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Use of Knowledge Management in Project Environments

A Cross-Case Analysis of Five Organizations

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Abstract

This master thesis in project management focuses on the use of knowledge management methods in project management environments, since these two fields of study are important factors for companies whose aim is to gain advantages by continuous learning and improvement.

For this study, organizations, as well as projects were divided into categories where project management methods and knowledge management methods were highlighted.

The main questions which are given attendance in this study were if any knowledge management activities were incorporated into the work in projects as well as what dimensions that affect the use of knowledge management in project environments. The dimensions assumed to affect knowledge management in project environments which were studied in this master thesis were the project category, the use of project management methodologies, the organization and the knowledge management methodologies. Belonging to the dimension of knowledge management, conditions concerning the organizations and the projects were also studied.

This study shows that, among five case organizations, only two actively use knowledge management methodologies to capture what has been learned by the projects.

The findings from the study further show that, even though no generally applicable model could be formulated, there is a tendency in organizations which has an active approach to information gathering and uses project management methodologies, to use more knowledge management methodologies in projects.

As a theoretical contribution, this master thesis shows than there is a connection between the organizational mode and the use of knowledge management and project management methodologies.

As a practical contribution, this study shows the importance of labelling and organizing knowledge before it is stored, since only when knowledge is reused the knowledge management activities brings a value to the organization. As another practical contribution this study presents a model for researching knowledge management in project environment, as well as showing that lessons learned and project auditing are the two most common knowledge management methods in the studied case organizations.

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The inspiration to the topic came while I was taking a course in Knowledge Management along with the studies in Project Management. Even though I have spent several hours reading and searching for information about these two fields, I still have the feeling that I just scratched the surface. At least I hope that this study can contribute to a new dimension of understanding for the complexity of knowledge management in projects, as well as a few practical methods.

Dedicated to my dad; you are missed.

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1 Introduction

This chapter will set up the frames for this master thesis in Project Management, introducing the reader to the background, the problem and the purpose of this study. Thus, the questions that are to be answered through this study are presented. This chapter also show the structure of the thesis.

1.1 Background

Projects are, by the traditional definition, temporary organizations meant to deliver a certain result within a certain time and to a certain cost (Wenell, 2000). Thus, it is understood that project managers and project teams will, from time to time, face new and unique situations. To handle these situations, project managers, project teams as well as project owner teams and the organization which surrounds them, have to be able to develop, learn, and share knowledge and experience from earlier situation.

The Need for Organizational Knowledge

Nonaka and Takehuchi (1995) state that knowledge assets are considered to be the greatest assets to a firm to create a competitive advantage. Clarke and Rollo (2001), following the tracks of Nonaka, argue that knowledge created by individuals is the most valuable asset for an organization, when it is embedded in the organizational routines. Martinson (2010) further states in her research that for an organization to be able to create an organizational advantage, not only within project based organizations (PBO), there is a need to develop capabilities which allow effective knowledge sharing and production of knowledge.

Disterer (2002) argues that most firms are not able to evaluate projects and learn from the experiences made. This has as consequence that mistakes and errors performed in the past are likely to be repeated in the future.

Nonaka and Takehuchi (1995) describe a very simple model of how a competitive advantage is reached through knowledge creation, depicted in figure 1. The creation of knowledge leads to a continuous innovation (the use of best practice, new innovations, etc.) within an organization, and through this innovation a competitive advantage is reached.

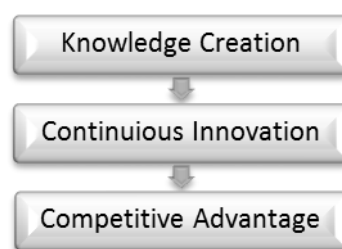


Figure 1 – Competitive advantage (Nonaka & Takehuchi, 1995:6)

Knowledge Management in Project Management Literature

Schindler and Eppler (2003) argue that the knowledge management in the classical project management literature often revolves around the capture of the lessons learned only at the end of a project. The major project management organizations, IPMA (International Project Management Association) and PMI (Project Management Institute), describe similarly how knowledge should be captured in a project. According to IPMA, handling of knowledge is shortly described: *“Project results and experience gained are evaluated and lessons learned are documented so that they can be used to improve future projects”* (IPMA, 2006:80). PMI also describes how to deal with the knowledge gained from a project, but as with the IPMA

description it is mentioned very brief and vague (PMI, 2008:64): “At a project or phase closure, the following may occur:

- Conduct post-project or phase-end review,
- Record impact of tailoring to any process,
- Document lessons learned
- Apply appropriate updates to organizational process assets,
- Archive all relevant project documents in the Project Management Information System (PMIS) to be used as historical data”

Another study (Disterer, 2002) also states that the tasks of project management have to be supported by activities of knowledge management, and that the routine project documentation (plans, schedules, etc.) is not to be seen as knowledge management units since they are mostly created for the individuals involved in the project.

Knowledge Management in Projects

To use knowledge management methodologies in organizations and projects is a complex issue, as argued among others by Davenport and Prusak (1998) as well as Schindler and Eppler (2003). To handle this complexity there is a need to look at factors surrounding, and affecting both organizations and projects.

One factor which could affect knowledge management in projects is the type of project which is being performed. As argued in many studies (Berggren & Lindkvist, 2001, Shenhar, 2001, Crawford et al., 2006, Jung & Lim, 2007, Ljung, 2011) there are different types of projects, depending on the project goal, organization, processes, etc. Different types of projects focus on different results, require different project organizations and need different processes to reach the specified goal.

Brooks and Leseure (2004) found in their study that good practices for knowledge management are strongly related to good project management practices. Project management methodologies are tools and techniques used to successfully and effectively manage the sub-processes of projects.

Another important factor which affects the use of knowledge management in projects is the organization where the project is performed. The organization is the base of the project, since the project often has an internal project owner. From the organization the project team members often originate, bringing routines, visions and knowledge into the project. Daft and Weick's (1984) developed a theory in which organizations are divided into categories depending on two factors: If the top management believes that the existing environment can be analyzed or not and if the top management actively searches for information. Through this classification of organizations, further conclusions of the organization can be made.

1.2 Purpose of the Study

This master thesis in project management has been conducted in order to find how knowledge management is used within projects. The frequency of knowledge management methodology used in projects will be explored, as well as factors affecting the success of knowledge management methodologies used within projects. Thus, the first purpose of this study is to explore to what extent knowledge management is used within project environments.

The factors affecting knowledge management within projects are chosen according to what is believed, by the author, to be relevant. The first factor which is believed to affect the use of knowledge management is the type of project. The other factor is if any project management methodology is used, as, according to Brooks and Leseure (2004), good knowledge management and good project management methodologies go hand in hand. The third factor believed to affect the knowledge management in project is which type of organization the project is being

conducted in, therefore organizations will, in this study, be divided into different organizational modes. The fourth factor is to what extent knowledge management methodology is being used in the organization and in the project. Thus, the second purpose is to establish the relations between knowledge management in projects and the four dimensions: the project category, the project management methodology, the organizational mode, and the knowledge management methodology. The dimensions of the second purpose of the study are shown in figure 2.



Figure 2 – The dimensions of the second purpose of the study

1.3 Hypothesis

This study contains the hypothesis that even though knowledge management methodologies are advantageous for a project and a project based organization, it is not common that knowledge management is used in projects. A second hypothesis is that even if knowledge management methods are being used, they are not used effectively.

1.4 Target Group

The target groups for this master thesis span from individuals involved and affected by projects, such as project owner teams, project managers, program managers and knowledge managers, to researchers in the fields of project management and knowledge management.

1.5 Structure of the Master Thesis

Theoretical Framework

In the theoretical framework the subject of project management and project categories will be described as well as knowledge and knowledge management. Project and knowledge management is then connected and research connecting these two subjects is presented. In the end of the chapter the model of organizational theory is explained.

Research Method

The research method concludes the method that has been used to conduct this study. In this chapter, the research model which has been used in this master thesis in project management is presented. Also presented are the choice of respondents as well as reliability and validity of the study as well as the logical research design.

Empirical Data

In this chapter, the data collected using the research model is presented together with a presentation of the respondents.

Analysis

In the analysis chapter the data from the Empirical Data chapter is compared with the Theoretical Framework and presented.

Conclusions

In the conclusion chapter, all conclusions from the analysis, and related thoughts by the author, are described. A reflection on the hypothesis is also presented in this chapter.

2 Theoretical Framework

In this chapter project, project management, knowledge and knowledge management are described and connected. Furthermore the organizational model which is used in this study is explained. In the end of this chapter Research Framework is presented.

2.1 Project Management

As stated in chapter 1, the traditional definition of a project is that a project is a temporary organization, with the aim to deliver a defined result within fixed frames of time and resources (Wenell, 2000). Further descriptions of projects are that they contain features of uniqueness and uncertainty, caused by the lack of previous experience (Patzak & Rattay, 2012). For an organization nowadays a common form of task performance is related to the use of projects as a work form.

Project management is the task of managing the sub-processes in a project as well as leading the project team through the project. The sub-processes are the project start, project coordination, project controlling and project close-down. The objective of project management is a professional management of the sub-processes of a project (Gareis, 2006). Project management methodologies are used to make the processes in a project clearer.

An example of a project management methodology is WBS (Work Breakdown Structure) a methodology to break down a project into pieces which can be easier given frames such as cost frame and time frame (Gareis, 2006). Another example is the CPM (Critical Path Method) with (Disterer, 2002), which a bar chart or Gantt-chart is used to find the longest (critical) path which a project needs from the beginning to the end (Gareis, 2006).

2.2 Project Categories

According to Crawford et al. (2006) organizations categorize their projects by giving them labels. These labels act as a shared language within the organization, making it easier to compare projects with each other. Jung and Lim (2007) also argue that projects need categorization to be comparable with other projects.

It has been stated that projects can be categorized, depending on their context, goal, etc (Berggren & Lindkvist, 2001, Shenhar, 2001, Crawford et al., 2006, Jung & Lim, 2007, Ljung, 2011) in opposition to the view of the major project management organizations (for example IPMA and PMI) where projects are looked upon as being just “projects” (Ljung, 2011). According to IPMA and PMI all projects can be described, planned and performed using the same general processes.

The categorization of projects is not a clear and easy subject as suggested by Sauser et al. (2009). They have depicted some of the project categorization frameworks which has been used in earlier studies, see table 1 on the next page. Sauser et al. (2009) describe Peart as one of the early writers on this subject, dated back to 1971.

Author(s)	Study description	Findings
Peart	Observed many organizations in order to understand their reporting and assessment of information on past projects.	Reported that most projects use unique numbering systems. Categorization can be further sub-divided into contract type, or similar sub-categories.
Henderson and Clark	Demonstrated that the traditional categorization of innovation as either incremental or radical was incomplete and potentially misleading.	Presented a 2 x 2 matrix that indicated four categorizations of innovation, and distinguish between the components of a product and the way they are integrated into the system that is the product architecture.
Bubshait and Selen	Developed a relationship between the number of projects management techniques and selected project characteristics.	Indicated a positive relationship between the number of project management techniques used and the level of complexity involved in the project.
Clark and Fujimoto	Described the various rationales for project organization and structure.	Specify the significance of "heavy-weight" project management structure in the automotive industry.
Turner and Cochrrane	Grouped project based on how well defined both the goals and the methods are for achieving them.	Proposed that projects can be classified using a 2 x 2 matrix and a definition of all four types with three breakdown structures.
Lindvist et al.	Used a case study methodology to demonstrate how a project typology model can detect error in a systematic complexity context.	Suggested a model identified by four different project organization logics related to the importance of "technological" aspects of the project context.
Payne and Turner	Tested the hypothesis that it is better to use a single approach to manage all projects.	Showned that people often report better results for their projects when they tailor the procedures to the type of project they are working on, matching the procedures to the size of the project, or the type of resource working on the project.
Florice and Miller	Described a conceptual framework for project strategy systems.	Showned that high performance requires strategic systems that are both robust with respect to anticipated risks and governable in the face of disruptive events.
Shenar; Shenar and Dvir	Showned how different projects are managed in different ways and proposed a multidimensional categorization scheme for projects.	Proposed a four-dimensional categorization tool based on novelty, complexity, technology, and pace (NCTP) for adapting the proper managerial style to the specific needs of a project.
Lewis et al.	Explored the nature, dynamics, and impacts of contrasting project management styles with a conceptual framework.	Found that styles can differ but are interwoven to monitoring, evaluation, and control activities; use of these activities fluctuates over time; blend of style enhances performance; and uncertainty moderates project management-performance relationships.
Youker	Contends that the most important and useful breakdown of project type is by product or deliverable of the project.	Suggested that projects grouped based on their product bear highly similar characteristics, and therefore require similar approach.
Terwiesch et al.	Demonstrated a classification model for determining alternative strategies based on the adequacy of information in current engineering activities.	Presented a model that allows for determining best project planning approaches while distinguishing among project strategies and reasons for choosing them.
Pitch et al.	Identify three fundamental project management strategies related to information adequacy (uncertainty): instructionism, learning, and selectionism.	Present a four quadrant model based on these three strategies that determines a project's style and approach.
Archibald and Voropaev; Archibald	Developed of a practical scheme for categorizing projects with similar life cycle phases and one unique process management process.	Proposed a project categorization and sub-categorization based on end product or service of the project.
Crawford et al.	Identified a system for categorizing projects to determine their purposes and attributes.	Two hierarchically ordered presentations resembling a decision tree. The first presents the multiple organizational purposes served by such systems and the second presents the many different attributes or characteristics organizations use to divide projects into groups or categories.

Table 1 - Project categorizations (Sausser et al., 2009:668).

For this study, the classification of projects according to Ljung (2011) has been chosen since it contains studies of organizations over several years as well as a deep theoretical analysis. Furthermore, in his study, projects are divided into four clearly separated categories. The categories are: *creating [product]*, *creating [activity]*, *activity [effect]* and *activity [evaluation]* (author's translation). The project categories are formed from the results they aim to achieve, the processes involved in performing the projects and the organization of the project. Below are the project categories as they are described by Ljung (2011)

2.2.1 Creating [Product]

Creating [product] projects are characterized through a number, of mostly, sequential, activities which lead to the creation of a service or a product, which is then to be transferred to the customer.

