Can a Knowledge Sharing Model be built for the Construction Industry?

- A Case study of Knowledge Management at Skanska UK

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Abstract

Title: ”Can a Knowledge Sharing Model be built for the construction Industry? – A Case Study of Knowledge Management at Skanska UK”

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Issue of study: Knowledge management is recognised as an essential part of company strategy, with the potential to generate significant competitive advantage. The theoretical basis of knowledge management is well developed, however the practical implementation is not well adapted with regards to construction organisations. More research with a practical perspective regarding knowledge management was therefore considered needed.

Purpose: The purpose of the thesis is to contribute to a deeper understanding how to manage knowledge sharing within a large construction company, by developing a framework for knowledge sharing.

Methodology: A case study has been conducted at Skanska UK, where interviews, observations and surveys have been conducted, at the majority of the Skanska UK departments. The thesis is conducted in an abductive approach where theories regarding knowledge management, change management and network-theory have resulted in a framework called Effective Knowledge Sharing Model.

Conclusion:

The thesis has resulted in the model; Effective Knowledge Sharing (EKS). The model can be used as a guide for large project based organisations when implementing knowledge sharing systems. It can also be used as a tool when evaluating current knowledge management systems within large project based organisations. The EKS model shows how organisations should think when applying knowledge sharing systems. The four dimensions; knowledge boundaries, learning processes, technical boundaries and change/implementation management together with cultural influence and "what kind of knowledge to share" constitute the framework and each dimension include factors and steps contributing to effective knowledge sharing.

The main conclusion when working with the wide subject of knowledge management is that defining which kind of knowledge should be shared, and how to share it is of greatest importance. The main conclusion when applying the EKS model at Skanska UK, is that there are many different knowledge sharing systems existing within the organisation, but they are lacking both regarding how they were implemented and how they are constructed to be used. The knowledge management systems are focused on explicit knowledge and tacit knowledge sharing is lacking.

Another conclusion for this study has been that each dimension regarding knowledge sharing needs to be considered in symbiosis to enable effective knowledge sharing, and all dimensions need to work together to foresee the synergies.

Keywords:

Knowledge Management, Change Management, Knowledge Management System, Knowledge, Network-theory, Implementation

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Glossary

Skanska AB	*The global Skanska AB corporate group.*
Skanska UK	*The UK branch of Skanska AB.*
Knowledge	*Knowledge is defined as both explicit and tacit knowledge.*
Information	*In this thesis information is defined as knowledge since information can be shared through documents and therefore has an explicit nature, as well as being shared during meetings and therefore also has a tacit nature.*
System	*A system is defined, in this paper, as a computer based system where it is either possible to search for, add or edit information both including document and processes. In this paper the definition of a system also include instant message programs and similar systems where one can contact or/and search for other employees, with intention to share or gain knowledge.*
Knowledge Management System	*System used for Knowledge Management, defined as a system where individuals can store, change or edit knowledge. The definition also includes systems where individuals can contact each other with the intention to share or acquire knowledge.*
Bids and tender	*Tender refers to the process whereby governments and financial institutions invite bids for large projects that must be submitted within a finite deadline.*

Table of content

1. Introduction

The following chapter provides a background and underlying reasons for the thesis, consisting of general reasons as well as the specific reasons expressed by Skanska UK. Followed by the relating issue of study, purpose, delimitations, target audience and disposition.

1.1 Background

"Not only is the effective management of knowledge argued to be a critical element of the innovation needed to be successful, knowledge management is, of itself, a major innovation." (Grant, 2012)

There are extensive academic research and studies made in the field of knowledge management, and it is regarded an area of great importance and a issue in which companies have been investing plenty and receiving quite varied results (Grant 2012). The benefits of good knowledge management have long been recognized, for example in project-based organisations. Therefore the ability to manage what the organisation knows has become crucial and an effective understanding of knowledge management has become essential.(Ajmal & Koskinen, 2008)

The area itself is nothing new and can be traced back at least 50 years (Lambe, 2011). It is viewed as a combination of at least four different knowledge fields; the recognition of the importance of intellectual assets or capital, the concept of the learning organisation, the existence of communities of practice and the evolution of its applications including interpersonal communications and unstructured data storage and sharing (Grant, 2012).

