge is created. Learning can also be investigated in two different levels: even though the response to the same stimulus in organizational level

stays the same, the routines themselves may be developed when the response in individual level has been changed. This is the case in learning curve effect. (Weick 1991: 119–122.)

4.2.2.3 Applied learning

Applied perspectives to organizational learning suggest that there are two factors that are needed for improving learning practices in both individual and organizational level: direct experience and intervention by a trained facilitator or a consultant. Learning is based on experience gained in real life situations. A facilitator is needed to help reflecting the experience. (DeFillippi et al. 2003: 29.)

Project-based learning

Different variants of project-based learning represent applied learning theories. In project-based learning the objective is to utilize experience from real-world projects and use it for learning purposes in the environment that more or less supervised by a facilitator. At one end of the continuum there is project-based learning that is used at schools, where the projects may be made up and the role of the facilitator is large and at the other end e.g. many project-organized companies utilize project-learning interventions after projects end to capture ‘lessons learnt’ to the company database so that they could be later used by other members of the organization. (DePhillippi et al. 2003: 29.)

Keegan and Turner (2001) have researched organizational learning in project-based organizations. According to them “*project teams are an important potential site for organizational learning*” (Keegan and Turner 2001: 79). They argue that there exist a number of practices for promoting learning in project-based organizations but the quality of these practices is often not very high. Most of these practices aim for retention, the use of routines already existing in the organization. The processes of variation and selection, that means processes related to creating and utilizing new knowledge, however, are much more rare, specially in engineering, procurement and construction industries. (Keegan and Turner 2001.)

The main characteristics hindering learning are time pressures, centralization and deferral. Keegan and Turner (2001: 92) state that “*time is a key resource that people*

must have in order to develop reflective learning practices and operate effective feedback mechanisms in project teams". When people do not have enough time for this during the project and when they are moving to a new project straight after the end of the first project, organizational learning does not take place. Centralization refers to a tendency to keep recourses for promoting learning controlled by senior members of the hierarchy. This signals to other members of the organizations that learning is not the responsibility of everyone in the organization. Deferral is caused by the fact that learning practices usually concentrate learning at the end of projects. The reflection would be more effective when done just after things actually happen, not when it is done after the project is finished. (Keegan and Turner 2001: 93.)

Project-based learning theory is mainly based on the cognitive psychology (DeFillippi 2003: 29) and it is closely related to constructivism and experimentalism that both emphasize the role of the concrete experience for learning. The experiential learning theory introduced by Kolb (1984) is presented in more detail in the following chapter.

Experiential learning

Kolb (1984) has introduced one of the most well-known theories of experimentalism: "experiential learning". He states that even this theory is differentiated from other cognitive theories and behaviorism by emphasizing the meaning of experience, it is not supposed to be a "third alternative" but rather a "*holistic integrative perspective on learning that combines experience, perception, cognition, and behavior*" (Kolb 1984: 21).

Kolb's theory is based on the work by Lewin, Dewey and Piaget, who all have developed a four-stages-learning model. Lewin's work is related to action research and laboratory training and the four stages of his model are: 1) concrete experience, 2) observations and reflections, 3) formation of abstract concepts and generalizations, and 4) testing implications of concepts in new situations. In Dewey's model the stages are: 1) impulse, 2) observation, 3) knowledge, and 4) judgment. Even though the names of the stages are different from the Lewinian model, the learning process in both cases is very similar. Piaget's model presents the development of a human from infancy to adulthood. The stages in her model are: 1) concrete phenomenalism, 2) internalized reflection, 3) abstract constructionism, and 4) active egocentricism.

According to Piaget the development happens in the cycle of interaction between the individual and her environment. This idea exists also in the models of Lewin and Dewey. (Kolb 1984: 21–25.)

A depiction of Kolb's model can be seen in the Figure 12. The learning process begins with here-and-now, concrete, experience. Reflection of this experience and data and observations that are related to it lead then to conclusion that may take the form of new abstract concepts or generalizations. These conclusions are then used in deciding about the next action, testing the new concepts in new situations. This again leads to new experience which begins a new learning process.

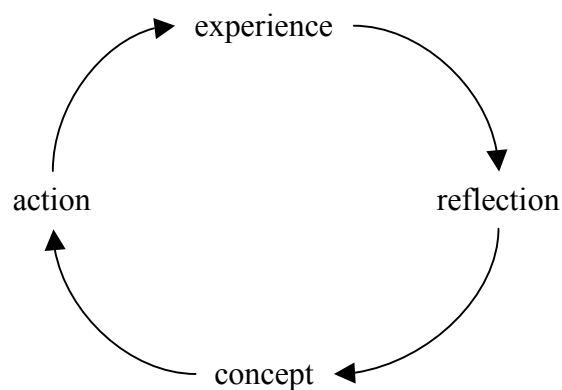


Figure 12. Kolb's experiential learning model.

Based on the model Kolb suggests several characteristics for learning. He states that because learning is a continuous process based on the experience and reflection, it should be looked at as a holistic process instead of putting the main emphasis on the outcomes. The continuousness means that all learning is relearning. The existing experience and knowledge the learner possesses always affect on the learning process. (Kolb 1984: 26–29.) Further, Kolb claims that in the learning process a conflict is needed: *“All the models above suggest that the idea that learning is by its very nature a tension- and conflict-filled process. New knowledge, skills or attitudes are achieved through confrontation among four modes of experiential learning”* (Kolb 1984: 30). This means e.g. that there may be a conflict between the new concepts and the concrete experience and by solving this conflict an individual learns.

Kolb also suggests that learning is the major process of human adaptation to the world. It is not restricted to a certain place like class room or to a single human functioning such as cognition. It happens all the time in every place and involves all human functioning: thinking, feeling, perceiving, and behaving. (Kolb 1984: 31–34.) This also means that interaction between an individual and her environment, that is teachers, co-learners or -workers, family etc., is an essential part of the learning process (Kolb 1984: 34–36).

The last character of learning is according to Kolb the connection between knowledge and learning. He states that *“to understand knowledge, we must understand the psychology of the learning process, and to understand learning, we must understand epistemology – the origins, nature, methods, and limits of knowledge”* (Kolb 1984: 37). The conclusion is the definition of learning: *“Learning is the process whereby knowledge is created through the transformation of experience”* (Kolb 1984: 38).

Action science

Also different variants of action science represent applied learning theory. Action science is originally based on the work of Kurt Lewin (1946) and *“implied in its moniker is the assumption that knowledge will be used in the service of action”* (DeFillippi et al. 2003: 30). The basic idea of action science is that in order to learn people need to carefully reflect on the mental models they have because these models may cause defense and hinder learning. In the initial approach of action science a clinical intervention by a facilitator was presumed, later versions tend to be more informal. (DeFillippi et al. 2003: 30–31.)

Argyris (2000: 279) states that problem solving and learning are not the same thing. He has introduced with Schön (see e.g. Argyris and Schön 1996: 20–24) the concepts of ‘single loop learning’ and ‘double loop learning’. Single loop learning is basically problem solving: individuals learn by finding new, more effective ways of doing things. This all happens within the existing culture and norms of the organization. Double loop learning is learning from the single loop learning experience. It is asking the “why –questions”: “why do I solve problems this way?” or “why do I have these objectives for problem solving?”. The objective of the double loop learning is to

evaluate and change the norms and procedures that guide the actions. (Argyris 2000: 279–280.)

Argyris (2000) claims that the only learning that usually happens in organizations is single loop learning. This is because the existing norms are so strong and people have too strong defensive mechanisms, mental models, that hinder the learning. If the result of single loop learning is not positive, people begin to blame the circumstances and other people instead of trying to find out what they did wrong themselves. *“It [double loop learning] is a reflection how they think – that is, the cognitive rules or reasoning they use to design and implement their actions... Defensive reasoning can block learning even when the individual commitment is high”* (Argyris 2000: 280, see for more about defensive reasoning Argyris and Schön 1996; Argyris 1999).

It seems to be somehow paradoxical that even individuals would like to do their best, would like to improve their work and would like to learn, they still cannot. Argyris (1985: 79–92) introduces the concepts of ‘espoused theory’ and ‘theory in use’ to explain this paradox. The espoused theory represents the values and beliefs that we think are guiding our behavior, like the true wish to learn and improve our behavior. However, there is another set of values and belief that actually guides our doings, specially when something goes wrong. And this is the theory in use. *“The theory in use, however, is the most powerful and the one that we are usually unaware of”* (Argyris 1985: 80).

The key for true learning is according to Argyris (1985; 2000) that these theories in use have to be espoused so that people become aware of them. Another issue is to create such an atmosphere that people do not feel they need to be so defensive, an atmosphere in which it is ok to be also wrong. An outsider is often needed to help open the situation.

Action science is built on several different psychological perspectives and has thus connections to different individual learning perspectives. The concept of the single loop learning is for example closely related to behaviorism: responding to a stimulus that is in this case a problem. The idea of mental models guiding behavior is on the other hand connected to cognitive learning perspective.

4.2.2.4 Social construction

Learning as a social process is one of the basic concepts in the wide range of learning theories. It has been discussed under several different “names”, e.g. ‘situated learning’ (e.g. Orr 1990; Brown and Duguid 1991; Richter 1998; Bresnen et al. 2005a), ‘practice-based learning’ (e.g. Gherardi 2000) and ‘learning as cultural processes’ (Cook and Yanow 1993, Yanow 2000). All these names emphasize different important characters of the learning process. Firstly, learning always has a context so it is ‘situated’. Information or knowledge without a context is hard to learn and difficult to use. As Elkjaer (2003: 44) says: *“the learning content is context specific, and it implies discovery of what is to be done, when and how according to the specific organizational routines, as well as knowing which specific artifacts to use where and how”*.

Secondly, learning often is most effective when it has a connection to learner’s own experience which means that it is ‘practice-based’. It is possible to learn also from books or someone else’s experience but transferring that knowledge then to one’s own work might not be easy, if possible at all. Learning also has a cultural and social aspect, the culture and other people around the learner have a huge effect on the learning process. According to Elkjaer (2003: 49–50) *“This means that the organizational actions directed to develop organizational learning cannot solely be focused on changing individuals’ ways of thinking but should be focused on the organizational context, its patterns of participation and interaction”*.

DeFillippi et al. (2003: 27) state that theories in social construction perspective *“assume that learning is embedded in the relationships and interactions between people. Learning is thus social and is grounded in the concrete situations in which people participate with others”*. Another important issue regarding social construction is sense making. The theory of ‘communities of practice’ (e.g. Lave and Wenger 2003) and the SECI model by Nonaka and Takeuchi (1995) rely on the idea of sense making (the SECI model has been introduced in the Chapter 3, communities of practice will be introduced later in this chapter) (DeFillippi et al. 2003: 27). Thus social construction perspectives to organizational learning theory are closely related to constructivism, both emphasizing the meaning of the social aspect of learning and sense making.

Social construction of knowledge

Berger and Luckmann (1972) present a deep discussion about the social construction of reality and knowledge. They concentrate on the every day life and taken-for-granted reality that we all deal with. This reality is socially constructed as well as knowledge: “*all human knowledge is developed, transmitted and maintained in social situations*” (Berger and Luckmann 1972: 15). The reality is shared by other people and interaction with others shapes it. This means that reality has both objective and subjective dimension. Also the knowledge is socially distributed, which refers to different people possessing different knowledge. In addition to possessing “the actual knowledge”, people also possess metaknowledge, knowledge about who knows what. (Berger and Luckmann 1972: 43–61.)

According to Berger and Luckmann (1972) there are two main concepts regarding social construction of reality: institutionalization and legitimation. Institutionalization turns habitualized human actions into institutions which means that a certain types of actions are performed by certain group of actors. Institutionalization process includes three phases, or ‘moments’: externalization, objectivation and internalization. Externalization and objectivation are processes in which humans produce products, construct them, that manifest themselves so that they exist in external reality. After externalization and objectivation process the product, e.g. knowledge, is available also for other humans. The third moment in this continual dialectic process is internalization. In internalization process a newcomer is socialized to these social products. (Berger and Luckmann 1972: 65–85.)

Legitimation is a process of explaining and justifying. For the ‘first generation’ it is clear why a certain institution exists because they have been participating in constructing it. However, for the ‘second generation’ the existence is not self evident. “*Legitimation ‘explains the institutional order by ascribing cognitive validity to its objectivated meanings. Legitimation justifies the institutional order by giving a normative dignity to its practical imperatives*” (Berger and Luckmann 1972: 111).

Sensemaking

Weick (1995) provides a deep presentation about sensemaking in organizations. According to him (1995: 6) “*sensemaking is about such things as placement of items*

into frameworks, comprehending, redressing surprise, constructing meaning, interacting in pursuit of mutual understanding, and patterning". Weick (1995: 11–13) argues that there are two different theories behind sensemaking: dissonance theory from social psychology and ethnomethodology. Both of these theories bring something into sensemaking but at the same time they make sensemaking robust.

According to Weick (1995: 17) there are seven distinguishing characteristics related to sensemaking process: it is retrospective, grounded in identity construction, enactive of sensible environments, social, ongoing, focused on and by extracted cues, and driven by plausibility rather than accuracy. Sensemaking is always related to making sense about things that have already happened, to explaining the outcome. Identity construction means in organizational settings that sensemaking is used in defining the environment and the position of the organization itself in it. (Weick 1995: 18–30; 76–77.)

Enactment refers to the fact that in organizational life people often produce a part of the environment they face. They interpret different things in a way that makes them behave in a certain way. Others may notice either this behavior or the change that has happened in the environment as a result of this behavior and this leads them to behave in a certain way which in turn may change something. (Weick 1995: 30–38; 78–79.) Both identity construction and enactment indicates that sensemaking process is a social process. For example organizations need other organizations to compare themselves with. There are usually also different kinds of interaction between organizations that help in the sense making process. (Weick 1995: 38–43; 79–80.)

According to Weick (1995: 81) cues are important because "*it is these cues that are assembled into the mental model. And it is these cues that are indexical and need context if they are to make sense*". External cues come to organizations from different sources, and they can be both extracted and enacted. They are enacted in the sense that when an organization makes decisions based on their beliefs, these decisions affect the feedback that the organization gets back and that in turn affects the next decisions to be made. The cues can also be extracted in the sense that when other organizations see the decisions made in one organization, they can use the same cues for their own decisions if they can make sense of them. (Weick 1995: 49–55; 81.)

Sensemaking process is also an ongoing process. Changes happen in the environment of organizations, and as stated earlier, organizations may cause some of them themselves. New cues become available and organizations must make sense of them. (Weick 1995: 43–49; 80.) Accuracy is important in sense making process but it is often difficult or even impossible to achieve. There are several reasons for this, sometimes there is for example only a limited number of information available, sometimes there is so much information that it has to somehow be filtered. So, if the reasoning fits the facts, it is often accepted even though it may not be correct. (Weick 1995: 81–82.)

Communities of practice

The whole idea of a new concept of learning begun to shape in late 1980's when Lave and Wenger worked together. They started their exploration with 'apprenticeship' and moved via 'situated learning' to 'legitimate peripheral participation'. (Lave and Wenger 2003, originally published in 1991). The 'apprenticeship' was seen both as a metaphorical concept, learners as apprentices and teachers as masters, and as a concrete form of education that was analyzed in several cases. The situated view to learning refers to the fact that learning always has a context, which is evidently clear in the case of 'apprenticeship'. Abstract knowledge itself is useless if it cannot be made specific to the situation in hand. (Lave and Wenger 2003: 29–34.)

However, Lave and Wenger (2003: 35) state that "*in our view, learning is not merely situated in practice – as if it were some independently reifiable process that just happened to be located somewhere; learning is an integral part of generative social practice in the lived-in world*". The practice happens in communities of practice that are described as "*a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice*" (Lave and Wenger 2003: 98). Communities of practice are typically informal groupings of people and often cross the boundaries of formal organizations. Wenger, McDermott and Snyder (2002: 4) define communities of practice as "*groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis*".

‘Legitimate peripheral participation’ is proposed to describe the engagement of the learner in this social practice. The term suggests that learning is not just observing and imitation but taking part in the practice. Therefore learning as ‘legitimate peripheral participation’ is both about the construction of the identity, knowledge, and skills of the learner as well as reproduction and transformation of communities of practice. A newcomer may start from a ‘peripheral’ location from the community, but as the learning is an ongoing process and changes both the learner and the community, it implies of the newcomer becoming a full member, an old-timer, of the community. (Lave and Wenger 2003: 52–58.) As Brown and Duguid (1991: 48) state: “*learning involves becoming an “insider”*”.

In the original work Lave and Wenger (2003: 40) argue that “*legitimate peripheral participation is not itself an educational form...it is an analytical viewpoint on learning, a way of understanding learning*”. However, Wenger and his associates (see e.g. Wenger 2000; Wenger et al. 2002) have later emphasize the importance social learning systems for the success of organizations. Wenger (2000: 229) argues that “*communities of practice are the basic building blocks of a social learning system*”. They have also given practical views for facilitating learning and the communities of practice within and outside of organizations.

Wenger (2000: 226) argues that in social learning systems competences are always historically and socially defined: it is not up to an individual to decide what for example a good doctor is like. However, these definitions do not always match to our everyday life experience and this creates possibilities for learning. A newcomer to a company wishes to belong to it, to fulfill the expectations and therefore she is eager to learn. But also old-timers learn, the new comers may bring some ideas or experiences that open the eyes of the old-timer to look at things from a new perspective.

Wenger (2000: 227–229) distinguishes three modes of participation in social learning systems: engagement, imagination, and alignment. Engagement refers to actual face-to-face interaction with others in the learning system. People discuss different things, solve problems together etc. Imagination means constructing images of ourselves and different communities. It helps us to create a sense of the world and us as a part of it. For example “*thinking ourselves as a member of community such as a nation requires*

an act of imagination because we cannot engage with all our fellow citizens” (Wenger 2000: 228). Alignment is to make sure that our ‘own’ activities are aligned enough with other processes so that they can be carried out. This can happen in different levels of our lives from e.g. checking that our spouse can pick up children from day care when making a doctor’s appointment to finding out what the competitors are doing when planning a marketing campaign.

Boundaries of communities of practice are usually rather fluid. Communities of practice exist within organizations, both in and across business units, as well as across organization boundaries. (Wenger 2000: 232–233; Wenger et al. 2002: 26). Wenger (2000: 233) argues that boundaries are important for two reasons: “*they connect communities and they offer learning opportunities in their own right*”. Experience and competences in different communities of practice usually vary and on the boundary these different elements meet which provides a chance for gaining new perspectives and learning.

There are three things that should be taking care of in order to gain full use of the processes that go across the boundaries: coordination, transparency, and negotiability. There should be coordination that accommodates the practices without burdening the others with the details. Boundary processes should also make it possible to see deeper than the surface of the practices: to make them transparent. This means making it possible to understand why the practices are used and why they are such as they are. Negotiability means that in order to the processes truly bridge the different communities they should provide a two-way connection. (Wenger 2000: 234.)

Wenger et al. (2002: 51) provide seven principles for cultivating communities of practice:

1. Design for evolution.
2. Open a dialogue between inside and outside perspectives.
3. Invite different levels of participation.
4. Develop both public and private community spaces.
5. Focus on value.
6. Combine familiarity and excitement.
7. Create a rhythm for the community.

Because communities of practice are typically unofficial groups, they cannot be designed in a meaning of giving them structure and assigning certain people to them but the purpose of design is to help the community to develop. “*The key to designing for evolution is to combine design elements in a way that catalyzes community development*” (Wenger et al. 2002: 53). These elements can be physical structures as well as social and organizational structures. (Wenger et al. 2002: 51–54.)

Community building requires insiders that have a deep understanding about the community issues. But it also requires outsiders that can for example have fresh views of what the community can achieve. For cultivating communities of practice it is important that there is a dialogue between these two perspectives. (Wenger 2002: 54–55.) People participate in communities of practice for different reasons and at different levels. There is typically a coordinator and active participants as well as peripheral participants and outsiders. This kind of behavior should be encouraged. (Wenger et al. 2002: 55–58.) The community practices should also involve both public spaces, meetings, web sites etc. as well as private connections, one-to-one or small group interactions via face-to-face meetings, e-mail etc. (Wenger et al. 2002: 58–59).

Communities of practice can bring value to organizations in two levels. Early value typically comes from solving current problems. As the community grows it can develop a systematic body of knowledge. (Wenger et al. 2002: 59.) However, it should not be concentrated in determining the expected value of the community of practice in advance, instead of that “*communities need to create events, activities, and relationships that help their potential value emerge and enable them to discover new ways to harvest it*” (Wenger et al. 2002: 60).