Examples of projects which belong to creating [product] project category are:

- Product development projects
- Construction projects

Result

Creating [product] projects deliver a physical product. In these projects it is easy to visualize the project result through pictures, drawings, models, etc., and it is also possible to test the quality of the product when it is finished, and to compare it with other existing products. It is also stated that the effects of the results are calculable and predictable through the uniform picture of the result and its value.

Process

Creating [product] projects, based on a logical sequence of activities, benefit from traditional planning techniques such as WBS (Work Breakdown Structure) or CPM (Critical Path Method), even if the projects also can be executed in parallel. Another aspect of the sequential process is that it is natural to establish clear milestones in the project.

Organization

Ljung (2011) argues that the organization within creating [product] projects is naturally related to the activities to be performed. If the project is more sequential than parallel, it might be natural that some project members only participate for a specific period of time. Even though there could be a constant change in the project organization, through the temporary members, the dependencies between the project members is still dominant throughout the whole project. According to the description, the project goals, which can be quantified and visualized, also act as the motivating force for the whole project organization.

2.2.2 Creating [Activity]

Creating [activity] projects are characterized by, mostly, parallel activities which lead to an activity. It is stated that in a creating [activity] project, the delivery of the project results and the use of the results is performed at the same time.

Examples of projects which belong to this project category are:

- Concerts
- Seminars / Lectures

Result

The goal of a creating [activity] project can be difficult to visualize, since the result is an activity. The project results will be reviewed for its content as well as the relationship which the performer has to the audience. The project goal can be used to create a uniform picture of the results, which

than can act as a motivator for the project organization. The actual results can differ from results gained during rehearsals and trainings, which means that the actual quality can only be measured at delivery. The effects and the response caused by the project result is not as easy to predict and measure as in a creating [product] project, but can in some projects be observed at the time of delivery.

Process

The project result is realized through a continuous parallel collaboration between different areas of responsibility according to Gustavsson et al. as cited in Ljung (2011). Through the parallel execution of work packages it is not optimal to use CPM or a bar chart for planning of the project or to describe the logical relationships between work packages. Furthermore, two types of planning needs to be represented throughout a creating [activity] project; the description of the parallel activities in the different areas of responsibility and a detailed planning of the execution of the project. The project control can be difficult to perform with traditional methods, due to the parallel activities within the project. Therefore the control should consist of continuous check points to display the processes in the different work packages.

Organization

In the beginning of creating [activity] types of projects it is normal that the different project teams consist of only a few individuals which plan their separate work package alone. At the end of the project it can change characteristics, so that more people are involved to execute the different project activities. The goal of the project can be vague and unspecified in the beginning, which makes it important to have a vision to motivate the project team members; this vision also has to be communicated to the project team members which joins the project as the end of the project is nearing. The motivation can be enhanced as the end is coming closer and the project goal is getting clearer.

2.2.3 Activity [Effect]

Activity [effect] projects are characterized through serial and/or parallel activities which aim is to create an effect. This effect can be either internal (in the organization) or external (outside of the organization).

Examples of projects which belong to this category are:

- To change the attitude in a target group (external changes)
- To change behavioral routines within an organization (internal changes)

Result

In activity [effect] projects there is no product or event which is to be delivered, except for a report of the executed activities in the project. Because of the lack of deliverables, and the problem to measure the result of the project, the executed activities have to represent the result of the project, which is not the same as a description of the project result. The description of the project results must therefore be constructed to be accurately measured. In some of these projects, with the effect close to the result of the project (i.e. a project to win a new customer), the result can be more accurate measured, otherwise a gap between the activities within the project and the effects of the project can occur.

Process

The lack of measurable results makes it important to create as good conditions for success as possible, to increase the chance that one or more of the project activities reaches the intended effects (Ljung, 2011). In activity [effect] projects it can be unnecessary and impossible to create too narrow and precise project plans, and it may constrict the potentials of the different activities to arrange them in sequential relations with other activities. Better is to use parallel planned activities with enough free space for changes of the project plan. The project controlling is to be performed through control of the performance of the planned activities, and through control of the

effects of the different activities. Ljung (2011) also states that the control of the effects may give guidance to which activities should be prioritized or if the project is to be cancelled. The only deliverable in activity [effect] projects is the project reports of the performed activities, which also can include the effects of the project if they were measured.

Organization

The number of project team members can vary from few to many, and the organization can be changed during the course of the project due to the measured effects. It can be a challenge to visualize the project goal for the project team members. Thus, the goals have to be made as concrete as possible to form a common picture of the result.

2.2.4 Activity [Evaluation]

Activity [evaluation] projects have the aim of evaluating a performed activity. The end result of the project is to gain experience and knowledge of the performed activity.

Examples of projects in this project category are:

- Testing of new machinery before delivery.
- Testing of installed system.

Result

The result is the described knowledge of the performed activity. This result can be used as foundation for decisions within the organization.

Process

The processes of activity [evaluation] projects, which often are parallel performed, consist of the activities of performing the evaluation and of collecting the result. Before the planning of the project activities, the aim of the project evaluation has to be made clear. The actual planning of the processes can then be done, and the definition of the responsibility framework can be made with traditional methods while the activities performed will have quantified frames (time frames, cost frames, etc.). The evaluation of the activities is done regularly and aims to show if the performed activities are enough to give the desired amount of information.

Organization

The project team consists mostly of individuals which are experts within the field that they are evaluating, and the motivation for the project team members is often connected to the role the individual has had in the past, for example in the development of the evaluated system.

2.3 Knowledge

Knowledge is a term which complex meaning has been discussed for a long period of time (Clarke & Rollo, 2001). Clarke and Rollo (2001) state: to define knowledge, there is a need to define the relationship between knowledge and data, as well as between knowledge and information. To depict the different views of knowledge definitions (as well as definitions for data and information), and thereby show how complex the subject is, the summary made by Stenmark (2001) is shown in table 2 below.

Author(s)	Data	Information	Knowledge
Wigg (1993)	-	Facts organized to describe a situation or condition.	Truths, beliefs, perspectives, judgements, know-how and methodologies.
Nonaka & Takeuchi (1995)	-	A flow of meaningful messages.	Commitments and beliefs created from these messages.
Spek & Spijkervet (1997)	Not yet interpreted symbols.	Data with meaning.	The ability to assign meaning.
Davenport (1997)	Simple observations.	Data with relevance and purpose.	Valuable information from the human mind.
Davenport & Prusak (1998)	A set of discrete facts	A message meant to change the receiver's perception	Experience, values, insights, and contextual information.
Quigley & Debons (1999)	Text that does not answer questions to a particular problem	Text that answers the question who, when, what, or where.	Text that answers the question why or how.
Choo, Detlor & Turnbull (2000)	Facts and messages.	Data vested with meaning.	Justified, true beliefs.

Table 2 - Summary of views of data, information and knowledge (Stenmark, 2001:3)

2.3.1 Knowledge Categories

According to Nonaka (1994, 2007), knowledge can be divided into two categories: tacit knowledge and explicit knowledge.

Tacit knowledge can be described as personal knowledge which is difficult to formalize and to describe. This type of knowledge cannot easily be written down or explained, and therefore the transfer of this knowledge is a difficult issue.

Tacit knowledge can be further divided into cognitive and technical knowledge, where the cognitive knowledge is made up of working models of the surrounding world, with which the mind creates and manipulates all what it interprets. The cognitive elements comprise beliefs, schemata, paradigms and viewpoints, etc., which is also used by the mind to perceive and define the world, to form a reality and visualize the future. Nonaka (1994) notes, that a person interprets the surrounding environment with the help from the patterns of the cognitive knowledge. The technical knowledge consists of know-how, skills and crafts which apply to specific situations.

In contrast to the tacit knowledge, Nonaka (1994) states, explicit knowledge is knowledge which can be formalized and easily transmitted between individuals. This means that the knowledge can, for example, be written down and archived, and then stored and/or transmitted between individuals and groups. This kind of knowledge also has the advantage that it can be searchable. Thus it can, after it has been stored, easily be found (Nonaka, 1994).

Nonaka et al. (2000) have furthermore divided, what they describe as, knowledge assets into four categories; experiential-, conceptual-, systemic- and routine knowledge assets. Knowledge assets are described as “firm-specific recourses that are indispensable to create values for the firm” (Nonaka et al. 2000: 20).

Experiential Knowledge Assets

According to Nonaka (1994), experiential knowledge assets are the shared tacit knowledge, created through interaction between the organizational members and external partners (suppliers, customers and other associating partners). Collected know-how and skills from all these internal and external organizational members are included within this category as well as emotional knowledge (love, care and trust), physical knowledge (gestures, physical expressions), energetic knowledge (enthusiasm, tension) and rhythmic knowledge (improvisation, entertainment). This knowledge asset, as it is a tacit knowledge asset, is firm specific and difficult to evaluate and also to imitate. This means that experiential knowledge assets are one part of a firm's identity.

Conceptual Knowledge Assets

Nonaka (1994) states that conceptual knowledge asset consists of explicit knowledge which is expressed through symbols, images and language established through the perspective of the internal and external organizational members. This knowledge asset, since it has a form, is easier to grasp than a tacit knowledge asset, even though the interpretation of what different individuals perceive may vary. Examples of conceptual knowledge assets can be designs or concepts, which then is perceived by customers or by organizational members (Nonaka, 1994).

Systemic Knowledge Assets

Systemic knowledge assets are systemized explicit knowledge which is knowledge that has been packed and presented. Examples of systemic knowledge assets are documents, manuals and product specifications (Nonaka, 1994). This asset can be transferred easily between individuals, and is a very visual type of knowledge. According to Nonaka (2000), systemic knowledge assets are the main focus of the current knowledge management, such as intellectual property rights.

Routine Knowledge Assets

Routine knowledge asset is described by Nonaka (1994) as routines and actions (tacit knowledge), which has been implemented in an organization. This includes know-how, organizational culture and routines concerning ordinary organizational situations. This knowledge asset is established through exercise, developed patterns and best-practice, and is reinforced by other organizational members.

2.3.2 Knowledge Reservoirs

As a further development of the theory presented by Nonaka (1994), McGrath et al., as cited in Argote & Ingram (2000), argue that knowledge is stored in three basic elements, or reservoirs, within an organization: members, tools and tasks. By combining these three basic elements sub networks are formed in which knowledge is transferred and developed. The member element refers to the human capital, the tacit knowledge, while the tools refer to the technological components of an organization, for example hardware or software. The task element reflects the goal, the intentions and the purpose of the organization.

The sub networks described by McGrath et al. (Argote & Ingram, 2000) are the basic elements in the following internal combination:

- Member-member network – The social network in the organizational environment.
- Task-task network – Refers to the sequence of the tasks or routines within an organization.
- Tool-tool network – Is the combination of tools and technologies used in the organizational environment.

And the following external combination:

- Member-task network – Are the tools to map members into tasks (how labor is divided).
- Member-tool network – Assigns the different organizational members to a specific tool or technology.

- Task-tool network – The specification of which tools are to be used to perform a specific task.
- Member-task-tool network – Specifies which member that performs which task with which tool.

Argote and Ingram (2000) further state that organizational performance improves when the internal and external networks are improved. To prove their theory about the knowledge reservoirs and the network connections, Argote and Ingram (2000) use two logical examples:

- If a task is performed by an organizational member who is well suited to perform this task (member-task network), there is a benefit for the organization.
- The organizational benefit can be increased if this member has suitable tools to perform this certain task (member-task-tool network).

Argote and Ingram (2000) describe two ways of developing organizational knowledge: by moving reservoirs and networks or by modifying reservoirs and networks. Moving reservoirs and networks can shortly be described as transferring individuals or networks into other organizational contexts.

Moving Reservoirs and Networks

As described by Argote and Ingram (2000), the principle that knowledge can be moved by moving the networks in which it is embedded is a simplification of the reality. As priority stated, the organizational performance depends on the compatibility of the networks (internal and external). The movement of the basic elements is a problematic issue, since the basic elements may have to be adapted to the new context in which they have to perform. Examples of a basic element moved to a new context are; an individual moved to another department, a machine is moved to a new location, or a task is to be performed in a new department. Argote and Ingram (2000) also state that the movement of the networks may be more problematic than moving the basic elements as the network consists of interactions which may not fit in its new context. Thus, moving the basic elements is to be preferred before relocation of whole networks.

According to the research of Almeida and Kogut (1999), the effects of individuals changing location contributed to the transfer of knowledge about innovation in the semiconductor industry. Zhao and Reisman (1992) has not only collected much research about technology transfer, but has also performed a study concluding that the relocation of technology is a complex issue. The movement of individuals is generally seen as a powerful mechanism for facilitating knowledge transfer according to one research performed by Galbraith and one by Rothwell, as cited in Argote & Ingram (2000). A combination of moving members and tools has been found to better facilitate the knowledge transfer than just the relocation of one basic element (Argote & Ingram, 2000).

Knowledge Transfer by Modifying Reservoirs and Networks

The other main activity of knowledge transfer is the modification of reservoirs and networks. To modify a reservoir (member, task and tool) it needs to be developed. This is done primarily through training and communication which has been shown in several studies (Argote & Ingram, 2000).

2.4 Knowledge Management

“In its simplest form, knowledge management is about encouraging people to share knowledge and ideas to create value-adding products and services” (Chase, 1997: 83).

As stated in the quote from Chase (1997) knowledge management is about sharing, but as will be shown, this is just one part of the concept of knowledge management.

Clarke and Rollo (2001) note that in the past, the organizational focus was on collecting and storing data and information, since these could be easily processed, while the human capital was to be paid little or no attention.

Knowledge Management Processes

The processes related to knowledge management have, as knowledge, been defined with different perspectives. According to Fischer and Ostwald (2001), knowledge management is a cyclic process which involves the three activities creation, integration and dissemination. Storey and Kelly (2002) also state that knowledge management can be assumed to consist of three main activities; this description has similarities to the definition by Fischer and Ostwald (2001).

According to Storey and Kelly (2002) knowledge management can be described to involve the processes:

1. Knowledge Creation
2. Knowledge Transfer
3. Knowledge Storage

These activities together form a complete entity, which can be utilized for the purpose of bringing more value into an organization and its services. The definition by Storey and Kelly (2002) has been chosen to be further presented in this study, since it is connected to the definition of knowledge used in this study.

