![CHALMERS UNIVERSITY OF TECHNOLOGY]

Knowledge Sharing practices in a construction project organization

Organizing individual responsibility

Master's thesis in the master's program Design and Construction Project Management

ANNIE BENGTSSON

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Abstract

Knowledge management [KM] is becoming a more and more common term in construction organizations around the world, as knowledge is today recognized as an important organizational asset. This has resulted in more focus being put on how project management should handle the knowledge their employees possess, as well as the knowledge gathered in the organizations previous projects, to ensure that the wheel does not need to be reinvented over and over again. The purpose of this thesis is to evaluate the knowledge sharing tools and practices of a construction organization. By evaluating practices and underlying social dynamics of knowledge sharing through a qualitative case-study, key points for KM in which it is important for project teams to focus on in order to maintain a well-functioning KM-work in their project are identified and presented. Management bear an overall responsibility to knowledge management in the organization. It is the organization that gains the most from having a well-functioning knowledge exchange within the organization – both between the projects members, but also from project to project. However, the individuals of the organization bear some part of the responsibility to share and seek knowledge, as the type of knowledge shared in construction projects is often deeply rooted in context and is highly subjective - meaning that it may not be possible for management to fully control the knowledge sharing practices of the organization. A more bottom-up approach is better suited to ensure a well-functioning knowledge exchange is taking place actively throughout the entire organization. The knowledge exchange within the organization is also largely affected by the social, physical and/or emotional closeness of the project team. Closeness, which is connected to organizational culture, is hard to manage, but by implementing supportive actions, the organization can help strengthen the bonds between their employees. If investment in KM are placed appropriately, it could pay back in dividends. Lastly, the culture and attitude towards knowledge sharing and knowledge management is one of the most important questions to handle. For knowledge management tools and practices to be successfully implemented in a construction project organization, they need to be seen as tools – not tasks.

Key words: Knowledge management, Knowledge sharing, Construction industry, Project-based organizations, Project knowledge management

Erfarenhetsåterföring i bygg- och projektorganisationer
Att organisera individuellt ansvar

Examensarbete inom mastersprogrammet Design and Construction Project Management
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Sammanfattning

Erfarenhetsåterföring är ett allt vanligare samtalsämne inom bygg- och projektorganisationer, eftersom att kunskap idag erkänns som en viktig organisatorisk tillgång. Detta har resulterat i att mer fokus läggs på hur projektledningen ska hantera den kunskap och erfarenheter som projektets anställda besitter, samt även kunskapen som organisationen vunnit i tidigare projekt, för att säkerställa att hjulet inte behöver återuppfinnas om och om igen. Syftet med denna avhandling är att utvärdera kunskapsdelningsverktyg och processer i en byggprojektorganisation. Genom att utvärdera praxis och underliggande social dynamik vid kunskapsdelning genom en kvalitativ fallstudie identifieras och presenteras viktiga punkter för erfarenhetsåterföring vilka det är viktigt för projektteam att fokusera på för att kunna upprätthålla ett välfungerande kunskapsutbyte i sitt projekt. Ledningen bär ett övergripande ansvar för kunskapshanteringen inom organisationen. Det är främst organisationen som vinner på att ha en välfungerande kunskapsutbyte - både mellan projektmedlemmar, men också från projekt till projekt. Individerna i en organisation bär dock också en del av ansvaret, då de själva är ansvariga för att dela och söka kunskap. Detta eftersom att den typ av kunskap som delas i ett byggprojekt ofta är djupt rotad i kontext och är mycket subjektiv - vilket innebär att det inte alltid är möjligt för ledningen att fullt ut kontrollera organisationens kunskapsutbyten. En botten-upp strategi är bättre lämpad för att säkerställa att erfarenhetsåterföring sker aktivt över hela organisationen. Kunskapsutbytet inom organisationen påverkas också till stor del av projektgruppens sociala, fysiska och/eller känslomässiga närhet. Närhet, som är kopplat till organisationskultur, är svår för projektledningen att hantera, men genom att genomföra stödåtgärder kan organisationen bidra till att stärka förbindelserna mellan sina anställda. Om exempelvis investeringar i KM placeras på lämpligt sätt kan det betala tillbaka med råge. Avslutningsvis, så är organisationskulturen och de anställdas inställning till erfarenhetsåterföring och kunskapshantering en av de viktigaste frågorna att agera på. För att kunskapshanteringsverktyg och systematiska processer för erfarenhetsåterföring aktivt ska genomföras i en byggprojektorganisation behöver de ses som verktyg - inte extra arbetsuppgifter.

Nyckelord: Kunskapshantering, Kunskapsdelning, Erfarenhetsåterföring, Byggbranschen, Projektbaserad organisation, kunskapshantering i projektbaserade organisationer

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Preface

This master thesis is a part of the M.Sc. programme in Civil Engineering, Design and Construction Project Management, DCPM, at Chalmers University of Technology, Gothenburg. The study has been conducted during the spring semester of 2019.

I would like to sincerely thank my supervisor and examiner Martin Löwstedt at Chalmers University of Technology for your time, insights and support during this semester. Without your expertise and dedication to the subject of organizations and knowledge management, I never would have been able to fulfil this thesis.

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Annie Bengtsson

Notations

CoP   Community of Practice
ECI   Early Contractor Involvement
IT   Information Technology
ICT   Information Communication Technology
KM   Knowledge Management
PKM   Project Knowledge Management
PBO   Project-Based Organization
PPR   Post-Project Review

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1. Introduction

Knowledge is today recognized as an important organization asset (Dalkir, 2011), which has led to more focus being put on how organizations should handle the knowledge their employees possess for competitive advantage (Bresnen et. Al., 2003). How well an organization deals with internal and external knowledge can be a crucial part of the organizations' success, or even survival (Dave & Koskela, 2009).

The construction industry today consists to a large extent of project based organizations [PBOs]. Due to their "one-of-a-kind" nature, project based organizations are subjected to additional challenges such as temporary project teams, short term orientation and lack of organizational routines (Koskela, 1992; Hanisch et. al., 2009). These challenges all contribute to that Knowledge Management [KM] in project based organization needs to be handled differently than in more traditional and stable organizations, in order to keep up their dynamic project environment (Lindner & Wald, 2011).

The biggest barriers to KM in construction project organizations are the lack of standardized work, the hard pressure to deliver on time as well as organizational culture (Robinson et. al., 2001). It is important for management to provide the tools and support needed to overcome these barriers, as, according to Hanisch et. al. (2009), the knowledge sharing within projects is closely linked to the project management methodology and the communication practices in the project. As these are both are strongly dependent on the project manager, the project managers individual managerial style consequently has a big influence on the choice of KM-strategy for the project. On contradictory notes, however, the type of knowledge which is at interest for construction project organization to harvest is often deeply rooted in context and is highly subjective (Hislop, 2013) which means that it may not be possible for management to fully control the knowledge sharing practices of the organization – but that some of the responsibility may also lie on the individuals within the organization. This dilemma leads up to one of the focus points of this report.

1.1 Purpose and aim

The purpose of this master thesis is to explore knowledge management tools and practices used in a construction project organization. By reusing knowledge, learning from previous experiences in other projects or from colleagues within the project team, and not having to reinvent the wheel repeatedly, a lot of effort can be saved for the project organization. Furthermore, possible mistakes can be discovered and avoided in the earlier project phases - which can result in time and money being saved.

Through a case study approach, the Knowledge Management practices of a project organization will be identified and described. Together with a theoretical base of knowledge management in construction project organizations, these practices can then be evaluated in accordance. The aim of the study is to identify key points in knowledge management in which it is important for

project teams to focus on, in order to maintain a well-functioning KM-work in their project. It is also to provide a picture of how the members of the project team in a construction organizations looks at the concept of Knowledge Management, and to explore how they prefer to seek and share knowledge in their daily work.

For the practical part of this report, a case study has been conducted in a big construction-client organization active in the Swedish infrastructural sector, and more specifically in the project team of one of their major projects located in Gothenburg. The clients' perspective is chosen as, according to Warsame et. al. (2013), it is important for clients to maintain enough skilled and competent workers and management in order to handle risks and safeguard their own and their stakeholders' interest in construction projects. Therefore, it is important that the client organization knows which demands to set and how to smoothly run operations in their projects.

As mentioned by Koskela (1992), it can be hard to adopt standards and standardized processes in a big project organization such as the one subjected to the case study - where the project teams are facing unique challenges. However, as one of the major clients in Sweden's infrastructure sector, the company has conducted previous complex projects also carried out in a metropolitan environment where parallels can be drawn to the current project. Due to the sheer size of the organization subjected for the case study, the organization has a unique opportunity of harvesting and utilizing the knowledge learned in previous projects - big and small.

Some limitations of scope and topic have been made in order for this study to be carried out. Firstly, it is important to clarify that the project organization is a major organization that is active within many different fields of operation. For this study, the focus has been on the division working with carrying out major, complex projects. The interviewees are both employees at the company as well as consultants that are working in the project team for the company. Secondly, the focus has been on exploring the company's role in knowledge management of the project. In other words, it is addressing the clients' perspective of knowledge management. As clients, the ability to influence the knowledge management of the contractors in the project can sometimes be limited, and can mainly be done by setting regulations and demands on their contractors and consultants. For this study, the focus has therefore been mainly on the internal knowledge sharing within the company, and not on the knowledge sharing with the contractors.

2. Theoretical Framework

2.1 Knowledge Management

Knowledge is today recognized as an important organizational asset, which has led to Knowledge Management becoming more and more popular amongst companies across a wide spectrum of sectors (Dalkir, 2011). The potential importance of managing knowledge for competitive advantage has also attracted attention from project managers across a wide spectrum of industries (Bresnen et. al., 2003). There is, however, still a lack in consensus regarding the definition of what Knowledge Management [KM] really is. For example, early KM had a strong focus on managerial and behavioral control. Another, more indirect, approach to KM is the attitudinal-based management perspective which focuses more on shaping the attitudes and norms of the organizations workforce rather than try controlling their behavior (Hislop, 2013).

A generic definition of Knowledge Management, according to Hislop (2013, p. 56), is: *"Knowledge Management is an umbrella term which refers to any deliberate effort to manage the knowledge of an organization's workforce, which can be achieved via a wide range of methods including directly, through the use of particular information and communication technology (ICT), or more indirectly through the management of social processes, the structuring of organizations in particular ways or via the use of particular culture and people management practices."*

Another definition, proposed in the article by Warsame et. al. (2013) is that:
"Knowledge Management is any process or practice of creating, acquiring, capturing, sharing, and using knowledge, wherever it resides, to enhance learning and performance in organizations".

Even the interpretation of "Knowledge" varies between the different KM approaches. In the Oxford-Dictionaries (2018), knowledge is described as *"facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject"*. However, according to Nonaka and Takeuchi (1995), there are two types of knowledge - explicit and tacit. Explicit knowledge is knowledge that can be precisely and formally articulated. As it often relates to facts and information (Hislop, 2013) it is easily codified into different formats that would allow for documentation, transfer, sharing and communication (Nonaka & Takeuchi, 1995). An example of explicit knowledge is knowing that Gothenburg is a town located in Sweden. Tacit knowledge is knowledge that comprises experience, and work-knowledge on an individual level, and is difficult to formally articulate (Nonaka & Takeuchi, 1995). Tacit knowledge is basically knowledge that is acquired by experience, like for example knowing how to ride a bicycle or tie your shoes. The tacit knowledge is much harder to codify as it is deemed highly personal and subjective, based on experiences and emotional impressions (Hislop, 2013).