In lively community of practice familiarity and excitement are combined. Familiar thing and routines provide stability that facilitates relationship-building. Excitement on the other hand brings a sense of common adventure. (Wenger et al. 2002: 61–62.) Finally, a strong and rhythmic beat provides the community a sense of movement and liveliness. This beat is created via regular activities: meetings, web site activities, informal lunches etc. (Wenger 2002: 62–63.)

Plaskoff (2003: 166) argues that communities can not be created from nothing but “*where there is a practice, there is community*” and these communities can be build. He sees community building as people in organizations learning to learn organizationally. A key element to community building is intersubjectivity. Intersubjectivity means that there is a shared situational understanding within the group or community. (Plaskoff 2003: 165.)

Plaskoff (2003: 172) introduces three dimensions of intersubjectivity: believing, behaving, and belonging. These dimensions are based on intellectual, social, and emotional pathways to intersubjectivity. “*Believing encompasses the cognitive, thinking components of intersubjectivity*” and for believing to happen, there has to be both a shared understanding of the community practice and community identity (Plaskoff 2003: 173). Believing creates the value system and the culture for the community.

As the community develops, also a certain norms for behaving are developed among the members of the community. These norms guide e.g. the accepted ways of communication and assessing problems. In the behaving process the members of the community also create different artifacts that are used to circulate the knowledge between existing and future members. Both believing and behaving then create a sense of belonging to the community for its members. (Plaskoff 2003: 173.)

In community building process community behaviors are learnt through four phases of expanding circles of intersubjectivity (see Figure 13). This means that in each phase a larger group of people becomes community participants. In phase one the community development team creates a common understanding about what constitutes the community. This is done by defining philosophical grounds, development processes and desired behaviors for the community. In the second phase the development team begins to work with potential community members that form the core of the community. A sense of intersubjectivity concerning this specific community is formed. Next, the core team expands the intersubjectivity to a larger group of potential community members. In the final phase the community members that interact with other people develop intersubjectivity also with non-members. (Plaskoff 2003: 166–167.)

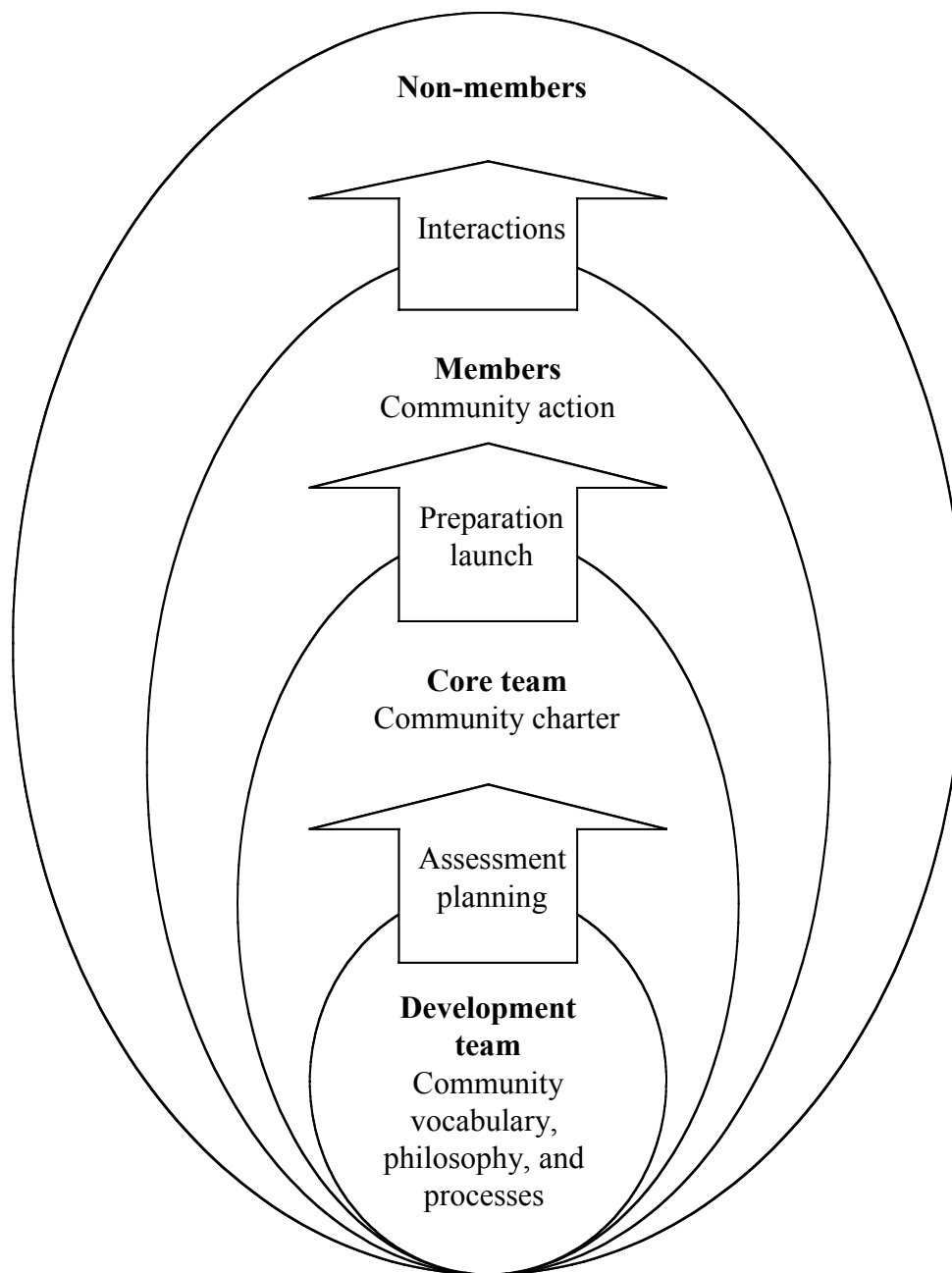


Figure 13. Expansive intersubjectivity in community development (Plaskoff 2003: 168).

Gherardi and Nicolini (2002) present an ethnographic study concerning the way of developing from a novice to a master in a building site and specially learning the competence about safety and danger. The study sees the community of practice in the building site as “*the privileged locus of learning and transmitting practical knowledge*” (Gherardi and Nicolini 2002: 191). Gherardi and Nicolini (2002: 193) argue that even though the workers participate in courses where they are taught safety

issues, they soon forget it all when they return to building sites, so the actual learning must happen in another setting. This setting is the workplace and learning is not understood as acquisition of knowledge but development of identity based on the interaction in social processes (Gherardi and Nicolini 193–194.)

Gherardi and Nicolini (2002: 206) claim that safety is not something that can be learnt, that it is a social competence that can only be practiced. The workers also have to develop a competence of recognizing what is dangerous. The learning process of the novice *“is largely based on a mechanism of imitation/emulation”* (Gherardi and Nicolini 2002: 206). It is distributed in several different actions. Looking, seeing and perceiving is the first. Perceiving hints that just watching is not enough but looking has to be both intentional and careful, that means that a great deal of attention must be paid. (Gherardi and Nicolini 2002: 206–207.)

Another important part of the process is language. Language is used for raising the attention of the novice, the master shouting “look!” does not only mean that the novice should look but also that he should look carefully because the matter is important. But language is also used for another purpose: for giving instructions and micro-explanations for different situations, e.g. about what kind of material should be used in certain situations. This can be seen as making the tacit knowledge of the masters explicit. (Gherardi and Nicolini 2002: 207–208.)

Gherardi and Nicolini (2002: 208) argue that safety is also partly an issue of feeling and sensing: *“through a combination of physical and linguistic actions, novices are taught how to feel according to the canons of the group and community”*. The novices develop new sensory maps that guide their actions in the new environment, both physical and social. The final aspect of the learning process is conversations in which different problems are discussed or debated. Conversations are both situations for showing the others the competences one has as well as chances for learning for those who’s competences are lower. (Gherardi and Nicolini 2002: 209–210.)

Therefore learning safety issues is a complex matter, consisting of interwoven sensorial, linguistic and social dimensions. It is a *“mental habit applied in everyday action”* (Gherardi and Nicolini 2002: 216). However, it is important to note that

learning process is not just passive observing, 'being absorbed', the key for learning lies within the interaction between the novice and the community.

Huysman (2004) argue that communities of practice are good for stimulating social learning in organizations but that at the same time their contribution in supporting organizational learning is not so clear. Huysman (2004: 2) claims that learning *within* organizations and learning *by* organizations is not the same thing. Learning within organizations can refer either to individual learning or learning as a social practice resulting in shared situated knowledge, and the latter is often labeled as organizational learning. Huysman (2004: 2), however, defines organizational learning as a "*process of institutionalization in which knowledge is gained acceptance by members of the organization and is taken for granted*".

There are three phases in the institutionalization process: externalization, objectification, and internalization (see Figure 14). Externalization refers to knowledge exchange, sharing individually held knowledge, either for reuse or renewal. Objectification means that the knowledge becomes collectively accepted in the organization. And in internalization process the knowledge is retrieved by the individuals. (Huysman 2004: 5–8, see also Berger and Luckmann 1972.)

Huysman (2004: 9) argues that communities of practice can be good in supporting internalization process in organizations. Through acquiring organizational knowledge people become members of the organization and this happens in internalization process. "*In fact, internalization means the process through which one becomes an 'insider'*" (Huysman 2004: 9). Communities of practice also support the externalization process. Learning in them happens so that knowledge can be shared and then reused or combined in new ways. (Huysman 2004: 9–10.)

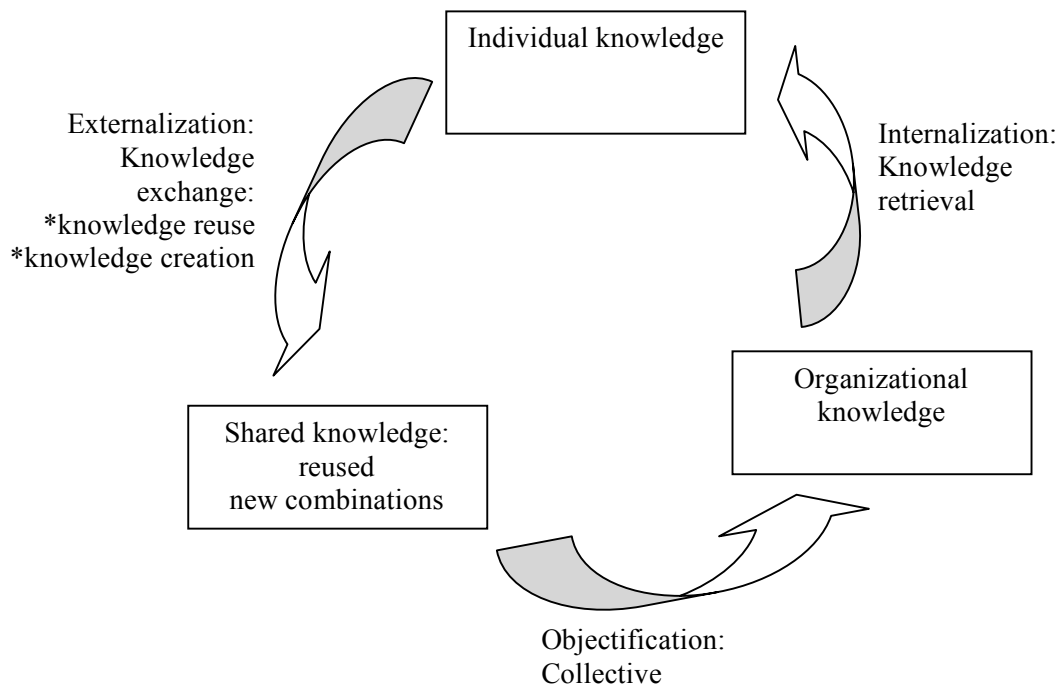


Figure 14. Processes of institutionalisation in relation to organizational learning (Huysman 2004: 8).

However, sharing the knowledge does not necessarily mean that it will be collectively accepted. And the only way for objectification to happen is that the organization's members accept it as such. Huysman (2004: 10) claims that "*Collective acceptance as a process is the link between individual learning and organizational learning*". This process is not usually conscious and happens often gradually, during a long period of time. Huysman (2004: 10) argues that "*Ignoring the importance of collective acceptance can be a serious obstacle for organizational learning*". The situation regarding communities of practice is often such that they effectively create and share knowledge to solve problems but this knowledge never becomes accepted within the whole organization (Huysman 2004: 11).

Learning as a situated and socially distributed process

Brown, Collins and Duguid (1989) emphasize the situated nature of knowledge and learning. They take the nature of knowledge as a starting point when defining learning. They argue (1989: 32) that "*knowledge is situated, being in part a product of the activity, context, and culture in which it is developed and used*". This means that the activity in which knowledge is developed and used is also an integral part of

learning and cognition. So both learning and cognition are very much situated in nature as well.

Brown et al. (1989: 33) see learning as a change in cognition. Conceptual knowledge is like a set of tools, possessing one or the other does not mean that one could use it, but there also has to be understanding that can only be developed fully in a certain context. Learning means both change in the learner's view of the world and adopting the belief system of the culture they are learning in. Thus, "*activity, concept, and culture are interdependent. No one can be totally understood without the other two. Learning must involve all three*" (Brown et al. 1989: 33). This also means that learning is a process of enculturation.

According to Brown et al. (1989: 33) learning often involves complex social negotiations, which leads to the idea that learning is a continual process. Every time knowledge is used, just like the tools, understanding may change and something new is learnt. Brown et al. (1989: 37) also argue that the cognition is distributed both socially and physically. Thus learning as well can be seen as a process that involves collaborative social activities and social construction of knowledge (Brown et al. 1989: 40).

The early work of Brown et al. (1989) concentrates mainly on the consequences of their work to pedagogical issues in the schools. However, Brown and Duguid (1991) continue their work later with organizational learning. The basic assumptions of the nature of knowledge and learning have retained the same: "*Concepts of knowledge or information transfer as learning have been attacked in recent years... in particular learning theorists have rejected the transfer models which isolate knowledge from practice, and developed a view of learning as social construction, putting knowledge back into the contexts in which it has meaning*" (Brown and Duguid 1991: 47).

Brown and Duguid (1991) explore the nature of working, learning, and innovating and specially connections between them. They base they discussion about working on Orr's ethnography of service technicians (see e.g. Orr 1990). Orr (1990) made observations about the actual work of the technicians and compared his findings with the way that the work was officially described in manuals, courses etc. Brown and

Duguid (1991: 41–44) call these the canonical and non-canonical work practices. The canonical practice refers to the official, espoused practices of organizations. According to Brown and Duguid (1991: 42) “*many organizations are willing to assume that complex tasks can be successfully mapped onto a set of simple, Tayloristic, canonical steps that can be followed without need of significant understanding or insight*”. However, this is often not the case. Beside of canonical practices, there exist numerous non-canonical practices in organizations. These practices are needed e.g. in such situations in which following the canonical practice does not bring the solution to the problem.

Non-canonical practices include narration, collaboration, and social construction (Brown and Duguid 1991: 44–46). Orr (1991) presents a case in which the machine could not be fixed by following the steps that the manual provided. Narratives helped the technicians in diagnosing the machine by gathering together its history and other similar cases. Narratives also work as repositories of accumulated wisdom. The process of the technicians was also very much collaborative. The technician that originally was assigned to fix the machine and could not do it begun then to work together with other technicians and discuss the problem with them. Therefore Brown and Duguid (1991: 46) claim that “*not only is the learning in this case inseparable from working, but also individual learning is inseparable from collective learning*”.

The third non-canonical practice according to Brown and Duguid (1991: 44) is social construction. The new understanding that the technicians create, or *construct*, about the machine reflects their view of the world. The views of the trainers or the engineers do not match to the situation in the hand so the technicians must construct a new one. This process also helps the construction and development of the identities of the technicians as well as the community of the technicians. (Brown and Duguid 1991: 46–47.)

Next Brown and Duguid (1991) begin to explore learning based on the work of Lave and Wenger about communities of practice (see e.g. Lave and Wenger 2003). Brown and Duguid (1991: 48) argue that “*workplace learning is best understood, then, in terms of the communities being formed or joined and personal identities being changed. The central issue in learning is becoming a practitioner not learning about*

practice". These communities are typically non-canonical and officially they do not even exist. However, the best way for fostering learning would be fostering the communities of practice and helping people to belong to them. (Brown and Duguid 1991: 49–50.) According to Brown and Duguid (1991: 50–53) changing the canonical practices is difficult and slow. However, the seed of the innovations may lie in the non-canonical practices that are carried out in the communities of practice.

Bresnen et al. (2005a) have researched the connection between organizational routines, situated learning and processes of change in project-based organizations. They (2005a: 27) argue that understanding change in project-based organizations is difficult specially because of the complex and dynamic nature of project work and the relationship between the projects and the whole organization. A situated view to organizational learning is taken, referring to "*the importance of shared practice and social context in promoting shared knowledge and the spread of learning within and across organizations*" (Bresnen et al. 2005a: 28).

Bresnen et al. (2005a: 28) argue that organizational routines can both retard change and be a source of flexibility and change in organizations. They (2005a: 28) define an organizational routine as "*repetitive, recognizable pattern of interdependent actions that involve multiple actors*" and that is collective and often distributed. Routines are performed by different people at different times, which mean that there can be different interpretations of routines. Thus the meaning and the outcome come of a routine is socially constructed. People performing routines often work with other people so performing a routine can be a collective, social thing. (Bresnen et al. 2005a: 29.)

Organizational routines are also source of learning, so engaging in organizational routines can be viewed as a learning process. Routines are not something that people "blindly", without thinking perform but subjectivity, enactment and choice are important issues of understanding routines. People reflect routines which may lead to new ways of doing things that is to learning and change. (Bresnen et al. 2005a: 29.)

For implementing new practices, changes, into an organization it is not enough that the new knowledge is turned from its abstract form to a form that is suitable for the

new settings. The new knowledge has to also be embedded into the routines, working practices and culture of the organization. (Bresnen et al. 2005a: 30.) Bresnen et al. (2005a) conducted a research in four construction companies investigating the implementation of new practices. As a result they (2005a: 32–33) argue that existing project management practices and routines have important consequences to ways in which new practices are accepted if the change: 1) interferes with the existing practices, or 2) disrupts the existing organizational power / knowledge balance.

Learning in organizational networks

Araujo (1998) takes one step further from the ideas of Brown et al. (1989; 1991). He (Araujo 1998: 325–326) agrees that learning have to be seen as a situated and practice-oriented process and that learning is an essential part of everyday life related to working and innovations instead of a mechanism of transmission of formal abstract knowledge. However, he criticizes these ideas by saying: “*But although conceived as a community of communities, Brown and Duguid’s organization is still a self-contained entity condemned to learn within its own walls and its own set of canonical and non-canonical practices*” (Araujo 1998: 326).

Instead of treating an organization as a one closed entity within the learning occurs, Araujo (1998: 317; 326) regards organizations “*as a set of interlocking and shifting relations, a locale internally differentiated where multiple interactions and relationships, comprising both social and material elements, take place*”. There are a numerous overlapping knowledge systems, communities, in organizations: e.g. functional areas, professional specialties, and project-based teams. Also people from other organizations are part of these communities. And in addition to belonging to one ore more of these, people in organizations belong also to wider communities based on their educations, place of living, hobbies etc. (Araujo 1998: 326–327.)

This leads to the idea that the learning communities does not exist only within organizations, but they continue also in inter-organizational relations and learning and knowing are resided in these networks of relationships. As Araujo (1998: 327) claims: “*we would stress the inter-organizational aspect of learning and the way communities of practice transcend organizational walls and link up with wider, occupational communities*”. New knowledge can be acquired outside of organizations via inter-

organizational relations, both formal and informal, and that creates chances for learning as well.

Araujo (1998: 227–330) uses examples from industrial settings, where connections from an organization to its suppliers and customers are typical and create inter-organizational relationships, to further research his ideas. These relationships and interactions provide the organization possibilities to gain knowledge about a range of local practices that are spatially and temporally distributed. This makes also learning possible. As Araujo (1989: 328–329) states: “*any form of knowing and learning in industrial settings is dependent on the inter-organizational network structures within which organizations exist, as much as on the internal workings of organizations*”.