Nowadays knowledge transformation is everywhere, in particular in areas of the so-called Web 2.0 and Enterprise 2.0, which facilitate the types of interactions that support knowing in practice. These developments led Time Magazine in 2006 to nominate the person of the year as "You". Web 2.0 is a term used to describe the new type of software that allows users themselves to create content and share directly with each other, whether through social networking sites like Facebook, Myspace, Youtube and LinkedIn, or through wikis and blogs. (Newell, Robertson, Scarbrought, & Swan, 2009)

At an organisational perspective the area of Knowledge Management Systems (KMS) assume that valuable knowledge, possessed by people can be identified, captured and processed via the use of information and communication technology (ICT) tools and turned into outputs. The focus is to make knowledge widely available for people to use frequently in order to become more efficient (Jennex & Olfman, 2003; Scarbrough & Swan, 2001). In Australia, Xu and Quaddus (2005) made a survey that

reports that 70 per cent of the 1500 companies participating indicated that they had some type of KMS.

The widespread usage of knowledge management indicates that there is plenty to gain from using and developing it further. The integrated nature of a KMS aiming to facilitate knowledge sharing across organisations indicates that ideally user representatives from different parts of the organisation should be involved in the implementation project. However, given the complexity of such system, it is perhaps not surprising that many organisations struggle with their ICT projects (Standish group, 2007). The Standish group (2007) estimated that 70 per cent of all IT projects relating to knowledge sharing fails. Many other researchers have also highlighted the difficulties with knowledge sharing across organisations. In a study made by Davenport (2005) it was establish that only 44 per cent of the respondents felt that the information they found in their existing KMS was useful to them. Davenport (2005) continues by showing that 26 per cent felt that e-mail was over-used in their organisation; even 15 per cent felt it was reducing their productivity. Successfully implementation of a so-called "knowledge processing" system like SharePoint, therefore requires managing organisational change (Newell et al., 2009).

There are a number of reasons explaining the difficulties with KMS, Newell et al. (2009) lists a few: difficulty to express the knowledge in writing, uncertainty with some knowledge, context-dependency, cost, politics in the way that some knowledge are too sensitive to share.

In relation to the storage and transfer processes, two different types of KMS can be contrasted: McAfee (2006) describes these as "platform" and "channel" technologies; while Alavi (2000) describes these as "network" and "repository" technologies. Channels or network technologies can be used when an individual needs information or knowledge on something specific from another individual. In other cases individuals or groups does not know what they need to know, this is when a platform or repository technology (e.g. internet) can be used so people can store and search for information as they need it (Newell et al., 2009).

A significant tradition has been developed in understanding such technologies as fundamentally social objects (Bijker, Hughes & Pinch, 1987; Weich, 1990). Individuals and groups both shape the design and the adoption of technologies depending on their interests and perspectives (Bijker et al., 1987). Users also shape the way technologies are used in everyday practice because most technologies can be used in multiple ways (Orlikowski, 2000). Other institutional theorists alert us that social pressures for legitimacy drive the adoption of technologies. Once a technology becomes very popular it will be hard for an individual to resist it without appearing to be out-of-touch (Newell et al., 2009).

1.1.1 Background to Knowledge Sharing at Skanska UK

The thesis is partly based on findings from Phil Taylor's work, "Enabling successful knowledge transfer across a large construction organisation" from 2012.

Taylor (2012) points out that social media is one source of knowledge transfer and that the awareness of the benefits related to this type of transfers is increasing within companies and employees with systems like LinkedIn, Jammer, Google+ and so on. Taylor (2012) also points out that the direct benefits from such networks can be hard to identify. Skanska UK was used as case company, where Taylor (2012) conducted an extensive survey focusing on where and how people gain information. The survey was completed by senior management level of business associated with project delivery, such as Project Managers, Construction Managers, Commercial Managers, Procurement Managers and Senior Design Engineers. Taylor (2012) chose these different areas of expertise because these disciplines are either the main hosts or seekers of construction knowledge within the organisation.

The key findings were that there is a large understanding within the organisation that knowledge is important. 100 per cent of the respondents to the survey answered that they believed that they required new knowledge and that knowledge transfers existed on regular basis within the company in an unstructured way. The study discovered that the majority of people prefer to gain knowledge from colleague or contact from within their discipline or outside their discipline. (Taylor 2012)

Taylor (2012) points out that the two key construction phases where a business needs a robust knowledge transfer process is through the bidding phase and the phase of moving in to new markets. The reasons being that these areas are knowledge transfer intensive. Taylor (2012) also concluded that a greater and more extended knowledge transfers system within Skanska UK can both aid the business goals and help the on-going knowledge transfer to occur more efficient.