2.4.1 Knowledge Creation

Nonaka (1994) argues that knowledge is created through a conversation (interaction) between tacit and explicit knowledge. Nonaka (1994) also portrays knowledge by stating that ideas start in the mind of individuals, but that interaction with other individuals plays an important role in developing these ideas. This interaction is also called knowledge conversation. The assumption that knowledge is created through a conversation between tacit and explicit knowledge allows Nonaka (1994) to propose four different models of conversation, depicted in figure 3.

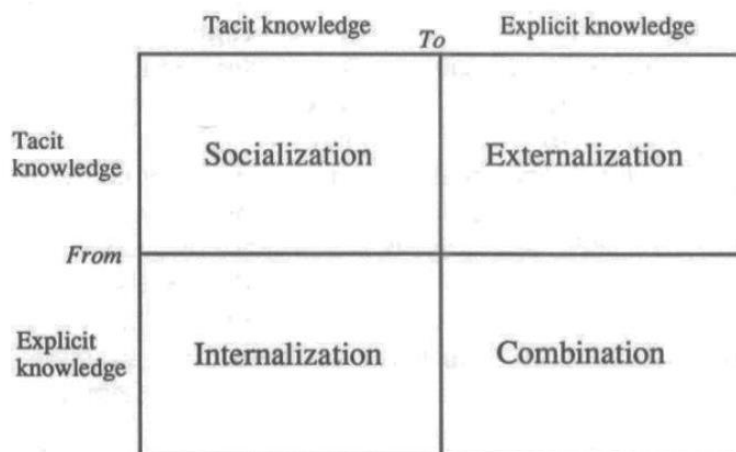


Figure 3 – Knowledge conversation models (Nonaka, 1994:19)

Socialization - From Tacit Knowledge to Tacit Knowledge

Socialization can be portrayed as one individual observing and imitating another (i.e. an apprentice watching and following a master) and then practicing what has been observed. Thus, the observer does not only see how something is done but can also study the emotions of the object (i.e. master). Even though the thoughts of the observed object cannot be interpreted, the patterns of emotions and movements are observed. Nonaka (1994) refers to this sort of knowledge

creation as “Socialization”. Important to notice is that “Socialization” also works without language.

Externalization - From Tacit Knowledge to Explicit Knowledge

The model of the tacit to explicit knowledge creating process, “externalization”, enables the receiver of the knowledge to interpret and formalize what has been observed, also bears the idea that tacit and explicit knowledge often cannot be easily separated (Nonaka, 1994).

Internalization - From Explicit Knowledge to Tacit Knowledge

The same idea of the connection between tacit and explicit knowledge is valid for turning explicit knowledge into tacit (Nonaka, 1994). This process, “internalization”, can be described best in the teacher-to-student-transfer of knowledge, also closely related to *learning by doing* (Clarke & Rollo, 2001).

Combination - From Explicit Knowledge to Explicit Knowledge

The model of creating knowledge from explicit knowledge to explicit knowledge, “combination”, is the use of a social practice (meetings, telephone conversations, etc.) to exchange knowledge (Nonaka, 1994). Thus, it is through the process of adding, sorting, re-categorizing and re-contextualizing knowledge that the “combination” process works.

Nonaka (1994) further argues that an organization, when using the four models of knowledge conversation, creates organizational knowledge. Thus, organizational knowledge creation refers to how members of an organization acknowledge in which way useful data and information is transformed into insights and new knowledge. This new knowledge can then be collected and applied elsewhere. This is emphasized by the idea that a business cannot, on its own, create knowledge. Thus, it is the individual of the organization which, through dialogues between tacit and explicit knowledge facilitates the knowledge creation (Nonaka, 1994). The organization provides the individuals with infrastructural support and context to encourage the knowledge creation (Storey & Kelly, 2002). Thus, through an organizational-process in which the individual knowledge is improved and outlined into an organizational knowledge network, knowledge is created.

2.4.2 Knowledge Transfer

Knowledge transfer is an important activity within an organization, to exploit the knowledge created in its full potential. As Storey and Kelly (2002) write about knowledge transfer, it can be done formally (trainings, books, etc.) and informally (face-to-face, learning on the job, etc.). The informal transfer of knowledge is looked upon as richer, including facial expressions, sign language, personalization, etc. To actively transfer knowledge between individuals, the use of knowledge management methods can be applied.

Methods of knowledge transfer can be divided into process-based and documentation-based (Schindler & Eppler, 2003), where the process-based methods focus on the relevant measures and their sequence for capturing knowledge, while the documentation-based methods focus primarily on the content and the storage of the experience.

Disterer (2002) argues that the methods of knowledge transfer should be defined already in the project planning workshop, and that time and budgetary funds should be dedicated to the capture and transfer of knowledge and experience.

Process-Based Knowledge Management Methods

Process-based knowledge management methods are, according to Schindler and Eppler (2003), among others: Project Review or Project Audit, Post Project Appraisal, After Action Review, Peer-Assist Meeting and Networking and Communities of Practice.

Project Review or Project Audit

A project review or project audit is a walkthrough during a project phase which aims to give a status clarification, and early recognition of risk situations (Schindler & Eppler, 2003). A project review or audit could also be performed after the project is realized, to summarize the project, and what has been learned during the project. Project participants and third parties which are affected by the project should be involved in the project review or audit. The result is then to be codified into a protocol, or report, which is to be transmitted to related parties.

Post Project Appraisal

Approximately two years after the project has been finished a complete project analysis is conducted, to help transfer knowledge of mistakes, success, etc. to third parties (Schindler & Eppler, 2003). The analysis, which covers the entire course of the project, is done after the finalization of a project and should include late effects into the project analysis. After the project documentation is reviewed, a set of interviews is to be carried out with related parties, and the final report should cover as much as possible of the project.

After Action Review

An After Action Review (AAR), originally developed by the US Army, is a short meeting after a certain event in a project, to enhance the quick learning from both failure and success (Schindler & Eppler, 2003). During these meetings four main questions should be answered: What did happen? What should have happened? Why didn't it work the way it was planned? What can you learn from this experience?

Peer-Assist meeting

Peer-Assist meetings are meetings between a more experienced individual or group and a less experienced individual or group. This could be seen as mentoring, where the less experienced follows the more experienced, or that the more experienced follows the less experienced and assist him or her in making decisions. The assistant should not be in any formal power position to the peer, rather should the assistant be seen as an expert which is there to support the peer (Dixon, 1999).

Networking and communities of practice

Networking, or meeting individuals with common interests, knowledge or who are in the same kind of situation, encourages sharing of experience and knowledge between individuals. Communities of practice refer to individuals which meet, because they find value in these meetings, by discussing their situation, aspirations and needs. Through these meetings a tacit understanding, or in some cases actual tools and standards can be created (Wenger et al., 2002).

The benefits of the process-based knowledge management methods are the enhancing of the experiential knowledge asset by sharing tacit knowledge through dialogue. Another aspect of the process-based methods is the laying of a foundation for a systemic knowledge asset through the tacit/explicit dialogue.

Documentation-Based Knowledge Management Methods

While process-based knowledge management methods focus primarily on knowledge transfer, the documentation-based methods also serve as knowledge storage methods. To mention a few of the more common documentation-based knowledge management methods, also described by Schindler and Eppler (2003): Micro Articles, Learning Histories and RECALL. Also noticeable is knowledge audit (Liebowitz et al, 2000) and knowledge mapping (Wexler, 2001).

Micro Articles

Micro Articles are short articles discussing the project, after the project has been finished. The scope of the micro articles covers about half a page to a page, and it should be written in an informal way. Also important for a micro article is the context, so that the information can be

connected to a particular project. The framework consists of; *Topic, introduction* and *keywords* for indexing the article.

Learning Histories

The learning history is a longer history, written in a non-strict form, of the most important events of a project. The use of many quotations is encouraged, to try to capture more tacit knowledge than through a usual documentation. The histories are written in a chronological, storytelling approach, and should contain between twenty and one hundred pages. They are often written using two columns on one page, where one column is for the learning history, and the other is for comments.

RECALL

RECALL (Reusable Experience with Case-based reasoning for Automating Lessons Learned) is an approach, developed by NASA, which uses a database to collect lessons learned through a normal internet browser. Guiding questions help the individual to know if information is worth to write down. Later on the individual has to answer context based questions, in order to make the lessons learned searchable in the system.

Knowledge audit and knowledge mapping

Other forms of documentation-based knowledge management are knowledge audit and knowledge mapping. A knowledge audit is performed to identify and document which kind of knowledge is processed in an organization, where there is a lack of relevant knowledge, as well as where “the wheel is reinvented” repeatedly (Liebowitz et al, 2000). Knowledge mapping is a visualization of who in an organization possess certain kind of knowledge, and how this knowledge connects with other knowledge resources within the organization (Wexler, 2001).

Disterer (2002) argues that the documentation from projects (project plans, folders, schedules, progress reports, protocols and likewise) is rarely meant for members of future projects. Thus, these documents should not be seen as knowledge transferring or knowledge storing entities.

2.4.3 Knowledge Storage

Knowledge storage, the last process of knowledge management, does not only refer to how knowledge is made explicit (codified) and stored within a database or in documents, but it also emphasizes how the created and transferred knowledge is reflected in organizational routines, processes and culture. This, the so called organizational memory (Walsh & Ungson, 1991), reaches its possible peak when the knowledge is collected in such a way that it is easy accessible for the individuals needing this special knowledge. Walsh and Ungson (1991) also argue that the most probable location for storage of organizational memory is within individuals, organizational culture, transformations (in this case transformation is referred to as processes with which the organization conduct modifications, i.e. raw material into a ready product), the organizational structure and the physical workplace structure.

Schindler and Eppler (2003) have found that even though knowledge management methods are used, there are often shortcomings in the actual storage of experience. They state that lessons learned are often not edited to be reused or it lacks value for other individuals. In their research they found that in the debriefings conducted the following risks occur:

- The result is not well documented and archived.
- The result is described in a too general manner, preventing reuse due to lack of context.
- The result is archived in a way which makes it difficult to retrieve.
- The result is not accepted, even though it is well documented and easy to locate.

2.4.4 Success Factors of Knowledge Management

Davenport and Prusak (1998) have identified nine important factors for a successful use of knowledge management tools, and Braf (2000) has commented the factors (or conditions as she rather calls it). These conditions focus more on the permanent functions of the organization than on projects. The conditions are:

1. **Knowledge oriented culture** – Refers to the creation of a positive atmosphere for knowledge sharing. To create a culture of knowledge orientation, it is important to have individuals within the organization who are willing to share and learn. Normally, individuals who are used to look for, and share, knowledge will continue doing so even if they face a new environment. On the other hand, individuals that appreciate their unique position in an organization are less willing to share their knowledge and experience (Davenport & Prusak, 1998). This is one of the more important factors for successful knowledge management within an organization (Braf, 2000).
2. **Technical and organizational infrastructure** – Knowledge management tools such as intranets or likewise, do not create knowledge, but help managing it. Infrastructure and meeting places encourage the sharing of knowledge between individuals. Within the organizational infrastructure, the roles of the individuals are also included (Davenport & Prusak, 1998). There could be roles constructed mainly for knowledge management, such as knowledge manager or likewise, even though the creation of a new role is an investment often connected with a high cost (Braf, 2000).
3. **Management support** – Even though the support is important for larger knowledge management activities, there is not the same need for support when it comes to the use of knowledge or to enhance single processes or functions. Knowledge management activities normally have to be supported from the organizational leaders. Management has the responsibility to make decisions about knowledge management and finance it, and also make clear what kind of knowledge is vital for the organization to share and store (Davenport & Prusak, 1998). Braf (2000) argues that management support is needed for any type of change and development. This is an important condition which has to be fulfilled to reach a success.
4. **Connections to economical values** – Knowledge management activities are connected to costs, therefore the benefits have to be measured and valued, to legitimate for both the management and the users (Davenport & Prusak, 1998). Braf (2000) states that the measurement of the economical values is important, but difficult and should rather be measured in which knowledge is used, which knowledge is needed and how to develop the knowledge within an organization. Thus, Braf (2000) does not recognize the importance of the economical values, rather the development of the knowledge and the knowledge management activities in an organization.
5. **A clear language about what knowledge is and the reason for Knowledge Management** – If an organization can define the expressions used (i.e. knowledge, learning, etc.) these expressions do not continue to be as abstract for individuals in the organization; rather, they become something which individuals can identify with activities (Davenport & Prusak, 1998). Braf (2000) further states that the meaning of the knowledge management activities must be established within the organization.
6. **Not looking at Knowledge Management as a process** – Rather seeing the activities as different projects, containing activities which lead to new ways of managing knowledge. With the project perspective of knowledge management, the activities do not stagnate or become out-of-date.

7. **To stimulate motivation and commitment** – Long term stimulation programs that are connected to the organization values and reward structure supports the long term use of knowledge management methods (Davenport & Prusak, 1998). According to Braf (2000) it can be a mistake to use only economic rewards for use of knowledge management, importance should also be given to consideration and other ways of encouragement.
8. **Creating a clear knowledge structure** – A clear knowledge structure means that knowledge, to some extent, needs to be categorized so that it can easily be used, stored, searched for, etc. (Davenport & Prusak, 1998). Braf (2000) argues that knowledge in this context also could be confused with information, and that information should be separated from knowledge management, and rather be managed through an information management system.
9. **Creating multiple channels for knowledge transfer** – With multiple channels for knowledge transfer is meant that one form of knowledge management methods is not enough to capture all knowledge. In an organization there have to be more methods used to capture a wider spectrum of knowledge. Thus, meeting places, conversations, etc., are important facilities for sharing of knowledge.

Schindler and Eppler (2003) have tried to find reasons why knowledge management methods do not work effectively in projects. They found a number of reasons which negatively affect the use of knowledge management methods. The reasons are all related to the four factors; time motivation, discipline and skills.

1. **Time** – Enlarged time pressure towards the end of projects results in a culture where the project result has priority before capturing knowledge.
2. **Motivation** – Insufficient willingness to learn among the project team members. It can be that project team members and project managers do not want to bring up mistakes made during the project.
3. **Discipline** – Lacking the discipline of conducting debriefings. This could result from the routines in the projects.
4. **Skills** – Lack of knowledge in debriefing methods and why they are important to conduct.