A cultural view to organizational learning

Yanow (2000) proposes a cultural view for addressing organizational learning. He (2000: 249–250) claims that organizations does not exist the same way as chairs or tables or even humans and therefore we cannot claim to know them by direct, objective apperception through one or more of our five senses. Instead, organizations exist and we can see them in the same way as culture: “*seeing a practice – a set of acts and interactions involving language and objects repeated over time, with patterns and variations – and inferring back that culture exists*” (Yanow 2000: 249). Thus it requires interpretation of sense data by members and researchers to know whether something is an organization or not. So, interpretive methods are needed for researching organizations and organizational learning. (Yanow 2000: 251.)

Taking an interpretive cultural perspective means focusing on collectives and their acts and interactions, objects of these acts and the language used, together with the site specific meanings that these artifacts have to the actors. This refers to knowledge being very strongly situation-specific. (Yanow 2000: 251–252.) This perspective also makes it possible to research learning by collective instead of concentrating on the individual cognitive learning processes: “*A cultural perspective on learning focuses on what we can see when we look at what people do, rather than searching for what might be going on in their heads*” (Yanow 2000:253).

Yanow (2000) uses a group of flutemakers as an example of a collective. Each flutemaker takes care of one part of the flute making process, e.g. making one subassembly, and then passes the flute to the next flutemaker until the flute is finished. So, it can be said that they make the flutes collectively and that they also hold the knowledge together, as a group. Because none of them has had the knowledge when born, there also has to be a way to pass this knowledge to newcomers, to help them to become practitioners. (Yanow 2000: 253–254.) The flutes have an important role in this all: *“the knowledge was expressed and communicated through the vehicle of the flute in acting on it, in interaction with and concerning it”* (Yanow 2000: 254). Thus, learning happens while working, interacting with the flute and other flutemakers, handling the flute, doing what flutemakers do.

The language that the flutemakers use in their interactions related to the flutes is often seemingly general and abstract: the flute may be handed back to the earlier flutemaker with phrase “the flute does not feel right”. According to Yanow (2000: 255) *“this led to the inference that these kinesthetic and aesthetic judgments of feel drew and reflected knowledge shared by the makers that was known tacitly”*. This tacit knowledge also could be communicated in interaction with and through the flutes, because the newcomers were able to learn this. Yanow (2000: 255) concludes these observations by defining organizational learning as follows: *“the acquiring, sustaining or changing of intersubjective meanings through the artifactual vehicles of their expression and transmission and the collective actions of the group”*.

The ‘third way’ of organizational learning

Elkjaer (2004) introduces the term ‘third way’ of organizational learning to combine ideas of individual and what she calls ‘social learning theory’. By the term ‘social learning theory’ she wants to *“indicate that we are in the field of social theory and that the point of departure for learning is the living experience of everyday life”* Elkjaer (2003: 39). She has reviewed and compared organizational learning literature that looks learning in the individual level with literature that emphasizes the importance of the social aspect of organizational learning (e.g. the concept of communities of practice). To bring some pragmatism to her theory, she also follows the ideas that Dewey developed in the beginning of 20th century. See Table 5 for a summary of Elkjaer’s findings.

Table 5. Individual, social, and pragmatic learning theory (Elkjaer 2003: 49) or three ways of organizational learning (Elkjaer 2004: 430).

	Individual learning theory The 'first way'	Social learning theory The 'second way'	Pragmatic learning theory The 'third way'
Content	Cognitive structures, know about practice	Identity formation, become a practitioner	Development of human experience, know about world and become part of world
Method	Discontinuity, knowledge acquisition, in the mind	Ubiquitous, participation and interaction, part of everyday practice	Inquiry to acquire, thinking as instrumental for action, reflection as necessary for learning
Relation between individual – organization	Separated ("soup and bowl")	Weaved together ("a rope"), two understandings of context: 1) individual and context as historically produced, 2) organizational activity as its own context	Impossible to separate, human knowing is a part of human being, individual and context "products" of human being and knowing

According to Elkjaer (2003: 49) in organizational learning literature based on individual learning theory learning is seen happening as a result of acquiring new knowledge and skills in a situation when a problem arises and needs to be solved. She calls this the 'first way' of organizational learning. The 'second way' refers to ideas of social learning theory, to learning as participation in communities of practice, becoming from a newcomer to an old-timer. (Elkjaer 2004: 419–420.) *"In sum, with regard to the what and how of social learning theory in organizational learning, a social learning theory emphasizes informality, improvisation, collective action, conversation and sense making, and learning is of distributed and provisional in nature"* (Elkjaer 2003: 44).

The 'third way' views organizational learning as a combination of skills and knowledge acquisition and participation in communities of practice. Thinking is the instrument of action, it is used to experiment in mind with different solutions to problems. Gaining experience means also gaining new knowledge if it is reflected. (Elkjaer 2004: 429–430.) However, *"thinking is never to be understood as an isolated*

personal and individual mind process but always as part of a transactional relation between individual(s) and environment” (Elkjaer 2004: 429). The organization is seen as a group of social worlds. People belong and are committed to one or more of them and these groups affect learning. (Elkjaer 2004: 429–430.)

Elkjaer (2004: 430) claims that intuition and emotion are also important factors for development of experience and knowledge in organizations. *“Organizations consist of real people, each with their own experience, history and hopes for the future. This embodies the organizational context together with the specific work practice, the artifacts or organizational rules and regulations. And it is from this starting-point that learning and organizational learning begins to occur”* (Elkjaer 2003: 50). The development of individual skills and knowledge happens at the same time as organizational development. The individuals and the organization are related in a way that changing one has inevitable an effect also to the other. (Elkjaer 2004: 431.)

Organizational learning and change

Nicolini and Mezner (1995) discuss organizational learning that can be noticed when organizational change happens. They state that *“organizational learning cannot be understood without taking into account the continuous ongoing change of organizational cognitive structures”* (Nicolini and Mezner 1995: 727). However, these changes must be identified and contextualized.

Nicolini and Mezner (1995) claim that it is not possible to see whether learning has happened or not without a discontinuity. There has to be a point where an observer (external or internal) describes the change in the organizational system’s reaction to its environment. *“Only at this point, when reflection process has taken place and the cognitive modification of the organization structuring has been represented, made explicit, discussed, and framed in terms of “a-problem-with-one-or-more-legitimate-solutions” is it usually accepted that learning has occurred”* (Nicolini and Mezner 1995: 739).

According to Nicolini and Mezner (1995) organizations socially construct learning in order to transform the cognition that has been acquired “in action” into abstract knowledge. However, in spite of the term ‘socially construct’ the work of Nicolini

and Mezner (1995) is closer to behavioral and applied learning theories to organizational learning because it emphasizes the organizational change as an indicator of learning and sees facilitator and reflection as an important part of the process. According to social learning theories learning takes place within the social interactions between individuals.

5 The starting-points of the empirical research

The empirical part of this thesis (Chapters 5, 6, and 7) is structured as follows. The key theoretical concepts from the Chapters 2, 3 and 4 will be summarized the beginning of the Chapter 5 for the basis of the empirical analysis. There will also be a short discussion about the relationship among projects, knowledge and learning. Chapter 5 provides also a general view to the research: what is the general framework under which the research is conducted, in what kind of case projects the material has been gathered and what kinds of methods have been used for gathering the materials. A detailed description of the analysis and results of the case 1 is provided in the Chapter 6. In the Chapter 7 the work and the results of the case 2 are presented.

5.1 The summary of the theoretical background of the empirical study

It is clear that during the empirical study I have had some definitions of the key concepts like knowledge and learning in my mind. These concepts are shortly presented in this chapter so that the reader would know what is meant by these different concepts in the following analyses. Since the connection between knowledge management and learning is the key interest in research question 1, a short discussion about the theoretical relationship among knowledge and learning is also provided.

5.1.1 The key theoretical concepts used in this research

This research is concentrated in learning within **projects**. Compared to traditional organizations there are some special characteristics related to projects that have an influence also in knowledge management and learning. Projects are temporary organizations, they bring people together to form a project team that will be vanished after the project ends. The special emphasis is on **inter-organizational projects** that bring together people from different organizations, people with different skills and knowledge, experience, and organizational culture.

For the purpose of this research **knowledge** will be defined as follows: knowledge is information that is understood by a person so that it can be utilized. This definition is

related to many of the definitions introduced in the Chapter 3: to those that see information as a bases for knowledge and those that emphasize understanding as a part of knowledge. Let's take an example from mathematics. There are lots of books full of different mathematical theories and problem solving. This represents information. Anybody who can read and write can copy it. But to use it in order to solve a problem one has to understand this information and what it means. If one can do that, the information has turned into knowledge for her. Also know-how allows a person to act or do something so it is knowledge.

Knowledge management includes all the processes that are needed so that all the parties in the projects possess all the needed knowledge at the right time. These processes refer to knowledge creation both by individuals as well as on the team level, knowledge sharing which may involve learning, and utilizing the knowledge. This may be realized by organizing meetings, sharing different documents for different parties, facilitating learning by some parties, etc. Also different mediums can be used in knowledge management, e.g. face-to-face meetings, e-mail, project databanks, and so on.

Four different perspectives to organizational learning have been introduced in the Chapter 4: information processing, behavioral, applied learning, and social construction. The definition of **learning** used in this research is strongly based on the social construction perspective to organizational learning. Both knowledge and learning are seen as situated and distributed phenomena. Learning happening in the projects is connected to different issues within the projects and is raising from the needs of the project and project participants. That is, learning is a process of creating understanding in the interaction between people. That can happen both in individual and organizational level.

However, also the other perspectives add something to the theoretical basis of this research. Information processing perspective views organizations as systems of information (or knowledge) and deal with issues like how to gain new knowledge, where and how this knowledge is stored and how knowledge is lost or forgotten. All these issues are important for knowledge management and organizational learning. I

do not see that they would be in contradiction to my views of organizational learning and this research. However, they are not the core issues in this research.

Behavioral perspective provides interesting issues for organizations as well. Also those organizations that are regularly involved in projects could benefit e.g. the ideas of Zollo and Winter (2002). It is often said that since projects are unique, it is not possible to write manuals or guidelines for them. According to Zollo and Winter (2002) codification process could still be valuable. However, I see that this view is more useful for the organizations behind the projects than for the projects themselves.

Applied learning theories provide some useful ideas for this research, too. Kolb's (1984) idea of learning as human adaptation to the world explains the learning in construction projects at least to some extent. For example end users often find themselves in situations where they experience that their existing knowledge about technical issues is not enough. By learning they adapt to the situation. It is also easy to find examples about the defensive mechanisms in construction project. If something goes wrong, there's always someone else to blame, the problem may e.g. be the impossible demands of the end users instead of the designers' inability to listen to the client.

5.1.2 The relationship among projects, knowledge and learning

Easterby-Smith et al. (2003b) examine the connections and the differences of organizational learning and knowledge management. They claim that the research in both fields has developed quickly during the last decade and at the same time the diversity and specialization in them have increased. However, there are different sub-areas that are overlapping and they should be identified for potential synergy. The distinction between learning and knowledge is defined as follows: "*knowledge being the stuff (or content) that the organization possesses, and learning being the process whereby it acquires this stuff*" (Easterby-Smith et al. 2003b: 3).

As the Figure 1 (page 16) depicts project management, knowledge management and learning are not detached phenomena, instead they are partly connected. There is a

huge amount of knowledge required in the projects (being the “stuff”). There is usually also some learning happening in the projects but a great deal of it seems to be incidental. However, if we see learning as the process of acquiring the knowledge as suggested above, this means that learning should be an integral part of knowledge management.

5.2 PROLAB-project

All the material presented in the report is gathered in the PROLAB-project. The project began in September 2003 and ended in August 2005. The main objective of the project was to find solutions for how knowledge management in projects could be improved, in construction projects specially. The overall goal of the project was to study questions like: How can information be efficiently used in project organization and public decision process? Which methods will contribute to effective knowledge management? How can the barriers of using effective methods be removed? These obstacles can be either related to use of new technology or to organization culture.

There were two full time researchers working in the PROLAB-project, the project manager and I. I was concentrating specially on learning issues in the case projects. However, there were also nine part time researchers in the project and they researched e.g. topics like utilizing ICT-tools in the project (a licentiate thesis in preparation), the network issues and project success (a licentiate thesis done and a doctoral thesis in preparation) communication issues in a project (a master’s thesis ready), participation in the projects (a master’s thesis ready) etc. So each researcher had more or less different viewpoint to the case projects. Altogether more than ten different construction projects were researched, both in public and private sector. Two of these case projects are analyzed in this thesis.

5.3 Case projects

In this research theme interviews of the participants in one construction project (case 1) and observations and results of action research interventions in another construction project (case 2) are analyzed. The analysis of case 1 aims for answering

to research question one: *How is learning related to knowledge management in the case construction projects? To what kind of issues is learning related in these projects?* The description of interventions and the analysis of their effect aim to answer research question 2: *How learning in the case construction project can be facilitated by group activities like vision building, activity cards, and mock-up room?* However, case 2 provides material also for answering the research question 1 and case 1 for answering the research question 2.

Case 1 is a construction project in which a nursing home for senior citizens has been renovated thorough. The project was introduced because the facilities did not meet today's requirements, there were problems with the condition of the facilities as well as some functional problems, for example bathrooms were too small because most of the patients need either some aids or assistance when using them. The size of the facilities is about 7 000 m² and there were places for 120 patients in the building before the renovation. The renovation has cut down the number of patients a little. The total budget of the project was about 5 700 000 euros.

The project started in 1996, in which point mainly the staff in the nursing home had discussions about what would be needed. The detailed project planning was done in year 2000. The actual work within the project (both detailed designing and construction work) was divided into several parts based on the different natural parts (e.g. floors and wings) and departments in the building. This has made it possible to keep the nursing home running also during the renovation: when one department is under construction the patients have been moved to other departments. The construction work begun at the end of 2002 and the whole building is expected to be finished in summer 2007. The research interviews were made at three different stages of the project: at the end of 2003, spring 2004 and at the end of 2004.

Case 2 is a school project in which the old buildings were renovated and some new facilities were built. This project was introduced because the existing facilities needed renovation and there were some functional problems and not enough space. The size of the school was originally 3000 m² and there are about 270 pupils. The budget of the projects is about 2 135 000 euros. During the construction the activities of the school were divided into a few other locations. This project started 2003, the

construction phase begun in spring 2005 and was finished in autumn 2006. Action research was going on in winter 2004-2005, mainly during the construction design phase of the project.

5.4 Theme interviews

In case 1 altogether 19 person were interviewed, five of them twice, at different phases of the project. Theme interview was used as interviewing instrument so that the interviewees would have a possibility to express their opinions in a free way. This way also some issues that the interviewer would not have understood to ask in more formal interview emerged. The sampling technique for interviewees was snowball sampling (Weiss 1994:25). The first interviewees were asked for referrals which then provided further referrals. In practice the group of interviewees consisted of the design team of the project and some extra representatives of end users. This method seems to work well because when a couple of other persons that the interviewer thought might be important were interviewed they didn't really have anything to add to the subject.

The interviewees were: project manager / architect (2), other designers (5), representatives of the end users (7), contractors (3), and supervisors (2). The interviewees and times when they were interviewed are presented in the Table 6.

The following themes were discussed in the interviews:

- What kind of phases there has been in the project?
- What kind of successes and failures were experienced during the project?
- How the co-operation was arranged?
- What kind of co-operation tools has been used?
- Who were the important persons in the project (for sampling)?

Table 6. Summary of the interviewees.

Role	Task / occupation	November 2003	May 2004	December 2005
Project manager	Architect design (old)	x		
Project manager	Architect design (new)	x		x
Other designer	Structural design	x		
Other designer	Interior design	x		x
Other designer	Electrical design	x		
Other designer	HVAC design	x		
Other designer	Automation design	x		
End user	Contact person	x	x	
End user	Head of the nursing home (new)		x	
End user	Head of the nursing home (retired)	x		
End user	Nurse		x	
End user	Nurse	x		
End user	Head of the social affairs	x		
End user	Maintenance responsible			x
Contractor	Main contractor		x	x
Contractor	Electrical contractor			X
Contractor	HVAC contractor		x	
Supervisor	HVAC	x		
Supervisor	Electrical and automation	x		x

It is important to note that learning issues were not straightly asked and information was gathered for several purposes in the same interviews. Informants, however, talk about learning related issues and this has been pointed out in the analysis. The interviews lasted from 30 minutes to two hours, they were taped and transcribed word by word. I have personally been present in all the interviews and the done the transcriptions for the interviews analyzed in this research.

5.5 Action research

One part of the PROLAB-project was action research. Dick (2004: 434) states that in the Scandinavia much of the action research is large in scale, “*spanning multiple*

organizations and reflecting the Scandinavian interest in participation and industrial democracy". Our research is not so large in scale but it certainly reflects the ideas of participation and democracy because it is a public case, not from industry.

During the action research participants from the case project 2 and the researchers planned and tested together several different ways to improve communication and learning in the project. Also several practices of project management were introduced to the project. All these practices were based on theory and existing practices both in construction and other industries. Some practices were modified to better serve their purpose in the case-project. Both the researchers and the participants reflected the practices to define whether they worked or not. I have chosen those practices that I describe in the Chapter 7 for two reasons:

1. I find that they are good examples of practices that actually do facilitate learning in the project and
2. I have personally been closely involved in developing and implementing the practices.

Other practices than those presented in this report tested include e.g. a visit to the school premises that was made together by some designers and the staff of the school. The designers found it good because they say that often they feel that they are disturbing when they go to see the facilities on their own. It was also found useful that the end users and designers could talk about the problems where they actually exist. However, I have not included this experiment into this thesis because I did not participate in the visit myself. There was also a proper project management plan made in the project which is new in the client's practice. This is not included in the thesis because I do not think it benefited the mutual learning in the project so much.

The history of action research is complex because instead of being a single academic discipline it's been developed over time from several different fields of humanities and social science both in Europe and America. The key question bringing the different views together is that how crucial and usable knowledge can be created. (Brydon-Miller, Greenwood and Maguire 2003: 11). For this reason, it is also difficult to define action research in a short way. According to Reason and Bradbury (2006a: 1) action research is:

“a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in participatory worldview which we believe is emerging at this historical moment. It seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities”.

Reason and Bradbury (2006a: 1) see action research as a systematic way for creating knowledge. However, it is usually considered, within natural sciences specially, that in order for a research to be credible, it must be objective and value free. Action research challenges this positivistic view by considering that knowledge is socially constructed and situated. (Brydon-Miller et al. 2003: 11; see also Hilsen 2006: 25.) The belief in social construction, that the world around us is constructed in social interactions of people, lies also behind our action research.

Reason and Bradbury (2006a: 2) introduce five typical characteristics of action research (see Figure 15). Firstly, action research aims for producing knowledge that people can use in their everyday lives. This also means that action research typically concentrates on practical issues. Thirdly, action research involves participation. *“Action research is only possible with, for and by persons and communities, ideally involving all stakeholders both in the questioning and sensemaking”* (Reason and Bradbury 2006a: 2). Action research is also about creating new forms of understanding. This in turn can contribute to human emancipation and to the flourishing of the community. And finally, since action research begins with the daily experiences of people and aims to result in living knowledge, it must be a developing process. As the circumstances change and new knowledge and experiences are gained, the action research itself has to evolve as well.

All of the characteristics described above can also be found in our action research case. The aim of the research was to find new useful practices that could be utilized in construction projects. So the knowledge to be created was very practical. The process itself was such that different parties of the construction project were all involved in it, some of them more deeply, both planning and implementing the new practices, than others that only participated in the implementation of the new practices.

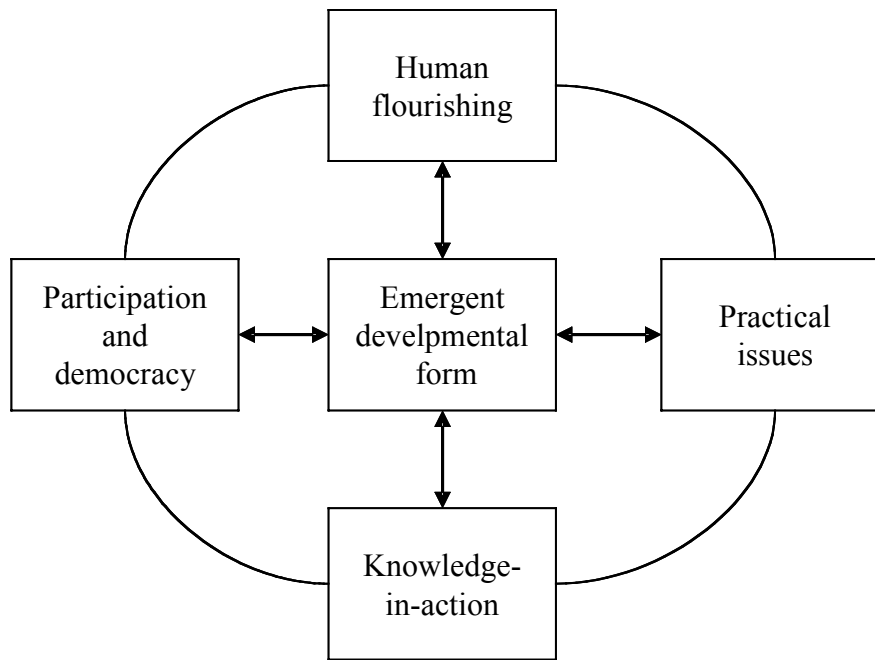


Figure 15. Characteristics of action research (Reason and Bradbury 2006a: 2).