1.2 Issue of study

Knowledge management is increasingly being recognised as an essential part of company strategy with the potential to generate significant competitive advantage. The theoretical basis of knowledge management is well developed, however the practical implementation is not well developed with regards to construction organisation. This can be explained by the evolving nature of knowledge management tools, the complexity of construction companies and the on-going shift from provision of products to provision of expertise.

Skanska UK has carried out research regarding existing knowledge transfer within the UK business (Taylor, 2012) and has also implemented a Global Knowledge Sharing Strategy (GKSS) based on people-to-people knowledge transfer. It is believed that business benefits can be achieved by enhancement of the people-to-people knowledge transfer, and development of people-to-documents transfer. The specific benefits targeted are:

- Support work winning by mobilising compelling information about Skanska's ability to meet customer requirements.
- Reduce bid costs by improving the efficiency related to mobilisation of knowledge.
- Reduce project delivery cost through dissemination and greater use of innovative solutions and techniques leading to increased operational efficiency.
- Generate innovative customer offers, through improved communication regarding consumer requirements.
- Reduce project risk through better identification and mitigation of hazards.

In order to fulfil the purpose of the thesis an introduction to knowledge management is considered to be a necessity. Area of Change Management is also important due to the vast number of possible changes relating to new knowledge management strategies. The third theoretical are considered needed is network theory, due to the complexity with large organisational interactions. The thesis will therefore take its starting point in the following theoretical areas: figure 1.1.

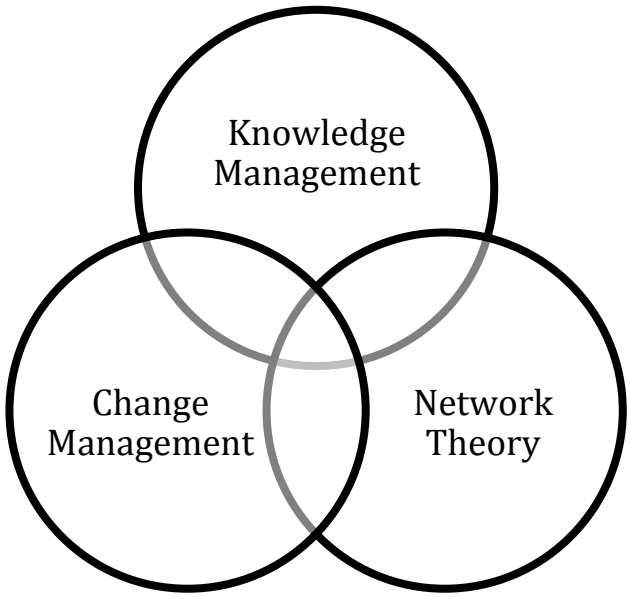

Figure 1.1: Theoretical framework

1.3 Purpose

The purpose of the thesis is to contribute to a deeper understanding of how to manage knowledge sharing within large project based organisations, by developing a framework for knowledge sharing.

1.4 Delimitations

One limitation of this paper is the focus on one construction organisation, however the lessons learned will have relevance to a wide range of organisations inside and outside of the construction industry. The paper focuses on knowledge sharing within large companies, and one delimitation is not to discuss the differences when applying the framework to smaller companies.

Many of the theories discussed, include different perspective concerning how to approach each respective subject. In the thesis the different perspective relating to each subject will be presented, however the thesis will not participate in the debate of pros and cons regarding the these different perspectives.

Delimitations of the theses can be seen in figure 1.2.

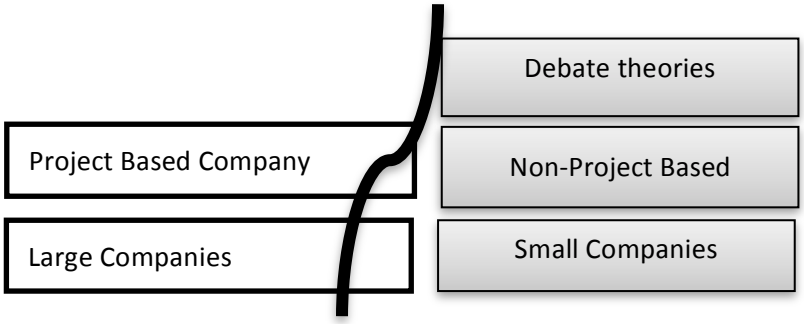

Figure 1.2: Delimitations

1.5 Target Audience

The target audience are individuals with interest to the subject, employees at Skanska AB and other companies planning to develop their knowledge management strategy. The thesis wishes to target a wide audience and is therefore written with an adopted educational approach.