2.5 Knowledge Management in Projects

A few studies have tried to capture the use of knowledge management in project environments (Kasvi et al., 2003; Jagadeesan & Ramasubramanian, 2002; Disterer, 2002; Kotnour, 1999). Even though they have all been entitled to a certain company, these studies have not made any attempt of dividing projects into categories.

Disterer (2002) puts knowledge management into the project context, and states that the responsibility for transferring knowledge and experience from the temporary project organization to the permanent organization is assigned to the project management. The knowledge transfer refers to the transfer of both the project result and about the lessons learned throughout the project. The transfer of the knowledge about the project result could be documentation-based (e.g. technical documentation, drawings, etc.) or process-based (e.g. training). On the other hand Distester (2002) also states that the lessons learned cannot be transferred in the same way as the knowledge of the project result. Hence, two different types of knowledge management strategies should be used in a project, one used to capture knowledge about the project result, and one used to capture knowledge and experience about procedures and events in the project. To capture the knowledge and experience about procedures and events, Diester (2002) suggests that in the project management there should be tasks designated to identifying and securing knowledge. Distester (2002) further argues that, for an organization as well as for a project manager, to be

able to manage complex projects, it has to manage and use knowledge from the permanent organization and from other projects. This is depicted in figure 4 below.

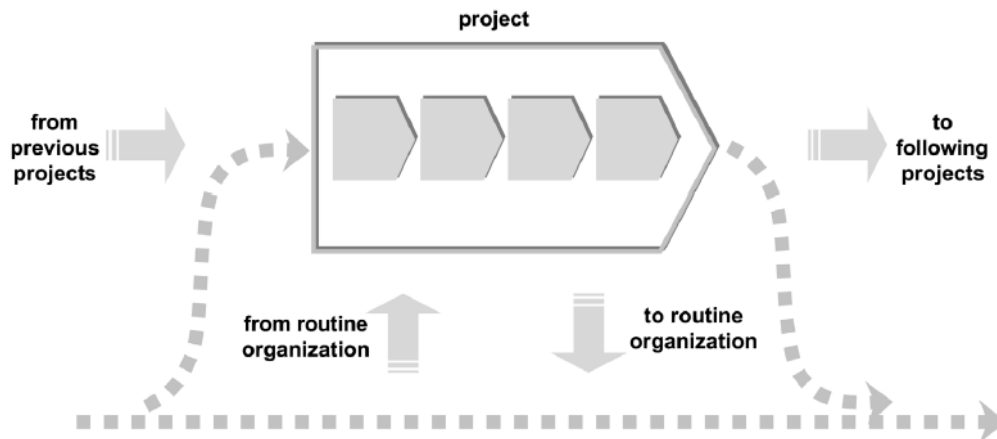


Figure 4 – Knowledge between project and the permanent organization (Disterer, 2002:515)

Distester (2002) concludes that the tasks of project management need to be supported by tasks of knowledge management to strengthen the reuse of knowledge. Brooks and Leseure (2004) show through their research that good project management practices correlate with good knowledge management practices. They state that in their research they made the experiences that where knowledge reuse was a problem, there was also a problem with the overall project management.

Kotnour (1999) describes how the development of knowledge management tools and practices used in project management could be performed by the plan-do-study-act (PDSA) cycle, as depicted in figure 5. The PDSA cycle is an easily understood and well spread model of improvement often used in quality management. The model, implemented into knowledge management, features:

- Plan – A knowledge management effort is planned. The plan consists of expectations of the effort and its result.
- Do – The plan is implemented
- Study – The project team reflects on the efforts taken. The output is a lesson learned about the effort.
- Act –The loop is continued by determining if the effort delivered corresponds to the expected result and what further actions are to be taken. Should the knowledge management effort be changed, terminated or implemented into another project?

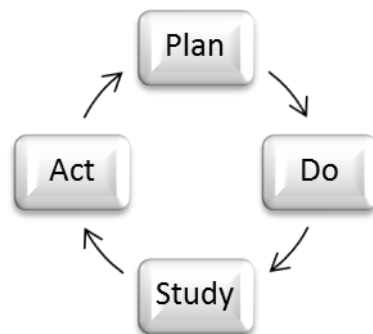


Figure 5 – PDSA cycle (modification of Kotnour 1999:33)

Atkinson et al. (2006) states that even though it is generally accepted that knowledge should be captured within projects the efforts taken are usually limited to a post project review. The lessons

learned are also linked to whether or not the project was delivered on time, within budget and to an agreed quality.

2.5.1 Studies Performed on Knowledge Management in Project Environments

According to Anumba et al. (2002) knowledge management within construction projects does consist of the following elements:

- High dependency on the knowledge of the individuals, but there is often no formal way of transferring and storing this knowledge. This means that the organization will suffer knowledge losses when an individual is no longer part of the firm.
- Long lasting agreements with suppliers, sub-contractors, customers, etc. promotes sharing of knowledge between these actors.
- Lessons learned are often captured at the end of projects in *Post-Project-Reviews* and turned into guidelines or best-practice behaviors.
- Individuals are part of different projects, thus the chance of discover new areas of knowledge is high.
- Formal and informal feedback, examples are site visits, presentations and likewise.
- Reliance of informal networks, so that an individual can get the knowledge he or she needs.
- In hierarchical organizations, individuals at a lower level trust, and is dependent on, their department / division manager to share the knowledge they possess.
- Use of IT-tools support sharing and communication within an organization

As stated by Kamara et al., as cited in Anumba et al. (2005), what is often needed within construction projects are systemic knowledge assets since the industry is performing poor when dealing with the transferring and storing of knowledge. Individual knowledge tends to stay individual since there often are no routines or standards dealing with knowledge management or knowledge sharing. Since the networks with suppliers, sub-contractors and customers are generally long term, there is a potential of a successful transfer of knowledge from one partner to another. In order to do so all parties have to gain knowledge from this cooperation and see the benefits from such knowledge transferee.

Madhavan and Grover (1998), state that companies performing product development activities could benefit from the transfer of routine knowledge assets by:

- Seeding new project teams with members from successfully past project teams
- Including team members which function is to learn from effective teams
- Using members of past successful project teams to mentor new project teams
- Making sure that not too many team members are changed at a time when project teams face changes in constellation

Jagadeesan and Ramasubramanian (2002) describe how, in a software producing company, knowledge management methods are defined by the project manager in the project plans. These plans are then are used as guiding documents throughout the project. They also state that knowledge management is the responsibility of the entire project team. The knowledge management method used is a documentation-based system, where individuals are rewarded for transmitting and reviewing documents in a shared database.

2.6 Organisational Model

2.6.1 Interpretation of the External Environment

Daft and Weick (1984) have developed and described a model dividing organizations into categories, depending on how the top management in an organization interprets their surroundings. Daft and Weick (1984) have characterized four different interpretations modes

depending on two factors. The two factors are: if the top management believes that the organization's external environment is analyzable and how active the top management searches for information.

When management believes the external environment is analyzable, it is represented by the ideas that the environment can be measured, that there are hard facts about the environment and that the organization can find the correct way of interpreting its environment (Daft & Weick, 1984). If top management believes that the external environment is unanalyzable, the organization creates and shapes its own external environment (an example is to create a market where there is none).

The other factor is if the top management of the organization actively searches for information (active interpretation) or if it accepts the information it's given (passive interpretation). An active search for information can be represented by the use of research departments, forecasting or the use of field agents (Daft & Weick, 1984). Through a combination of these two factors, four combinations are possible; these four combinations are referred to as organizational modes. The four organizational modes are: undirected viewing, enacting, conditioned viewing and discovering. Depicted in figure 6 are the four organizational modes.

ASSUMPTIONS ABOUT ENVIRONMENT	Unanalyzable	UNDIRECTED VIEWING Constrained interpretations. Nonroutine, informal data. Hunch, rumor, chance opportunities.	ENACTING Experimentation, testing, coercion, invent environment. Learn by doing.
	Analyzable	CONDITIONED VIEWING Interprets within traditional boundaries. Passive detection. Routine, formal data.	DISCOVERING Formal search. Questioning, surveys, data gathering. Active detection.
		Passive	Active
ORGANIZATIONAL INTRUSIVENESS			

Figure 6 - Model of organizational interpretation modes (Daft & Weick, 1984:289)

Enacting

The enacting mode represents organizations where the top management actively searches for information and where the top management believes that the external environment is unanalyzable. These categories of organizations create their own environment and gain information by trying and experimenting. These type of organizations also create their own markets rather than waiting for an evaluation of the market, by developing products which the organization believes they can sell (Daft & Weick, 1984).

Discovering

An organization with a discovering interpretation of the external environment has a top management which actively searches for information and believes that the external environment can be analyzed. These kinds of organizations use, for example, experiments, research as well as market research or trend analysis to predict the market where they act (Daft & Weick, 1984).

Conditioned Viewing

Organizations with a conditioned viewing interpretation are distinguished through the top managements believe that the external environment can be analyzed, and their passive search for

information (Daft & Weick, 1984). These organizations trust established data collecting methods as well as the organization's own procedures, developed through time. Thus, these organizations are limited to their own procedures and do not develop further than its own limits.

Undirected Viewing

Undirected viewing is an interpretation mode which is represented by organizations where top management believes that the external environment is unanalyzable and which has a passive approach to information searching (Daft & Weick, 1984). As conditional viewing, the organization uses information which is presented to it, but management believes that the external environment cannot be analyzed. Thus, managers create their own soft environment, relying, for example, much on personal connections more than on facts.

2.6.2 Organizational Characteristics

According to the model of organizational modes, the different organizational modes can be connected to how different organizational processes are practiced. The different organizational processes affected by the organizational mode are: scanning characteristics, interpretation processes, and strategy and decision making (Daft & Weick, 1984).

Scanning Characteristics

Scanning characteristics represent how top management receives data about the environment. The different organizational modes have different scanning characteristics, which are divided into data sources and acquisition (Daft & Weick, 1984).

- Data sources - can be internal (within the organization) or external sources as well as personal and impersonal (written documentation, newspapers, etc.).
- Data acquisition - passive organizations use little effort to acquire data whereas active organizations will use much effort.

Interpretation Processes

Through interpretation processes, management translates data into knowledge and understanding. The interpretation processes can be divided into equivocality reduction and assembly rules (Daft & Weick, 1984).

- Equivocality reduction – how unclear the data is, and how much it can be interpreted.
- Assembly rules – the procedures to interpret data, the cycles represent the number of cycles data needs before it is established among top management.

Strategy Formulation and Decision Making

Daft and Weick (1984) describe the strategy formulation and decision making in an organization in relation to how the organization interprets its environment.

- Strategy formulation
 - Prospector – The organization changes fast and reacts to the changes in the environment
 - Analyzer – The organization watches and analyzes the environment before a change is made.
 - Defender – The organization maintains its traditional markets, is focused on internally efficiency.
 - Reactor – The organization reacts to seemingly random changes in the environment, and “moves along” with the general market.
- Decision making
 - In the enacting organization the incremental trial and error decision making is performed. This means that the organization develops a custom solution and tries it; if it does not work then a new solution has to be developed and tried.

- System analysis, computation is used by the discovering organization. This is a solution which is based on analysis of the environments as well as other options. A solution will not be approved unless all options have been carefully weighted.
- A conditioned viewing organization is based on a passive approach to information search as well as believing that the external environment can be analyzed. This makes the decision-making process simple, and programmable, since there are no surprises which could occur.
- Since the environment in an undirected viewing organization is considered to be unanalyzable and while management receives information from personal sources, management needs to understand what has happened before agreeing on a decision.

In figure 7, the scanning characteristics, interpretation processes and strategy and decision making for the different organizational modes, according to (Daft & Weick, 1984), are depicted.

ASSUMPTIONS ABOUT ENVIRONMENT	Unanalyzable	UNDIRECTED VIEWING Scanning Characteristics: 1. Data sources: external, personal. 2. Acquisition: no scanning department, irregular contacts and reports, casual information. Interpretation Process: 1. Much equivocality reduction 2. Few rules, many cycles Strategy and Decision Making: 1. Strategy: reactor. 2. Decision process: coalition building.	ENACTING Scanning Characteristics: 1. Data sources: external, personal. 2. Acquisition: no department, irregular reports and feedback from environment, selective information. Interpretation Process: 1. Some equivocality reduction 2. Moderate rules and cycles Strategy and Decision Making: 1. Strategy: prospector. 2. Decision process: incremental trial and error.
	Analyzable	CONDITIONED VIEWING Scanning Characteristics: 1. Data sources: internal, impersonal. 2. Acquisition: no department, although regular record keeping and information systems, routine information. Interpretation Process: 1. Little equivocality reduction 2. Many rules, few cycles Strategy and Decision Making: 1. Strategy: defender. 2. Decision process: programmed, problemistic search.	DISCOVERING Scanning Characteristics: 1. Data sources: internal, impersonal. 2. Acquisition: Separate departments, special studies and reports, extensive information. Interpretation Process: 1. Little equivocality reduction 2. Many rules, moderate cycles Strategy and Decision Making: 1. Strategy: analyzer. 2. Decision process: systems analysis, computation.
		Passive	Active
ORGANIZATIONAL INTRUSIVENESS			

Figure 7 – The scanning characteristics, interpretation processes and strategy and decision making for the different organizational modes (Daft & Weick, 1984:291)

2.7 Research Model

The way a research approaches and combines theory and empirical research is symbolized in the research model. This represents a set of broad concepts which lays as a foundation for the research (Willis, 2007). For this study the research model is used for the collection of data, the analysis of the data as well as for the conclusions drawn from the analysis. The research model, depicted in figure 8Figure 1, illustrates factors that affect the knowledge management (creation, sharing and storing of knowledge) in project environments.

Knowing which category a project belongs to, and therefore knowing project specific conditions, such as project processes and organization, leads to a better understanding of how knowledge is to be effectively created, transferred and stored within these projects. The successful use of knowledge management methods is also believed to depend on factors, related to the organization, such as the organizational mode. This proposes that the organization affects the use of knowledge management methods. The use of project management methodology can affect how knowledge is handled in a project, because it affects how the sub-processes of a project handled.