The research process was also living and changing during the project. New practices were implemented when a need arose. Not all the practices that were suggested by the researchers were implemented because the participant objected them. Also the way of implementation was changed if needed. The research also changed the communities, both in the technical sector of the city as well as among the teachers. At least some people in the technical sector now better understand the importance of the cooperation with the end users and teachers know that there are some practices that they can demand to be used when their school is being renovated.

There are a range of approaches to action research, from the more technical focus on organizational or educational change in which the researcher is “expert” to emancipatory and participatory processes that aim to engender radical social change where the participants are equal as co-researchers (Fisher and Phelps 2006: 146). Chandler and Torbert (2003) have introduced 27 different modes of action research based on the dimensions of time, voice and practice used in the research, each of which can get one of the three possible values. The ‘time’ refers to whether the research is past, present or future-oriented. Chandler and Torbert (2003: 135) claim that *“In action research, timely action in the present, transforming historical patterns into future possibilities, is the ultimate aim and achievement”*.

The ‘voice’ in the typology of Chandler and Torbert refers to how the research is conducted and represented to participants of the research or to some other audience. According to Chandler and Torbert (2003: 139–140): “*Sometimes research is conducted and reported in one’s own, frankly subjective voice...*” and this is the case of first-person voice. This is typically when research is presented either by the researcher or the informants describing their own experiences. Secondly, “*...sometimes in multiple intersubjective voices...*” and this refers to second-person voice. This kind of situation is e.g. when the researcher ask the interviewees to comment on the performance of their boss and the results are told to the boss by giving quotes of the answers instead of some statistical information. And finally, “*...sometimes in an anonymous, generalized voice*” which is the case of third person voice, which is the traditional way of reporting research.

The ‘practice’ refers to first-, second-, and third-person practice. The first-person practice means researching one’s own actions. Writing a thesis can be an example of this, one reflecting her own doings. The second-person practice is used when two or more people are interacting around issues of mutual concern. This practice may e.g. be problem solving or sharing experiences about the issue of mutual interest. The third-person practice involves many others that may not have a close connection or interaction. (Chandler and Torbert 2003: 142–145.) “*Third person strategies aim to create a wider community of inquiry involving persons who, because they cannot be known to each other face-to-face, have an impersonal quality. Writing and other reporting can of the process and outcomes of inquires can also be an important form of third person inquiry*” (Reason and Bradbury 2006b: xxvi). In some literature ‘practices’ are also referred as first-, second-, and third person focus (see e.g. Fisher and Phelps 2006: 146–147, 161).

In our action research case all the three “modes” of time can be found. The focus was on the present, working with an ongoing construction project, trying to achieve best possible results. However, a huge amount of experience from the past was there also all the time, provided by all the people working in the project. This experience was utilized both for identifying the “problems” and finding solutions for them. And of course, the ultimate goal was to create something that could be used also in the future. The way of reporting the research is mainly via third-person voice. But since I’ve

personally been involved in the research process and I'm also trying to reflect my own work, sometimes a first-person voice is also present.

The practice of our research was second-person practice, several people working together to achieve a common target. A huge amount of the work was done in face-to-face situations. The first-person practice comes into the picture when I'm writing this thesis and try to analyze my own doings. At most of the time my own doings cannot be separated from the doings of our research group, because knowledge and ideas were usually created not by one of us but more as a result of the work of the whole group. Writing this thesis and other publications written by the research group and I brings also the third-person practice into this research. These writings that are available to anyone mean that a much wider audience can "join" the research.

6 Learning within the case projects

The analysis process and the results of the analysis of case 1 will be introduced in this chapter in detail. Deeper discussion about the findings based on the theoretical basis will be in the Chapter 8. The main objective of the analysis is to find out how learning is related to knowledge management in the case construction projects and what kind of issues is learning related to in these projects. As often in qualitative research the analysis and material gathering are not totally separate processes in this research either. Some interesting issues have certainly risen up already during the interviewing and transcription processes. However, as Weiss (1994: 151) states, it is often that only after interviewing has ended the researcher can give full attention to analysis. This is also the case with this research. During the time between finishing the interviewing and beginning the analysis I have learnt a lot about construction projects and this certainly has had an effect on the analysis.

This chapter also contains some material from the case 2. This material used to answer the research question 1, specially to what kind of issues is learning in the project related to. In case 2 the participants of design meetings were asked to tell if they feel that they had learnt something during the project and if the answer is yes, what have they learnt. This material will complement the findings from case 1.

6.1 Analysis process (case 1)

Weiss (1994: 152) introduces four different kinds of ways to analyze qualitative materials. The focus can be either on 'issue' or 'case'. In the issue-focused analysis the purpose is to find out about the issue itself, based on the material got from all the interviewees. In the case-focused analysis the focus is on the interviewees, how just they have felt certain issues. Since the objective of this analysis is to describe the learning in the case project in general and not from the point of a single respondent, this analysis is issue-focused.

According to Weiss (1994: 152) both issue-focused and case-focused analysis can be either 'concrete' or 'generalized'. Concrete analysis remains on the level of

respondents' answers, whereas generalized analysis aims to bring up some general facts about the phenomena. Since this research aims to provide some understanding about learning in projects in general, this analysis is generalized.

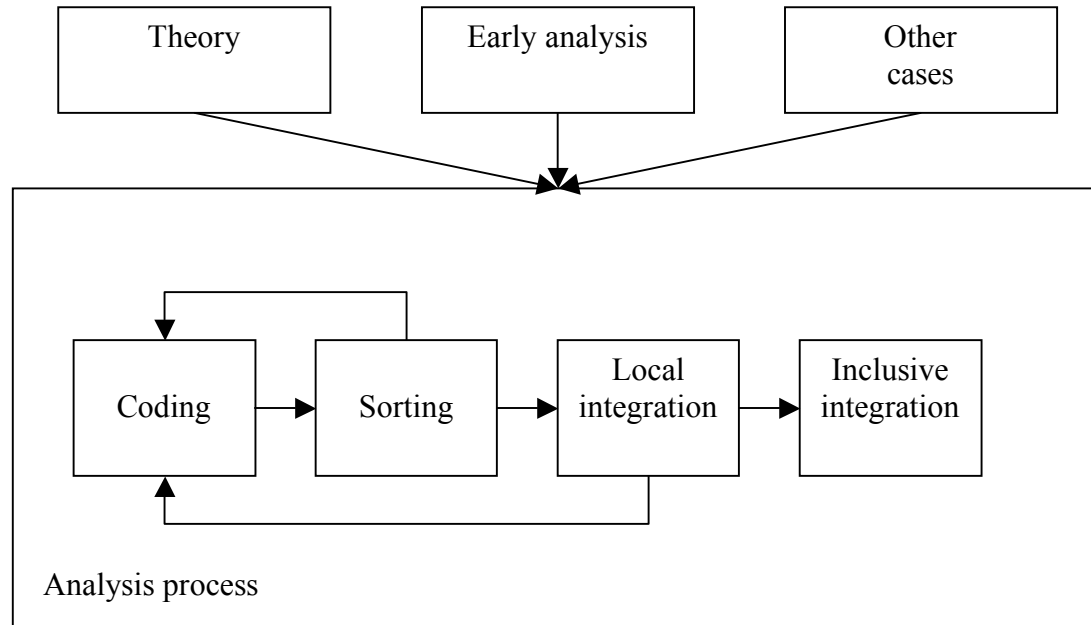


Figure 16. Analysis process.

6.1.1 Coding and sorting

The analysis process is depicted in the Figure 16. It began by coding and sorting the material. I had already come up with some categories during the interviewing and transcribing and some extra categories were added during the coding and sorting process. Computer software N-Vivo was used in this phase of the analysis (see Figure 17). The aim was to code everything the informants said that had something to do with knowledge sharing, understanding different things and learning. These issues were chosen because they all are somehow related to the fact that the knowledge of all project parties should be utilized in order to reach a good end result for the project.

After this phase of the analysis and renaming some categories there were three main categories left: 1) 'Learning'; 2) 'Understanding'; and 3) 'Knowledge'. The 'Learning' category consists of only a few quotations that are related to doing similar thing more than once and learning from the first time how to do things better next

time. For example a contractor says: *“This part of the building is similar than the one we renovated at first, I guess we have learnt something from our mistakes, or I do not know if they are mistakes but we have noticed that some thing can be done in another way”*. The other two categories consist of several sub-categories.

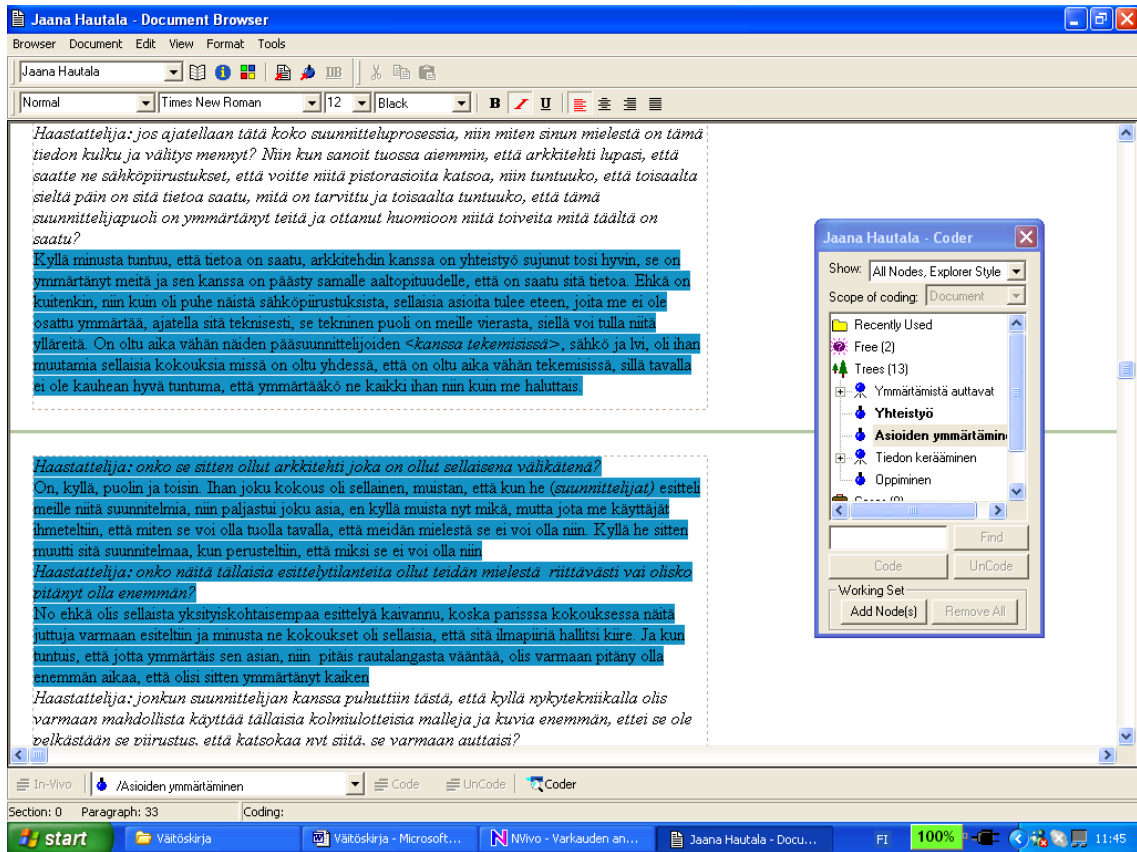


Figure 17. An example of the use of N-Vivo.

The ‘Understanding’ category consists of two sub-categories: ‘Problems’ and ‘Tools’. In the ‘Problems’ category people talk about how they themselves or somebody else did not understand something or may not have understood something which may cause some problems with the end result of the project. Both the end users and the “technical side of the project” talk about how difficult it is for the end users to understand technical drawings: *“It feels that things should be bended of iron wire so that they could be understood, there probably should have been more time to understand everything”* (end user) and *“And one more thing that was noticed, if we present some drawings, the end users do not really understand what it means... And when even the different designers may not understand each others’ drawings, because*

it's different technology, we can't assume that someone who is not working with technical issues would understand" (supervisor).

In the 'Tools' category people talk about several tools and methods that helped them or someone else to understand something. For example one end user representative says about importance of the mock up room that was built during the design phase to see what kind of bathroom / toilet –combination works well: *"we heart that there was a mock-up room when the health center was being renovated and we insisted that we should have one here as well... We tested it with customers and noticed that the first version did not work well and then another version was built and it was better"*. This category is further divided to several sub-categories based around the different tools.

The third category that includes issues related to knowledge was the most difficult to be divided into clear sub-categories. People talk about issues like 'knowledge in general', 'knowledge transfer', 'problems and tools related to knowledge transfer', 'sharing the tacit knowledge', 'knowledge brokers' and 'routes for knowledge transfer'. These were the original categories for coding and they built up the main category 'Knowledge'. However, the sub-categories were so overlapping that the division was pretty artificial and did not serve any real purpose. Therefore the 'Knowledge' category is dealt as one large category even though issues within it vary quite a lot. The view to same matter also may vary depending is it the view of an end user or of a designer. For example about the knowledge sharing in the meetings: *"... and then there are meetings where are the architect and the other designers, it's no use of having the end users there anymore"* (a designer) and *"the drawings could have been explained in more details, they were presented in some meetings but I feel that there were always such a hurry in the meetings"* (an end user representative).

6.1.2 Local and inclusive integration

At this point of the analysis it seems clear that there is learning happening in the case project. The next thing to do was to carefully read through all the material related to different categories. An interesting perception was made: there are a lot of quotations that are either already in more than one category or they could be placed in more than

one category. For example the following quote is both in ‘Understanding’ and ‘Knowledge’ –categories: “*And then, it’s us who possess the expertise related to the people living here, and there’s been what’s irritated us most, because about colors and materials and things like that, it’s not worked like it should work, because our expertise has not been utilized* ”. An end user representative describes here some problems with interior designer: on the other hand it’s about knowledge (expertise) that should be transferred from one party to another and on the other hand it’s about the interior designer not understanding the situation and the feelings of the end users.

This shows that the categories are interrelated. The “big picture” of the phenomena was beginning to appear when looking at case material but also the theory has certainly had an effect on results. The learning process is related to issue of understanding new things, for the representatives of the end users specially. And this is related to knowledge and knowledge management because without understanding things under discussion proper decisions cannot be made. The results of this phase of the analysis are presented in detail in the Chapter 6.2.

6.1.3 Detailed analysis of what is learnt and by whom

At this point of the analysis the interest moved towards the issues *what is learnt during the project* and *who is learning*. To answer these questions a new round of sorting was done. All the material coded earlier was carefully read through again and all the references to anything related to learning were coded by the learner and the issue that was learnt. This phase of the analysis was done manually because I felt it easier to have all the material in front of me at the same time and not to have just one computer screen of material to be seen at once. The working method can be seen in the Figure 18. All the originally coded material was printed and all the parts that referenced on learning were marked by category number. The ‘L’ on the left side of the paper means that I’ve considered that part to be a potential quote for the thesis. New categories were created whenever a reference to new group of learners or new learning issues was found. Altogether 14 categories were formed, e.g. ‘architect learning about the end user needs’, ‘designers learning about the existing building’,

and ‘learning from one construction phase to another’. Later some of the categories were combined. Categories will be presented in more detail in the Chapter 6.2.

Some of the categories were such that there was nothing surprising within them, for example it was clear based on the early observation that the end users learn about the technical issues. Sometimes the fact that the end users not understanding something was exposed later during the project and when learning had happened, plans had to be changed: *“I remember that there was a meeting in which they (designers) presented their plans to us and one thing was exposed, I do not remember what it was, but we end users began to wonder how it can be like that, that we think that it should be in another way. However they changed the plan when we explained why it couldn’t have been like that”* (end user). More surprising it was to notice that there was a clear need for the end users to learn about their own functions, how things are done and how they should be done: *“Like someone said that it makes us think our work in a totally new way, that is everything we used to do so rational”* (end user).

Another significant thing that rose up during the analysis was that people not only talk about such issues that they themselves or someone else learnt during the project but they also talk about such issues that someone else should have learnt. For example the main contractor talks about the other contractors informing their staff about the policies in the construction area: *“There are areas that are not supposed to be used for bypassing, and elevators that may not be used, and others, everybody has to inform his own staff about these. All the circumstances in the working site must be explained, we have a form for acquaintance, it has to be filled up and explained, but not all do that”*. Noticing this thing led to another question to be answered: *are people talking about things they have or should have learnt or about issues that someone else learnt or should have learnt?* To answer this question, a table was drawn to bring together the questions who is learning, what is learnt / should have learnt and who is talking about this. The detailed results are presented in the Chapter 6.2.

<Documents\██████████> - § 6 references coded [20,51% Coverage]

Reference 1 - 4,62% Coverage

Kyllä minusta tuntuu, että tietoa on saatu, ████████ kanssa on yhteistyö sujunut tosi hyvin, se on ymmärtänyt meitä ja sen kanssa on päästy samalle aaltopituudelle, että on saatu sitä tietoa. Ehkä on kuitenkin, niin kuin oli puhe näistä sähköpiirustuksista, sellaisia asioita tulee eteen, joita me ei ole osattu ymmärtää, ajatella sitä teknisesti, se tekninen puoli on meille vierasta, siellä voi tulla niitä ylläreitä. On oltu aika vähän näiden pääsuunnittelijoiden <kanssa tekemisissä>, sähkö ja lvi, oli ihan muutamia sellaisia kokouksia missä on oltu yhdessä, että on oltu aika vähän tekemisissä, sillä tavalla ei ole kauhean hyvä tuntuma, että ymmärtääkö ne kaikki ihan niin kuin me haluttais. (2)

Reference 2 - 3,16% Coverage

Haastattelija: onko se sitten ollut ████████ joka on ollut sellaisena välikätenä?

On, kyllä, puolin ja toisin. Ihan joku kokous oli sellainen, muistan, että kun he (suunnittelijat) esitteli meille niitä suunnitelmia, niin paljastui joku asia, en kyllä muista nyt mikä, mutta jota me käyttäjät ihmeteltiin, että miten se voi olla tuolla tavalla, että meidän mielestä se ei voi olla niin. Kyllä he sitten muutti sitä suunnitelmaa, kun perusteltiin, että miksi se ei voi olla niin (2)

Reference 3 - 3,21% Coverage

Haastattelija: onko näitä tällaisia esittelytilanteita ollut teidän mielestä riittävästi vai olisiko pitänyt olla enemmän?

No ehkä olis sellaista yksityiskohtaisempaa esittelyä kaivannu, koska parissa kokouksessa näitä juttuja varmaan esiteltiin ja minusta ne kokoukset oli sellaisia, että sitä ilmapiiriä hallitsi kiire. Ja kun tuntuis, että jotta ymmärtäis sen asian, niin pitäis rautalangasta vääntää, olis varmaan pitänyt olla enemmän aikaa, että olisi sitten ymmärtänyt kaiken (2)

Reference 4 - 2,07% Coverage

Niin. Ja olisiko sellainen, että olisi vaikka ollut sellainen kokous missä olisi ollut tämä sähkösuunnittelija, että olisi keskitytty pelkästään sähköpuoleen ja sitten olisi ollut lvi-puoli erikseen. Nyt kun ne oli kaikki yhtä aikaa, ja ne levitti rullaita niitä suunnitelmia, niin siinä oli jo ihan pää sekaisin (2)

Reference 5 - 1,65% Coverage

Haastattelija: no entäs sitten sellaisia huonommin menneitä asioita, onko kenties jotain, jossa olisi ollut parantamisen varaa?