1.6 Disposition

The disposition of the thesis is shown below, each chapter starts with a brief introduction of the focus of the chapter.

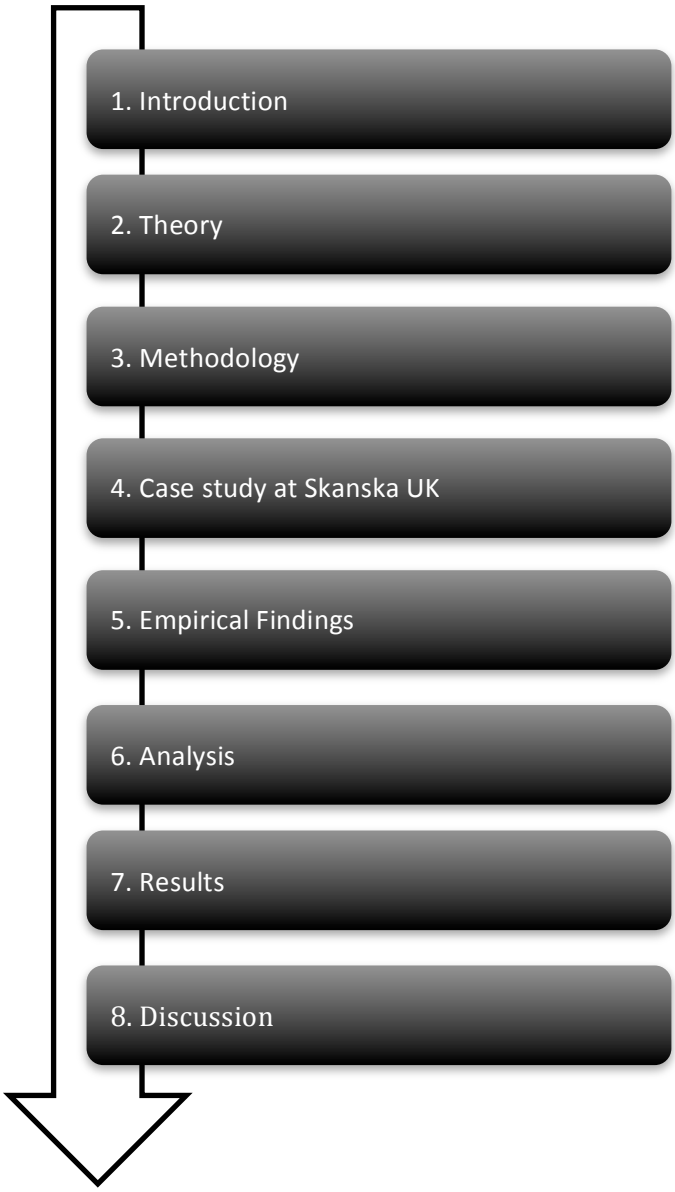

Figure 1.3: Disposition

2. Theory

The following theoretical chapter will cover four different fields of theory relating to knowledge sharing: Knowledge Management, Theory regarding Learning Processes, Change Management and Network Theory. Finally the theoretical chapter is summarised and results in the theoretical framework that will be the foundation for the empirical study.

2.1 Knowledge

Philosophers have been wrestling over what knowledge is since the classical Greek period resulting in a whole branch of philosophy called "epistemology". Epistemology deals with and debates on the nature of knowledge, where two views stands out; "epistemology of possession" treating knowledge as something people have, and "epistemology of practice" treating knowledge as something people do.(Cook & Brown, 1999)

"Epistemology of practice"
Those adopting the view of epistemology of possession view knowledge as a cognitive capacity or resource that can be applied and used to improve the effectiveness in the workplace. Knowledge, considered to be divided in a hierarchical order consisting of: comprising data, information, knowledge and even wisdom. (Ackoff, 1989)

"Epistemology of possession"
Knowledge according to the epistemology of possession is seen as a personal property of the individual knower, who is able to confer meaning on data and information by drawing her own subjective experiences, perceptions and previous understandings. In this sense knowledge is considered "possessed" by individuals, and therefore it is reasonable to suggest that different people, with different pasts, interfere differently from the same information (Newell et al., 2009). The view of "knowledge as possession" is implicit in much of what is written about managing knowledge work e.g. Nonaka (1994).