Both of the previously mentioned examples of explicit and tacit knowledge refer to knowledge on a more "personal level". There are, however, also the concept of "Organizational Knowledge". Organizational Knowledge can be defined as *"a learned set of norms, shared understandings and practices that integrates actors and artefacts to produce valued outcomes within a specific social and organizational context"* (Newell et. al, 2009). According to Nonaka's framework from 1994, the way to create organizational knowledge is to identify important tacit (personal) knowledge, make it explicit, and convert it back into the tacit knowledge of others elsewhere in the organization so that it can be applied (Newell et. al., 2009). Beyond this, Bresnen et. al. (2003) introduce the social aspects to this equation. As tacit knowledge can be difficult to exploit organizationally even when it is clearly formulated, the diffusion of the knowledge also needs to consider that the receiver of the knowledge needs to accept and understand the insight in order to apply it to their own context.

In the scientific field of Knowledge Management, Pathirage et. al. (2007) claim that the tacit knowledge based on skills, experience and talent of people is considered relatively unexplored and underutilized when compared to the work on explicit knowledge. Information Technology [IT] tools often address the explicit knowledge while non-IT tools address the tacit knowledge (Pathirage et. al., 2007). Furthermore, as explicit knowledge is more easily formulated and distributed, it is often seen as more useful for organizational learning.

2.2 Managing uniqueness

In the context of the construction industry, the type of production has the characteristics of *"one-of-a-kind nature projects, on-site production, and temporary multi-organization"*. These characteristics tend to cause situations where the flow-processes in construction are unnecessarily fragmented, complex, intransparent and/or variable. Consequently, the project managers are too occupied with solving the problems currently at hand and not having the time for planning, carrying out improvement programs etc. (Koskela, 1992)

This has consequences for the behavior and mind set of all parties in the construction project, as all focus lies with the so called *firefighting*. For example, a uniqueness that comes with on-site production is that soil conditions can vary from site to site, and that they are often difficult to determine precisely prior to actual production. If the soil conditions vary greatly from what was expected, a quick decision on whether to continue or to change the technical solution may need to be made by the on-site team. This combined with the responsibility to keep the project on schedule sometimes means that it is important for the project team to be able to make quick decisions, which we have previously defined as *firefighting*. Due to their urgent nature, these quick decisions often need to be based on the experience of the individual, i.e. the individual, tacit knowledge, rather than the explicit knowledge that is gathered by the project team (Koskela, 1992).

In addition to the uniqueness of on-site production, it is important to acknowledge that the *one-of-a-kind* nature, uniqueness and complexity to the construction project itself also contributes

with an additional challenge for the project team (Koskela, 1992). A new construction project is rarely based on the same exact design as prior projects. Instead, the new design often contains some further development or improvements from previous design, which requires innovation. As construction projects often involves project or process innovation, studies have shown that lessons learned are often tacit, intangible and context-dependent, e.g. involving changes in work practices, roles and responsibilities as well as attitudes and values (Bresnen et. al. 2003).

Consequently, it is important to learn how to manage the uncertainty and uniqueness that characterizes construction projects (Koskela, 1992), and the best way to do so is by looking at how other have dealt with similar challenges (Bresnen et. al., 2003). As previously mentioned, learning is more easily captured and transferred in explicit forms, like for example via product design templates. Therefore, the tacit knowledge that is commonly shared in construction projects is not only difficult to measure and evaluate, it is also difficult to capture in explicit forms, in ways that can be understood and applied in new contexts, or even applied consistently across different parts of the firm (Bresnen et. al., 2003).

2.3 Project Knowledge Management in the Construction Industry

Many organizations in the construction industry are so called Project Based Organizations [PBO]. Project Knowledge Management [PKM] is the application of KM in a PBO. However, it is only comparatively recently that attention has been aimed directly towards the opportunities and limitations of managing knowledge in project environments (Bresnen et. al., 2003). This shift in focus is, according to Bresnen et. al. (2003), long overdue as project organizations are an increasingly common way of organizing, and is considered the best way of handling the complex processes of new product development and innovation.

What differentiates PKM from general KM is that KM was originally developed under the assumption of relatively stable organizational settings, whilst project organizations are often temporary, unique and therefore facing the additional challenges of organizational learning in a continually changing environment (Bresnen et. al., 2003). As previously mentioned, it is well known that the *temporary multi-organization* that makes up a PBO adds to the uniqueness and complexity in managing construction projects (Koskela, 1992), as they are characterized by discontinuous personnel constellations and work contents, a lack of organizational routines, a short term-orientation and a cross-disciplinary integration of internal and external experts (Hanisch et. al., 2009). Thus, the organizational processes in a PBO differentiates from those in a standard organizational setting, as in addition to all the previously mentioned characteristics that feature a construction project, PBOs also share the unique feature of having to organize each new project on geographically different locations, thus making it distributed not only in time, but also in space. Consequently, discontinuous project teams and workforces leads to knowledge integration challenges between the individuals and the organization. Therefore, general KM needs adaptation to fit in a dynamic project environment (Lindner & Wald, 2011).

Beyond the additional challenges of the internal knowledge sharing in the project organization, it is, according to Boh (2007), well recognized that PBOs face difficulties in sharing knowledge from one project to another, which in turns contribute to problems with creating and building up knowledge capabilities (Boh, 2007). As PKM does not only include internal knowledge sharing within projects, but also knowledge sharing between different projects, and knowledge about other projects (Hanisch et. al., 2009), it is important that the knowledge generated in construction projects is captured and shared between projects as well as internally in the project, i.e. between project team members. This to enable continuous improvement, to prevent the 're-invention of the wheel' from project to project and to avoid repeating previous mistakes (Tan et. al., 2006). Consequently, it is not sufficient to only implement a strategy for how the project team should work with PKM internally, but the entire organization should have a strategy for handling KM between projects as well.

2.4 Implementing a Knowledge Management Strategy

As knowledge is undoubtedly central to organizational learning and innovation, a knowledge management strategy should already be implemented in every construction organization. However, in their study, Robinson et. al. (2001) found that a relatively low proportion of construction organizations had, or even planned to implement, a knowledge management strategy. Naturally, the decision not to implement a KM-strategy may depend on many different reasons. According to Hanisch et. al. (2009), the knowledge sharing within projects is closely linked to the project management methodology and the communication practices in the project. Both are strongly dependent on the project manager, meaning that the project managers individual managerial style has a big influence on the choice of KM-strategy.

So why would a project manager choose not to work with a KM-strategy, knowing all the benefits it could harness? The project manager often work under pressure to make the right decisions for the project to ensure that the project is on time, within budget as well as providing the predefined quality. Therefore, all actions and strategies must be relevant and benefit the end-result of the project, meaning that activities that are deemed irrelevant may be ruled out. To ensure the relevance of the knowledge shared, it is of course important to acknowledge that the relevant types of knowledge differs along the stage of the project lifecycle. For example, experience from previous projects, information about the buyers as well as knowledge about the technology and markets are types of knowledge that are of particular importance during the early stages of the project. Learning about existing technical solutions, experience from scheduling and the application of different tools might be more interesting at later stages of the project (Hanisch et. al., 2009).

Project Planning

- Resort to lessons learned of previous projects
- Resort to customer-, technical- and acquisition knowledge
- Evaluation of new project ideas on basis of project experience (feasability, risk, mode of implementation)
- Drawing on knowledge of previous projects
- Possible synergies with parallel projects
- ...

Project Implementation

- Application of knowledge from Completed projects for
  1. Planning and budgeting
  2. Proposal preparation (pricing)
  3. Teambuilding (identification of knowledge bearers)
  4. Project organization
- Resort to best-practice documents at different project stages
- Identification of experts in the particular project stages/-tasks
- Use of established and improved PM-methods (tools, templates)
- Reuse of whole task packages
- ...

Project Close-out

- Archiving of lessons-learned and best practice documents for future projects
- Conducting post-project interviews
- Testing and evaluation of newly gained knowledge
- Inclusion of knowledge in knowledge data-base
- Personal transfer of experience knowledge to other project-teams
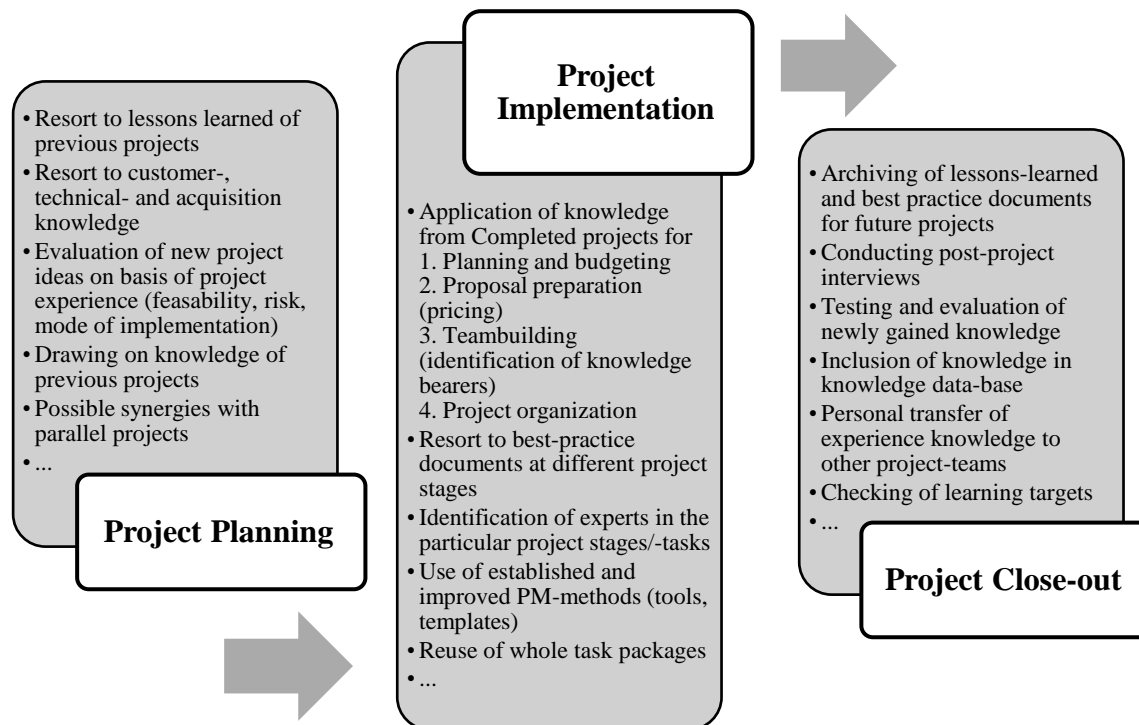- Checking of learning targets
- ...