No varmaan se, että olisi paremmin ymmärtänyt niitä teknisen puolen suunnitelmia, jotain omia palavereita heidän kanssa (2)

Reference 6 - 5,79% Coverage

Varsinaisen haastattelun jälkeen haastattelija kysyy vielä "kaakelikysymyksestä", joka on tullut esille useammassa aikaisemmissa haastatteluissa. Käy ilmi, että käyttäjät olisivat halunneet jokaiselle osastolle erilaiset värykset, jotka olisivat auttaneet dementikkoja tunnistamaan "oman kotinsa", mutta suunnittelija ei hyväksynyt ajatusta. Käyttäjien mielestä suunnittelijalla ei ole riittävästi tuntemusta dementikkojen tarpeista ja hoidosta. Henkilökunta on pettynyt, kun he eivät päässeet vaikuttamaan sisustus suunnittelijan valintaan, heillä olisi ollut oma ajatus, jota ei kuitenkaan kuunneltu, käyttävät sisustus suunnittelijasta ilmausta "kallis nainen" eli heidän mielestään raholle ei tässä tapauksessa saada kunnon vastinetta. Henkilökunta kokee, että miksi pyydetään toiveita, kun niitä ei kuitenkaan huomioida. Heillä kuitenkin olisi sitä asiantuntemusta. (4)

<Documents\██████████> - § 2 references coded [11,07% Coverage]

Reference 1 - 4,95% Coverage

mutta pääsääntöisesti on kyllä yritetty, että niistä mitkä ne tietää etukäteen, niin pitää riittävän hyvissä ajoin olla, mutta se on kyllä jännä juttu, kaikki urakoitsijat ei, tuntuu, että ne ei vieläkään sitä muista eikä ymmärrä, että ne saattaa edellisenä päivänä, että nyt me laitetaan sitten sähköt poikki huomenna koko iltapäiväksi ja sitten kuitenkin meillä tietyt päivät on ne saunomispäivät ja käy ulkopuolisia saunoja ja tämmöisiä, että se ei niin kuin yhden päivän varoitusajalla ihan välttämättä onnistu, että pitäisi ennakkointia olla pikkuisen enemmän meillä. Mutta kyllä sieltä aika hyvin on se tieto tullut aina. (3)

Reference 2 - 6,12% Coverage

Kyllä ja kyllä se on yleensä urakoitsija itsekin laittanut, kun tulee joku selkeä alue, niin ne laittaa nämä "työmaa-alue, pääsy kielletty" ja alussa tuntui, että me henkilökuntakaan ei välttämättä osannut edes lukea, että sokeasti meni vaan siitä mistä on ennenkin mennyt, ennen kuin ne hoksasi, että pitää ihan oikeasti alkaa lukea näitä lappuja, koska siellä oli asbestin purut ja tällaiset, että se oli sillä tavalla ihan vaarallista mennä sinne, että kyllä ne sillä tavalla on ihan, mutta sitten on tietysti se, että kyllä me on käyttäjän puolelta aina kun on saatu sitä tietoa, niin yritetty itsekin jakaa sitä, vähän vielä ennakkoon mielellään jos tulee joku muutos, että ei voi enää kulkea sitä kautta sosiaalilaitaan että siitä ja siitä alkaen muuttuu sitten reitit. (3)

<Documents\██████████> - § 1 reference coded [3,77% Coverage]

Reference 1 - 3,77% Coverage

Niin, oman mielen mukaan on saanut tätä vetää, eikä ole ollut kenelläkään mitään sanomista paitsi nuo sivu-urakoitsijat, että nämä alueet pitäisi tehdä vasta sitten, mutta ne ei ole koskaan vaivautuneet ajattelemaan, että miksi ne on nyt jo mukana nämä alueet. Aina kun viemärilinjoja, niin ne on vietävä alhaalta ylös sitten kerralla ja iv-kanavat ja muut, että ei sieltä voi jättää niitä töitä tekemättä. J (3)

<Documents\██████████> - § 1 reference coded [4,61% Coverage]

Figure 18. An example of the detailed analysis.

6.2 Results (research question 1)

Two sets of results were drawn from the analysis of the material of case 1 that is explained in detail in the Chapter 6.1. The first part of the results answers to the first part of the research question one by forming a framework for the issues of knowledge management, understanding and learning and their relationships in projects. This framework emerged when the coded material from the interviews was carefully read through again and again. The second part of the results answers to the second part of the research question one by presenting what kind of things the participants of the design team of the case 1 learnt during the project, especially during the design phase. This part of the results is based on the further categorization of the material.

6.2.1 Framework for knowledge, understanding and learning

The framework for the relationships of knowledge, understanding and learning in the projects is presented in the Figure 19. This framework answers the research question *how is learning related to knowledge management in the case construction projects?* The basis for this framework comes from the definition of knowledge: knowledge is information that is understood by a person so that it can be utilized. Having information available is not enough alone, it has to be understood so that it can be used. The empirical findings connect learning to understanding, learning is the vehicle that turns the information into the knowledge.

There are lots of decisions that need to be made and problems to be solved in the projects. In many of them the knowledge from several parties of the project team is needed in order to reach a satisfying end result for the project. For example when designing the new building the knowledge of the end users about the actual needs for the building has to be combined with the technical knowledge of the designers as well as the knowledge of the project manager about the project restrictions, e.g. the budget. If the end users do not understand for example the drawings of the architect or the electrical designer does not understand what kind of need there is e.g. for plug points in the facilities, wrong solutions may be made and in the worst case it is noticed only when the facilities are being used. *“What is clear in this project is that there is a large*

risk in how well the end users have understood what is presented in the designs. Someone actually asked in a meeting that is this really what we got” (a supervisor).

In this situation, if things go as they should, some learning happens. For example the end users talk about the difficulties of understanding electrical drawings and how the project manager has helped them: “like we talked about electrical drawings, there are things that we do not understand, we are not familiar with these technical issues” and “we didn’t look at the drawings much on our own, N.N. (project manager) was there with us, we went them through with him, when we had to check for example electrical drawing, if there is all that’s needed, we felt that it was impossible... So that in this case the co-operation with N.N. has been pretty good”. The learning process helps people to understand things and the right choices can be made. This way a good and satisfying end result for the project can be achieved.

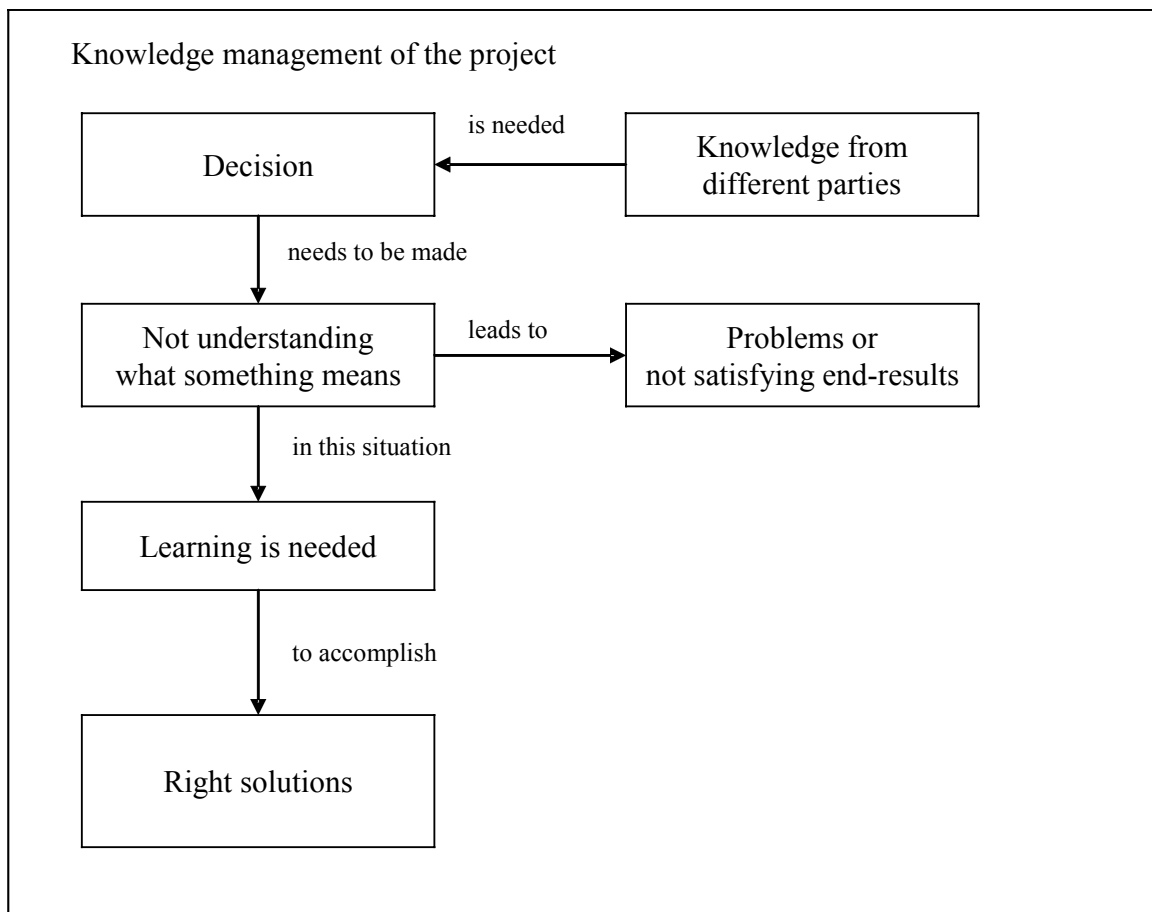


Figure 19. Framework for knowledge, understanding, and learning in projects.

However, it should be noticed that this framework is, just like models typically are, a simplification of the reality. The process is often not linear, moving from one stage to another. Rather it goes back and forward, for example when learning happens, it can lead to changes in the original situation, make the decision obsolete and bring new decisions to be made. If the first “round” leads to problems or not satisfying end results, there are often new decisions to be made to solve these problems in the future and the process begins again. Sometimes the original “right decision” proves later to be a wrong one. This can also lead to a new decision process. Another thing to be noticed about the framework is that it introduces decision making as one part of the knowledge management of the project that connects knowledge management to learning. Naturally, the knowledge management is a wider concept than just decision making, involving e.g. informing different parties about different issues and storing some of the knowledge into databases, designs etc.

6.2.2 Learning issues

It is shown in the Table 7 that all the parties in the case project either learn something or were aware of the need to learn something during the project. Table 7 answers to research question *to what kind of issues is learning related*. The first column presents who is the one learning, the second column presents what is the learning issue and the following columns present who is talking about the issue. It is important to notice that in this case project the same person has been both the architect and the project manager representing the client. This person was also changed during the project. In all cases the participants of the project talk about their own learning but all the learning issues are also talked about by someone else than the learner.

These learning issues cover all the different kind of learning that could be somehow expressed explicitly. Some of this learning is informal and some it is more formal and facilitated. Some learning does not even happen, but the informants feel that it should happen. However, there can also be some incidental learning happening which the informants do not know about and cannot therefore express. It is also possible that some of the learning would have not been realized by the informants in the normal

course of the project but when they started to think about the project, they realized that they have learnt something.

Table 7. Summary of the learning issues.

Who is learning?	What is learnt about?	Who is talking about this?				
		Architect / Project manager	Other Designer	End user	Contractor	Supervisor
End users	Technical issues	x	x	x		x
End users	Their own ways of working	x	x	x		x
End users	Practices of construction site			x	x	
Architect	End user needs	x		x		
Architect	Other designers' work	x				
Other designers	End user needs	x	x	x		x
Other designers	Condition of existing building		x		x	
Other designers	Quality of design documents / needs of constructability	x	x		x	x
Contractors	Work site policies	x		x	x	
Contractors	Construction business				x	
All parties	From one construction phase to another	x		x	x	x

Based on this material, the end users have learnt about three different issues: about technical matters, about their own way of doing things now and how it should be done in the new facilities and about how one should behave on a work site. The first group is closely tied to co-operation with the architect and other designers, it is about dealing with issues like how to understand what the technical drawings actually mean in practice. The architect says about the mock-up room: *“We worked around the core of the facilities, the room and bathroom combination, with the help of the mock-up*

room, of which we made a couple of versions... This is not a unique situation in our work, we have used them earlier and noticed that they are good tools. With them we can better discuss, to understand each others, to build a common idea". At the same time the architect is talking about himself learning about the end user needs

Another important issue for the end users to be learnt is how to express what their needs actually are. In order to do this they have to form an idea of what they are doing and how and what is needed for this. Also others than the end users talk about this: *"Somehow I got the impression, and about this access control specially, that when we talk about us making the plans and the needs (the end users have), it felt that the end users didn't actually know what they want"* (a supervisor).

The case project was such a project that the building was in use during the construction phase. This has meant that the end users must have learnt what kind of restrictions this brings along. One of the end users says herself: *"They put signs 'Working site, no trespassing' on the doors, but in the beginning I felt that us, the staff, didn't know how to read, we just went where we were used to go, before we realized that we really must begin to read these signs, there were places that it was actually dangerous to go there"*.

It seems natural that the end users need to learn about the technical issues and it should be as natural that the architect and the other designers learn about the end user needs for the new facilities. As one of the end users say: *"The fact is that we (the end users) have the knowledge about these customers and their needs, this is what has been bothering us the most, like about colors and materials and others, it has not been as it should have, because our expertise has not been utilized"*.

However, there seems to be quite large difference how different designers regard finding out the end user needs. The architects see it as a natural part of the design process: *"We have a continuing discussion for example with the cleaning department, it comes up during the design phase, it's become into such a way of doing things that also the maintenance and use is taking into account when choosing materials and colors"*. Another designer is not so interested in what happens in the facilities: *"I'm not so interested in if there are two or three grannies sitting in a room."*

It is also not so clear that the architect or the other designers understand the plans that the others are drawing or are not considering them: *“There has been a such negative thing about the architectural, electrical and hvac-planning that they have not been enough reconciled”* (designer) or *“It’s like when I get the electrical drawings, something I do understand and something I do not understand”* (hvac-supervisor). In some situations learning can be replaced by using the knowledge of someone else: *“We need to use experts and discuss with them, the kitchen has been one place for that, it’s no use for stretching the own resources if there are experts available”* (architect).

Because the case project is a renovation project, it is important that the designers are familiar with the existing building: *“It’s good that all the designers are from this town or near it, it’s been possible to visit the building to see problems that there are”* (designer). According to the client they should also learn what kind of drawings are required: *“There are such situations that we would like to get something (drawings) quickly, but we do not get it, next time we get something and the result is that we are happy to get the drawings anyhow... and there are always something missing from the end result”* (supervisor).

The main learning needs for the contractors have been related to the fact that the building has been in use during the construction and attention must be paid to this. One of the end users talk about this: *“It’s been tried that about those things (blackouts in e.g. water or electricity supply) that they know in advance, must be told us early enough, but it seems that not all the contractors, they do not either remember or understand this, they may tell the day before that tomorrow there will be no electricity in the whole afternoon and we have certain days for sauna, people from outside of the facility come to sauna, so one day is not enough to handle things”*. One younger contractor also talks about how he has learnt about the construction business in general and ways of doing things in construction because he’s new in business.

The actual construction phase of the case project had been divided into a few phases that followed each others. This way there was a chance to learn from mistakes or experiences in earlier phases. This learning is mentioned several times during the interviews by different parties: *“The latest example is that there’s already been*

installed some lamps in the departments and they are absolutely not good, they are not going to work in practice, we didn't see them in before hand, and now we realize that they can't be like that... but this is good in that way that it's only the first phase now and we now know many things, and there is a chance to have an effect to other phases" (end user) and "It's been possible to gain experiences from those facilities (already renovated), we can use them, and based on that we are now doing some things in different way" (architect).

6.3 Findings from the case 2 complementing the answers to research question one

In the middle of the planning process of a school renovation project (case 2) the participants of the design meetings were asked to tell if they feel that they have learnt something during the process. This survey was made with simple A4 sheets with the following questions:

- Do you feel that you have learnt something during this project?
- If yes, what have you learnt?
- Do you feel that you should have learnt something (else)?
- If yes, specify what.

The results from this survey are used to complement the findings from the case 1 to answer the second part of the research question 1: *To what kind of issues is learning related in these projects?*

The group of answerers consisted of an architect, representatives of end users (both teachers and service providers), a project manager, designers, and supervisors. They filled up the survey at the end of the meeting and it took for them about five minutes. None of the people present in the meeting refused to answer. All together eleven people gave their answers and all of them said that they felt they had learnt something and also specified the issues learnt.

The answers of what was learnt can be categorized into three groups:

1. the importance of communication and understanding other parties,
2. general issues related to projects and project management, and
3. concrete issues related to construction and school work.

In several answers it was emphasized that it is important that the end users are included in the planning process from the beginning of the project. The architect and the other designers are not specialists in school work so it is essential that the experts in this area, teachers, cleaners etc. are involved in the project. One of the answers by a designer was: *“it is very useful to get to know the school in actual teaching situation”*.

But it is not enough just to have the end users involved in design process if the different parties do not understand each others. Many answerers said that bringing the end user side of the project and the designers together made them realize that the viewpoints of the different parties can vary a lot. Reciprocity can be hard but the more discussion there is, the easier it is to understand other parties. It is important to try to create ‘a common language’ for all the participants of the project. Creating a vision for the project was seen as a good way to help avoid contradiction.

Learning related to project management dealt with issues like understanding the importance of creating a project management plan and learning some other procedures that could be used also in other projects. Some of the learning happened through the new ways of doing things that were introduced in this case project. One of the answerers (a designer) said that *“it’s good that we are thinking about the mock up room because it helps going through details and end user wishes”*. Also the importance of adequate recourses in planning phase was seen important.

The learning about the concrete issues related to construction and school work were also stated in many answers. It is typical that the end users have very limited knowledge of construction projects, if any at all. In order for them to understand why some things can be done and some can’t they must learn about construction. One of the answers by an end user representative was: *“I’ve learnt about possible solutions for different wishes and also about some restriction”*. Also designers felt they have learnt something about today’s school environment, some of them had had no connection to schools since their own school days and saw that many things have changed after that.

There are certain similarities between the learning issues found in the case 1 and the case 2. In both cases the architect and the end user representatives understood that

they have to learn something from each other's world in order to communicate effectively and to gain good end results. In case 2 the understanding the importance of co-operation and communication is even larger. The action research has probably influenced this because the importance of these issues was constantly emphasized by the research group. The research group also brought up the issue of project management practices so that may explain why the participants in case 2 felt that they learnt about project management and the participants of case 1 do not refer to this.

7 Methods for facilitating learning in the case projects

The methods for gathering the material in the case 2 and analyzing it differs remarkably from the methods used in the case 1. The research method used, action research, is introduced in the Chapter 5.5. The analysis of the case 2 and its results will be introduced in this chapter in detail. The main objective of the case 2 was to develop and test methods that could be used for facilitating learning in construction projects and therefore this chapter aims for answering the research question two: *How learning in the case construction project can be facilitated by using facilitated group activities like vision building, activity cards, and mock-up room?* The material from the case 2 will be complemented by presenting some material also from the case 1.

7.1 Research process

One part of the PROLAB-project was action research. During the action research the participants from the case-project and the researchers planned and tested together several different ways to improve communication and learning in the project. The special focus was on the knowledge transfer from the designers to the end users and vice versa. The case-project was a renovation and partly new building of a school of 270 pupils (for more details see the Chapter 5.3.). Some of the methods were better approved by the project participants than others. There were also differences between the different groups of participants in how closely they were involved in the research.

It is typical for action research that the researcher is involved in the action that is planned and implemented. This is also true for this research. For all the three different interventions that were organized in the case project 2 and that will be presented later in this chapter I've been personally involved in planning the actions, implementing them and also reflecting the results. I was also the one mainly responsible for documenting these interventions. Fisher and Phelps (2006) discuss writing an action research thesis in their article. They propose story telling and narratives as one way of reporting the research. The research can also be written as a case study of the process of the work. I try to utilize a bit of both here, I begin by describing the background and the objectives of the interventions to explain why we ended up using the action

we did and connecting it to the bigger picture, this will be followed by the “story” of what actually happened during the action, and finally I will discuss the results of the action.

7.2 Methods for facilitating learning

In the Chapter 6 it has been shown that the participants of construction projects usually learn something during the projects. What they learn varies depending on the background of the person and his/her role in the projects (e.g. end user, designer, project manager). However, learning is usually not planned, it's not intentional, it just “happens” because circumstances push it to happen, just like the case 1 shows. Often this way of learning is not an easy way and it causes stress for the participants of the projects. For example Edmondson, Bohmer and Pisano (2005) have emphasized the importance of managing the learning efforts for effective and fast learning in groups.