Thus, how the project is managed is believed to affect the use of knowledge management in projects.



Figure 8 – Research model

Project Category

If the project category can be determined, other conclusions can be made about the project, concerning the goal of the project, the processes within the project, and the project organization. For this study the categorization according to Ljung (2011) has been chosen since Ljung describes four clearly separated categories, which comes from a long study of more organizations. Thus, projects are divided into the following categories:

- **Creating [Product]** – Projects with the aim to create a physical product, the project normally consists of sequential activities, clear milestones and the project team members are connected to the tasks to be performed.
- **Creating [Activity]** – Projects which aim is to deliver an activity (concert, lecture) which are performed mostly using parallel activities. The delivery of the project result and the use of the result are performed at the same time. The result can be difficult to visualize and the project team works closer together at the end of the project.
- **Activity [Effect]** – Projects with the aim to create a change. The result is often difficult to measure, and the control of the result must therefore be concretely specified to be useful. The organization depends on the project.
- **Activity [Evaluation]** – Projects which result is to describe knowledge of the evaluated target. The project team usually consists of experts or individuals with vast knowledge of the target.

When the goal, the organization, and the processes of a project are known, it can be established which project management methodologies are to be used to ensure a professional management of the sub-processes of a project. Therefore the project category affects the use of the project

management methodology. Furthermore the project category affects the knowledge management in project environment, as is illustrated by the arrows in figure 8.

Project Management Methodology

The project management, and the effective use of project management methodology, affects the way a project is performed. Thus, the use of project management methods affects the use of knowledge management methods (Brooks & Leseure, 2004). Project management methods represent tools and techniques used for a successful and effective management of the sub-processes of project management. The dimension of project management methodology is divided into:

- **Active use** of project management methodology
- **No active use** of project management methodology

The arrows in figure 8 show how project management methodology affects knowledge management methodology as well as knowledge management in project environment.

Organizational Mode

The organizational mode, as described by Daft and Weick (1984), describes how top management views the external environment and to which extent the organization searches for information.

The organizational modes are divided into four categories:

- **Enacting** – These organizations are represented by organizations where management actively searches for information and believes that the external environment is unanalyzable.
- **Discovering** – Discovering organizations are characterized through management's active search for information and by their idea that the external environment is analyzable.
- **Conditioned viewing** – In these organizations, management use information which is presented to them, and they believe that the external environment is analyzable.
- **Undirected viewing** – In organizations with an undirected viewing organizational mode, management does not actively search for information and they believe that the external environment is unanalyzable.

Through the organizational mode, other organizational processes, which can influence the use of knowledge management methodology, can be predicted. These processes are scanning characteristics, interpretation processes and strategy and decision making. The arrows in figure 8 represent how the organizational mode affects knowledge management methodology as well as knowledge management in project environment.

Knowledge Management Methodology

The professional use of knowledge management methods affects how knowledge is created, shared and stored within a project. This is also valid in the relationship between a project and the permanent organization as well as between projects. The dimension of knowledge management methodology within this study has been separated into two sub-dimensions:

- **Active use of knowledge management methodology** – do the studied organizations use any knowledge management methodology within their projects? If any methodology is used, than which is used within the studied projects?
- **No active use of knowledge management methodology** – even if no active use of any knowledge management methodology is performed within the organization, are there any unconscious knowledge management methodology used?

Success Conditions

Which conditions have been fulfilled within the studied projects, as well as in the permanent organization, in order to use knowledge management methods effectively within projects? The focus in this study is on the following conditions from Davenport and Prusak (1998):

- **Knowledge oriented culture** – Is there a sharing and supporting atmosphere in the organization?
- **Technical and organizational infrastructure** – Are the infrastructures supporting knowledge management activities?
- **Management support** – Do management actively support the creation, sharing and storing of knowledge?
- **Connection to economical values** – Does management communicate the economical aspects of knowledge management?
- **A clear description of knowledge and reasons for knowledge management** – Is it clear in the organization what knowledge is?
- **Not looking at knowledge management as a process** – Are knowledge management activities looked upon as being processes or projects?
- **Stimulation of motivation and commitment** – Are individuals stimulated to perform knowledge management activities?
- **Creating a clear knowledge structure** – Is it clear how knowledge should be stored and structured to be searchable?
- **Creation of multiple channels for knowledge transfer** – Are there multiple types of channels are used for knowledge management?

And from Schindler and Eppler (2003):

- **Time** – Is there enough time in the project for capturing what has been learned through the project?
- **Motivation** – Is the project manager and the project team motivated enough to perform activities for capturing knowledge created in the process of the project?
- **Discipline** – Do the project manager and the project team possess enough discipline to perform knowledge management activities?
- **Skills** – Do the project managers have enough understanding of knowledge management activities to perform them?

The arrow, depicted in figure 8, between knowledge management methodology and knowledge management in project environment represents how the use of knowledge management methodology affects the knowledge management in project environment.

Even if no active use of any knowledge management methodology is registered within the organizations studied, the success conditions will still be analyzed. The analysis shows if it would be difficult to implement knowledge management methodologies in the affected organizations.

3 Research Method

This chapter contains a description of method used, the choice of respondents, the validity and reliability of this study as well as the research design.

To contribute to the collected knowledge within the project- and knowledge management, and to explore the propositions of this master thesis and its theoretical framework, an empirical study has been performed and analyzed.

This study has as its first purpose to how common the use of knowledge management is in project environment. This question could benefit from such research method as a survey. However, in this study, the second purpose is to find an answer to how the following four dimensions relate to knowledge management methods in project environment: project category, project management methodology, organizational mode and knowledge management methodology.

3.1 Case Study Method

A case study is often used when a research study wants to give an answer to questions containing the phrases “how” and “why”, but also when contextual conditions are to be covered (Yin, 2006). The method of performing a case study should also be used when a particular process is to be studied (Yin, 2006). Because the contextual conditions of the performed knowledge management methods, as well as the contextual conditions of project management are to be studied the case study method is used for this master thesis.

There are two major designs of a case study, the *single case study* and the *multiple case studies* (Yin, 2006). This study contains a multiple case study, to capture a wider picture of the projects, the four dimensions of the study and the related environments of the studied objects. The design of the multiple case studies performed is described in figure 9, where the analyzing units represent the research questions.

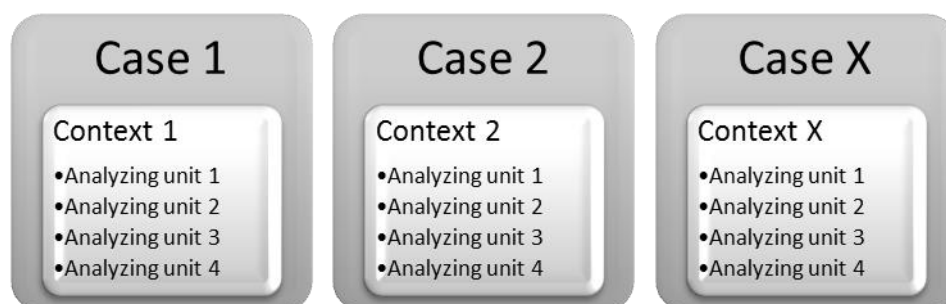


Figure 9 – Design of multiple case studies

The analyzing unit consists of questions related to the four dimensions: project category, project management methodology, organizational mode and knowledge management methodology. The context depicts to the related environment (size of organization, location of organization, etc.), and the respondents (gender, working experience in the present position, etc.), but will only play a minor role in the analysis.

3.2 Respondents

The samples, or respondents, for this study were selected based on a purposive sampling. Purposive sampling is when a sample is chosen based on knowledge of the population and the purpose of the study (Babbie, 2001). The following criteria were used for the choice of the

respondents. All respondents were: project managers, living and working in Austria. One was chosen because she was a member of the IPMA (International Project Management Association).

3.3 Performed Multiple Case Studies

The multiple case studies performed within the boundaries for this master thesis were located in Austria in spring of 2013. Five respondents were interviewed for about 45 to 90 minutes. Three of the five interviews were telephone interviews, and two were personal interviews.

The language used during the interviews was mainly German, but a few English sentences did also occur. To prepare the respondents for the interview, the questions (see Appendix A) were sent to the respondents one week in advance. Thus, the respondents could prepare for the interviews. The questions were further explained before the respondent got to answer. The questions which were presented to the respondents were all in English. During the interviews, notes by the author were taken.

Telephone Interviews:

The telephone interviews were performed because a physical meeting could not be arranged. By all telephone interviews the respondent was located in Vienna and the author in Villach.

Personal Interviews:

From the two personal interviews one was performed in Villach and the other one in Vienna.

3.4 Reliability

Reliability is described by Yin (2006) as being the chance that if another researcher performed the same study, the study would show the same results. Every study performed need to pay certain consideration to the reliability of the study (Yin, 2006). According to Yin (2006), the multiple case studies has more reliability than the single case study, since multiple sources of evidence is used. The reliability is also enhanced by the use of the same questions for all respondents.

The potential problematic, as described by Baxter and Jack (2008), that the amount of data collected can be too much, and therefore confuse the for the researcher should be noticed considering the reliability of the research.

This study could, by using the research model, be done again using other respondents. It should be made clear that the result would most probably vary since only five respondents have been used, from a limited amount of industries. If other respondent, from other industries would be used, there would probably be more and / or other conclusions made. Nevertheless, the conclusions made from this research do give a coarse picture of how other industries handles knowledge in projects.

3.5 Validity

Validity is, according to Yin (2006), basically described how a research can be trusted. Validity means that the researcher has drawn conclusions in a truthful and subjective order.

This study has been made with the hypothesis that knowledge management is seldom a part of project management. Nevertheless, the author has, through the whole process of the research, tried to keep a subjective attitude to the respondents, the empirical data collected and the conclusions made.

3.6 Research Design

Every study contains an unexpressed, or sometimes expressed, research design. A research design is the logical sequence in which the research is performed. It should be noted that a research design is more than just the working plan of the study; it is to be looked upon as greater guide line and helps the researcher to perform a relevant empirical study (Yin, 2006).

The research design for this study, divided into five categories according to Yin (2006), describes the frame in which the empirical study has been performed. The five categories; the research purpose, the hypothesis, the analysis, the logical connection between data and hypothesis and the criteria's for interpreting the results are presented below.

The Research Purpose

The first purpose of this study is to explore to what extent knowledge management is used within project environments. The second purpose is to establish the relations between knowledge management in project environment and the four dimensions: the project category, the project management methodology, the organizational mode and the knowledge management methodology.

The Hypothesis

Through the theoretical framework it has been established that project based organizations can develop an organizational advantage if methods for knowledge management are incorporated into projects. The hypothesis throughout this study has been that even though knowledge management methodology are advantageous for the developing, sharing and storing of knowledge within a project, it is not common that it is used in projects and project based organizations. Furthermore the hypothesis is that even if knowledge management methods are being used, they are not used effectively.

The Analysis

To be able to analyze the result of the empirical research, the case studies have to give answers to how creating, sharing and storing of knowledge is performed in the projects. Furthermore the analysis will depict the specific project category, if any project management methodology is being used, which organizational mode the organization belongs to and if any knowledge management methodology is being used in the projects. This will be done using the research model presented in chapter 2.8 together with the research method.

The Logical Connection between Data and the Hypothesis

The connection between the collected data and the hypothesis is mostly to be recognized through the definitions of patterns between the different case studies and the theoretical framework. The hypothesis that knowledge management is not common in projects and that if it is used it is not used effectively will be discussed in the conclusion chapter of the study.

The Criteria's for Interpreting the Results

To interpret the result, the patterns found through the empirical research have to be analyzed within the range of the theoretical framework for this study.

4 Empirical Data

This chapter contains a presentation of the empirical data obtained through the case studies.

4.1 Case Study A

The case study was performed in Villach, Austria, on 07.01.2013 at IBK ZT-GmbH.

Organization

IBK ZT-GmbH is an engineering company based in the south of Austria, with focus on planning urban water- and sanitation facilities, road construction (including bridges and tunnels) as well as construction supervision. The company has about 50 employees in Villach and Vienna.

Personal Background of Respondent

Mr. Kogler has been working at IBK for about three years, as a project manager and expert within the fields of hydraulics and GIS implementations.

Project Category

According to the respondent, the projects managed result in the form of drawings and calculations, and can therefore be said to be creating [product] projects. The respondent explains that the goal of a project is normally very clear, such as to deliver drawings and hydraulic calculations concerning the waste water transmission from point A to point B, following the route C. The project teams consist of between 2-3 individuals, working on average a few months on one project. Normally there are about 2-4 projects being worked with at the same time, containing almost the same individuals.

Project Management Methodology

There is no active use of any project management methodology within the projects. There are no project plans made, the respondent knows only the delivery date and how many man-hours can be spend on the project by the project manager and the project team. The reason for the lack of project management methodology is, according to the respondent, that there is no interest from the management. According to the respondent, management is only interested in results, and not in the use of any methods to improve the efficiency of the project work.

The activities performed by the project manager consist mostly of solving problems which occur during the project work, and to answer questions from the customers as well as the project team. A further task, performed by the project manager, is to coordinate the project member's activities in the different projects, according to the project with the highest priority at the moment.

Organizational Mode

According to the respondent, management does consider the surrounding environment as analyzable and, often, with constant factors (such as the type of service which the market desires). The organization does use a very passive form of information searching, relying mostly on information presented to it.

Knowledge Management Activities

The respondent states that there is no active use of knowledge management methods within the organization. The respondent notes that he uses peer-assist meetings when asking colleagues about help and explanations. The peer-assist meetings are characterized through that the respondent usually asks colleagues for more information than just the answer to a question. This is done using many "why" questions. Nevertheless, the respondent also notes that he knows of no one else which uses this technique within the organization.