Figure 1. Knowledge Types and project phases. Adapted from Hanisch et. Al. (2009)

In figure 1, different types of knowledge during the project lifecycle are depicted. As proposed by Hanisch et. al. (2009), the KM-actions during the project planning phase should focus more on lessons learned from previous projects, learning about customer-, technical- and acquisition knowledge. It is also during the planning phase that there is time for evaluating new project ideas based on project experience, i.e. evaluating the opportunity for innovation. During the project implementation phase, i.e. the "main" part of the project, the focus should be on the application of the knowledge learned from previous project rather than collecting the knowledge itself. Examples of this are planning and budgeting, executing teambuildings and lessons learned within the project organization as well as using the tools and templates collected during the earlier phases. Finally, during the final stages of the project, i.e. the project close-out, it is all about collecting and archiving the lessons learned and experiences from the project for future use. During this phase, the processes and methods used during the project should be thoroughly evaluated in order to see if they can be optimized before future use (Hanisch et. al., 2009).

Apart from the relevance of the knowledge shared, the participants of an interview study by Tan et. al. (2006) identified the following four requirements as vital for a successful implementation of a KM-strategy: *Cost*, *Workload*, *Legal Issues* and *Accuracy*. *Cost* refers to that a KM-action should not incur significant additional costs on the company, or if so, the cost

should be justifiable by the benefits of the action (such as increased profit or reduced production costs). *Workload* refers to that the KM-action should not create significant additional workload on the project members. *Legal issues* are related to the secrecy of organizations and/or projects. For example, secrecy-policies may prevent companies from disclosing information and knowledge learned to other organizations. The last one, *accuracy*, refers to the fact that a KM-action must be deemed capable of capturing and representing the knowledge accurately before people will start relying on it (Tan et. al., 2006). For KM in a project organization, it is also important that the *social aspects* are considered, as the knowledge shared in PBOs is often tacit, situated and embedded within teams or situations. In project settings, the processes of knowledge capture, transfer and learning rely heavily upon social patterns, practices and processes, which helps emphasize the importance of implementing a community-based approach to managing knowledge (Bresnen et. Al., 2003).

To summarize, knowledge is defined as a cornerstone for organizational learning and improvement, and there is in fact an increasing awareness that a KM-strategy is a valuable tool in improving business performance. (Robinson et. al., 2001)

2.5 Barriers to Knowledge Management in Project Organizations

So why is it that such a low proportion of construction organization has implemented, or are planning to implement, such a strategy? The answer to this lies in understanding how knowledge is perceived, and the barriers to managing knowledge and implementing a KM-strategy. Because even if the requirements mentioned above are met, there could still be difficulties in implementing a KM-strategy into a PBO. In a survey conducted by Robinson et. al. (2001) amongst organizations in the construction sector, the following three aspects were identified as the main barriers to KM; *Organizational culture*, *lack of standardized work* and t*ime constraint*.

Culture was identified as the most significant barrier in the implementation of KM strategies. A supportive organizational culture can enhance interdisciplinary cooperation and knowledge exchange in the project teams (Hanisch et. al., 2009). The participants in the survey conducted by Robinson et. al. (2001) noted that both the culture of formal and informal sharing of knowledge is important. Culture is however a difficult barrier to overcome, as it cannot be changed directly, but only through indirect means such as incentives, role models etc. (Robinson et. al., 2001). One very common and versatile tool to try address this barrier, is to create informal forums for knowledge sharing. Some examples are Communities of Practices [CoPs], groupware's and discussion forums (Tan et. al., 2006).

Before going further into the concept of these forums, the differences between a project team simply working together and a CoP, must however be addressed. A team or a group have a task orientation, and is often formed for a specific purpose, such as a construction project. This means that the team/group have formal requirements for membership. Communities of Practice,

on the other hand, have an informal membership that is often fluid and self-organizing in nature (Lesser & Prusak, 1999).

A CoP is often formed over time, by individuals who see a need to associate themselves with others who are facing similar issues and challenges within an organization. In most organizations, CoPs exist without formal charters or organizational mandates. As mentioned by Lesser & Prusak (1999), there exists a formal structure within all organizations that can be explained by boxes arrows, documented policies and procedures. They also add that this formal structure may be contrasted by a less formal environment, which is more based on self-organized group interaction and individual relationships. Described in an organizational context, this means that behind every organizational chart lie informal clusters and networks of employees who work together, share knowledge, jointly solves problems, exchange insights, stories and frustrations (Lesser & Prusak, 1999).

However, as many organizations are beginning to recognize CoPs as a powerful tool for managing organizational knowledge, many companies are now beginning to invest time, energy and money into supporting their communities of practice. A common question asked by these organizations are "How should we best allocate our resources to assist these informal communities, manage knowledge and ultimately derive value for the rest of the organization?" (Lesser & Prusak, 1999). Furthermore, when considering the tacit and situated nature of the knowledge that is often shared in project organizations, it is important to create such forums as the knowledge is often embedded within the social groups and situations (Bresnen et. al., 2003).

In CoPs, and similar types of informal forums, knowledge is constructed as individuals share ideas through collaborative mechanisms, such as narration and joint work. Through this, organizational members are provided with identity and cohesiveness, which in turn makes up the basis for effective learning as it cultivates trust, norms and shared values amongst the CoPs members. The biggest advantage of these sort of forums is that they are a very powerful, and often informal knowledge sharing tool. However, one negative aspect is their passive nature. For example, if a question is not asked, the knowledge associated to it will not be shared. Another negative aspect is that it is generally only the participants who directly benefit from them. (Tan et. al., 2006).

Another risk when seeking knowledge from a community or forum is reinforcing an "inward-looking" perspective. This creates a dilemma; the greater the social bonds in the community of the internal network (which is typically desirable, as it may favor the sharing of knowledge), the more likely it is to encourage a localized search behavior and not look outside of the community for information. This could in turn be harmful for innovation. Therefore, there is a delicate balance between encouraging the development of communities and internal networks based on strong, but redundant ties, while at the same time, encouraging the maintenance of other, potentially very useful networks that are based on weak, but non-redundant ties. In other words, to benefit fully from the knowledge that the organization possess, the networks and forums from different project teams also need to interact with each other, adding to the importance of the social dimension (Bresnen et. Al., 2003).

Consequently, these CoPs play a major role in creating, sharing and applying organizational knowledge if managed correctly and appropriately supported by the formal organization (Lesser & Prusak, 1999) as well as paired with other, complementing knowledge sharing tools (Bresnen et. Al., 2003). However, while it is recognized that the creation of networks of individuals who share knowledge and experiences are important for an organizational knowledge exchange – the social capital and the interpersonal dynamics between the individuals within the network are equally as important. This adds a relational dimension that addresses issues around trust, shared norms and values, obligations, expectations and identification that are critical in developing social capital and cohesiveness among members of a group. To put this into an organizational perspective, we can circle back to the previously stated question asked by the organizations; "How should we best allocate our resources to assist these informal communities, manage knowledge and ultimately derive value for the rest of the organization?". Assuming that strong social bonds within the networks have a positive impact on knowledge creation, sharing and use, then how should project managers act in order to increase the level of social capital and cohesiveness? (Lesser & Prusak, 1999).

According to Lesser and Prusak (1999), the following rules of thumb are the most important to bear in mind. First, the organizations should focus the resources on the CoPs most related to the ones with direct impact on the organizations strategic objectives, as there in most organizations may be a large number of communities existing independently. Secondly, the communities should be provided with the means, and be encouraged, to meet face-to-face. Especially in geographically dispersed organizations, CoPs face an additional challenge in the lack of direct connections which fosters social capital and builds strong relationships within the network. This will make the process of community-building more effective, which will benefit the organization as a whole. Furthermore, providing tools for the members of the CoP to identify new members, as well as maintaining the contact with existing members. Technology, such as web pages, videoconference-platforms or knowledge repositories, can play a big role in supporting CoPs. Lastly, although CoPs are often naturally present in all organizations, they often require formal investments from the organization in order to effectively create, share and use organizational knowledge. Such investments could enable existing communities to be more effective, efficient and/or innovative. The investment of resources can vary between many forms, ranging from money for face-to-face meetings, technology to support geographically dispersed communities, to involving experts to spend time aiding others in the network. These are all tangible investments which, if spent appropriately, can pay back dividends in terms of stronger, more vibrant communities.

Following the challenges related to cultural barriers, the lack of standardized work processes in construction projects was also identified as a key barrier. As described earlier, the uniqueness of construction projects adds to the complexity of knowledge sharing. This is supported by Hanisch et. al. (2009), who state that projects are often unique and temporary undertakings with the added challenge of ever changing conditions, workforces and obstacles - which makes up a major barrier for organizational learning. According to the participants in the survey by Robinson et. al. (2001), this has led to many of the construction organizations suffering from having too many different processes for performing similar activities. But although the

uniqueness is harder to manage, and although it may be hard to establish steady state routines to maximize the flow of knowledge between projects (Bresnen et. al., 2003), some aspects can often be standardized. For example, best practices and methods can be identified and transferred within the company or project, supportive routines can be established and consistent language and terminology can be set and distributed to all employees (Hanisch et. al., 2009). By identifying and distributing the standard, reusable details - resources can be allocated to the right thing - which is often to solve the more unique aspects and challenges of the project. However, as argued by Tan et. al. (2006), standardization as a KM-tool is probably best suited for companies with a high proportion of similar projects.

The time constraint was identified as the third key barrier to implementing KM-strategies in construction organizations. This due to that projects-teams are often governed by fixed time frames as well as the need to deliver on time. The participants of the survey by Robinson et. al. (2001) explained that even though project members wanted to share knowledge, the pressure to deliver under tight project schedules often did not allocate the time to do so. Furthermore, as explained by Gann (2001), the lack of organization in the internal business processes meant that project-based construction organizations often struggle to learn from project to project. Therefore, as a consequence of the hunt for reduced project durations, there are rarely enough time spent on documenting lessons learned from previous projects.

2.6 Project Knowledge Management during the project lifecycle

PKM during project life cycle

Beginning of project	**During project cycle**	**End of project/Indepent of project cycle**
• Staffing along skill/competence database	• Training project members PKM	• Lessons learned
• Use of typical errors database	• Review/lessons learned at project milestones/check points	• Project review
• Recourse on proposals written for similar projects in offer phase	• Evaluation of external consultants/sub-contractors and resource of this experience during project cycle	• One pager project summary for evaluation on potential project knowledge by knowledge management office
	• Meeting of project leaders on a regular basis	• Debriefings

Figure 2. PKM During the project lifecycle (adapted from Hanisch et. al., 2009)

Considering the challenges mentioned above, there may not be one, single action that can be applied to the entire project in order to ensure well-functioning knowledge exchanges. Hanisch et. al. (2009) propose that several different KM-tools should be used during different stages of

the project lifecycle. In figure 2 above, their proposition of a possible allocation of KM-actions during the project lifecycle is depicted. As shown in the figure, the focus during the beginning of the project should be on strategic staffing, and learning from mistakes made by previous projects. During the "main" part of the project, the project team should focus on training the project members, reviews and lessons learned at project milestones, and "internal" PKM within the project team. During the final stages of the project, the focus should lie on collecting lessons learned and reviewing the project so that it can be compiled and applied to future projects (Hanisch et. al., 2009).