In construction projects e.g. end users feel sometimes that they are left alone, they feel that they need to learn for example to be able to read the blue prints, but nobody helps them. In the worst case learning is not taking place and this causes problems either during the project or with the end results of the project. In this chapter the following three methods of improving communication and making learning easier will be discussed:

1. vision building,
2. activity cards, and
3. mock-up room.

In vision building all the project participants in very broad meaning were brought together to create a common vision for the project. The aim was to make sure that the whole project team has a common goal for the project. Activity cards were introduced to help the communication between designers and the end users. By filling up the activity cards the end users formulated the basis of their needs for the renovated facilities. The mock-up room was build for making it easier to the end users to understand the plans of the designers. It's been often noticed that for non-professional in construction it is difficult to really understand what the end result will be just by

looking at the designs. In addition to the mock-up room tested during the action research also another example of a mock-up room will be provided from the case 1.

7.2.1 Vision building

7.2.1.1 Background and objectives

Vision building is one of the basic strategic management tools. It is usually done so that everyone has a clear idea what is the direction of the organization. As Grant (2002: 29) states: “*A fundamental concern is what the firm (or the individual or the organization more generally) wants to be in the future. Such a view is often made explicit in a statement of company vision*”. It is not enough that the CEO of the company knows what the firm is wanted to be, the target must be made open and clear for the whole organization to know. This can create motivation for the personnel to achieve higher performance. (Grant 2002: 29, 59.)

The same benefits of vision building process can also be achieved in projects. Christenson and Walker (2004) discuss the role of vision in project success. They suggest that vision is one of the critical success factors to project outcomes. The subsystems parts of the projects are often difficult to coordinate and align because people in them may have different motivations, aspirations, and agenda which may differ from what is actually the best for the project outcomes. In construction project e.g. the project manager may wish to hurry the project which may cause the early planning to be poor and the end users may have expensive wishes concerning some parts of the building which may cause problems with the budget and other parts of the building. Christenson and Walker (2004: 40) propose that vision may help all the team members to make sense of the project goals.

Christenson and Walker (2004: 42) argue that a project vision should have the following four characteristics: it must be understood, motivational, credible, and demanding and challenging. The core purpose and the essence of the project objectives have to be clearly stated in the vision. The vision must also be convincing so that the team members wish to internalize it. The vision may not be in contradiction to the participants' cultures and values or otherwise it will not be

accepted. And finally, the vision has to be such that it challenges the team to work more effectively. (Christenson and Walker 2004: 42.)

The vision building process in our action research case had three objectives:

1. to motivate participants to take part in the design process (specially school personnel)
2. to make sure that the whole project team has a same “big picture” of the project and its objectives
3. to use the vision later in the process as a tool for guiding the prioritizing the different needs and wishes.

7.2.1.2 Vision building in practice

A half day session was organized by the researchers and city personnel to build the common vision for the renovation project. The parties invited to the session included all the staff from the school (including kitchen and cleaning), some parents of the students, school office and city planning office, building and maintenance of the city, museum office and all the designers involved in the project that had been already chosen. All together 69 persons participated in the vision building process. The largest group of the participants was representing the people working at the school. Also the building department of the city was represented by several people, including e.g. the project manager, the architect and supervisors. Other parties included only a few persons.

Already before the session some of the participants were ask to write a short introduction about their own viewpoint and goals for project. After the deputy mayor of the city had opened the session these introductions were presented. E.g. the following viewpoints were presented:

- The representative of school office talked about the future student amounts in different areas of the city and about developing the teaching.
- The head master of the school presented some of the problems at the school and the wishes of the teachers for the renovation.
- The project manager introduced some of the limitations for the project that budget and timetable will bring along.
- The representative of the maintenance department of the city introduced the needs of maintenance.

- The architect told what kind of information the designers need for the design process.

All together 12 different viewpoints to the project were presented. It was clear that these introductions helped different parties to understand that their own needs and wishes are not the only ones and that it will probably not be possible to make all the different wishes to come true. The introductions also showed that outside the small core team of the project there are several different parties involved in the project.

After the introductions one of the researchers briefly explained how the vision will be actually created so that the participants would know what will happen. Participants were divided into smaller groups to discuss what kind of school would be wanted. Groups were formulated randomly so that each group would consist of the representatives of the different parties. There were 7–8 persons in each group and a tutor who was familiar with the method that was used.

Three different scenarios were given to the groups: small village school, scenario of poorness and specialized school. The aim of this was so force the groups to consider different possible futures and to keep the vision in enough abstract level. In the small village school scenario the future would be such that the school is the heart of the area and there are lots of other activities than teaching happening at the school. The scenario of poorness would mean that the economical situation is getting tighter and the education for big group of students must be provided with only a little money. In the specialized school scenario the competition between schools would increase in the future and schools would have to specialize in order to attract students and to be able to survive.

In the groups people thought about what were the most important things about the future school keeping in mind the scenario that was given to them. Each person in the group had to come up with his / her own ideas which he / she wrote on small pieces of paper. After that the group had a small discussion about all the ideas and then they voted for the three most important things. The voting was used in order to give also the more silent people a chance to influence the decision of the group.

Ideas developed in the groups were next presented to other groups by writing them to paper and hanging the papers on the wall. Words like ‘safety’, ‘cosines’, ‘practical’ and ‘good acoustics’ came up. After the presentations all participants cast their votes, each for the three most important things. The eight things that got the most of the votes were:

- ‘practical’ (21 votes),
- ‘safety’ (19 votes),
- ‘facilities that are versatile and can be changed according needs and thus support specializing’ (13 votes),
- ‘the construction process is safe and of good quality’ (12 votes),
- ‘versatility’ (9 votes),
- ‘a school that emphasize culture and presentation’ (8 votes),
- ‘economical in the whole life cycle’ (7 votes), and
- ‘student must come first’ (7 votes).

The common vision was created next in discussion, based on the voting results. Discussion about the actual meaning of the different words emerged and some changes were made so that the vision would better serve its future purposes. The final vision was:

*“Practical and safe school
that supports specializing
by multipurpose rooms
and that is
economical in the whole life cycle
as well as good quality”.*

7.2.1.3 Discussion

It is clear that the great number of participants shows that there was a need for this kind of session. For example all the teachers of the school participated in the session in their own time. People were also quite eager to prepare and present the introductions when they were asked to do it. The feedback from the session was very positive, people felt that they have had a chance to influence and also to get some information. It was even said that vision building should be done in every construction project.

If we look at the vision building in the light of the objectives, it can be said that all of them were met. All participants committed to making the vision come true and the project manager took the major responsibility of the matter. The feeling of having a chance to influence motivated specially the teachers to participate in the project also later. Later during the project the vision was used as a guideline of what is the goal of the project when deciding which of the end user wishes should be realized and which are not so important.

Christenson and Walker (2004: 43) claim that merely preparing the vision is not enough. There has to also be a communication strategy that helps sharing the vision in the organization. The process of together creating the vision definitely has acted as a process of communicating the vision in our case project. However, there is also a negative side of the process: costs. Keeping a large amount of people occupied half a day with vision creating creates rather high costs.

The vision building process also facilitated learning in the project. The introductions specially gave people a chance to learn from other parties viewpoints. The end users learnt things about the framework that budget and timetable set for the project as well as about the information needs of the designers. The project staff learnt about the needs and wishes of the end users and also something about what was behind the wishes. This all could have done also in other ways, through personal discussions and discussions in meetings but this could have meant e.g. that not all the end users would have gained this information. This way a lot of information was delivered for a large group of people and since it was possible to make questions and discuss matters in the small groups, it's more likely that participants also understood the information.

Vision building session was greatly about sense making (Weick 1995), about putting things to a larger framework than the perspective of one party in the project. Participants of the session learnt about the project as whole, they learnt that their own perspective is only one (small) part of the project. But the vision building was also about social construction (Berger and Luckmann 1972), about building a shared mental model (Senge 1994). All the participants brought their own objectives to the session and during the facilitated work these objectives were socially turned into a mutually accepted vision.

Also Fong, Hills, and Hayles (2007) emphasize the role of a facilitated workshop for creating shared awareness and developing shared understanding in a project. The shared awareness includes understanding each other's problems, needs, and wants as well as the project in general. If different parties can break their functional mind set and see the project from the others' viewpoint, it is possible to develop a shared understanding about the project. (Fong et al. 2007: 45–46.) The findings from our facilitated vision building session show similar results as the ones Fong et al. (2007) report.

7.2.2 Activity cards

7.2.2.1 Background and objectives

Both end users and designers have a lot of tacit knowledge that is needed in construction projects. The end users are the experts about the activities in the facilities that are built or renovated. The designers have the know-how about how to make the end user needs come through within the given budget and timetable. In order to a project to be a success the tacit knowledge of the both groups must be used. However, as described in the Chapter 2 uncovering tacit knowledge is not an easy task. One of the common problems in the projects is the lack of 'a common language' between designers and the end user representatives.

At one point of the action research case it was suggested that the end users could fill up room specification cards in order to get their view of the needed facilities. Room specification cards are used for defining the quality of a room by a detailed explanation of e.g. materials for roofs, wall and floors, numbers and sizes of windows, level of ventilation etc. However, it was felt that the room cards contain too much technical information and also take the matters more into solutions than problems, so they may be too difficult for the end users and not even serving the purpose at the situation.

On the basis of the room cards a small group of researchers begun to think what kind of cards would make the end users the really think about the activities in the facilities. Concentrating on the activities is important because it's been argued (see e.g.

Pennanen 2004) that the basis for designing facilities should be the actual activities happening in the facilities, activities that fulfill the organization's strategy, that other kind of investments are waste. Pennanen (2004) proposes preparing 'Activity Bills' as a part of workplace planning procedure. "*The Activity bill is a description of the core and supporting activities that are employed to ensure that the organizational goal is fulfilled*" (Pennanen 2004: 146).

Another objective for the cards was that they should also be easy enough to fill up. Finally, activity cards (see Figure 20) were introduced in order to find out the end users' view of the activities in the different facilities of the school. The objective was to move tacit knowledge between the different parties of the project and to help them to understand each other better.

7.2.2.2 Activity cards in practice

The end users of the school building were asked fill up the activity cards. They were given an empty card as well as some that were already filled up (examples) to help them to understand the idea of the card. They were asked to think about the activities happening in different premises, classrooms, kitchen, room for teachers etc. and write this down. E.g. about the classrooms was asked, how many students there are, what is done there, what kind of requirement the activities bring for the room and what kind of connections is needed to the other premises.

SCHOOL X

ACTIVITY CARD

ROOM: _____

Describe what kind of activities there are in this room do that a good renovations solution can be planned.

USERS OF THE ROOM: _____

Activities:

- _____
- _____
- _____
- _____
- _____

Other use

- _____
- _____
- _____
- _____

Connetions to other rooms

- _____
- _____
- _____
- _____

Large equipment needed

- _____
- _____
- _____

The most important things in the room (describe with your own words):

- _____
- _____
- _____
- _____

Figure 20. Activity card.

All the staff working at the school filled the activity cards up even though the time given for them was very short. They said that the card was easy to fill up and that it was good also for them to think about what is actually happening in the different rooms. All together 22 cards were returned:

- Basic class room (home class), 11 pieces
- Facilities for technical handicraft
- Kitchen
- Dining room, 2 pieces
- Facilities for morning and afternoon care, 2 pieces
- Library
- Class for teaching music
- Facilities for needlework, 2 pieces
- Teachers' room

In addition to this the cleaners wrote down their ideas about different rooms.

The next phase was that the architect made a summary of the cards. In the summary he stated about the basic class rooms e.g. that “the time for uses in basic classes is between 8 and 15, and there is about 20 to 30 pupils in each class”, “there is a need for a place for small group working in the classes which may causes some difficulties because the size of the classes is such that already 25 desks make the class pretty full” and “in each classroom there has to be a place for three computers”. Afterwards the architect discussed the cards with end users several times to get a good picture what was meant in the cards and to find out what are the requirements for the different rooms. These discussions acted as a basis for decision making because they revealed the end users' needs for the architect.

7.2.2.3 Discussion

The reaction of the end users towards the activity cards was very positive. All of them returned the cards filled up even though they had practically only one day to fill them up. They say that the cards were easy to fill up and that the cards forced them to really think about the activities in the facilities. The architect said that the cards helped him to find out the end user needs, that they were a good foundation for the discussion.

It can be seen that the activity cards really helped formulating the tacit knowledge of the end users. The cards helped the end users to concentrate on the “important” matters: the activities in the different rooms. Writing down tacit knowledge is not an easy task. In fact, it is possible that all the tacit knowledge cannot be written down. However, the activity cards certainly helped to make at least a part of the tacit knowledge of the end users explicit. The cards also acted as a medium to move tacit knowledge from the end users to the architect. The cards alone might have not been enough, the discussion helped in defining some unclear matters.

From the learning point of view the activity cards helped mainly the architect, making him better understand the needs of the end users, though the discussion about the cards also provided some valuable information for the end users. The discussion about the end user needs was naturally continued around the sketches which the architect drew. Architect based his work on the knowledge he gained from the end users but in some cases he could not provide what end users wanted for example because the size of the existing facilities limited the possibilities. In those cases he tried to explain the situation for the end users so that they would know why something could not be done. In these cases it can be said that the final decision was made by the architect but that there was a mutual understanding about the reasons for the decision. However, the architect’s attitude was such that he genuinely tried to do his best to fulfill the end users’ needs and there were no larger conflicts between him and the end users. Other designers than architect were not involved in the process but in might have been helpful also for them.

7.2.3 Mock-up room

7.2.3.1 Background and objectives

Mock-up room is a room or a space where it is possible to test different things according to the designs and plans that will be in the final rooms of the new building or after the renovation in the existing building. The room can be build in the original room or in some other facility if some new layout solutions need to be tested or if it is a totally new building that it is been planned. For example colors can be tested as well as furniture, try different places for wall sockets or lamps etc.

The aim of building a mock-up room is to illustrate how different solutions in designs affect the end result. It is easier to comprehend things in mock-up room than it is just by looking at two-dimensional drawings and this helps the end users to understand better what the designs mean and what will the end result be like. It has been noticed that for un-experienced person it is extremely difficult to realize for example the real size of different spaces by just looking at the drawings.

The idea of the mock-up room can be referred to prototypes used in new product development. Kelley and Littman (2002: 5) describe prototyping as *“both a step in the innovation process and a philosophy about moving continuously forward, even when some variables are still undefined”*. Prototypes can help making discoveries, they bring something fairly abstract to something tangible that can be touched and tested. Kelley and Littman (2002: 129) present a case of prototyping an entire Amtrak train car: *“You couldn’t walk by it without finding three or four people pacing around, sketching, sitting down, asking questions. The space invited experimentation”*. Kelley and Littman (2002: 111) argue that prototypes can also help people changing their minds, accepting new idea and making hard choices.

In the action research project one of the classrooms was planned to be a mock-up room that could be tested by the teachers in real teaching situations. The participants of a design meeting came up with the following objectives / gains for the mock-up room:

- Bringing a diversified view to different matters (taking into account the viewpoints of different parties).
- Resulting a functional room for both users and maintenance so that the both views are balanced.
- Forcing to bring up all the ideas already during the design phase which should lessen the changes during the construction phase.
- Showing the places for the main activities and furniture.
- Showing the places where pupils sit because that affects the design of ventilation.
- For electrical design all the rooms are different, there are many options to do things, mock-up room could provide comments from end users.
- Could bring a method to be used in all school renovation projects.

- Could be used in compromising.
- Visualizing things and aesthetical solution.

In the case 1 a new room-bathroom combination was been designed which also changed the sizes of the old rooms. For this purpose an ideal size of the new combination needed to be found as well as the optimal layout for the bathroom. A mock-up room was build to provide the end users a chance to try the new solution in practice.

7.2.3.2 Mock-up room in practice

In the action research case project the building of the mock-up room did not begin in a very positive way. It was seen as a demanding and time consuming process and the gains of it were probably not clearly seen even though the project team had come up with several positive objectives as was presented earlier. For this reason the process was delayed several times. The mock-up was meant to be ready in February so that it could be tested before summer holidays but nothing happened until in May. At that point the research team got some participants of the project team become inspired and the mock-up room was decided to be build by a group of volunteers instead of the city personnel.

The architect had already earlier made such drawings that it was possible to build the room according to them. The architect also took part in the volunteer group which was a great help because, as stated earlier, for those who were not construction professionals, it was difficult to understand what something in the drawings meant in the real room. Other participants volunteering in the process were teachers, researchers, some parents and a supervisor. The equipment and the materials needed in the process were very simple and not expensive: some tools like hammers, saws and scissors, cardboard, wood, nails, and tape. The aim was not to build a finished classroom but to show what kind of effects different solutions in the designs would have, e.g. the new kind of blackboard, the locations of the cupboards and the location of computer desks.

The time used for the whole building process of the mock-up room was about 4–5 hours. The number of the people participating was about 15. Some old cupboards that

would not be in the new room were removed and some new ones were built in the right places. The ventilation channels were built because they were so large that they changed the look of the room quite radically. The boards were marked on the walls so that their new size could be easily understood. The architect also presented the new colors for the floor and the walls.

In the other case project the mock-up room was built in the early phase of the design process. The architect had participated earlier in another project where a mock-up room had been built and he found it very useful. The bedroom-bathroom combination was built in the basement of the facility being renovated (nursery home for elderly citizens), that way the new size could be easily seen and it was also near to the end users so that they could try the solution out.

The room was built based on the plans from the architect and the end users didn't participate in the building process. The bathroom was also furnished. Afterwards several end users, nurses, went to see and test the mock-up room, also with clients, the old people. It was also important that the users were able to try different ways of using the bathroom: old people going there alone or with a nurse or two to help or with some helping equipment. After some comments from them the room was changed so that it would be more suitable. The architect was strongly supporting and helping the end users during the design process and did not take the comments too personally. He truly believes that the experiences from the mock-up room helped to achieve better end results.

7.2.3.3 Discussion

The whole process of building a mock-up room was not an easy one in the action research case. There was a lot of resistance towards the idea. One reason was probably that people didn't realize that a mock-up room does not necessarily have to be a finished room with every little detail being as in the final version but it is possible to build a "lighter" version of it. Also the real use of the mock-up room for the designing purposes was minor because it was built so late during the design phase.

However, the process got positive feedback from two different parties: the end users and the other designers than the architect. The designers said that because the

architect made more detailed plans for the room than usually is done, it made their work easier. So even just planning to build a mock-up room would have been useful for them. During the volunteer group was actually building the mock-up room, it was clear that reading the designs is not easy for the end users. In many occasions they said that the end result was at least at some point different than they expected and some small details were also decided to be changed according to their comments. The architect did not seem to have a problem with the end users' comments.

In the other case the starting-point and the relevance of the mock-up room were totally different. The mock-up room was intentionally built to be a helpful tool in the design process. Testing of the room also affected the layout solution as well as some smaller details. Both the architect and the end users were satisfied with the room and they believe that thanks to the mock-up room the final end result is better.

From the learning and communication point of view, the mock-up room proved to be useful in both cases. There was some tacit knowledge of the architect engaged in the designs, but even it had been turned into explicit knowledge this way, it was difficult for the end users to understand it. The mock-up room helped them to learn and understand and then they were better able to comment the design solutions. There was also discussion that the mock-up room could have been used even more effectively by taking the other designers and the end users there together, to discuss about e.g. electrical or ventilation solutions.

The main objective for building a mock-up room in both cases was to visualize the design for the end users. However, these mock-up rooms also served the design purposes, because the comments of the end users affected the design decisions. Mock-up rooms are used in construction in some cases but they are not very common. However, the findings from our cases show that they can provide value for the design process.

7.3 Summary

Three methods for facilitating learning were introduced in this chapter: vision building, activity cards, and mock-up room. These methods were all tested in our action research case. All these methods are planned for the design phase of a construction project, vision building for creating common understanding and objectives in the beginning of the work, activity cards for easing the communication between the architect (and other designers) and the end users in the beginning of sketching, and mock-up room for making it easier for the end users to understand the designs.