Discussing the different conditions affecting the knowledge management activities, the respondent does mean that the company lacks strength in the conditions concerning the permanent organization as described by Davenport and Prusak (1998):

- **Knowledge oriented culture** – There is no culture of sharing knowledge within the company. It is more likely that individuals look for help or answers, but they are not interested in learning more about the subject.
- **Technical and organizational infrastructure** – There is no technical infrastructure in the organization for storing of knowledge and lessons learned. All project documentation is archived one year after the project has been finished.
- **Management support** – Management does not think that managing knowledge sharing or storing is of importance.
- **Connection to economical values** – There is no connection between knowledge management and economical values, according to the respondent.
- **A clear description of knowledge and reasons for knowledge management** – There is no definition what knowledge in the organization means, but the respondent argues that it implies by management that individuals with a high degree in engineering also possess much knowledge.
- **Not looking at knowledge management as a process** – There are no knowledge management activities present in the organization, according to the respondent.
- **Stimulation of motivation and commitment** – Since there is no management support for knowledge management, there is no reward system or stimulation for performing knowledge management activities.
- **Creating a clear knowledge structure** – There is no clear structure, or labeling of, knowledge with the purpose of storing it correct. Nor is there a clear structure how knowledge is to be searched for.
- **Creation of multiple channels for knowledge transfer** – There are few channels for knowledge sharing. Since the employee's lack support and motivation to perform any knowledge management activities, the channels which exist are not used to its full extension.

It was also stated by the respondent that, mostly because of the management, the project specific conditions, according to Schindler and Eppler (2003) were not fulfilled:

- **Time** – There is never any planned time to performed lessons learned activities or likewise.
- **Motivation** – The only time when feedback comes, is when something has gone wrong, making the motivation for receiving, and talking about, feedback very low.
- **Discipline** – No discipline to perform any activities is recognized within the project teams
- **Skills** - No knowledge of any knowledge management activities among the project managers or in the project teams

The respondent posts that he would be interested in using both project management methods as well as knowledge management methods in his work, if any support from management for these types of activities is shown. He believes that these two fields do have a connection, and that they work at its best when they are used together.

The respondent states that he would be interested to know where to find knowledge within the organization, he thinks that organizational mapping through GIS (Geographical Information System) could be interesting.

4.2 Case Study B

The case study was performed in Vienna, Austria, on 24.01.2013. The respondent wants both him as well as the company to be anonym.

Organization

The company is an engineering company, based in Vienna. It has about 20 employees, and the scope of their work reaches from being a subcontractor to other engineering companies, producing drawings and calculations, to producing their own engineering services to contractors.

Personal Background of Respondent

The respondent has worked in the company for about seven years, the last 3 as project manager. He has a technical education and has been working with production of drawings in the construction industry for over 15 years.

Project Category

The results from the projects performed within the company are mainly presented in form of drawings and calculations, thus the project types can be seen as creating [product] type of projects, according to the respondent. The project teams consist mainly of 2-5 employees, and reach from periods of a few months to one or two years.

Project Management Methodology

There is no active project management methodology being performed in the organization, but the respondent means that there are a few forms which have to be filled out at the start of each project. These forms do resemble a simple type of project plans, but they are never filled out with any effort. The respondent thinks that missing communication from management about the importance of the use of the project management methodology is probably the main reason for the lack of the effort.

The respondent describes the role of the project managers as being, apart from a project team member, the contact person for the external customers and management.

Organizational Mode

According to the respondent, the company management does believe that the external environment can be analyzed. The organization does perform the work which is asked of their customers to do, they do not create any own market or likewise. Management does not actively search for information, but uses the information which is presented to them.

Knowledge Management Activities

The respondent states that it is encouraged from management to share knowledge, even though there are no special activities which are being performed. Mostly the employees are encouraged to work together or in the nearness of each other in order to exchange knowledge and information. This is also reflected, the respondent states, through the many social activities which the management creates and supports, even though the sharing of knowledge is not the main reason, it is still seen as a good way of interacting with many individuals in the organization.

The respondent commented on the organizational criteria, developed by Davenport and Prusak (1998), affecting the knowledge management in the organization:

- **Knowledge oriented culture** – The culture is open for sharing and most employees' want to share their knowledge and they are also willing to learn from each other.
- **Technical and organizational infrastructure** – There is no direct technical infrastructure in the organization for storing of knowledge and lessons learned. Nevertheless there is an organizational infrastructure which allows meeting and working together.
- **Management support** – There is support from management for the few knowledge management activities performed.
- **Connection to economical values** – There is no connection between knowledge management activities and economical values.

- **A clear description of knowledge and reasons for knowledge management** – There is no clear description of what is seen as important knowledge in the organization, but the reasons for knowledge management are expressed by management.
- **Not looking at knowledge management as a process** – Knowledge management is mostly viewed as process.
- **Stimulation of motivation and commitment** – There is no stimulation of motivation or commitment by the management.
- **Creating a clear knowledge structure** – There is no clear structure of knowledge in the organization. According to the respondent, there is no storing of knowledge in the projects or in the organization.
- **Creation of multiple channels for knowledge transfer** - Multiple channels for knowledge transfer are present, even though they are not effectively used.

The project specific criteria, according to Schindler and Eppler (2003), were also commented by the respondent:

- **Time** – In the projects there is almost never time to reflect on what went good or bad in a particular project, and no time is made free for these activities.
- **Motivation** – There is an attitude within the company that it is ok to share knowledge, and this affects the motivation in a positive direction. It is ok to make mistakes, but is required that the employees learn from them.
- **Discipline** – There is no discipline, since no active knowledge management actions are performed.
- **Skills** – The project managers as well as the project team members lack skills in knowledge management methods.

4.3 Case Study C

The case study was performed as a telephone interview on 07.02.2013. The respondent wants both her and the organization for which she works to be anonym.

Organization

The company is an NGO (non-governmental organization) developing educational material about sustainable development for children (and teachers). The materials are in form of papers, movies, workshops, etc. The organization employs about 30 persons; about half of them work part time, and the other half full time.

The organization has had a major restructuring the last year, bringing project management and knowledge management on the agenda.

Personal Background of Respondent

The respondent has been working in the organization for about one year as project manager, but also with public relations and organizing events.

Project Category

As stated by the respondent, the projects in the organization do mainly have as a goal to create a product, but in some cases there are also projects with the goal of organizing events, such as workshops. For this study the respondent talked in general about all projects in the organization, but noted that the majority of the projects performed in the organization belongs to the creating [product]-category.

Project Management Methodology

The last years the respondent has been part of a team which has introduced an own developed project management methodology in the organization, which is used by all project managers in all types of projects in the organization. This project management methodology is mostly used for

planning and controlling of the projects. The methodology is still being developed by the project managers, and will continue to improve over time.

Organizational Mode

The organization has an external environment which management sees as analyzable, they deliver a product which is requested by the customers. The organization does actively search for information for their projects through inviting individuals with specialized knowledge, and through contact with other similar organizations and project stakeholders.

Knowledge Management Activities

There are two major knowledge management activities being performed within the organization, one documentation-based and one process-based. The documentation-based activity is that all project related documentation is being stored on a server where everyone can access it. The process-based activity is carried out through the use of workshops at the end of each project, with the focus on project evaluation. Apart from the two major activities there are occasions where brainstorming, workshops and planning is performed with individuals from different departments. A position partly used as knowledge manager has been installed in the organization, which aim is to develop and secure the creation, transfer and storage of knowledge.

The respondent commented on the organizational criteria, according to Davenport and Prusak (1998), affecting the use of knowledge management methods:

- **Knowledge oriented culture** – The culture has developed during the organizations restructuring and is now characterized of an atmosphere of sharing.
- **Technical and organizational infrastructure** – Both the technical and the organizational infrastructure are under development but are both present and actively used. The technical infrastructure is represented by the server for information storage, and the organizational infrastructure by the encouragement to work together creating an atmosphere of sharing.
- **Management support** – Management strongly supports the sharing of knowledge within the organization.
- **Connection to economical values** – Management does not communicate any connection between knowledge management activities and economical values.
- **A clear description of knowledge and reasons for knowledge management** – The description of knowledge and which knowledge that is important to store, is under development, but is present, as well as that the reason and the benefits of sharing is being communicated by the management.
- **Not looking at knowledge management as a process** – Knowledge management activities are mostly viewed as processes being part of the projects.
- **Stimulation of motivation and commitment** – There is no direct stimulation to motivate sharing of knowledge.
- **Creating a clear knowledge structure** – The structure and definition of the different knowledge areas which is important in the organization is not well developed. There is a system missing for the storage of knowledge in the organization.
- **Creation of multiple channels for knowledge transfer** – There is a server where document and other related information is being stored, where everyone has access. There are also the workshops planned at the end of each project.

The criteria concerning the projects (Schindler & Eppler, 2003) were also discussed by the respondent:

- **Time** – There is seldom enough time to evaluate the projects enough, even though time is set aside for this activity in the project plan.
- **Motivation** – The organization and the employees are open to learning, even though some individuals find it hard to talk about mistakes made.

- **Discipline** – The discipline is there, and most project managers do make some kind of project evaluation
- **Skills** – There are no special skills needed to perform the activities, only knowing what is important to store.

4.4 Case Study D

The case study was performed as a telephone interview on 10.02.2013. The respondent desires that both he and the organization which he works for remain anonymous.

Organization

The company is a larger organization (about 1000 employees) with the head office in Germany and a few other offices around Europe. The company produces sensors for the automotive and other industrial customers. The marketing department of the organization, which try to follow and predict the market trends, is the customer for the ready products which are developed in the form of projects.

Personal Background of Respondent

The respondent has been working as a project manager in the organization for about four years. He has a technical education in the field of microelectronics and has advanced to project manager after a few years in the organization.

Project Category

The projects in the studied organization do, according to the respondent, belong to the category creating [product] since the results are plans for the sensors, which then are used for production.

Project Management Methodology

The organization uses an own developed project management methodology, dividing the projects into about ten different phases. To be able to move to the next project phase, criteria's for the specific phase need to be fulfilled. For the project planning, the Critical Chain Project Management is used. Critical Chain Project Management means that every work package is given a timeframe with a buffer and that the buffers for all work packages are put together, and the project development is then measured through how much of the total buffer that has been used.

The project management methodology used in the organization is a support both for the project manager as well as for management. Management has, through the criteria which need to be fulfilled, a better view of how the projects in the organization are developing.

Organizational Mode

The management of the organization tries to interpret the market and deliver products which can be easily sold to the final customer, through the marketing department. Management does actively search for information through experiments and research.

Knowledge Management Activities

There is no active use of any knowledge management activities in the organization. The activities which do take place are thought of as being too less to have an impact, for example networking once a year for the project managers.

The respondents meaning concerning the criteria which was developed by Davenport and Prusak (1998), affecting the knowledge management use in the organization:

- **Knowledge oriented culture** – The culture in the organization is, to some extent, knowledge oriented. There are a few ways of sharing knowledge in the organization, but it is not encouraged by the management.

- **Technical and organizational infrastructure** – The technical infrastructure is present in the organization, since the organizational members are spread across Europe, and constantly need to share information. The organizational infrastructure is, for the same reason, reduced, concerning only a few individuals per office.
- **Management support** – Unfortunately, management does not express their support for knowledge management activities.
- **Connection to economical values** – There is no connection to economical values to use knowledge management methods, more the opposite, since management sees knowledge management as “a waste of time and resources”.
- **A clear description of knowledge and reasons for knowledge management** – Knowledge and experience is well defined in the organization, making this condition fulfilled even though the reasons for knowledge management are not present or communicated.
- **Not looking at knowledge management as a process** – Knowledge management is basically seen as process when it is looked upon.
- **Stimulation of motivation and commitment** – There is no active stimulation of any kind for individuals who share their knowledge with others.
- **Creating a clear knowledge structure** – There is no clear knowledge structure in the organization. The knowledge structure, or definition, is very complex in the organization, and would need much attention before it could be cleared.
- **Creation of multiple channels for knowledge transfer** – There are multiple channels for sharing and storing knowledge within the organization, but they are not used for this reason.

The criteria specific for the projects (Schindler & Eppler, 2003), described by the project manager:

- **Time** – Since there is a precise planning of the projects, and knowledge management activities is not a part of the planning, there is no time set aside for these activities.
- **Motivation** – The employees are not motivated to share knowledge or talk about good or bad experiences in different projects, since there is no motivational factor present in the organization.
- **Discipline** – Since there is no direct use of any knowledge management activities in the projects, there is no discipline to perform these.
- **Skills** – There are not enough skills present in the organization or among the project managers about knowledge management activities.

4.5 Case Study E

The case study was performed as a telephone interview on 25.02.2013. The respondent was Iris Hauck-Rameis, who works at Bewin Party.

Company Background

The organization, Bewin Party, an online gaming provider, with headquarters in Gibraltar, has about 1800 employees worldwide, and about 700 to 800 employees in Vienna, Austria, where the respondent works. The organization works mainly in project based forms, developing games and software, as well as doing marketing projects.

Personal Background of Respondent

The respondent has been working as a project manager in the organization for about seven years. The respondent does mainly work with projects which aim is to launch a product in a new country. She holds a certificate as Senior Project Manager through the IPMA.

Project Category

The projects, led by the respondent, do belong to the category creating [product], since the result is to integrate a product in a new environment. The product itself does exist, but has to be adapted to the environment (consisting mostly of legal institutions).

Project Management Methodology

The organization has a PMO (Project Management Office) which develops the methodology to be used by the project managers. The methodology is based on the standards following IPMA, including the development of a project plan with WBS, Gantt-charts, goal descriptions, role descriptions, stakeholders etc. The projects are divided into three classes, depending on how complex they are, and each class responds to the use of a certain amount of project management methods. Thus, a more complex project encloses the use of more project management methods.

Organizational Mode

The assumptions about the environment are that when the organization started its business it was pending towards seeing the external environment as being unanalyzable, since the organization was one of the first to deliver their products to the market. Today the external environment is pending more towards being seen as analyzable, states the respondent, with management using studies of customers, user groups, etc. to analyze its market and the related trends.

The search for information is, according to the respondent, very active in the organization. Management uses information from user groups, customer studies, etc. As an example, the respondent stated that the organization also does research together with the Harvard University.

Knowledge Management Activities

The organization, and the management, encourages the use of knowledge management mainly through the sharing and documentation of lessons learned, minutes of meetings, etc. The main problem with knowledge management in the organization is that the knowledge stored is not being labeled or structured and is therefore not easily found. This means that there is a will to learn from previous projects, but when a new project is about to start, there is no method to find knowledge from similar projects, done by another project manager. The lessons learned documentations are therefore mainly used by the same project manager who created them. The PMO tries to develop guidelines for the use of knowledge management methods in the projects, but these are not really being used by the project managers.