And when it comes to re-cycling project-based learnings from project to project, many additional barriers can be found. Of course, inevitable discontinuities occur in the flow of resources (especially personnel and information) across time and space, from one project to the next. Capturing and diffusing the knowledge and learnings from project to project, or even between the different project phases, can therefore be a major problem (Bresnen et. al., 2003). As previously mentioned, one important tool, or action, to ensure knowledge sharing from project to project is to take time after project completion and gather knowledge that could be useful for coming projects. This process of collecting lessons learned after the project is completed is called Post-project reviews [PPR] by Tan et. al. (2006). PPRs are important, and by learning from experiences from previous projects, it is easier to prevent repeated mistakes (Hanisch et. al., 2009). However, PPRs are often time-consuming and slow and furthermore, the time lapse between the discovery and creation, and the capture and sharing of knowledge could lead to the loss of important insights (Tan et. al., 2006). Furthermore, there is also a tendency to "reinvent the wheel" whenever a new problem occurs, rather than rely on the insights and experiences from previous projects (Bresnen et. al., 2003).

Another strategic KM-tool can be found in the staffing of the project. By making the right recruitments of project members, with regards to capacity and competence of the employees, a lot can be gained in the aspect of finding the optimal allocation of resources (Hanisch et. al., 2009). It can be argued that this action is more a practice for getting new people to fill existing and future anticipated knowledge and skills gaps than a KM-related action. However, it can be an effective strategy to enable the reuse of project knowledge to involve people with valuable experiences from previous projects (Tan et. al., 2006).

Finally, it is important to mention the dimension of digitalization. Some of the most commonly discussed tools when it comes to Knowledge Management are the ones related to IT or ICT. Even amongst the previously mentioned tools, some sort of IT-system is often used to create a platform where knowledge is gathered and easily distributed. It has been proven that the support of IT/ICT-tools is a necessary, but not sufficient factor for ensuring a qualitative KM-work (Hanisch et. al., 2009). Many companies build their knowledge sharing platforms online in order to ensure all employees easy-access to the information that has been gathered through other KM-processes. However, some companies criticize such tools for their lack of detail and reuse value (Tan. et. al., 2006). So, without good-enough supportive IT/ICT-tools it is difficult to implement, but even the best IT-support tools are insufficient if the corporate culture and routines does not encourage the use of the provided software and applications (Hanisch et. al.,

2009). In an interview study by Bresnen et. al. (2003), an identified key problem with IT/ICT in KM was found in the difficulties with motivating the project team to continuously use and update the databases available. Therefore, the main focus when discussing IT/ICT-tools in KM is currently on the people, and their acceptance of the IT-tools they are to use (Hanisch et. al., 2009). In addition, one factor that influences the usage of IT/ICT in PKM is that many people tend to revert to interpersonal forms of contact whenever new information or knowledge is needed (Bresnen et. al., 2003).

3. Methodology

As described in chapter 2, there is currently a lack in consensus regarding the definition of Knowledge Management (Hislop, 2013), and both Knowledge and Knowledge Management are difficult topics to define as they are highly subjective. This is because they to a large extent involve organizational culture and norms. As argued by Gherardi and Nicolini (2000), knowledge is rooted in the context of interaction and social situations in which organizational members participate. Consequently, for this study it has been important to try to understand and respect the complexity in context of the research topic. This has led to an inductive, qualitative research approach being used to fit the particularities of the very multifaceted nature of the research topic (Hislop, 2013).

A qualitative methodology refers to a broad approach in producing descriptive data, like people's own written words or observable behaviour. Furthermore, performing a qualitative study involves developing concepts, insights and understandings from the gathered data rather than collecting data to assess it according to preconceived models, hypotheses or theories. This leads to the research methodology being inductive as well (Taylor et. Al., 2016). By applying the inductive, qualitative approach, a core concept during the research has been to try to understand the different interviewees from their own perspectives, as it depicts how they perceive the topic. In the end, that is how they will experience and act in their everyday life and how they actually work with KM (Taylor et. Al., 2016). This also provides an interpretative stance towards the subjective research topic.

As described by Taylor et. Al., (2016), in qualitative studies, researchers follow a flexible research design. A literature review has been conducted on the topic of Knowledge Management in the construction industry. However, in the beginning of the study, the research questions had only been vaguely formulated, meaning that the literature study has been an iterative process throughout the entire study. In the beginning of the study, the research focus was more directed generally towards the KM-practices which were applied in the project. Consequently, the literature study explored KM- tools and practices and general concepts related to KM. Gradually, as the research question have been more defined, additional data has been collected in order to support the findings from the case study, in which the knowledge sharing processes of the project team in a large construction project has been studied. Much of this additional data includes theories about organizational culture, individual responsibility and the more social aspects and their effects on KM in a project organization.

3.2 Case study

In general, case studies are the preferred strategy when "how" or "why" questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context (Yin, 2009). This is supported by Flyvbjerg (2006), who states that a case study also provides a closeness that is needed to gain deeper understanding of the underlying dynamics of the social life within the organization.

As stated by Yin (2009), "A case study is an empirical inquiry that; investigates a contemporary phenomenon in depth and within its real-life context especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2009).

For the practical part of this thesis, a case study has been conducted in a construction project organization active as clients in the Swedish infrastructural sector. More specifically, the case study has been conducted in the project team of a major infrastructural project in Gothenburg, in which the author of this thesis has also worked part time in for over one year.

The organizational structure of the project team has had some impact on the knowledge sharing processes within the project team. In order to manage the major project, it has been divided into several sub-projects, see organizational chart in figure 3. This has led to the project teams facing the challenge of coordinating the sub-projects while at the same time conveying the picture of one single, joint project. This includes utilizing the knowledge of all its project members (throughout all the sub-projects organizations), as well as coordinating the communication to the public and sharing lessons learned between the different sub-projects. However, the organizational structure of the case project organization also offers some unique opportunities when it comes to knowledge sharing, as the members and counterparts in the different sub-projects can learn a lot from each other.
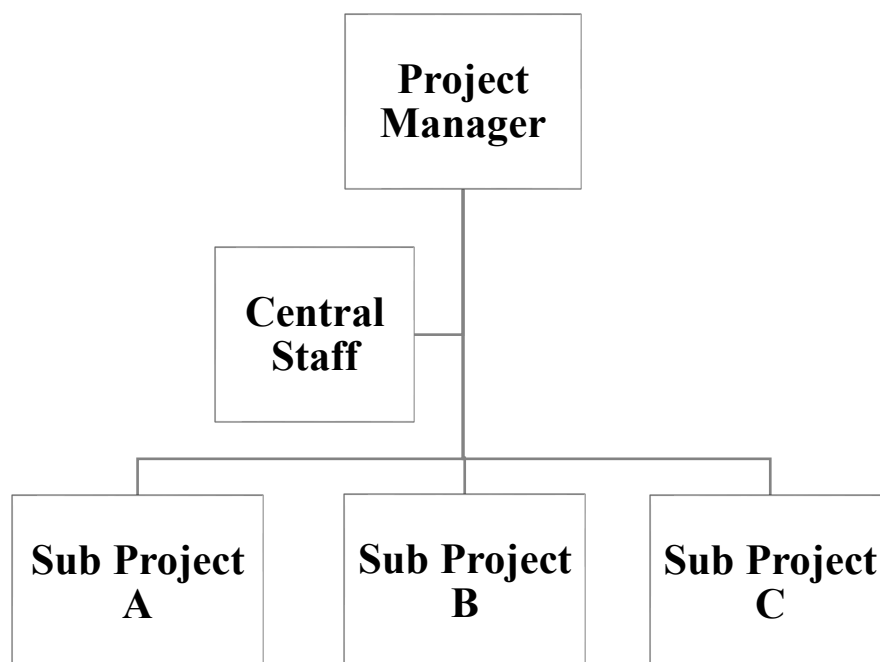
Figure 3. Organizational chart of the case study project organization

Furthermore, it can be hard to adopt standards and standardized knowledge sharing processes in a big project organization such as the one subjected to the case study - where the project teams are often facing unique challenges. However, as one of the major clients in Sweden's infrastructural sector, the case-company has conducted previous complex projects also carried out in a metropolitan environment where parallels can be drawn to the current project. Due to

the sheer size of the organization subjected for the case study, the organization also has a unique opportunity of harvesting and utilizing the knowledge learned in previous projects - big and small.

Due to the authors closeness to case, and the project team, a bigger understanding of the social interactions taken place within the organization has contributed to a more nuanced view of the actual practices and interactions of the workplace. This closeness has also provided the author with easy access to information, such as organizational documentation on knowledge sharing strategies within the company as well as project members to interview. This was one of the reasons for selecting this company for the case study, as it provided the opportunity to directly initiate qualitative data gathering.

For the case study, three methods of data gathering were utilized; interviews, observations, internal document review as well as a literature review. This method of gathering findings from different methods, and combining them, is called *triangulation*. The use of triangulation helps strengthen the validity of the study, as the data from each method provides further insight and a deeper understanding of the research topic. It also helps verify the result of the conclusions (Woodside, 2010). For example, as stated by Nicolini (2017), there might be a level of dissonance between what interviewees say and what they actually do. By applying triangulation, the result from the interviews can easily be compared to observations from the workplace, and thereby provide a more accurate picture of the KM-processes within the project.

3.2.1 Interviews

In case studies, one of the most important methods to collect information is by conducting interviews (Yin, 2009). Also, as pointed out by Benney and Hughes (1970), interviews are the "favored digging tool" of social researchers as they rely largely on verbal accounts for learning about the social life of the organization.

This statement is strengthened by Löwstedt & Räisänen (2012), who mean that from a research point of view, collecting stories is a powerful insight into the lived experiences and values of both employees and managers. The stories shared within a collective, such as an organization, will often create a common frame of reference which will come to represent the dominant logic of the collective. However, as explained by Löwstedt & Räisänen (2012), this narrative of the organizations´ employees can have large discrepancies from the governing narrative – the one typically foregrounded by top-level managers and often presented in formal organizational documentation. With that said, very different stories can materialize, depending on the point of view taken. Löwstedt and Räisänen argue that the lived narrative, however, generally better reflect the realities of the broader cohort of organizational members – and that the formal version serve more as a symbolic artefact of the organization. They do however state that if there is a "truth", this may lie somewhere in-between these different realities (Löwstedt & Räisänen, 2012). Alongside this reasoning, interviews have made out the main source of data collection for this study, and then being complemented by other sources of data (such as formal documentation).

The project members interviewed for the case study are presented in Table 1. The result of the interviews is presented in Chapter 5.

Table 1. List of interviewees

Title of interviewee	Description
Construction Manager	Tasks and responsibilities are connected to production for one of the sub-projects as well as keeping up to date regarding the ongoing design.
Construction Manager	Same a s above.
Quality Coordinator	The employee who is responsible for the overall quality work of the project. This includes all work connected to knowledge management, collecting and evaluating experiences.
Design Coordinator Installations	Responsible for coordinating the design of the installations for one of the sub-projects. Shares interface with coordinating the design with the other subprojects.
Design Coordinator	Same as above, but for the overall design of the sub-project.
Design Coordinator External Stakeholders	Same as above, but for the design of the sub-project that needs to be coordinated with external parties.
Deputy Project Manager	Deputy project manager of one of the sub-projects. Tasks and responsibilities is securing the project keeps moving forwards, both in regards to design and production.

For this study, interviews were held with 7 project members. Due to the organizational structure, most of the interviewees were actually consultants, although working full time for the organization within the project. The interviews were held in Swedish. The questions from the interview has for the purpose of this thesis been translated into English, and are listed in appendix 1.