All these methods proved to be useful in the case project. The vision building activated all the interest groups of the project and got specially the end users committed to planning. The vision statement was also used during the planning as a tool for making choices. However, the vision building process took quite a long time for many people, so this method is quite expensive. The activity cards were welcomed by both the end users and the architect. According to the end users they were easy to fill up and forced them to really concentrate on the activities in the different facilities of the school. The architect got a good picture of the end user needs from the activity cards and the cards provided a good ground for the discussion between the end users and the architect. The costs of the activity cards were very near zero.

The resistance towards the mock-up room was high among the technical personnel of the city and therefore it was built by volunteers, mostly researchers and the school personnel. Also the architect participated in the process. The objective of the process was to build a room that helps the end users to understand the plans, not a finished class room. Cheap materials and tools like hammers and saws, cardboard, wood, and nails were used. During the process it became clear that understanding the designs is not easy for a “non-technical” person, so it was very good that the architect was there to tell how things are supposed to look like. As a result of the process the end users got a good picture of what is planned and some minor changes for the designs were made.

8 Discussion

This final chapter discusses the main findings and contributions of this research and provides answers to the research questions presented in the Chapter 1.2.2. Also some implications that this research have to project management practices in construction projects specially are introduced. There is also evaluation of the research process and the results in this chapter. And finally, some ideas for future research will be presented.

8.1 Main contributions and conclusions

This work contributes both by providing new deep understanding about learning in inter-organizational projects, especially in construction business and by providing tested methods for facilitating learning in these projects. This research also contributes methodologically by showing that action research is a good vehicle for implementing new practices in organizations. All these contributions are discussed below in detail.

A literature review was made to explore the issues of the research. The nature of project work and project management was defined based on the literature. Types of knowledge and knowledge management were explored to gain understanding about knowledge in project and what is / can be done to ensure the effective use of knowledge. Organizational learning literature was reviewed to better interpret and understand the findings from empirical research. This literature review provided some important views also to the connection between learning and knowledge management.

Two case studies were made to answer the research questions. Both cases were construction projects but the research methods were different because different methods were found to be the best ones to answer different research questions. The case 1 aimed of answering the research question one and the material was gathered by interviewing the participants of the project. The case 2 was an action research case in which some methods for facilitating learning were develop and tested.

8.1.1 Contribution from answering the research questions

The main objective of this research was to gain more knowledge and understanding about learning in inter-organizational projects where participants from different organizations, with different backgrounds, need to combine their knowledge in order to accomplish good end results. Another objective was to develop and test some methods that could facilitate learning in projects and thus improve knowledge management in them. Two research questions were formulated in order to meet the objectives:

1. *How is learning related to knowledge management in the case construction projects? To what kind of issues is learning related in these projects?*
2. *How learning in the case construction project can be facilitated by using facilitated group activities like vision building, activity cards, and mock-up room?*

By providing answers to these research questions this research contributes in two ways: 1) new knowledge is developed about learning processes and their importance in inter-organizational projects, and 2) new tools for improving knowledge management in construction projects are presented. The implications of these contributions for the theory on knowledge management and organizational learning will be discussed more deeply in the Chapter 8.1.2.

8.1.1.1 Contribution by the research question 1

A framework relating learning and knowledge management in inter-organizational projects was created based on the theoretical findings and material from case study 1 (see Figure 19, page 108). In the projects there are a great number of decisions to be made and problems to be solved. Some of these decisions are such that one person of the project team cannot make them alone but knowledge from different parties is needed. For example the design phase of any construction project is typically full of this kind of situations: knowledge about the end user needs is needed to be combined with the technical knowledge of architects and other designers. This means that the new knowledge concerning the new building has to socially and mutually constructed by different parties.

If there is not a mutual understanding within the project team, some problems may arise either instantly or later. In construction projects this may happen if e.g. the architect does not understand the end user needs or the end users do not understand the plans of the designers and accept incorrect designs. These misunderstandings may lead to expensive changes during the construction phase or even to an end result that does not fulfill the end user needs.

If the project team and its participants are willing to learn and this learning is facilitated, these problems may be avoided. Both willingness to learn and the level of facilitating learning seem to vary a lot in practice. Some of the project team participants are more eager and open for learning than the others, and this seems to be the case especially regarding the end users. Some of the designers seem to think that they know everything needed without asking or learning anything as if their knowledge alone would be enough for a good end result. Learning can be facilitated in many ways, at the very least open discussion is needed between the parties. However, there are several different tools for facilitating learning as well, some of these tools were tested in case project two and will be discussed later in this chapter.

The empirical findings from the case 1 show that all participants of that project either had learnt something during the project or are aware that there is a need for learning something. The need for learning can also be stated by one party to suggest that another party should learn something. The summary of the learning issues is presented in the Table 7 (page 110). The end users have learnt about technical issues whereas the learning of the architect and the other designers is related to end user needs. This learning is mainly about understanding the “new” knowledge so that it can be utilized. However, some learning regarding the end user needs is needed also by the end users themselves before the tacit knowledge of the issue can be shared with the architect and the other designers.

All the parties except the end users also bring up an issue in which learning should happen but does not. This issue is related to the quality of the design documents of the other designers. The documents of the designers do not often match to the needs of the architect or the other designers or to the needs of constructability.

Some learning issues regarding the construction phase also arose in the last interviews. In the case project the construction work was done while the “normal” activities in the building were carried on. It seems to be clear that the end users and the contractors needed to create a common understanding about how to behave in the work site, to learn how the work of the other party restricted their own work. Because the design and construction work were both done in separate phases that followed each others chronically, this created learning possibilities for all the parties, to learn from the mistakes and problems in the earlier phases.

To conclude it can be stated that there is lots of learning happening in inter-organizational projects. Different parties are learning different things for different reasons. The most of the learning is closely related to knowledge management of the projects: using knowledge, sharing and combining it and creating new knowledge. And without learning it is often impossible to reach the objectives of the projects.

8.1.1.2 Contribution by the research question 2

The first part of the research clearly shows that there is lots of learning happening in construction projects and that it is needed in order to accomplish good end results for the projects. However, the findings from case 1 show that learning is mainly unintentional, it happens because the circumstances force it to happen. In some cases this can mean that learning happens only if the participants of the project team are open and willing for learning. For example an end user may choose to go through the trouble of learning to understand the blueprints and thus can affect the designing in the early phase or she may choose to just accept the plans without understanding them which may cause changing the design later during the process.

The methods tested in the case study 2 were vision building, mock-up room, and activity cards (for a detailed description of the methods see the Chapter 7). Vision building and mock-up rooms are occasionally used in construction projects but they are not very common. However, these findings show that these methods truly facilitate learning and creating shared mental models in the projects. Activity cards provide a totally new way for communicating the tacit knowledge of the end users for the architect and maybe also for the other designers.

Vision building contributed for learning in two ways. Firstly, the *vision building process* helped the participants of the project to realize that their own view to the project and its objectives is not the only one. They learnt to understand that on one hand there are certain reasons for renovating the building and keeping the school location at the level of the whole city, and the other hand there are concrete end user needs for the facilities and these needs come from both those people who work in the facilities as well as from the maintenance. But this is not all, the budget and the timetable bring their own restrictions for the project and so on.

Secondly, the *end result of the vision building, the vision*, provided a summary of the objectives of the project. The shared understanding of the different parties of the project regarding the meaning and the aims of the project was crystallized in the vision statement. This statement formed a basis for the later co-operation of the participants in designing the facilities.

Activity cards helped knowledge sharing, especially between the end users and the architect in the case project in two ways. In the first step the cards forced the end users to concentrate on the activities performed in the facilities instead of just listing needs and wishes. By filling up the activity cards the end users formulated some at least of their tacit knowledge about the activities in different facilities into explicit knowledge that could then be shared with the architect.

The second, knowledge sharing step, was not based only on the activity cards. The architect made a summary of the cards regarding different facilities and the cards and the summary were then used as a basis for discussion between him and the end users. After this the architect started designing. This way both parties provided the project with their core knowledge: the end users as experts of the activities in the facilities and the architect as an expert in designing facilities. During the discussions a mutual understanding what was needed and what could be done was created.

Knowledge of architects and other designers is finally embedded in designs and blueprints. At this phase the designs are usually shown to the end users for comments. It would be important that the end users can react at this point if something in the plans do not fulfill their needs because changes done later in construction phase are

usually very expensive. However, for a person with not technical education or experience, understanding the designs is difficult. Mock-up room was introduced to ease this situation.

In mock-up room the solutions in a design are made tangible. For example understanding different distances can be difficult from a two-dimension sketch. If a mock-up room is built one can walk in it, so understanding the dimensions of the space is much easier. The end users in the case project commented that the mock-up room really helped them understand the designs better.

It can be clearly seen that different tools and methods can be utilized in the learning process. In addition to the experiences from the action research also in the case material 1 people talk quite a lot about the mock-up room and interpreter. An interpreter is a person who have the knowledge of one party of the project team (e.g. technical side) and who can see the issue on the hand from the viewpoint of the other party of the project (e.g. end users that do not understand the technical issues) and who this way can explain the issue to the party that does not understand it. *“We would have taken N.N. (consultant) to help us with the designers, but the technical bureau wanted to take care of it and we didn’t see that as a good way of doing it. I do not know what the situation is at the moment, if the system is going to be simple enough and well working. There is the fear that sometimes they (systems) are too complicated and difficult for the users. The technical bureau wanted to use their own designer but this N.N. wouldn’t have been a designer, but help for us, like an interpreter, because we didn’t understand them (designers) well enough and they didn’t probably understand our wishes”* (end user).

Because the different tools and methods can have such a huge effect on learning, it seems to be sensible to add them to the framework of knowledge, understanding and learning (see Figure 21). For example as one end user representative says about importance of the mock up room that was built during the design phase to see what kind of bathroom / toilet –combination works well: *“when decisions this large are made, it is worth building, in this case, if we would have seen the drawings for the first option, we would have said that it works but in practice it would have not worked (which was seen during testing the mock-up room)”*. In this case, the end users didn’t

understand what the drawings meant in practice, the mock-up room performed as a teacher and helped them to understand and the right decisions were made.

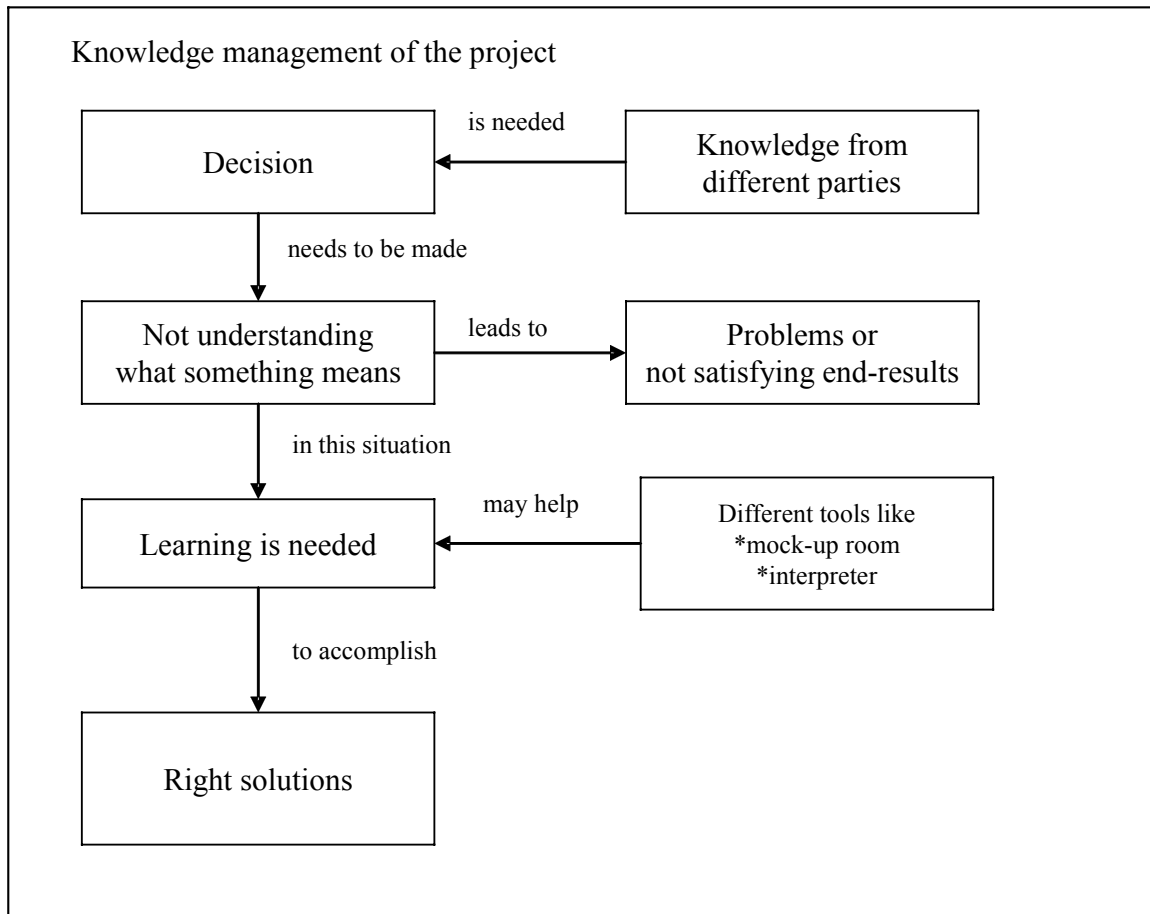


Figure 21. Modified framework for knowledge management of construction projects.

8.1.2 Implications for the theory on knowledge management and learning

The literature review provided ideas for understanding the nature of learning in inter-organizational projects and reasons why it happens. The findings from empirical research completed the picture of learning from the viewpoints of the learners themselves. The definition of knowledge forms the basis for understanding learning. For the purposes of this research knowledge was defined as follow: knowledge is information that is understood by a person so that it can be utilized. This involves learning: *“Project team members have to incorporate new information into their understanding to solve technical challenges they meet. Thus, learning is inherent in the work they do”* (Fong 2005b: 42). Or as Chakravarthy et al (2003: 306) states *“Both*

learning and knowledge have been defined in terms of new or greater understanding... to define knowledge as a type or degree of understanding... and learning as a process of acquiring this comprehension". The findings from the case studies strongly support the views of Fong and Chakravarthy. The participants of the project teams learn in the situations in which their existing knowledge is not enough to contribute for the success of the projects.

The definition of the knowledge also reveals something about the nature of knowledge: knowledge is situated. In order to understand something one must know the connection between the knowledge and its context. Often a person with her knowledge is related to other people that may possess different understanding about things. In this kind of situation the "final" knowledge is created through negotiations. For example Orr (1990: 170) depicts this well: "*Definition of the problem, or the state of the machine, is accomplished through social interaction between technician, customer and machine*". This view connects this research to social construction, which emphasizes the role of knowledge and learning as socially constructed phenomena (see e.g. Berger and Luckmann 1972; Lave and Wenger 2003; Brown and Duguid 1991; Bresnen et al. 2005a; 2005b; Gherardi 2000). It should be clear for the all participants in the construction projects that there is not a one person that could struggle through a project alone, that there are views of several different parties that have to be taking into account.

However, situation is even more complex. Some of the knowledge possessed by project participants is tacit and some of it is explicit. Tacit knowledge is such that it is not easy to be expressed in speech or written form. People actually know things that they don't even know that they know. An end user representative provides a good example of this when she is telling about an incident when planning the kitchens. When the architect asks what the kitchen should be like, the end users say that they do not know. But later when working in the kitchen the ideas began to come to them. They had already noticed problems concerning the existing kitchens but they needed to be reminded of them before they could express them. This means that living again the situations, not just in stories but also in actual context may help formulating the tacit knowledge when people know what kind of knowledge is needed. The importance of relating the context and the questions was also seen when testing the

activity cards in the action research case. The end user needs were found out by concentrating on the activities that are performed in the facilities.

Explicit knowledge is easy to share and may often be embedded in documents or in other artifacts (Nonaka and Takeuchi 1995). However, the findings from this research show that the explicit knowledge cannot always be understood by others even though it is presented in the form of a document. This is the case e.g. about the drawings in construction projects. If for example the electrical designer makes drawings, the other engineers understand them at least partly but for those with no technical background it is impossible to interpret them. Knowledge can also be embedded in processes: *“As knowledge is created and captured, learning can take place and the knowledge that is applied can then be embedded within individual, organizational and inter-organizational processes”* (Liebowitz and Megbolugbe 2005: 189). This brings us to a conclusion that knowledge is not only socially distributed (Berger and Luckmann 1972; Brown et al. 1989) but it can also be physically distributed in artifacts.

The problems of not understanding explicit knowledge that is available in documents was behind testing the mock-up room the case study 2. When the architect and the other designers prepare the designs, comments from the end users are needed. However, as stated earlier, for a person with not technical education or experience, understanding the designs is difficult. In a mock-up room the solutions in design are visualized for the end users so that they can truly understand what the end result will be like.

The SECI –model (Nonaka 1994; Nonaka and Takeuchi 1995) provides a good framework of understanding learning situations in inter-organizational projects. Understanding is created in internalization and socialization processes. These processes mean turning either tacit (socialization) or explicit (internalization) knowledge into tacit knowledge and learning is needed in these processes. A person or a group learns something new and after this learning process it is likely that this person or group is also able to utilize the new knowledge acquired. There is a lot of one way learning, learning of one domain by others in construction projects, e.g. the end users learning about technical issues and this is a good example of internalization.

Combining explicit knowledge with another piece of explicit knowledge may create new knowledge under favorable circumstances. The combining process is extremely important in inter-organizational projects because it means that the existing knowledge of different parties is turned into new knowledge, e.g. the knowledge of the end users and the architect and other designers to a plan of a building that fulfills the needs. It can be said that the new knowledge is socially constructed by the different parties of the project. Before the combining process the externalization process is often needed. Externalization means turning tacit knowledge into explicit so that it can be shared. As stated earlier, this process can sometimes be very difficult because people do not necessarily even know what they know.

Nonaka and Takeuchi (1995) view learning as largely occurring in teams because they provide the shared context where individuals can interact with each other, create new points of view through dialogue and discussion, pool their information and integrate diverse individual perspectives. Lave and Wenger (2003) state that the context for organizational learning is a community of practice, that Wenger et al. (2002: 4) define as *“groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis”*. Plaskoff (2003) sees communities of practice and work communities (project teams) as different things but emphasizes the role of intersubjectivity in both. Intersubjectivity means that there is a shared situational understanding within the group or community.

Also other literature in social construction view to organizational learning brings up interesting viewpoint regarding learning in projects. Araujo (1998: 329) emphasizes the important role of social learning for discussion: *“Technical discourse alone will not, in all likelihood, provide a framework for a dialogue between both parties. A process of social learning, involving the understanding of the social economic expectations of both parties can help the development of common, local rules restricting the potential for opportunistic behavior and fostering a climate for mutual trust”*. All the parties should acknowledge the expertise of the other parties. It seems that typically in the construction project the end users are not considered to be experts. But which one could know better the requirements for a school, an electrical designer or a teacher?

Learning can also be viewed as becoming a member of the community, an insider (Lave and Wenger 2003; Brown and Duguid 1991; Yanow 2000). When a newcomer learns the practices, culture, language, etc. of the community, she becomes accepted as a full member of the community. In construction projects this seems to be a motivation for learning especially for the end users, who are willing to be full members of the “design communities”, mainly consisting of engineers and architects. Also Elkjaer (2003: 44) sees learning as a vehicle for empowerment: “*Learning is that which enables actors to modify their relations to others while contributing to the shared activity*”.

If we look at the learning in the case projects in the light of Huysman’s (2000) learning biases (see Table 8), we notice that the findings follow only partly the biased view that Huysman introduces. We know that nearly all the individuals have learnt something during the project but has the organization, the project team as an entity, learnt something? Sense et al. (2003: 487) state that “*organizational learning is about increasing an organization’s capacity to take effective action*”. In fact, practically all the learning in the case projects aims for better success of the projects. In the case 1 the architect has worked hard to help the end users to understand technical issues and to be able to communicate their needs for the designers. In the case 2 a vision building process has been used for building a mutual understanding about the project objectives. These examples, just to mention some, show that there is also organizational learning happening in the case projects.

It seems to be that learning in there projects is more volunteer than determined. Nobody is forced to study or learn during these projects by the organization itself. However, many interviewees describe learning as a necessity for surviving in the project. This way it can not be seen totally volunteer either. However, some of the interviewees said that they would have wanted to study and learn more but they had no time for that because they were participating in the project in addition to all their normal work.

Table 8. Characteristics of learning (modified from Huysman 2000).