The respondent's statement concerning the criteria affecting the use of knowledge management methods in the organization (Davenport & Prusak, 1998):

- **Knowledge oriented culture** – The organizational culture is very knowledge oriented, focusing on the sharing of lessons learned through meetings, workshops and documentation.
- **Technical and organizational infrastructure** – The technical infrastructure is present, with a server for storing project related documentation. The organizational infrastructure also allows an easy sharing of knowledge between employees.
- **Management support** – Management supports and encourages sharing and documentation of lessons learned in the projects as well as when employees want to use the knowledge and experience gained from previous projects.
- **Connection to economical values** – Management does not show any economical values to the use of knowledge management methods.
- **A clear description of knowledge and reasons for knowledge management** – The PMO tries to develop guidelines for knowledge management activities, describing what knowledge is, as well as how it should be shared.
- **Not looking at knowledge management as a process** – Knowledge management is seen more as a process than as a project, even though the implementations of knowledge management activities can sometimes be seen as projects.

- **Stimulation of motivation and commitment** – There is no stimulation, except from verbal encouragement, from management affecting the motivation and commitment to create, share and store knowledge
- **Creating a clear knowledge structure** – There is no clear structure of how knowledge should be divided or labeled to be easily found or searched for. The lack of structure is the main problem for the documentation storage in the organization.
- **Creation of multiple channels for knowledge transfer** – In the organization there are many channels for knowledge transfer. Examples are workshops, meetings with the intention to share lessons learned, etc.

The criteria concerning the projects (Schindler & Eppler, 2003), as stated by the respondent:

- **Time** – According to the respondent, there is often enough time in the projects to document lessons learned and to share these with other individuals. What is missing is time at the start of a project, to search for knowledge and other lessons learned.
- **Motivation** – The organization has an open atmosphere towards learning from mistakes, and individuals do talk about mistakes that have been made.
- **Discipline** – In the organization, and among the project managers, there is the discipline to perform the lessons learned documentation as well as the workshops and presentations of the results.
- **Skills** – The project managers, and the project teams, do possess the skills to perform the documentation of the lessons learned and the sharing of the results.

5 Analysis

In this chapter the empirical data from the case studies are compared with the theory chapter, following the structure of the theoretical framework.

5.1 Project Category

All the respondents from the case studies do manage projects which belong to the creating [product] category (Ljung, 2011). In this category of projects, there is often a clear picture of the project results, in the form of illustrations, drawings, sketches, manuals and likewise. The projects in this category are normally conducted using sequential activities, and usually benefit from a traditional project planning methodology, such as the use of WBS, Gantt-charts, CPM, etc. (Ljung, 2011). The sequential activities do create natural milestones in the projects, which could be used as points for knowledge management activities, such as project audits, AAR's, etc.

Case Organization A and B

In the case studies A and B the project results are normally in the form of drawings and calculations used for construction of buildings, utility and waste water lines, bridges, tunnels, etc. Both respondents note that the project results are normally clearly defined, and that the projects are executed by performing sequential activities. Nevertheless, the natural milestones following the sequential execution of work packages are not used for any project management activity or knowledge management activity.

Case Organization C

In the case study C, the respondent manages projects belonging to two categories: creating [product] and creating [activity], where the result from the creating [product] projects is often in the form of educational material. The respondent C means that the project result is usually clearly defined by the external customer. The creating [product] projects are usually performed through the execution of sequential activities.

Case Organization D

The respondent in case study D manages projects belonging to the creating [product] category, where the results are in the form of drawings for electrical components. The project results are always clearly defined, as perceived by the respondent D. The natural milestones in the projects, following the sequential execution of work packages, are used for project controlling.

Case Organization E

In case study E, the respondent identifies the projects she is managing as belonging to the creating [product] category. In this case the product already exists, but its environment is new. The aim of the projects is to adapt the product to this new environment.

Depicted in table 3 are the project categories encountered among the case organizations.

	Case organization				
	A	B	C	D	E
Project category	Creating [product]	Creating [product]	Creating [product] Creating [activity]	Creating [product]	Creating [product]

Table 3 - The project categories among the case organizations.

5.2 Project Management Methodology

The use of project management methodology is correlated with the use of knowledge management methodology, according to Brooks and Leseure (2004). They made the experience

through their research that in organizations where the reuse of knowledge is a problem there is also a problem with the project management. Problems in the project management can partly be avoided by the proper use of project management methodology, since project management methodologies are used as tools to handle the sub-processes of projects.

Case Organization A

The respondent in the case study A states that no project management methodology is being used in the organization to support the projects managers.

Case Organization B

In case study B, the respondent agrees that project management methodology to some extent is being used to manage the projects. This is, according to the respondent, illustrated by the filling of a few project initiating forms at the beginning of a project. The problem is that the importance of the project management methodology is not being communicated by the management. Hence, there is only limited use of any project management methodology by the project manager.

Case Organization C and D

In the case studies C and D, there are active uses of project management methodologies. These project management methodologies have been developed for the organizations needs. In case study C, the methodology has been developed by the project managers to fit the needs of them. In case study D, the methodology which is being used has been developed to fit both the project managers and the management of the organization.

Case Organization E

In the case study E, the project manager uses a project management methodology which is based on the methodology advocated by the IPMA, including the traditional project management tools such as WBS, Gantt-charts, etc. The organization has a system to increase the applied methods for more complex projects.

In table 4 the use of project management methodology in the case organization is presented in a tabular form.

	Case organization				
	A	B	C	D	E
Project management methodology	No	No	Yes	Yes	Yes

Table 4 - The use of project management methodology among the case organizations.

5.3 Organizational Mode

By interpreting the mode of an organization, other organizational processes can be predicted. The processes which can be predicted through the organizational mode are scanning characteristics, interpretation processes and strategy and decision making, according to Daft and Weick (1984).

Organizations A and B

In the case organizations A and B, management believes that the external environment can be analyzed. This means that management expects the market to follow a certain direction and to demand certain services. The two case studies also have in common that management is not actively searching for information. None of the organizations performs any user group studies, has any research department or uses any other methods of gathering information. Combined, these two factors position the two organizations in the organizational mode of conditioned viewing.

Organizations C, D and E

In case organizations C, D and E management believes that the external environments are analyzable. Furthermore, management in these three organizations searches actively for information. This is done in the case organization C, by gathering information through contact with stakeholders, experts and other organizations in the same field. In the case organization D, there is a research department which presents information to, among others, the management. The respondent in the case organization E, states that the organization has a market research department as well as research collaborations with the University of Harvard. Organizations belonging to the discovering mode have a management which idea is that the external environment can be analyzed in combination with an active search for information. Therefore the case organizations C, D and E all belong to the discovering mode. See figure 9, pp. 28 for the overview of the organizational modes.

The two organizational modes among the case organizations are presented in table 5 below.

	Case organization				
	A	B	C	D	E
Organizational mode	Conditioned viewing	Conditioned viewing	Discovering	Discovering	Discovering

Table 5 - The organizational mode among the case organizations.

Conditioned Viewing Organizations: A and B

Conditioned viewing organizations are, according to Daft and Weick (1984), characterized by the use of internal and personal sources for information. There is no department in the organization which gathers or creates information for the top management. Thus, the information which reaches the top management is characterized by being routine information from the organization. The information gathered needs little interpretation from the top management, and there are many rules for how the information will be interpreted. In an organization belonging to the conditioned view mode, the information gathered needs few iteration cycles, since the information has a low equivocality (how unclear the information is) , before it is established among the top management. Other characteristics in organizations with conditioned viewing mode are that they focus on their traditional market as well as on internal efficiency. In a conditioned viewing organization, the decision making process is based on the assumption that the external environment can be analyzed. The conditioned viewing organizations are also characterized by a passive approach to the search for information. This, the analyzable external environment and the passive approach to information searching, makes the decision process automatic, depending on certain factors.

Discovering Organizations: C, D and E

A discovering organization is, according to Daft and Weick (1984), characterized by that the top management has internal and impersonal sources for information. The impersonal sources are, for example, departments, studies and reports. The process of interpreting the information is characterized by the need for little interpretation of the information, even though the top management has many rules for it. There is a need for a medium amount of iteration cycles, since the equivocality is on a medium level, before the information is established among the top management. Organizations in the discovering mode do also analyze their environment closely before an organizational change is being implemented. The decision making process in a discovering organization is based on an exhaustive system analysis by the top management. Through this analysis, the external environment is assessed, as well as all alternative options.

Project Management and the Organizational Mode

Whether the use of project management methodology is directly related to the organizational mode or not, cannot be established through this study, since there are too few respondents to draw any generalizable conclusions. Comparing the organizational mode and the use of project management methodology leads to the suggestion that the organizational mode and the use of

project management methodologies covary highly. This covariance is depicted in table 6 below. Since only two organizational modes were found among the case studies, the only conclusion which can be drawn from this finding is that whether or not management in an organization searches actively or passively for information, can be related to the use of project management methodology. If the top management in an organization believes that the external environment can be analyzed or not, could affect the use of project management methodology cannot be concluded through this study.

	Case organization				
	A	B	C	D	E
Project management methodology	No	No	Yes	Yes	Yes
Organizational mode	Conditioned viewing	Conditioned viewing	Discovering	Discovering	Discovering

Table 6 - The use of project management methodology and organizational mode among the case organizations.

5.4 Knowledge Management Methodology

The use of knowledge management methodologies in an organization, as well as the conditions which affects the use and implementation of such methodologies, can affect the use of knowledge management in project environments. To the conditions described by Davenport and Prusak (1998) counts the following:

1. **Knowledge oriented culture** – Is there a positive atmosphere for knowledge sharing?
2. **Technical and organizational infrastructure** – Do they support knowledge sharing?
3. **Management support** – Does management support knowledge management?
4. **Connections to economical values** – Can management communicate an economical advantage through the use of knowledge management methodologies?
5. **A clear language about what knowledge is and the reason for Knowledge Management** – Has knowledge been defined in the organization?
6. **Not looking at Knowledge Management as a process** – Are knowledge management activities seen as projects?
7. **To stimulate motivation and commitment** – Is commitment motivated?
8. **Creating a clear knowledge structure** – Is the collected knowledge labeled and stored correctly for an easy search?
9. **Creating multiple channels for knowledge transfer** – Are multiple channels for knowledge sharing present?

Schindler and Eppler (2003) have described the following conditions, concerning knowledge management in projects:

1. **Time** – Is there enough time within the projects for knowledge management activities?
2. **Motivation** – Are the members of the project teams motivated enough to learn from the events in the project?
3. **Discipline** – Do the project managers, and the project teams, have the discipline to perform any knowledge management activities in a project?
4. **Skills** – Do the project managers possess enough skills concerning methods and activities to support the creation, sharing and storing of knowledge?

Case Organization A

In case organization A, no knowledge management methodologies are being used in the entire organization, according to the respondent. The conditions described by Davenport and Prusak (1998) are in no extent fulfilled in the organization. Through the lack of fulfilled organizational conditions, the organization would have difficulties in directly implementing any knowledge management methodologies. The more project specific conditions, as described by Schindler and Eppler (2003), which are also not fulfilled, the less the chance for any implementation of knowledge management activities in projects to be successful.

Case Organization B

In case organization B, there is an idea among the management that sharing of knowledge and experience between the employees should be encouraged. No particular measures are being taken to encourage the sharing, except for providing the organizational infrastructure. The two success conditions, as described by Davenport and Prusak (1998), which are fulfilled in case organization B, are the presence of support from management and the organizational infrastructure. The support from management is important for the motivation, but not enough, according to the respondent. The technical and organizational infrastructure promotes sharing of knowledge and experience. The project specific conditions, according to Schindler and Eppler (2003), are not fulfilled, except for the motivational condition. This means that time, discipline, and skills for knowledge management activities are missing in the projects.

Case Organization C

The organization, described by the respondent in the case study C, is welcoming knowledge management activities to a high degree. The major activities in the organization with focus on knowledge management are to document lessons learned, to store these documentations on a server and to have workshops at the end of each project to evaluate the projects. The organizational conditions, as described by Davenport and Prusak (1998), are mostly all fulfilled in the organization. Missing in the organization is the connection between knowledge management and economical values, any kind of stimulation or reward for using knowledge management methods. Furthermore the organization views knowledge management as a process rather than a project as well as missing a working structure for labeling and storing of knowledge. The project related conditions, as described by Schindler and Eppler (2003), are almost all fulfilled, except that the respondent expressed that there is always a lack of time for the project managers, to carry out the knowledge management activities, at the end of the projects. This leads to that the documentation of lessons learned is done in a pragmatic way, in order to save time.

Case Organization D

In case study D, there is no active use of any knowledge management methods except for networking among the project managers, taking place once a year. About half of the conditions presented by Davenport and Prusak (1998) are fulfilled in the organization. What is missing is the clear communication from management that knowledge management can be important for the development of the organization. None of the project related conditions (Schindler & Eppler, 2003) are fulfilled in the projects. This means that within the projects, there is neither time, motivation, discipline nor skills present for a successful implementation of any knowledge management activities.

Case Organization E

The respondent in case study E stresses that a lot of effort is put into capturing lessons learned from the projects. Management fully supports and encourages lessons learned documentation, workshops, presentations, etc., among the project managers and project teams. The employees are open for learning and want to share what they have learnt. There is also a PMO in the organization which tries to make guidelines to support the project managers in the process of capturing knowledge. The conditions presented by Davenport and Prusak (1998) are mostly fulfilled in the organization. The less satisfied conditions were related to that knowledge management should be better connected to economical values, that knowledge management activities should be better rewarded as well as the missing labeling and the systematization of the storage of knowledge. The organization also views knowledge management as processes rather than projects. The conditions associated with projects, presented by Schindler and Eppler (2003), are all satisfied. This means that there is enough time, motivation, discipline, and skills among the project managers and the project teams to perform knowledge management activities within the projects.

From the findings presented in table 7 below it can be concluded that among the case organizations, there is a higher frequency of knowledge management activities where the organizational and project specific conditions are to a vast amount fulfilled.