2.1.1 Explicit and Tacit knowledge

Knowledge can be divided up in to different types of knowledge, there are however two fundamental areas explicit and tacit knowledge (Polanyi, 1966).

Explicit Knowledge

From the Latin meaning "to unfold" or to be able to open, in other words to explain. Explicit knowledge consists of facts, rules, relationships that can be stored, coded and transmitted to others without any further explanation and are often presented in documents and manuals. (Steward, 2001)

Tacit Knowledge

Has a subjective and intuitive nature, knowledge that people posses but that is difficult to transfer to others in writing or verbal. The Latin definition of tacit knowledge means, "to be silent". (Steward, 2001; Polanyi, 1966)

Tacit Knowledge (Subjective)	Explicit Knowledge (Objective)
Knowledge of experience (body)	Knowledge of rationality (Mind)
Simultaneous knowledge (here and now)	Sequential knowledge (there and then)
Analogue knowledge (practice)	Digital knowledge (theory)

Table 2.1: Summary Tacit and Explicit Knowledge (Steward, 2001)

2.1.2 Knowledge on an individual and collective level

According to Spencer (1996; 1998) social knowledge can exist beyond the individual; hence it is possible to make a "contrast between the explicit knowledge that individuals feel they possess and the collective knowledge on which this explicit knowledge actually stands, and the interaction of the two". Spencer (1998) argues that collective knowledge is not dependent on certain individuals. This knowledge is also considered to be the most valuable knowledge to a company, since it can be very hard to imitate and therefore become a competitive advantage.

Another author Blackler (1995) agrees with Spender that there are different kinds of knowledge both in individual- and collective levels. However, according to Blackler (1995), this knowledge can be more or less explicit, giving rise to a fifth knowledge, encoded knowledge. What Blackler (1995) tries to illustrate, is that different types of knowledge dominate in different types of organisations. More dynamic, innovative firms will rely on either encultured knowledge, if they are communication intensive or embedded knowledge if they on the other hand are mostly dependent on the knowledge and expertise of the individual's employed.

2.2 Learning

There are many different explanations of how individuals learn and process information. One is that the mode of learning is defined by combining a type and level of learning. The types refer to individual and collective mechanism through which knowledge and capabilities are developed, shared and incorporated in to practices. The Levels of learning refers to the nature of the feedback effect attached to a particular type of learning, which affects the organisation's capabilities. (Boerner, Macher, & Teece, 2001)

Another explanation is presented by Grant (2012), he refers the context of learning to the architecture of interactions between individuals. Given examples are hierarchical relationships, formal and informal ties, trust relationships and decentralized interactions. He also refers to the quality of the knowledge created and exchanged by people, tacit knowledge, explicit knowledge, strategic knowledge and on the artefacts used by the organisation, communication technologies, documentations and technical systems.

Further, Argyris & Schon (1978) developed the work of Bateson (1972) and proposed a *three-level* evolutionary model for different levels of learning:

Level 1: Single-Loop Learning
This adoptive level of learning involves detecting and rectifying errors or expectations within the scope of the organisation's existing practices. This is done in order to ensure that its objectives are met in order to detect and correct in advance. However, this would not feed back into the questioning of, or amendment of the organisation's original objectives.

Level 2: Double-Loop Learning
This concerns going beyond correcting variance in standards and targets and instead involves challenging the appropriateness of the organisations basic norms, values, policies and operating procedures that create these norms and standards in the first place. This reconstructive learning typically involves questions like outsourcing new behaviour.

Level 3: Triple-Loop Learning
This involves questioning the rationale for the organisation and, in the light of this, radically transforming it. A typical example of this might be a traditional manufacturing organisation attempting to reinvest itself as a company with all the implications for culture, structure and practices that such move should require. (Argyris & Schon, 1978)

2.2.1 How organisations learn

"A learning organisation is an organisation skilled at creating, acquiring, and transferring knowledge, and at modifying to reflect new knowledge and insights."(Garvin, 1993)

Teece, Pisano and Shuen (1997) contended that organisational learning provides organisations with effective means to develop new capabilities. They argue that scholars consider learning as a process that fosters the creation, storage, dissemination and exploration of tangible and intangible resources within the firm. Learning which comes along with the acquisition and exploration of new knowledge drives most organisational change. In line with fore going the authors suggest that organisational learning is tightly connected to the creation, integration and dissemination of individuals as well as collective capabilities.