As stated by Yin (2009), when conducting interviews, the questions should not be leading but rather be constructed in a way that welcomes new perspectives and opinions. Furthermore, the interviewer should aim to minimize their effects on the people they study, although it can never be eliminated completely (Taylor et. al., 2016). Accordingly, the interviews were conducted in a semi-structured manner with the guidance of the questions listed in appendix 1.

Throughout the process of conducting the interviews, some questions were rephrased, replaced or removed from the original structure. Therefore, all interviewees were not asked all of the

questions specifically, but the questions listed in appendix 1 were customized to suit the interviewee and their position within the project. Furthermore, as pointed out by Taylor et. al. (2016), a researcher who has spent some time in a setting can use the knowledge already gained to obtain even more information, which results in being able to ask more in-depth questions. Consequently, the interviews conducted first were not as in-depth as the ones conducted at the end of the study. The length of the interviews spanned between 35 minutes to one hour. All interviews were recorded in order to more easily go back and revisit the discussion during the development of this thesis.

3.2.3 Observations
The second method of data gathering was observations. As noted by Jorgensen (1998), the participant observation method is particularly applicable if the research topic is in terms of human interactions which are best observed from inside the organization and if it can be studied in an everyday context. Given the nature of KM, this method was considered suitable.

However, as proposed by Flick (2009), it is important for the observer to retain an external perspective in order to maintain a systematic observation. By losing the objective gaze, the study could end with the result being too biased by the researcher. To mitigate the risk for such bias, triangulation, i.e. multiple methods of data collection, have been used for this case study. The ultimate purpose of triangulation is to portray an as accurate and impartial picture of the organization as possible (Woodside, 2010).

Furthermore, it could be argued that as the author working closely with many of the interviewees, objectivity could have been affected. However, working part time in the project for about 10 months prior to the start of this thesis has also provided the author with own insights, which has given the opportunity to comprehend and critically analyse the answers given by the interviewees – as well as given a better possibility to know which questions to ask and where to look for the right information. Furthermore, daily access to the project office, has provided the possibility to study human interactions and observe the KM-processes from an everyday context. It has also given the author a longer time span to conduct the study, which in turn will provide a more accurate picture. The main findings from the participant observations has been those regarding organizational culture and social interactions taking place on the workplace.

3.2.4 Literature review and internal document review
For this study, a review of relevant literature has been conducted – both previous scientical studies on the field of knowledge management as well as the internal document of the studied organization. Due to the inductive research approach, the reviewed literature has been chosen after the authors previous experiences of the workplace of the company subjected to the case study as well as the research topic. As described previously, an iterative approach has been utilized for the literature study, and additional literature has later been added after the author has taken part of the experiences of the interviewees, which has contributed with new aspects needing literary support. As proposed by Flick (2009) a variety of literature types should be

utilized in qualitative studies. Therefore, both theoretical and empirical literature on the topic of knowledge management has been reviewed.

As stated by Yin (2009), relevant internal documents could be a significant component when collecting data in a case study. By being given free access to the projects PKM-strategy as well as other databases with documentation, the third method of data gathering has been made possible. The internal documentation has mainly provided a basis which the interview questions later has been formulated around, rather than being subject to review. However, observations as a research method has also been used to confirm details found during the study.

Finally, it is important to mention that the reviewed literature has to a large extent been particularly focused on knowledge management in the construction industry, as opposed to other sectors, due to the great selection of previous literature within the topic om KM in construction projects.

3.3 Data Analysis

Because collecting qualitative data is an inductive process, it is often performed hand in hand with the analysis of the data. Therefore, throughout the data collection, qualitative researchers are generally trying to theorize and make sense of the collected information. And vice versa, when analyzing the data – the researchers attempt to gain an even deeper understanding of what they have studied and to continually refine their interpretations of it (Taylor et. Al., 2016).

For this study, the analysis of the data has been an iterative process. The interviews have been one of the major sources of data. As they were recorded, the author has been able to go back and listen to them more than once. However, the first step was to begin building the theoretical chapter. As the theoretical work progressed, theories and questions began to hurdle – which were saved to be picked up later during the interviews and the discussion. At the same time, the work of performing the interviews began – which contributed to insights and directions to be explored further in the theory. Therefore, the collection and analysis of the data has at the very definition been an iterative process.

Before the work began with compiling the empirical data, the theoretical chapter was for most parts finalized. However, as the work with the empirical data and the analysis of the data has progressed, the theory has been optimized to fit the context and the picture portrayed in the later chapters of this thesis. For the actual compilation of empirical data, the results have been narrated in an order that will portray the best insight into the KM-work in the organization. Therefore, no parallels can be drawn to the order and priority in which the interviewees expressed their opinions on the research topic.

The main structure of the discussion was developed alongside the compilation of the empirical data, i.e. interviews, information from internal documentation as well as observations. Therefore, these two chapters have to a large extent evolved together. One useful approach to

analyze the case study data and finding these previously mentioned patterns and recurring themes, is according to Yin (2009), to follow the structure of the theoretical framework as it helped form the direction of the research. This has only partly been applied for this study, as the iterative process has entailed the structure of the theoretical framework to evolve during the study. However, providing it is considered as a dynamic approach – it has still shown useful to try follow the same structure.

Furthermore, the theories can help screen the data and pinpoint relevant findings and form conclusions. As this study has been based on an inductive, qualitative research approach, the collected data has formed a basis for the choice of theories (Hislop, 2013). Therefore, the statements and opinions from the theoretical framework has helped pinpoint the related data from the results which the analysis has been based on.

3.4 Ethical Considerations and Possible Conflict of Interest

Ethical considerations are necessary for any field research (Taylor et al., 2016). Furthermore, as noted by Flick (2009), qualitative research can be connected to ethical issues, therefore it is of large importance to consider ethics when conducting the study.

As previously mentioned, no personal details about the interviewees has been included in this thesis in order to protect their integrity. All interviewees were informed prior to the interviews that their identity would be kept anonymous. Consequently, no negative (or positive, i.e. special treatment) is to be expected as an outcome for the participants of the interview study.

The participant of the study must also be informed about the purpose of the study. Furthermore, during the analysis of the data, justice should be given to the participants of the study and their opinions (Flick, 2009). This is of particular significance in this study, as the author also works closely with the interviewees. Therefore, it is important that all analysis and conclusions are based on data collected, and not founded on the authors own opinions and judgement about certain processes. To help ensure this objectivity, all interviews were recorded. All interviewees were asked before the interview if they were comfortable with being recorded, to which they all gave consent. This has helped the author make sure an accurate picture is being depicted regarding the opinions of the interviewees.

Finally, it could be argued that there was a potential conflict of interest as the author of this thesis is also employed at the organization subject to the case study. Due to this, a clear distinction has been kept on when I was working, and when I was conducting research for the thesis. For most parts of this thesis, apart from interviews, the work has been conducted out of the office.

5. Result

5.1 Initiatives for knowledge sharing tools and practices in the company

As depicted in figure 1, the project organization is divided into a matrix organization, with a central staff function and several sub-projects. In the central staff, most of the projects overall functions – such as administration and economy, are managed. The projects quality coordinator, who is also responsible for the knowledge management processes in the entire project, are placed in the central staff.

The organizations' KM-work is described in the formal organizational guidelines, and according to it there are two prominent tools; the digital experience log and a post-project evaluation after the project closeout. In addition to these tools, some main everyday activities conducted by the project team that are connected to KM also include the concrete actions of starting up forums/networks for some project-wide disciplines and collecting suggestions for improvements through the internal newsletter.

The digital experience log is a log located on the company intranet, and is available to all employees. Anyone can enter experiences into the log, although the task is often allocated to one employee or function within the project team. To make it easier to navigate in the log, certain metadata has been chosen to classify the different entries. The metadata that needs to be entered is; The name of the project, Project Phase, Contract Form, Field and Technology Area. Moreover, the date of entry as well as a contact person for the experience should be added in case of questions arise. Below, an assortment of examples from the log are presented. The names of the projects and the contact persons have been changed to protect the anonymity of the organization.

Project/ Department	Project Phase	Contract Form	Title	Experience	Contact Person	Field	Technology Area	Date	Continued Handling
Project A	Closing of project; Production Phase		Plan for Project handover early on	It is important that the handover of the project is planned early on together with the receiving organizations. When handing over to external organizations who are lacking experience of receiving big facilities, the understanding of the handover-process can be insufficient. Therefore, the planning for handing over the facility needs to be started early on, to facilitate a detailed handover and secure adequate operation and maintenance management after handover.	Person A	Project Handover		2016-XX-XX	
Project B	Production Phase	Design & Build	Time planning for critical production tasks	For critical production tasks, where we (client) have our own time schedule and our contractor has their own, we have a forum where we discuss	Person B	Time, Cost and Quality		2018-XX-XX	

				and make sure they coincide with each other.					
Project C	Design Phase		BIM	Many of our sub-project has good experiences from working with BIM. In one sub-project, the contractor has used this to visualize the project time schedule, which has been very helpful.	Person C1	Documen tation and Informati on Manage ment; Time Cost and Quality	BIM	2017-XX-XX	Will be distributed internally in the projects monthly report
Project C	Planning Phase	ECI	ECI – positive signals	We have during this procurement received positive signals from the market for working with ECI-contracts.	Person C2	Procurem ent		2015-XX-XX	

Figure 4. An excerpt from the case organizations' digital experience log.

As previously mentioned, the digital experience log is one of the formalized practices also mentioned in the written down strategy for the entire organization, and not just for this project. The log is supposed to help ensure a knowledge exchange is held between all the organizations different projects around the country, and that lessons learned in one project can be brought into future projects.

According to the project quality-coordinator, an attempt was made early in the project to spread the knowledge of the digital experience log, and that the different project managers of each sub-project were informed that it was their responsibility that each of the sub-projects reported experiences to the log, and that the employees in the sub-projects were made aware of its existence. When introducing the log to the project team in the beginning of the project, the main purposes was to increase the discussion and spreading of experiences, trigger an interest to actively seek experiences/knowledge of others, provide a source to documented/and established "good examples" and to nurture an openness in reporting all types of experiences. The organization then acknowledged that in order to make the implementation of the log successful, it needed to be supported by the project management, they needed "ambassadors" who could help promote the usage of the log, and the existence of the log needed to be known by all project employees. The plan for the implementation during the early stages of the project was to introduce the log on meetings and in the monthly newsletter, to spread the work to the entire project.

When asked about the implementation of the digital experience log, the quality-coordinator (who, as previously mentioned is the employee responsible for coordinating the log) told that there is no continuous work with the log across the project team. An attempt was made to collect and report experiences during a project-review after the completion of the planning phase, and these experiences were brought into the log. After that, no more entries have been brought to the log. The interviewee does also add that she is aware that the word has not been spread accordingly, and that there probably only a few persons in the project organization that are even aware of the existence of log. This statement is strengthened by the rest of the interviews. Out of 6 interviewees that were asked the question, none were aware of logs existence, and had never used it. Most of the interviewees thought that it would be good if they were aware of it

and believed they could learn valuable lessons through the log. Some of the interviewees did not believe that a log is a sufficient tool for collecting and sharing experiences. These interviewees stated that most lessons learned in infrastructural projects are often complex, which may make them hard to put into writing or in a log.