Who learns?	Individual learning bias	Individual Organization ←Y-----X-----→
How do they learn?	Active agency bias	Voluntarism Determinism ←Y----X-----→
When do they learn?	Purposeful learning bias	Purposeful Accidental ←Y-----X-----→
Why do they learn?	Improvement bias	Improvement Decline ←YX-----→

Y = Org. learning literature in general
X = Findings from the case projects

In the case project 2 the balance between accidental and purposeful learning was quite balanced because several methods were introduced to facilitate learning. However, in the other case it seems that some individuals learn because they have to in order to survive through the project which means that learning is more accidental even though e.g. the architect was quite active to help the end users and e.g. the mock-up room was used. But not even in the action research case it could be said that all the learning was purposeful, so our findings does not support the biased view of purposeful learning that Huysman (2000) have found.

There were no sings in the case projects about negative results of the learning. Therefore the findings support the biased view that Huysman (2000) proposed. In traditional organization this kind of results can been seen e.g. when the newcomers learn the “bad habits” the older workers, which could mean for example a negative attitude to the customers. However, since the timeframe of the projects is limited, it is possible that this kind of learning does not exist so much in project.

The findings from the literature and case 1 refer that learning is often related to communication and creating understanding which in turn makes knowledge

management processes possible. For example Taylor and Osland (2003: 213) have written about the issue: *“At the base of all theories concerning organizational learning... lies the assumption that communication must occur in order for knowledge to be created or disseminated”*. These two facts were behind introducing and testing methods for facilitating learning in case 2 and the choice of the methods: there is a need to ensure the necessary amount of learning in the projects and certain practices can help in this, and the practices used should aim for improving communication between the participants of the project and increasing their understanding about the issues related to the project.

Fong et al. (2007) have written about the importance of facilitated workshop for creating shared awareness and understanding in cross-functional projects. Christenson and Walker (2004) have written about the vision building as a vehicle for creating understanding and culture for a project. The vision building process in the case study 2 clearly supports these claims. Participants of the process learnt to see the project also from the others' perspectives and created together a shared understanding of the objectives of the project. A shared understanding was also needed when the activity cards were used in the case 2. It was not enough just to fill the cards by the end users, discussions with the architect were also needed to be sure that he really understood what the end users mean.

All the tools introduced in this research have a strong connection to routine work and processes of construction projects. With no doubt this is one reason why they have facilitated learning so well. Organizational learning is often viewed as routine-based, target oriented (e.g. Levitt and March 1988), situated (e.g. Brown and Duguid 1991) or practice-based (e.g. Gherardi 2000). People are willing to learn when the results clearly help them do their work. Learning in the case projects is situated also in the sense that it is the needs of the situation that give the impulse for learning. The fact that learning happens within the normal work tasks of the people also helps to minimize the costs, there is minimum need for outside classrooms, utilization of free time or teachers. However, learning efforts need to be facilitated but the role of the facilitator could be easily adapted by the project manager.

8.1.3 Contribution from the research methods

This research also contributes by showing that action research is a good method for implementing new practices in an organization. Garvin (1994) has introduced three stages that must be gone through in an organization if learning is wanted to be useful. The first stage is cognitive, in which new ideas are welcomed as well as new ways of thinking. In action research the researchers can bring some of these new ideas into the organization. However, because of the participative nature of action research the people in organization have also a possibility of creating and modifying the new ideas which may lower the typical resistance for change.

The second stage is behavioral change that means that the new ideas of the first stage are learnt and used in practice. Action research can contribute in this stage by providing very practical help for using the new methods, the researchers can facilitate the learning process. The third change is the effect of the two earlier into the organization. The last stage is naturally dependent of the organization itself and the people within it but it is likely that if the practices introduced in the first staged and tested in the second stage prove themselves to be useful they will also be utilized in the future.

8.2 Managerial implications

It is important for a project manager to understand that there are different kinds of knowledge in projects: embrained knowledge, embodied, encultured, embedded, encoded knowledge. Some of this knowledge is in tacit form and some takes explicit form. (See the Chapter 3.2 for a detailed depiction of different forms of knowledge.) The enormous amount of knowledge means that the project manager should recognize which knowledge is important and which is less important. This is important because it is the project manager in the first place that should ensure the availability of necessary information for all the parties in the project.

It seems that there should be a more systematic way of dealing with knowledge management and learning in the construction projects. Figure 21 in the page 139

provides a good framework for a project manager to clear the issue for him/herself and also for the other participants of the project. According to Fong (2005b) the development of a constructed facility can be viewed as a new product development and knowledge-creating skills are particularly important in this kind of context. This means that the “traditional” view of knowledge management as mainly sharing the knowledge is not enough, special attention has to be paid for the process in which all the participants create new knowledge by utilizing the expertise of each one.

The second important issue for a project manager in inter-organizational projects is to acknowledge that participants of the project team

- are different: they have different backgrounds, educations and experiences; and
- possess different kinds of knowledge: this knowledge is often such that the participants themselves do not even know that they have it, it is so called ‘tacit knowledge’.

This is important because the situation is often such that only by utilizing the knowledge of all the different parties, good end results can be achieved. However, this research shows that utilizing the tacit knowledge of different people is not easy and even when the tacit knowledge is turned into explicit knowledge, it may not be understood and thus cannot be used by other participants without learning. The learning needs of the parties are also different. Table 7 (page 110) can be used to help in recognizing the different learning needs in construction projects so that they can be facilitated in effective ways.

The project manager should create an atmosphere that encourages participants of the project to share their knowledge and ask when they do not understand. There are also several methods that can be used in project to facilitate learning and thus easing the communication between the different parties (see the Chapter 7.2 for some examples). The success of the communication and knowledge sharing should not be taken for granted.

8.3 Validity and reliability of the research

Eskola and Suoranta (1999: 209) argue that qualitative research is sometimes criticized about the obscure criteria for reliability and validity of the research. Because it is typical for qualitative research that there are no calculations and statistical methods used in the research, there cannot be mistakes in them. Therefore the evaluation of the qualitative research is a question about evaluating the research process. (Eskola and Suoranta 1999: 211.) Eskola and Suoranta (1999: 210) state also that one of the ethical norms in making science is ‘the principle of systematic suspicion’, which means that the researcher should and the audience will suspect every detail of the research. I try to keep this in mind in the following discussion about the validity and reliability of this research.

8.3.1 Validity and reliability of case 1

Yin (2003: 34) proposes four tests that can help to judge the quality of case study research, and qualitative studies in general. These tests are: construct validity, internal validity, external validity, and reliability (see also Table 8). Internal validity is about establishing the causal relationships and is a concern only in explanatory and causal studies. In the following I will look at the case 1 in the light of Yin’s ideas and partly also the case 2.

Table 9. Case Study Tactics for Four Design Tests (Yin 2003: 34).

Tests	Case Study Tactic	Phase of the research in which tactic occurs
Construct Validity	<ul style="list-style-type: none"> • Use multiple sources of evidence • Establish chain of evidence • Have key informants review draft case study report 	Data collection Data collection Composition
Internal Validity	<ul style="list-style-type: none"> • Do pattern-matching • Do explanation building • Address rival explanations • Use logic models 	Data analysis Data analysis Data analysis Data analysis
External Validity	<ul style="list-style-type: none"> • Use theory in single case studies • Use replication logic in multiple-case Studies 	Research design Research design
Reliability	<ul style="list-style-type: none"> • Use case study protocol • Develop case study database 	Data collection Data collection

8.3.1.1 Construct validity

Construct validity is a question about establishing the correct operational measures for the concepts being studied (Yin 2003: 34). Eskola and Suoranta (1999: 214) state that the theoretical and philosophical choices, defining the key concepts and method selection for the research should be logically related. In qualitative research the constructs are often formulated only after material gathering so it can be said that construct validity is also the validity of the conclusions. Yin (2003: 34; 36) defines three ways of ensuring and testing construct validity: using multiple sources of evidence, establishing chain of evidence, and having the key informants to review the results of the analysis.

I have used in this research all the methods mentioned above for ensuring the construct validity. I have used multiple sources of evidence (for a detailed description about this method see Yin 2003: 97–101; see also Eskola and Suoranta 1999: 69–75). Even though the two cases I have researched aimed for answering different research questions, I have also cross-used the material. The learning of the project participants was investigated both by thematic interviews (in case 1) and by a survey and observations (case 2). Both cases provided similar results. The methods for facilitating learning in the projects was mainly researched in case 2 but also case 1 provided supporting material for this issue because one of the methods had been used also in it. This method for ensuring the construct validity is called methodological triangulation (Yin 2003: 99; Eskola and Suoranta 1999: 70).

I have also tried to establish a continuous chain of evidence so that the reader could understand how I've come to certain conclusions (for more about this issue see Yin 2003: 105–106; Eskola and Suoranta 1999: 217–219). I hope this helps the reader to check the validity of this research. Especially concerning the gathering and analysis of the material from the interviews in case 1, I have tried to describe the process very much in detail (see the Chapters 5 and 6). In the description of the analysis, I have provided a lot of citations from the interviews and also copies of my own 'notes' to help the reader to follow my thoughts. The background, objectives and actual way of proceeding in the case 2 (action research) are presented in the Chapters 5 and 7.

After I finished the analysis of case material 1, I wrote a summary of the results in Finnish and sent that by e-mail for a review to all those people that had been interviewed in that case (for more about this issue see Yin 2003: 159–160; Eskola and Suoranta 1999: 212). I asked the interviewees to comment the results, to tell me do they feel that the results represent what actually has happened. I got back three comments, from a project manager, an end user and a designer. All of people commenting were positive, they felt that the summary represented the reality well. One person commented that the part of the summary that represents learning among that group to which she belongs, was truthful. However, she was surprised that a couple of other parties in the project did not talk about learning in certain situations. I assume that one reason for this could be that it was not straightly asked in the interviews: “who learnt and what in which situations” but instead the analysis is based on the spontaneous mentioning about learning. And if those parties just are not so interested in issues concerning the other parties and their learning, they did not talk about it spontaneously. This could, however, also refer that even though the results represent the reality well, they do not depict the whole phenomena.

8.3.1.2 External validity

External validity means establishing the domain to which a study’s findings can be generalized. Generalization is typically connected with survey research in which a sample readily generalizes to a larger universe if it is correctly selected. Generalization in case studies, however, does not rely on statistical methods but on analytical issues: the researcher is trying to generalize a particular set of results to some broader theory. (Yin 2003: 34; 37.) Even though the main objective of this research was not to conclude generalized results, there are issues that suggest that the findings from this research may be true also in other similar cases.

Yin (2003: 34; 37) proposes two methods for ensuring the external value: using theory in single-case studies and using replication logic in multiple-case studies. Replication logic means that when having findings from one case, another study would be conducted to replicate the first one to see if the findings are the same (Yin 2003: 47). Though two cases are presented in this research, the methods and objectives in them were different so replication logic was not used. However, the findings from each case support the findings from the other case. And the ‘theory’ behind this research that

lead us to believe that in construction projects in which the participants are from different organizations and have different education and experience, learning may be needed, suggests that if this idea proved to be correct in these cases, it may very well be true also in other similar cases. (For more about using theory in single-case studies see Yin 2003: 37.)

8.3.1.3 Reliability

Reliability of a research means that the operations of the study, e.g. material acquisition, analysis etc., can be repeated with the same results. The way to ensure this is to document the whole work well enough, so that another researcher could collect the same material and draw the same conclusions of it. (Yin 2003: 34; 37–39.) Eskola and Suoranta (1999: 217) argue that because of the amount of interpretation in qualitative research, it may not be possible to ensure the reliability this way, but that one can and should always try. Yin (2003: 34; 38) proposes two ways of ensuring reliability: using a case study protocol and developing case study database.

A case study protocol should include all the important information about the background of the study, data collection procedures, case study questions and the outline of the case study report (Yin 2003: 67–77). The objective of this research was to gain knowledge about learning in inter-organizational projects. The public construction projects were chosen because they provide an excellent example about project environment with parties from different organizations and disciplines. The two cases were used for answering different research questions but both cases provided material also for answering the other question. The method used in case 1 (theme interviews) was chosen because I wanted to see the learning in the same way as the project participants see it. Action research for case 2 was chosen to really see if the methods for facilitating learning do work or not.

Chapter 5 includes detailed description about the field procedures and interview questions. However, to maintain the anonymity of the informants, no names or actual places are mentioned. To avoid the questions to provide the expected answers to the interviewees the learning issue was not directly asked. The idea was that if learning is an important issue, the interviewees will talk about it spontaneously. If it would not have been mentioned in interviews, the conclusion would have been different, e.g.

that learning is either not happening in the projects or it is not an important issue. Another issue is related to the nature of the interviews: because the questions are more like themes that were discussed than strict questions and because the informants were let to talk very freely about these themes and also some other issues, it would probably not be possible to conduct the very same interviews again.

A case study database consists of two parts: 1) the data or evidentiary base and 2) the report of the researcher (Yin 2003: 101). This thesis represents my report: it presents the background issues of the research, theoretical part, the field study and conclusions. This report also includes examples of the raw data: quotes of the interviews and some of my own material developed while analyzing the data. However, Yin (2003: 101–102) argues that the report is not enough. There should be also be a database that contains the raw data of the research so that is someone wants to inspect it, it would be available. Most of the material about case study 1 does exist in ‘databases’: the interviews both on tapes and written, the organization of the material into categories I’ve done and so on. Detailed descriptions of the methods tested in case 2 are all in electronic form and the original answers to the survey done in case 2 exist in paper form.

8.3.2 The validity and quality of case study 2

Some issues about the validity and reliability of case 2 can be found in the Chapter 8.1.1. However, Reason and Bradbury (2006a: 12) proposes a framework for judging the validity and quality of action research. Within the framework, five types of questions should be asked: questions of emergence and enduring consequence, questions of outcome and practice, questions about plural ways of knowing, questions of relational practice, and questions about significance (see also Figure 22).

Questions about relational practice concern the participation possibilities to the research. Do all the interested people have a chance to participate all the phases of the research from planning to reflection? (Reason and Bradbury 2006c: 346-347.) In our action research case we tried to activate all the people from the core team of the case project to participate in the different practices that were carried out. There were

different people from different organizations and their attitudes to the research varied quite a lot, some of them were eager to participate but some of them resisted fairly hard. The research group introduced some practices to be tested, the opinions of the participants were listened, some practices were abandoned because of the resistance and some of them were modified. But at some points we had to 'push', otherwise the resistance of some participants would have killed the whole research.

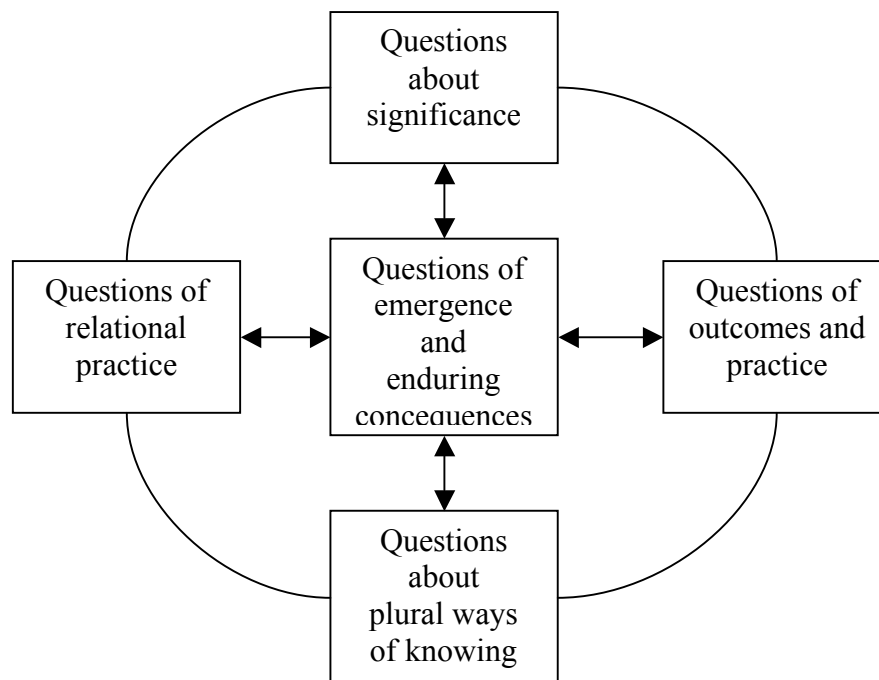


Figure 22. Questions for validity and quality in inquiry (Reason and Bradbury 2006a: 12).

Another way for determining the validity of action research is to look at its practical outcomes: is the research validated by participants' new ways of doing things? (Reason and Bradbury 2006c: 347). In our action research case it is not so easy to answer this question. Some of the participants have told that they find the tested practices at least somehow useful. I know that at least one of the methods have been used also after the action research in other cases. But only time can finally show which methods will stay alive. And possible changes in peoples attitudes, that would be at least as important as using the methods, are even more difficult to see.

Quality of plurality of knowing refers to conceptual-theoretical integrity, extending ways of knowing, and methodological appropriateness (Reason and Bradbury 2006c:

347–348). Naturally, it is not necessary for one research to emphasize all these issues. The objectives of our action research case were more practical than theoretical in nature. Reason and Bradbury (2006c: 348) argue that “*the outcome of the inquiry can be a shift in ways of being in the world, and in the development of new skills*”. Our research has provided new ways of seeing things as well for the researchers and the participants of the case project. Many of the participants from the ‘technical’ side of the project said that they have learnt how important the involvement of the end users in the early phase of the project is. That is a major shift of an attitude in a business like construction where the end users are often being considered as a burden.

Quality of the action research is also related to its significance, to the importance it has to a certain group. Reason and Bradbury (2006c: 348) state “*it can be of course argued that any participative form of inquiry, well-grounded in the everyday concerns of people, will necessarily be worthwhile*”. Our action research certainly was connected to concerns of the staff in the school that was to be renovated. They are the ones that have to live with the end result of the project: the renovated school. I believe that our research has provided them with a better chance to affect the renovation planning. But our research may also have an effect also to a larger community: the personnel of the other schools that will be renovated in the future. Our research may emancipate them to demand the same possibilities to affect the planning processes.

All the perspectives presented above build up the total quality of the action research: the emergence of the inquiry and endurance of the consequences (Reason and Bradbury 2006c: 349). I do believe that our action research was significant, the procedures of it were participative and that it has enduring consequences but I leave the final judgment for the reader as well as for the participants of the research.

8.3.3 Experimenter effects

Weiss (1994: 211–213) introduces some ‘experimenter effects’ that may lower the quality of a qualitative research. This means that the researcher may act to produce results that she expects, often unconsciously. At first this can happen in sampling phase. A biased sampling would mean taking respondents who have a particular point

of view as a representative sample of a more inclusive group. (Weiss 1994: 212.) In this research the cases were not picked by the researcher, but by the public organizations themselves participating in PROLAB-project. They were chosen mainly because of the timing of the project, so it can be said that they present a random sample of public Finish construction projects. The interviewees in the case 1 were picked so that all the people actively participating in the design phase were interviewed so that as full picture of the issues as possible could be drawn.

The next possible chance for the experimenter effect to occur is the interviewing phase. The researcher may ask leading questions to get the answers she wants. (Weiss 1994: 212.) My main issue of interest was learning within the project. In the interviews, however, I didn't ask about whether the informants had learnt something or not. The idea was that if there is learning happening and it is important for the participants, they will talk about it. And this is what happened.

Interpretation and reporting are especially vulnerable for experimenter effect (Weiss 1994: 213). Therefore I have tried to describe the analysis process very carefully and asked different people, both those that know the case as well as those that do not know the case, to review my ideas. I have tried to, as Weiss (1994: 213) says *“discipline myself to deal fully and fairly with all the evidence and to report everything I've learnt about the issue”*.

8.4 Suggestions for the future research

There are two clear directions for the future research that can be suggested based on this research:

- Doing more action research to test the methods introduced in this research further.
- Comparing the findings about learning in this research to other environments.

The action research with different methods for facilitating learning and easing communication in a construction project provided some positive results. However, these methods should be tested in new projects to find out which of them are the most

effective in different projects considering the resources needed for them, e.g. renovation / new production cases or small / large projects. It could also be possible to invent some new methods.

The empirical material of this research comes from construction industry, from public construction cases, to be precise. Thus the findings from case 1 describe learning that takes place in inter-organizational construction projects. However, it would be interesting to find out what kind of learning takes place and what kind of methods could be used for facilitating it in other types of projects, e.g. in new product development. This kind of research would show if it is possible to generalize the findings from this research to all projects.

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