Following Teece et al. (1997) the concept of capability "*emphasizes the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organisation skills, resources and functional competence to match the requirement of a changing environment*" (Prahalad & Hamel, 1990). The authors claim that the previous definition insists that the role played by managers in identifying, exploiting and renewing strategic knowledge assets within the firm, and on the managerial mechanism generate sustainable competitive advantage.

There are a few aspects of organisational learning that most writers would agree upon:

- An organisation's survival depends on its ability to learn at the same pace or faster than changes in its environment.
- Learning must become a collective and not just an individual process.
- There must be a fundamental shift towards system or triple-loop thinking by the organisation's members. (Burnes, 2004)

2.2.2 Organisational learning

A well-known explanation of organisational knowledge is made by Nonaka and Takeuchi (1995). They argue that for tacit knowledge to be communicated and shared through the organisation it has to be converted in to words and numbers that everybody understands. It is precisely during this process that the conversion from tacit to explicit and back again that the organisational knowledge is created. The author's view of tacit and explicit knowledge is that they are not totally separate but mutually complementary entities. They interact with and interchange into each other in the creative activities of human beings. They claim that knowledge creation can be expanded through social interaction between tacit and explicit knowledge.

Nonaka and Takeuchi's well-cited "SECI"-model regards knowledge creation as a spiralling process of interactions between the knowledge types explicit and tacit. The authors identifies four knowledge conversion processes where knowledge creation could take place; socialization, externalization, combination and internalization. (Nonaka & Takeuchi, 1995)

Socialization: from tacit to tacit

Socialization is a process of sharing experiences and thereby creating tacit knowledge such as shared mental models and technical skills. There is no need for using language when acquiring knowledge in this process, and illustrating this, one example of socialization is when an apprentice is working with his master, he learns not through language but through observations, imitation and practice. These same principles are used in today's business on-the-job training. Experience is the key to acquire tacit knowledge. Experience is however often inadequate, inconsistent, and insufficient. Such gaps between images and expressions, however, help promote "reflection" and interaction between individuals. (Nonaka & Takeuchi, 1995)

Combination: from explicit to explicit

Combination is the transfer from explicit to explicit forms of knowledge. This model involves people combining different bodies of explicit knowledge such as documents, meetings, phone calls, conversations, or computerized communication networks. New knowledge can be created through reconfiguration of existing knowledge, for example explicit knowledge such as computer databases can be sorted, re-categorised, information can be added or combined, all can lead to new knowledge. Knowledge taught in formal education and training in school usually takes this form. (Nonaka & Takeuchi, 1995)

Externalization: from tacit to explicit

Externalization is a process of articulating tacit knowledge into explicit concepts; these will take place in forms of metaphors, analogies, concepts, models or hypotheses. When individuals attempt to conceptualize an image, they express its essence mostly in language; writing is an act of converting tacit knowledge in to explicit (Emig, 1983). Nonaka and Takeuchi (1995) claim that much externalization is done when creating a concept of something that is understood to be correct. Externalization mode of knowledge is often seen in the process of concept creating and is triggered by dialogue or collective reflection. This makes externalization often presented as metaphors and, or analogy. Examples are often found in design philosophies, for example Honda's expression for "man maximum, machine minimum" expressed to conceptualize the design of the Honda City, from which they designed a tall and short car.

Internalization: from explicit to tacit knowledge

Internalization is the transfer from explicit knowledge to tacit knowledge; it is closely related to "learning by doing". When experience through socialization, externalization and combination is internalized into individual's tacit knowledge base, they become valuable assets. By using technical knowledge, such as documents or networks as a way to gain knowledge, and then by implementing the new knowledge people can gain further knowledge of the activity through experience, which is an example of internalization. Internalization can also occur even without having to "re-experience" other people's experiences. One example is when reading or listening to a success story, triggers the reader to feel the realism and essence of the story. The experience that took place in the past may change into a tacit mental model, which is use in the future. (Nonaka & Takeuchi, 1995)