When asked why not more efforts has been put into distributing the log, the quality-coordinator states that the organization is aware the implementation of the log has nog been entirely successful in the organization, and that the log itself is not ideal for use. Therefore, she proposes that one of the reasons they have not tried pushing it more upon the project team can be that they simply do not think it is well designed for usage. She also states that it is the company's' business plan for 2019 that the log is to be optimized and restructured

Another reason no more entries have been added to the log is that no experiences have been collected. To make sure that the collection of suggestions for improvements occurs continuously, the central quality-coordinator in the project has recently started to collect suggestions of improvements through the internal newsletter. The suggestions can, according to the quality-coordinator be regarding everything concerning the daily works in the organization – like for example improvements of office spaces, optimizing communication ways in the organizations, or pointing out that a template or a guideline needs to be updated. Furthermore, some of these suggestions of improvements are also what is supposed to make up the foundation of what is brought in to the digital experience log and shared with other projects.

Although a newsletter is sent out to the entire organization on a monthly basis, containing the request for employees to send in suggestions for improvements, only a handful actually send in suggestions. Furthermore, it can be clearly seen that it does not reach out into the sub-projects as the suggestions mostly derive from the central staff. When asked if they had ever sent in suggestions of improvements, most of the interviewees working in the sub-projects stated that they had not. Some meant that newsletters quickly got lost in their busy inboxes, that they had not had the time to read them properly or send in suggestions – or that they did not feel they had anything to contribute with. One interviewee stated that as he did not know what the central staff could contribute with to fix the problems he had in his daily work, he did not involve them in the process but would rather try solving the problems himself.

When asked about the clear division of suggestions sent in, and why the request did not seem to reach out to the sub-projects – the quality-coordinator in the project expressed frustrations. According to the interviewee, many employees complained about certain processes or templates, but very few had tried changing them into working more effectively. She also expressed frustration as that meant that the central staff had difficulties being involved in the problems affecting several sub-projects, and that this could result in the work being done by several people at the same time with no project-wide coordination.

She proposed that as she in her role as quality-coordinator is working more closely to the rest of the employees in the central staff – and that that may be one reason for she received more answers from her fellow colleagues in the central staff. As she does not encounter as many

employees in the sub-projects on a daily basis, they are not as aware of her role in the project, which could make it easier for them to discard her e-mails with request for sending in suggestions as mass-mailings.

As previously mentioned, the post project evaluation (PPR) is stated to be used as a tool to ensure the lessons learned in the project are brought into coming projects. Just like the digital experience-log, the PPR is one of the formalized practices also mentioned in the written down strategy for the entire organization, and not just for this project.

It basically involves the process of summarizing the lessons learned in the project into a final report. Gathering information from different fields and technology areas are a main source of information for the PPR, and it is most commonly done through thorough interviews with different key persons within the project under review. However, depending on situation, inputs can of course be gathered from, for example, the study of relevant documentation.
All the gathered information is then compiled into a list of concrete suggestions of how future projects should handle similar questions. As support for the interviews, the organization has proposed a guide for what questions could be asked. The guide contains general questions, and it is clarified that more concrete questions needs to be added to be able to use it as a basis for the interviews. It is also proposed that "project review days" are to be held (concerning one or more fields or technology areas) to help verify and collect experiences for the PPR, or even invite members from other projects, and thereby directly spread the projects experiences to future projects. During the project review days, workshops and evaluations can be held in groups to achieve a good discussion.

All final reports, which is the end-result of a PPR, are uploaded to the organizations intranet. Currently, they are only uploaded as internal documents, meaning that they are not accessible to the entire organization – but only to the project members. According to the interviewed Quality-coordinator in the project, there are however plans that the default setting of the file should make it possible for everyone whit a login to the intranet should be able to access the final reports. and are available to all employees in the organization to take part of. Further distribution is under the responsibility of the person who has produced the report. This person should, according to the guidelines, make sure that the report is distributed to the project sponsors, project management, final receivers of the project result, members of the project team as well as project sponsors and project management for ongoing and future projects that might draw benefits from the report.

The project reviews should, as previously mentioned, according to the organizations governing documents be performed during the project close-out. For the case project, the project team has however not yet reached that stage and has therefore not produced a post-project review [PPR]. However, according to the project quality-coordinator, the project team decided to conduct a project-review after the completion of the planning phase. This decision was made as the project management of the project believed a lot could be learned from the early stages, both for the rest of the project and for other projects conducted by the organization. One main reason was also that the project team had chosen to work with a unique contract form (ECI-contract) for

some parts of the works, which the organization wanted to evaluate for use in future projects. Furthermore, as the project is expected to last for many years – the project team simply believed it would be better to collect the knowledge earlier so it would not be lost. According to the quality-coordinator, the organizations governing documents, in which it is stated that a projects-review should be conducted only after project is finished, are not adapted to large, complex and long-lasting projects such as the case project but rather to the many smaller projects conducted by the organization.

Another initiative taken to improve the knowledge exchange within the project team is to set up networks for different roles/disciplines. According the interviewee responsible for the KM-works, these informal networks are one of the most important tools for coordinating the different disciplines between the sub-projects as well as learning from each other's experiences. The idea is that the different disciplines, such as project managers, construction managers, design coordinators, project engineers working with economy, administration etc., are supposed to meet regularly and exchange experiences and solutions with each other. From the beginning, the suggestion from the projects quality-coordinator, who started the initiative of the networks, was that the networks would meet biweekly or monthly – either in person or via skype. The agenda of the meeting could vary, depending on what different problems the members were currently dealing with.

When discussing networks and forums for knowledge sharing, the interviewees have different opinions and experiences. Most of the interviewees agree on the importance of such networks, and mean that a lot could be learned through communicating with others in the same role. Especially in a project such as the one subject for the case study, where the project is divided into sub-projects, as most employees have a counterpart in another sub-project. The forums are however working differently well for different disciplines. One interviewee portrays a picture of a functioning network within his discipline. In the network, the members from the different sub-projects meet weekly for a joint meeting. They also meet up for lunch several times a week. The information exchange between the members are informal, and the interviewee believes that they gain a lot from each other's previous experiences. Worth noting is that several of the members in the network knew each other prior to the start of the project, and some of them even represent the same consultancy agency. Other employees mean that the networks for their disciplines are working poorly. Some mean that they are non-existent, as they "ran out in the sand" when no one agreed to take responsibility in coordinating the group and their meetings. Others mean that they work to some extent, but that they feel it is hard to come up with topics for the forums to discuss, and that the discussion held can sometimes be forced. They also report that there is a problem with no one overseeing the coordination of the network gatherings, and that it results in the network meeting very seldom due to the members' busy schedule. These interviewees do however clarify that once the networks do get together, their exchange of experiences often leads to good results – and that they learn a lot from their counterparts.

The quality-coordinator, who is one of the persons who took the initiative to start up the networks, acknowledges that the initiation of the networks has not gone completely according to plan, and reflects that the lack of resources and support in the sub-projects has made it hard

for her to follow up how the networks are working. The interviewees who expressed that their networks are not functioning agrees that the responsibility may not lite with the quality- and KM-coordinator – but state that there should be a clearer definition of someone responsible for keeping the networks up and running.

5.2 Summary of the usage of the tools and practices within the organization

The organizations written down KM-strategy does not sufficiently mirror the way the KM-works within the project team is functioning. For example, the digital experience log is featured in the KM-strategy as one of the biggest tools – but in reality it is barely used and only a few employees are aware of its existence.

The one tool that was mentioned by most of the interviewees were the networks and forums for knowledge exchange, or to simply go directly to another project team member and ask questions directly. The tools where the knowledge is put into writing and shared across the organization through the organizations databases did not seem to be brought up by the interviewees until asked directly. It did not seem to make up a part of their daily knowledge-sharing exchanges in the same way as those connected to direct, social contact.

The knowledge sharing tools and practices in the entire project organization is managed by one employee, who is responsible for overseeing the central staff as well as the implementation in the separate sub-projects. This responsibility has from the interviews shown to be hard to put on one single employee, which has led to the lack of managerial oversight regarding the KM-works and has resulted in the project teams not always being coordinated in their KM-works. As previously mentioned, this was something brought up by the interviewees – who asked for additional support in coordinating and setting up guidelines on how a functioning knowledge exchange could be nurtured within the project team. This of course brings to discussion the responsibilities of the quality coordinator in relation to the responsibilities of the individuals of the project team.

5.3 The responsibility of the individual

One recurring focus point throughout the interviews is the one regarding the role and responsibilities of the individual versus the responsibility of the organization. For example, as previously mentioned, some of the interviewees expressed that the knowledge sharing forums for their respective disciplines were not functioning – as no one took the responsibility of coordinating them. They also stated that there needed to be clearer definition of who were in charge of keeping the networks up and running. However, most of these interviewees did not speculate on if it was maybe their own responsibility in defining this person – or if it were in fact their role to coordinate the networks. Most of them did instead state that it was the organizations responsibility to appoint someone responsible.

Many of the interviewees state that there are a lot of knowledge to take part of, if one only knows where to search for it. There is however, according to some of the interviewees, no clear guidance as to what that knowledge consists or where it is to be found. Another example of this is the company's internal networks, which constitute big databases where all sort of information regarding all the company's' projects can be accessed. One interviewee explained that he felt he could easily navigate through the databases at hand, and explained that since he had been in the project from the beginning he has had the time to get to know the databases. Another employee, who had come in to the project at a later stage, did not feel comfortable with the databases at all, as he had not had the time to explore them. This has resulted in him not relying on them to find information, and that he rather asks his colleagues where to find the information.

When asked about the lack of guidance that was expressed by many of the project members, the quality-coordinator meant that this also was due to the fact that the construction industry has a certain tendency to want to "solve problems in their own way", which sometimes makes it hard to work in a similar way across such a big project. She states the project has previously set out occasional "run troughs" of the databases by the project data-coordinators as well as for some special causes sent out e-mails to the entire project-organization with information about certain topics and where to find more information about these. However, she means that the interest in attending such "run troughs" is low, and that the response of mailings with information is lacking. There are also guidelines as to how and where all the sub-projects are to store their data. The goal is that by working in the same way across the entire project – it should be easy to navigate and to find information uploaded by others as well, as the naming and the structure of the files within the databases should be the same. However, according to the quality-coordinator, it is often hard to keep everyone following these guidelines, as everyone always tends to find their own preference of how to work. Then it becomes the central staffs job to act as police, and make everyone change the way they set out to work – which adds to the confusion to navigate in their own – as well as other sub-projects – databases.

All of the interviewees acknowledged that they as individuals share a responsibility in actively seeking knowledge when needed and did not express any troubles with that, and agree that it is relatively easy to know where to go for guidance within the project. Most of them did however state that they had to "learn this by doing", and none of them were aware of if there were any written down guide to support them in how or where to seek knowledge.

The quality-coordinator agrees that there is a certain expectation on employees to seek knowledge on their own. She means that it is important to acknowledge that it is impossible for all new employees to feel at home in the databases before getting to know them properly on their own, and that there is only so much that the project management can do to help.

5.4 Social aspects of Knowledge Sharing

As previously mentioned in the context of the knowledge-sharing forums, the networks where the social connections between the members ran across the frames of their professional roles

worked more effectively than the ones where the social bonds between the counterparts in the other sub-projects were weaker.