	Case organization				
	A	B	C	D	E
Knowledge management methodology	No	No	Lessons learned documentation, project review	No	Lessons learned documentation, project review
Fulfilled organizational conditions (Davenport and Prusak, 1998)	None	Few	Many	Medium	Many
Fulfilled project specific conditions (Schindler and Eppler, 2003)	None	None	Many	None	All

Table 7 - Summary of the use of knowledge management methodology and fulfillment of the related conditions according to the case studies.

Project Management Methodology, Organizational Mode and Knowledge Management Methodology

The use of project management methodology, organizational mode and the use of knowledge management methodology are presented in table 8 below.

	Case organization				
	A	B	C	D	E
Project management methodology	No	No	Yes	Yes	Yes
Organizational mode	Conditioned viewing	Conditioned viewing	Discovering	Discovering	Discovering
Knowledge management methodology	No	No	Lessons learned documentation, project review	No	Lessons learned documentation, project review

Table 8 - The use of project management methodology, the organizational mode and the use of knowledge management methodology in the case organizations.

From the studied case organizations it can be suggested that the organizational mode discovering, and the use of project management methodology is more frequent in organizations which use any kind of knowledge management methodologies. This does not necessarily mean that if project management methodology is used, and the organizational mode is beneficial for the use of knowledge management activities, that any knowledge management activities are being used, as seen in case organization D.

5.5 Knowledge Management in Project Environment

The two case organizations, which use knowledge management methodologies, both have process-based and documentation based knowledge management activities included in the project work. When looking at these two organizations, there are some dimensions which covary as will be discussed below.

Project Category

In this study the project category, creating [product] is the same as in all case studies performed, even though the respondent in the case organization C also managed creating [activity] projects as well. Therefore no specific conclusion can be made on how different project categories affect the use of knowledge management methodology.

Project Management Methodology

The use of project management methodology seems to covary with the organizational mode as well as the use of knowledge management methodology. The statement by Brooks and Leseure (2004) that good knowledge management practice goes hand in hand with good project management practice could thus generally be seen as true, even though one could argue that the statement lacks a relation to the organizational mode.

Organizational Mode

The two case organizations which used knowledge management methodologies have the same organizational mode, discovering. Discovering organizations are characterized by investigating all options before making any decision, meaning that there are no quick ways to solve a problem that occurs. Discovering organizations also tend to actively gather information. This would lead to that a discovering organization, facing problems with project management, tends to consider many options, and therefore also the use of project management methodologies, to a larger extent than a conditioned viewing organization, for handling the processes in projects.

Knowledge Management Methodology

The two case organizations which used knowledge management methodology also had in common that they both had many organizational conditions as well as project related conditions fulfilled. The conditions developed by Davenport and Prusak (1998), which are missing in the two case organizations, is the connection to economical values, the stimulation of motivation and commitment, and a clear knowledge structure. The connection to economical values works as an extra motivator and as a tool to measure any progress which has been done by using knowledge management. To stimulate the motivation and commitment among employees is used to create a more extensive use of the knowledge management methodologies. The clear knowledge structure, and labeling of knowledge are important for both the storage as well as the search for knowledge.

6 Conclusions

This chapter summarizes the findings from the study, discusses the hypothesis and the conclusions, as well as what this study has made for contribution to the field of knowledge management and project management.

This study has two major purposes. The first purpose of this study is to explore to what extent knowledge management was used within project environments. The second purpose is to establish the relations between knowledge management in projects and these four dimensions: the project category, the project management methodology, the organizational mode and the knowledge management methodology.

Apart from the purposes, the study did also contain two hypotheses concerning the two purposes. The first hypothesis is that even though knowledge management methodologies are advantageous for a project and a project based organization, it is not common that knowledge management is used in projects. The second hypothesis is that even if knowledge management methods are being used, they are not used effectively.

6.1 Findings from the Study

Findings Regarding the First Purpose

The findings regarding the first purpose show that among the studied organizations the use of knowledge management methodologies is not common. Only two of the five case organizations do actively use any kind of knowledge management methodology within their projects. As suggested by the respondent A, the main reason why no knowledge management methodologies are used is that management lacks interest in the subject, or simply does not know about the benefits of creating sharing and storing knowledge. This, the lack of interest and not recognizing the benefits of knowledge management, may be expected to be the main reason why no knowledge management methodologies are being used in the other organizations as well.

One perspective which partly could explain the lack of knowledge management methodologies in two of the case organizations (A and B) could be that they belong to the construction industry. The construction industry dates back much longer than, for example, the online gaming industry, as in case organization E. Hence, there is much knowledge within this industry, among the people and the organizations acting within it. Since the industry dates back so long, one could argue that the industry relies much on tradition and using the methods developed in the course of time, and can therefore be seen as slow changing and conservative. The case organizations C, D and E are active in much younger industries, and this may be the cause that they have a more active approach to the search for information.

Findings Regarding the Second Purpose

The empirical data from this study suggest that the use of knowledge management methodologies in project environments is related to the use of project management methodologies as well as the organizational mode. As shown in figure 9, the organizations described by the organizational mode discovering show a frequent use of mainly project management methodologies, but also knowledge management methodologies. The organizations described by the organizational mode conditioned viewing do not show any use of either one of these methodologies.

	Case organization				
	A	B	C	D	E
Project category	Creating [product]	Creating [product]	Creating [product] Creating [activity]	Creating [product]	Creating [product]
Project management methodology	No	No	Yes	Yes	Yes
Organizational mode	Conditioned viewing	Conditioned viewing	Discovering	Discovering	Discovering
Knowledge management methodology	No	No	Lessons learned documentation, project review	No	Lessons learned documentation, project review
Fulfilled organizational conditions (Davenport and Prusak, 1998)	None	Few	Many	Medium	Many
Fulfilled project specific conditions (Schindler and Eppler, 2003)	None	None	Many	None	All
Knowledge management in project environment	-	-	Medium successful	-	Medium successful

Table 9 - Summary of the dimensions studied in the case organizations.

A further finding from this study, as depicted in table 9, is that organizations belonging to the organizational mode discovering tend to fulfill more conditions needed to successfully create, share and store knowledge in the organization and in the projects.

The findings from this study suggest that the following success conditions would be needed to have a successful knowledge management in a project:

- Active use of project management methodology
- An active approach to information search among the top management of the organization
- Most of the organizational conditions, according to Davenport and Prusak (1998), fulfilled
- Enough time, motivation discipline and skills (Schindler & Eppler, 2003) to perform knowledge management activities in the projects

6.2 Conclusions Made from the Study

Conclusions Regarding the First Purpose

The main conclusion regarding the first purpose, which can be drawn from this study, is that knowledge management is not common in organizations which work in areas with a long tradition, such as the building industry. Even though projects in younger industries, such as semiconductor or online-industries, do not necessarily involve knowledge management, the probability seems higher that more effort is put into the management of knowledge.

The hypothesis that knowledge management is not common in projects can be emphasized, but not clearly confirmed by this study since there were too few respondents.

Conclusions Regarding the Second Purpose

Some conclusions have been drawn regarding the second purpose. The use of knowledge management methodologies does, according to this study, become more frequent in organizations that use any kind of active search for information, such as discovering organizations. This might be the result of how information and experience is valued within these organizations.

It cannot be concluded from the findings from this study that the use of project management methodologies affects the use of knowledge management methodology. The statement by Brooks and Leseure (2004) that good knowledge management practice goes hand in hand with good project management practice can only partly be supported by this study. It can be highlighted that it is more likely that the relationship between the use of knowledge management methodologies and the use of project management methodologies is more complex than what has been stated by Brooks and Leseure (2004).

The findings from this study illustrate that the organizational mode discovering describes both the organizations where the respondents use both knowledge management methodologies as well as the use of project management methodologies. The organizational mode discovering describes organizations where the top management actively searches for information and where the top management believes that the external environment can be analyzed. The active search for information can be, for example, market research, experiments, trend analysis, etc. (Daft & Weick, 1984).

Through the analysis of the case organizations it can be noted that the organizations which use knowledge management methodologies also have many of the conditions described by Davenport and Prusak (1998), as well as Schindler and Eppler (2003), fulfilled. The success conditions by Davenport and Prusak (1998) which are fulfilled in the case organizations where knowledge management methodologies are being used are:

- Knowledge oriented culture
- Technical and organizational infrastructure
- Management support
- A clear description of knowledge and reasons for knowledge management
- Creation of multiple channels for knowledge transfer

The conditions which are not fulfilled

- Not looking at knowledge management as a process
- Stimulation of motivation and commitment
- Connection to economical values
- Creating a clear knowledge structure

The success conditions according to Schindler and Eppler (2003), time, motivation, discipline and skills, were almost all present in the case organizations which use knowledge management methodologies. In case study C, the respondent stated that there often is too less time for performing knowledge management activities.

The hypothesis that knowledge management, when used, is not used effectively used is confirmed by this study, since in both the organizations which used knowledge management, not all factors for success were fulfilled.

Personal Reflections

The author's personal reflection regarding the first purpose and the hypothesis from this study is that the use of knowledge management was more common than expected. The difference in use between more modern industries and the construction industry was clearer than presumed.

Regarding the second purpose, the author believed that fewer factors for a successful use of knowledge management would be fulfilled among the organizations studied, as stated in the hypothesis.

Another aspect of the study which the author wants to stress is that organizations which promotes project management methodologies, should also better promote the use of knowledge management methodologies. Thus, it is the meaning of the author, that it is important to see knowledge management as a part of project management.

6.3 Contributions to the Field

Theoretical Contribution

A theoretical contribution with the present study is that the findings from the case studies suggest that the use of project management methodologies and knowledge management methodologies are related to the organizational mode. Before the case studies were conducted, the organizational mode was believed to be independent from the use of project management methodologies, as depicted in the research model (figure 8, pp. 32).

Practical Contribution

A practical contribution from this study is that the findings from this study show that the documentation of lessons learned and project auditing were the two methods used for creating, sharing and storing knowledge. It also shows that the problem with the documentation of lessons learned is that this information is almost never labeled, making it very difficult to store and retrieve when needed. To label the knowledge, and to structure it, is one of the success conditions described by Davenport and Prusak (1998). They argue that a clear knowledge structure for labeling and storing of knowledge is very important for a successful knowledge management. It is noted from the cases studies that even though effort is put into capturing lessons learned after the projects have been finished, there is not enough structure in the storing of the knowledge to create an effective, easy to use, documentation-based storage system. Only when knowledge, which has been created, transferred and stored, is reused it creates a value for the organization.

Another practical contribution to the field of project and knowledge management is the research model created for this study. The model can be used for other studies within this field, for example to test the reliability of the study or to extend this study.

6.4 Further Studies

Research within the field of project management which would be of interest to compare with this study and would most probably be helpful for individuals working in and around projects.

- Studies and comparisons of theories concerning the categorization of projects, since there are a few different approaches to this subject. Can the classification theories be categorized?
- How are knowledge management and project management methodologies incorporated into projects? How can organizations best prepare for implementing such methodologies?
- What factors (organizational mode, project category, etc.) affect the use of project management methodologies?

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Appendix A – Case study questions

Name (or anonymous N.N):

Background:

Education? Employed in the organization since? Role in the organization?

Organization:

How would you describe the organization which you work in? How many employees, location, fields of work, etc.?

Organizational mode

According to this model, organizations can be divided into four types, depending on how management views the environment surrounding the organization and how management searches for information.

The external environment is divided into being analyzable or unanalyzable.

Where analyzable means that the market can be researched through surveys, etc. and turned into predictions like figures and numbers. Unanalyzable means that management goes into new markets, rather believing in their product than in researching what the market wants.

The search for information is divided into active and passive. Active means that the organization performs own experiments and research, developing its own knowledge. Passive is referred to as trusting information served to the organization from outside sources.

How would you describe the organization where you work?

ASSUMPTIONS ABOUT ENVIRONMENT	Unanalyzable	UNDIRECTED VIEWING Constrained interpretations. Nonroutine, informal data. Hunch, rumor, chance opportunities.	ENACTING Experimentation, testing, coercion, invent environ- ment. Learn by doing.
	Analyzable	CONDITIONED VIEWING Interprets within traditional boundaries. Passive detec- tion. Routine, formal data.	DISCOVERING Formal search. Questioning, surveys, data gathering. Ac- tive detection.
		Passive	Active
ORGANIZATIONAL INTRUSIVENESS			

Projects

For this study, projects have been divided into four categories, depending on what they want to achieve. Which project type does best describe the projects you work with? Why?

Creating [product] – Often results in products, drawings, etc.

Creating [activity] – Creating events, concerts, lectures, etc.

Activity [effect] – Change attitudes or behaviors in a target group

Activity [evaluation] – Evaluation of performed activities such as an evaluation of an installed computer program

Project Management Methodology

Do you use any project management methodology within the projects you run in your organization?

This includes for example the methodologies from IPMA, PMI, PRINCE2 or another methodology used in your organization. Please explain what kind, if any, of project management methods you use. This could be the use of WBS, Gantt-charts, etc.

Knowledge Management Methodology

Do you use any knowledge management methods within the projects you run in your organization?

This could be process-based methods, such as reviews together with customers at the end of a project, short meetings with the project teams to discuss what can be learned in different situations. It could also be peer-assist meetings, or mixing of personnel to encourage individuals to learn from each other.

Knowledge management methods could also be documentation-based methods such as when the project manager, alone or together with the project team, writes down what happened during the project, or documenting lessons learned, etc.

Factors affecting the success of the knowledge management methods:

A lot of factor can affect the use of knowledge management methods. Please consider the below mentioned factors and comment on them. If you do not use any knowledge management methods, please still consider the factor and comment on how you believe that your current organization would affect the use of knowledge management:

Organizational factors:

- **Knowledge oriented culture**
- **Technical and organizational infrastructure**
- **Management support**
- **Connection to economical values**
- **A clear description of knowledge and reasons for knowledge management**
- **Not looking at knowledge management as a process**
- **Stimulation of motivation and commitment**
- **Creating a clear knowledge structure**
- **Creation of multiple channels for knowledge transfer**

Project factors:

- **Time** – Enough time at the end of a project to review the project?
- **Motivation** – Are the project team members ready to learn from mistakes?
- **Discipline** – Does the project manager/team has the discipline to use methods if time, motivation and skills where present?
- **Skills** – Do you as the project manager, or the project team, know how to manage knowledge within your projects?