The content of the knowledge conversation created in each mode is by nature different. The output from each different mode is; socialization yields, which the authors call "sympathized knowledge," such as, shared mental models and technical skills. Externalization outputs "conceptual knowledge". Knowledge created through metaphors of concept. Combination gives rise to "systemic knowledge" such as a prototype and new component technologies. Internalization produces "operational knowledge" about project management, production processes, new product usage and implementation. These contents of knowledge interact with each other in the spiral of knowledge creation. (Nonaka& Takeuchi, 1995)

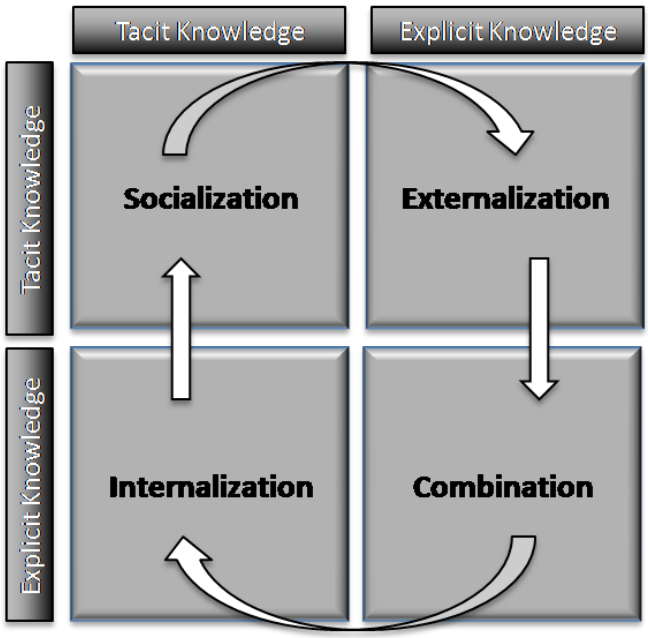

Figure 2.1: The Knowledge Creating Spiral (Nonaka& Takeuchi, 1995)

Organisational conditions for knowledge transfer

Ambiguity and redundancy are organisational conditions that have to be taken in consideration in order to enhance the knowledge-creation process. Ambiguity can prove useful at times not only on sort of a new sense of direction, but also a source of alternative meanings and fresh way of thinking. In this respect, new knowledge is born out of chaos. (Nonaka & Takeuchi, 1995)

Redundancy plays an important role in management of the knowledge-creation process, because it encourages frequent dialogs and communication. This helps create a "common cogitative ground" among employees and thus facilitates the transfer of tacit knowledge. Since members of the organisation shares overlapping information, they can sense what others are struggling to articulate. Redundancy, which takes place primarily in information sharing, spreads explicit knowledge through the organisation so that employees can internalize it. Further ambiguity and redundancy is considered by Nonaka& Takeuchi (1995) to be some of the reasons why Japanese companies manage production development as an overlapping process, in which different functional divisions work together in shared labour divisions. Another unique feature that the Japanese companies had was the sense that no single department or group of experts has the exclusive responsibility for creating new knowledge. Front line employees, middle managers, and senior managers all play a part in the creation of new knowledge. New knowledge is the product of the dynamic interaction amongst them. (Nonaka & Takeuchi, 1995)

Criticism against the SECI model

The view from Nonaka and Takeuchi (1995) that tacit knowledge can be converted into explicit knowledge is roundly attacked by proponents of the "epistemology of practice" (Brown & Duguid, 1995; Gherardi, 2001; Lave & Wegner, 1991; Nicoli, Gherardi, & Yanow, 2003; Orlikowski, 2002). These authors states that knowledge is constructed and negotiated through social interaction, and therefore intrinsic to the localized social situations and practices that people perform. They claim that knowledge therefore cannot stand out from those practices, and that people from all kind of social groups do not learn things by converting tacit knowledge into explicit knowledge, but rather from sharing and creating all kind of norms, stories and symbols which enable the experience of individuals to be related to the knowledge of the wider community.