The social aspects in KM, and the organizational culture, are important, as agreed by all interviewees. None of the interviewees expressed the feeling of an organization where they felt the organizational culture suppressed the knowledge exchange. They did however depict different social bonds to their counterparts in the other sub-projects, which is natural in all organizations. Some interviewees (to a big extent the ones who had non-functioning networks with their counterparts) felt they had a better connection to their project team within the sub-project than to their respective counterparts. This has resulted in a "team within the team" forming, as they felt a stronger bond within the project team than to their counterparts in the different sub-projects.

The interviewees that expressed stronger social bonds within the sub-project were more likely to ask a person within the sub-project for help, even though they did not possess the same role and responsibilities – and may not even work with the same type of questions.

The interviewees that expressed a closer bond with their counterparts within their discipline did not experience the same connection to the "team within the team", but was rather unlimited to their belonging within the entire project team. These interviewees were most likely to ask their counterparts for help when they came across a problem they did not know how to solve. As stated by one of these interviewees, his counterparts were more likely to know the answers as they work with the same types of questions on a daily basis – which is why he would first turn to them for help.

The origin of the social bonds in the project-team varies greatly. The organization may impact them by setting out forums for socializing. These forums mostly help nourish the "teams within the team", as the physical closeness of the sub-project team when performing day to day activities undoubtedly helps them form strong social bonds with each other rather than with their counterparts in the other sub-projects, which are seated in different offices across the city. There is also the closeness that comes from the trust and friendship that underlies a strong social bond. This type of closeness can of course form from working in the same offices, but it can also origin from knowing each other from before the start of the project. In this project, such bonds are common. As mentioned previously, the organization is largely built upon hired consultants. This means that many of the different consultancy firms has several consultants' representing them in different sub-projects. Consequently, these consultants have a network of their own – with their consultancy colleagues within the project. Furthermore, as many project members have been active within the construction industry in the region for several years – many of them have met during previous projects. Some may have been colleagues, or even counterparts, but they have during these exchanges formed some sort of social bond.

5.5 Late changes affecting project prerequisites

Another topic, which has been recurring through the interviews is the topic of changes. Many of the interviewees stated that a big problem lies with changes that has come in to the project prerequisites (contracts, routines etc.) at a late stage of the project, as it can create confusion. It is however agreed that these problems are difficult to avoid completely, but should be kept to a minimum.

Connecting this to the topic of knowledge management – it is according to one interviewee very important that the project management of the project has collected a stable foundation of experiences from previous projects. Often the project team has not grown to its full size until the project is started up – which means that the experiences for the early knowledge exchange lies fully on the project management, according to the interviewee.

On the other hand, one interviewee means that it would not be possible to have everything (i.e. documentation, handbooks, routines etc.) in place prior to construction start, as not all prerequisites were known at the time the contracts were drawn out. Some interviewees do however mean that a lot more could be finished at an earlier stage, and that the project suffers from the changes that are made at this late stage. For the aspects that could be finalized before project-start, one interviewee mentions specific working methods, routines, control plans etc. The interviewee means that as this is not the first time the organization conducts a big infrastructural project – many lessons could have and should have been learnt from previous projects, which could have resulted in fewer changes being made at the later stages – as well-tested and functioning working methods would be in place from the beginning.

Another employee means, that when they have already started working in one way – and has implemented a method within their sub-project – it is hard to change once they get new instructions from the central staff. This sometimes results in the sub-projects not following the routines set up by the staff – but instead setting their own routines. The interviewee means that the lessons learnt that are causing these changes should have been learnt at previous phases of the project, which could have meant that the measures taken to address the troubles would been done earlier – and not have as big of a consequence.

6. Discussion

6.1 How to handle standardized knowledge sharing practices in a unique project

Throughout the interviews, a read thread has been the topic of standardization. When discussing experiences that should have been learnt from previous projects – both practices and more specific tools – it is hard not to fall into the topic of standardization – both of the knowledge sharing processes but also to some extent on the actual nature of the knowledge being shared.

As mentioned by Bresnen et. al. (2003), lessons learned are often tacit, intangible and context-dependent. However, the uniqueness of the contexts themselves can be disputed. So firstly, it needs to be discussed whether there exists such a thing as a "unique" project. The science establishes that it is common that construction projects possess unique aspects which makes them harder to manage (Koskela, 1992). Consequently, in big, infrastructural projects such as the one subject for the case study, it is well known that some unique aspects contribute to a difficulty for standardization of practices – which was also mentioned by several interviewees.

One interviewee, the quality coordinator, did however state that people tend to rather highlight the differences of construction projects rather than their similarities, which provides a challenge in standardizing practices even between the different sub-projects. This attitude would also be an explanation as to why a project member would not turn to a colleague in another sub-project for guidance, as he/she would not consider them to be dealing with the same nature of problems. The implications of this would be the difficulty in seeing possibilities of standardization and common denominators, which has big consequences for knowledge sharing practices. However, as stated by another interviewee, although the combination of different, project specific aspects may be unique – put alone they are rarely unique. This would mean that standardization, to some extent, is possible for all projects.

Having established that some standardization and exchange of experiences, practices and tools should be able to be passed from project to project, the additional challenges that comes with KM in "unique" projects should be addressed. As noted by Koskela (1992) and Bresnen et. al. (2003), the uniqueness that often characterizes a construction project does actually contribute to a more complex learning environment, and often leads to the project team having to focus on so called "firefighting" instead of exploring opportunities to learn from previous projects. Many of the interviewees expressed a similar attitude towards seeking knowledge from previous projects, meaning that it would be more time consuming to ask others rather than find a solution on their own – within the team. Consequently, in this project, and others, there seems to be a recurring tendency to keep reinventing the wheel, which is often excused by the fact that there are a lot of unique aspects which makes it impossible to follow the practices of previous projects. However, as previously mentioned, the science is clear with that there is a lot to gain from looking to other projects and see how they have dealt with different problems, and thereby

not having to "reinvent the wheel" every time facing a new problem (Boh, 2007; Hanisch et. Al., 2009; Tan et. Al., 2006).

Nevertheless, as proposed by Bresnen et. Al. (2003), the best way to manage the uniqueness is to actually look at how other, similar projects have dealt with the issues. This statement indicates that "uniqueness" may not be a sufficient explanation as to why a project is not working with KM. On the contrary, KM should contribute as much to a "unique" project as it would in a smaller, simpler project. Many of the interviewees shared this view, and stated that they knew the organization has performed several similar projects from which the project team could seek knowledge. Furthermore, all the interviewees but one had counterparts in another sub-project which they expressed was a possible connection for sharing experiences which are valuable and relevant for their daily work. However, very few had a continuous knowledge exchange with said counterparts in their daily work.

6.2 Turning tacit experiences into explicit, shareable knowledge

As was stated by Nonaka (1994), the way to create organizational knowledge is to make tacit experiences explicit, share, and then convert back into tacit knowledge of another organizational member. A tool to address this, as used by the case organization, is the digital experience log. In the company's written KM-strategy, the experience-log is listed as one of the main tools for gathering and sharing knowledge. However, as was mentioned by Bresnen et. Al. (2003) the difficulty to motivate the project team to use continuously use and update the databases available is one of the main key problems with IT/ICT in KM. This proved to be a big barrier in the case organization as well, as, in practice, very few of the project employees were even aware of its existence and it was not used regularly by anyone within the organization.

Therefore, firstly the question of the awareness of the log needs to be addressed. As only the interviewee responsible for collecting experiences for the log were aware of its existence, it must be concluded that not enough work has been done to spread the word of its existence. No clear responsibility is delegated down to the sub-projects, and the attempts to spread the word has been sparse. It seems that it is not sufficient for one employee being responsible for gathering the experiences and knowledge of such a big project team, and comprising it all into the log. Secondly, the format of the log needs to be discussed. During the interviews, it was discussed whether the format of the log (metadata etc.) is insufficient for its use – and that this is one of the biggest reasons that it is not used as much. The quality-coordinator suggested that the design should be revised in order to make it more user friendly before requesting the project team to work with it.

Another impression from going through the experiences in the log is that many of the inputs are similar to each other, and may address the same problems. This suggests that even the projects that are using the log to insert their experiences, may not have read through previous

inputs beforehand. This depicts a very one-sided collection of experiences – but no further sharing of the experiences.

When collecting inputs for the experience log, the project team has relied on a project review. According to the projects governing KM-documentation – a thorough project review should be performed only after project closeout. Project management have however chosen to perform one during the closing of the planning stage. As mentioned by Hanisch et. al. (2009), the type of knowledge to be shared is different for different project stages. Therefore, to ensure relevant experiences are shared – KM should be performed throughout the project phases – and not only during project closeout.

As mentioned by some of the interviewees, they experienced that a lot of changes were being made at late stages which were affecting the way they are to work. They stated that a lot of these changes were due to not enough time and resources being spend on learning from other projects what had worked and not – which has led to management being forced to implement the changes after the work has already begun. Some of the examples the interviewees mentioned were routines, templates, control plans etc.

When discussing knowledge exchange in project organizations, there is a tendency to focus on the tacit knowledge and experiences, as mentioned by Newell et. al. (2009). However, amongst the examples of what should already have been learnt from other projects during the early stages of the project, the interviewees mostly mentioned explicit types knowledge. Furthermore, when discussing which kind of knowledge is easier to standardize – explicit knowledge is easier to define and distribute (Nonaka & Takeuchi, 1995). If done at the right project stage – many changes would then be easier to avoid (Hanisch et. al. (2009). A good timing of KM-actions during the entire project lifecycle could therefore help ensure resources are not wasted or used inefficiently.

6.3 Informal knowledge exchange through Networks /Forums

As noted by Koskela (1992), informal and formal forums can be a powerful tool for knowledge sharing in a project. In the case project team, the forums were identified as one of the most prominent tools by the quality-coordinator. These forums/networks are basically an adaption of the CoPs, which were presented by Lesser & Prusak (1999). However, following the interviews, the impression is that the network and forums that has been set out for knowledge sharing between the different counterparts are highly dependent on someone being responsible for managing/administrating the network and highly dependent on the social relations between the network members. Furthermore, the fact that no one has been able to follow up the network gatherings has led to many of the initiatives running out in the sand. The question of administrative and overall responsibility for the forums were not brought up by either Koskela (1992) or Lesser & Prusak (1999), however, Lesser & Prusak (1998) encourage project managers invest resources in such forums as they can pay back dividends if managed correctly. By managing correctly, Lesser & Prusak (1999) mostly refer to making sure the CoPs have

access to the tools and opportunities to communicate – which they can do by investing tangible resources into the CoPs. However, they do not mention about time and commitment being invested from the management.

In the case project organization, it has proven difficult for the organization to manage the tool of the networks. Consequently, the forums were working differently for all the interviewees – for some they functioned effectively and for some they did not function at all. Across the organization, there are however informal groups formed where knowledge sharing comes natural, which may not necessary be the groups intended by the company. These forums were most commonly originated from the strong social bonds of its members.

The social bonds of the project members are affected by many things, such as closeness in the day-to-day activity, i.e. sharing knowledge with the people that are physically close to you, or the friendship and trust aspect that may characterize strong social bonds that has time to grow stronger, i.e. friendship from before the project start. The social aspects are hard to manage, as was also noted by Robinson et. al. (2001), as they cannot be changed by direct actions – but only through indirect measures and over a long period of time. The organizational culture does however have a big impact, as both noted by Hanisch et. al. (2009), as well as by the interviewees in the case study.

One of the difficulties in managing the social aspects has to do with that they are both affected by the organizational culture, but that they can also depend on the social life and personal-qualities of each of the organizations employees. These are of course hard for the organization to affect. As mentioned by the quality-coordinator, recruitments are not seen as a KM-action. The organization does however want to recruit employees with previous experiences from within the industry. However, as mentioned by Hanisch et. al. (2009), and Tan et. al. (2006), staffing of the project team can contribute with a unique opportunity for the project management to affect the social-bonds and informal networks of the project team. With the right person on the right place, it will be easier to ensure communication and knowledge exchange is carried out between the projects.

6.4 Individual responsibility in knowledge management

One of the topics discussed during the interviews was where the limit goes between individual and organizational responsibilities when it comes to knowledge management. On one hand, all of the interviewees accepted that they have part of the responsibility in maintaining a well-functioning KM-exchange within the project team as well as within the company. On the other hand, it does not seem sufficient for a company to rely so heavily on the individuals' role in a knowledge exchange that in the end is supposed to promote the organizations profitability/effectiveness. With this notion in mind, what is reasonable to leave to the individuals? And how much of the responsibility should be on the company as it should be them who gains the most from a well-functioning knowledge exchange.

As mentioned by Hanisch et. al. (2009), the knowledge sharing within a project is closely linked to the project management methodology and the communication practices in the project. Consequently, management plays a big role in the KM-work of the entire project team. This implies that a top-down system should be applied for knowledge sharing, meaning that someone in the organizations management should manage and be responsible for the knowledge exchange in the company. Hanisch et. al. (2009), does however not reflect more upon which role the individuals of the project team play in the organizational knowledge exchange, in this top-down perspective. At the same time, Bresnen et. al. (2003), propose that the lessons learned in construction projects are often tacit, intangible and context dependent, i.e. they are deeply rooted in context and are, according to Hislop (2013), deemed highly personal and subjective as they are based on experiences and emotional impressions. This is supported by the results from the case study. The findings from the actual knowledge work in the case study depict a more bottom-up approach to knowledge sharing, which in parts show a contrast to the theory presented by Hanisch et. al. (2009). This bottom-up approach, as opposed to a typical top-down perspective, suggest that everyone should be responsible for their knowledge exchanges, and that it is hard for management to interfere. It should also be noted that, for example, a KM-action can be easily reinforced, but not contribute very much. In other cases, the action is hard to reinforce, but it will contribute greatly to the knowledge exchange within the company. That means that some KM-actions needs to be decided upon by the management in the organization, and that responsibility cannot be left entirely to the individuals.

The patterns of feeling connection to different parts of the project team did to some extent also mirror the interviewees patterns of actively seeking knowledge. The more "introvert" were also the ones more likely to try solving the problem on their own rather than ask other sub-projects how they had dealt with the problem while the more "extrovert" were more likely to ask for guidance externally. Turning to people outside of the project for help could however result in not feeling as included in the internal works and decision-making within the project.

As mentioned by one interviewee, he was aware that the organization had a big database with experiences and knowledge which were available for anyone who knew where to look for it. Another interviewee did not feel comfortable navigating the databases, and therefore felt he missed out on a lot of knowledge.

The findings from the case study seems to support the theory in that IT/ICT-tools are necessary for a well-functioning knowledge exchange within the company, but that they are not sufficient for ensuring qualitative KM work (Hanisch et. al., 2009). It also mirrors the theory in that although a company may have an online knowledge sharing platform, it is often criticized for its reuse value (Tan et. al., (2006). The case organization has put a lot of work into collecting all the information and compiling it into databases available for all employees. However, when it comes to sharing the information – there are not very much work being done. This the responsibility on the individuals to either search for the knowledge on their own, or ask for it. Consequently, just like in the case of the digital experience log, the challenge lies with spreading the word and ensuring that the collected knowledge, experiences and tools reaches all the way out into the organization. As argued by Hanisch et. al. (2009), even the best IT/ICT-

tools will be insufficient if the corporate culture and routines does not support and encourage the usage of them. In order to achieve this, the organization needs to take on a more active role in spreading the word, instead of passively leaving it to the individuals.

6.5 The factor of closeness

Throughout the case- and the literature study, a common denominator that seems to affect the knowledge exchange in a project organization is closeness. Closeness in terms of similar professions, in terms of trust, or just the physical closeness that the team members experience from working in the same office. However, social, physical and/or emotional closeness provide both challenges and opportunities for the KM-work within the project team.

Challenges with physical closeness adheres to the fact that the project team is divided into several project offices around the city. For some of the interviewees, they expressed a closer bond with their fellow colleagues which were located at the same office. Of course, IT/ICT tools such as videoconference-platforms can help overcoming the geographical distance, but the lack of face-to-face communication complicates things as it will not build as strong sense of community (Lesser & Prusak, 1999) which could affect the closeness and knowledge exchange of those concerned.

However, one of the biggest challenges lies in, as previously mentioned, the social- and emotional closeness, as it is largely affected by the organizational culture – which may be hard for the organization to manage. As mentioned previously in the discussion, about individual responsibility in knowledge management, there is no clear line as to where the organizations responsibility for KM ends and where the individuals' responsibilities begins. Furthermore, closeness suggest that knowledge sharing should be performed and organized all the way down the lines in the organization, i.e. not only at managerial levels but at the bottom levels where its actual needs are more apparent. This also contrasts the more common perspective, where top-down managerial control is implied to manage the knowledge sharing systems.

An additional factor that adds to the challenge is the organizational structure, as the organization is largely built upon hired consultants. But does working with many consultants offer mostly challenges or a unique opportunity to manage the closeness of the project organization?

As previously mentioned, by Bresnen et. al. (2003) and Koskela (1992), the temporary-multi organizations which characterizes a project team, face additional challenges in organizational learning as they are, according to Hanisch et. al. (2009), characterized by discontinuous personnel constellations and work contents, a lack of organizational routines, a short term-orientation and a cross-disciplinary integration of internal and external experts. So, for this case study, the challenge of maintaining social closeness within the project team is even greater as the different consultants do not have the community of working for the same organization. The project organization is new for each project, which does not help foster strong bonds "from project to project" – but the project team basically starts from zero every time. However, this

statement may not be valid for all instances – if taken into account that many of the project members have met previously during their work on other projects. However, their role in the current project may differ-meaning that the new constellations can create new difficulties which will take them back to step one.

Furthermore, many consultants from the same consultancy agency within the project team may in fact help nourish the "teams within the team". It could however be argued whether this is good or bad. It may just be an informal group where knowledge exchange comes naturally, and therefore something to be encouraged. It could however also be negative as the consultant may have difficulties creating new, strong bonds outside of his/her already existing network of colleagues.

One big opportunity lies with the organization having the chance to focus on the social bonds more when recruiting. For example, one of the interviewees had a well-functioning network with his counterparts, largely due to the fact that they belonged to the same consultancy agency. Although the quality-coordinator stated this is not an outspoken KM-strategy in recruitments, it is always an underlying qualification whether the applicant has experiences from working with people in the project previously – as they would probably have recommendations of their previous accomplishments.

7. Conclusion

Individual responsibility does to some extent apply when working with knowledge management. In order to effectively perform their daily work, employees are expected to actively seek knowledge and to share experiences with their fellow colleagues. This is only natural for any organization. On another note, when it comes to organizational learning, it is the organization and not the individual who stands to gain the most from a well-functioning collection of their employees' experiences – which means that they should have an overall responsibility of making sure the KM-works within their projects are working. This can be done by providing the right tools, opportunities and forums for their employees to share their knowledge and to seek knowledge from others. This overall responsibility often leads to the traditional top-down perspective on managerial oversight being implemented for managing the organizations knowledge sharing systems. However, for knowledge sharing in project organizations – it may be more effective to implement a more bottom-up approach, as the lessons learned and knowledge shared is often deeply rooted in contexts, highly personal and subjective as they are based on experiences and emotional impressions.

Furthermore, the KM-work is largely affected by the closeness of the organization. Many tools could be introduced, but not function properly if the project member does not share social, physical and/or emotional closeness. These factors, which are connected to organizational culture, are hard to manage, but by implementing supportive actions, the organization can help strengthen the bonds between their employees. If investment in KM are placed appropriately, it could pay back in dividends.

For the case organization, the recommendation is to oversee the existing KM-tools that are already implemented in the organization, but not used by the project teams. By making them more user friendly, performing more thorough monitoring of whether they are being used and offering support for their employees to keep up the KM-work – they can come a long way with the already existing tools and practices. For this monitoring and support to be possible, it is not sufficient to have one single employee in charge of managing the entire project organizations KM-work, but the task and responsibility to support must be delegated to the sub-projects. In other words, a more bottom-up approach could help ensuring the organization is actively taking part in knowledge sharing practices.

Regarding the organizations digital experience log, it does not seem to be used the way it is intended to by management. The few entries that has been made are often similar to previously made entries, which depicts a very one-sided collection of experiences and no further sharing of the collected knowledge as no one seems to have read through previous entries before adding their own. One idea to make it more user friendly may be to create a way of linking the objects to one another, creating threads where the experience-inputs are followed up. For example, instead of creating an entirely new experience, the project can insert "We tried this suggestion, which worked well, but we also had to complement with this".

Lastly, the culture and attitude towards knowledge sharing and knowledge management needs to be adjusted. For knowledge management tools and practices to be successfully implemented in a construction project organization, they need to be seen as a tool – not a task.

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Appendices

1. Interview questions
The questions presented below make up a general foundation for the questions asked during the interviews. Each interview is adapted to the interviewee.

1. Tell me about your background and earlier experiences. Who are you and how did you get here?
    a. How can your background be connected to your current position?
2. Knowledge Sharing
    a. Why do you believe it is so important? In what contexts? Different phases of the project? What do you believe can be gained from knowledge sharing? Do you think there are any risks related to knowledge sharing?
    b. Internally in the project? Externally between projects?
3. What do you do when you come across a problem/challenge which you do not possess the knowledge/experiences to solve on your own?
    a. Who do your turn to? (internally/externally?)
    b. How do you find out to who you can turn?
    c. Can you think of anything that would have been helpful in such a scenario? (i.e. tools, counseling etc.)
4. Can you think of any tools you use in your daily work that are connected to Knowledge Sharing?
5. How do you experience you most easily take in knowledge? (i.e. meetings, direct communication, reading etc.)
6. How do you most often go about when sharing your knowledge with others? (i.e. knowledge that you believe others could benefit from)
7. Do you feel like the company you work for provide you with enough support/tools to easily find the information you need in your daily work? (i.e. handbooks, checklists, templates, contact information etc.)
    a. Do you use these tools? If yes, how? If no, why?
    b. Is there any support/tools you feel are lacking?
8. [If not yet brought up] What are your experiences with the organizations digital experience log?
    a. Have you come across the log in your work?
    b. If yes: How do you use it? When have you used it? In what context?
    c. Do you believe it is a good platform for knowledge sharing? Please elaborate.
9. According to you, do the company you work for work with knowledge sharing between its many projects?
10. Do you feel like it is hard to know what is going on in other projects?
1. Do you have any inputs as to how the knowledge sharing in the company can be improved?
    a. Internally in the project? Externally, between projects?
2. Is there anything you would like to add that you feel has been left out?