2.2.3 Barriers to Knowledge Sharing

"A final problem … is actually getting users to be interested in participation. This lack of engagement is a reflection of human nature, where we only become interested in something when it is salient to us and when we can actually begin to learn about the technology through practice and participation" (Wenger, 1998)

Knowledge and Learning Boundaries

When understanding problems associated with exploiting[1] and sharing knowledge, it is relevant to make a distinction between knowledge boundaries and learning boundaries. The difference can be expressed as the more radical the problem-solving is within a particular project, the harder it is for the organisation to learn from that particular project. Another way of expressing this is, the more knowledge boundaries that have been overcome within a project, the greater the learning boundaries between the project and the organisation will be (Newell et al., 2009). At organisational level no organisation of any scale would survive for long if every situation was treated as an opportunity to learn and do things differently. In projects however, this is exactly what is expected, and if nothing new was expected a project would not be set up. The problem is that the new practices that are set up are so different from the other parts of the organisation that it becomes difficult for the organisation to learn from the project. Such learning boundaries help to explain some of the difficulties with transferring knowledge across projects or from projects to the whole organisation. (Newell et al., 2009)

Syntactic, Semantic and Pragmatic Boundaries

Carlile (2002: 2004) developed a framework explaining three kinds of boundaries for knowledge sharing*: syntactic, semantic and pragmatic* boundaries. The first type of boundaries, the *syntactic*, refers to the possibility for two people with different backgrounds to interpret symbols, labels, grammar or language differently. Once recognised, the boundary is fairly easy to overcome through creating a common language where the sender can represent their knowledge in a way that a receiver will understand. (Newell et al., 2009)

Semantic boundaries refer to different meanings and accepted interpretations among actors. The critical step to overcome this boundary is to make the individuals recognize these differences so that unique thoughts from different actors of knowing are made visible and therefore accessible to others. For example when an engineer is speaking to a lawyer, the engineer might have to take the perspective of the lawyer trying to explain the risks with a certain technical solution so that the lawyer can understand. (Boland & Tenkasi, 1995; Newell et al., 2009)

The final boundary is *pragmatic*, created by differences in interests between people. Even if people communicate with each other, they might still not agree on the best solution. According to Carlile (2002, 2004) this occurs when people have different interests and incentives. Under these circumstances the interest of one individual might have negative impact on another.

[1]Knowledge exploitation = improving the existing knowledge in order to enhance efficiency. Knowledge exploration = create knowledge (Newell et al., 2009)

Knowledge-Sharing in Reality

Even though many boundaries are acknowledged, organisations still consider knowledge sharing to be of great importance (Cardile 2002, 2004; Von Kroght, Ichijo, & Nonaka, 2000; Newell et al., 2009; Boland & Tenkasi, 1995; Brown & Duguid, 2000; Dodgson, 1994). Organisations are therefore developing practices aiming to exploit knowledge that is created within projects, for example maintaining documentation and concluding lessons learned (Raelin, 2001). These reviews are often done after a certain amount of time or a reached milestone (Kotnour, 1999). Knowledge is therefore facilitated in these documents and put out for everyone to search trough. In this way knowledge and learning are assumed being shared across projects (Sharp, 2003).

However, this kind of documentation has been reviewed not very helpful (Von Zedtwitz, 2002; Keegan & Turner, 2001; Kotnour, 1999). One reason for this is time pressure (Keegan et al., 2001). It is also evident that even when time and data are sufficient, there are limits to how many lessons that are actually learnt (Kotnour, 1999). Some of the main reasons for this lack of knowledge sharing and learning are:

- ✓ *Belief in uniqueness of context:* Even though there might be projects of similar nature within an organisation, individuals do not necessary see the connection between the projects.

- ✓ *Standardisation:* While some projects are seen as unique other are considered standard. For example in a construction company where many projects are repeated, routines may work well when a project fits the normal template. However if a project differs from this template, the standard procedure may become an inhibitor rather than a facilitator. Knowledge sharing in these projects is often considered not to be necessary due to the belief that the project is unique and therefore not suited to develop standard procedure.

- ✓ *Ability to capture and access "softer" lessons*: Softer learning, like lessons learned regarding work processes, is often found difficult to share.

- ✓ *Project reviews and milestones:* Even if there is a process of doing project reviews, these are not done systematically or with any real emphasis to learning. There is often a time lag between the actual project and the project review leading to the implication that employees have moved to another project and might therefore not be interested or have time to review the project properly any longer.

- ✓ *Lack of awareness that knowledge transfer is needed:* People are considered to mainly seek knowledge when they recognize they lack information about

a specific problem, and are therefore not aware that knowledge is important to pass on to others. (Newell et al., 2009)

2.3 Change Management

The reason to focus on change management is that change is an on-going process within the organisation that affects all the processes and daily work. Burnes (2004) states: *"Organisational change cannot be separated from organisational strategy, and vice versa."*

Another reason given by Dawson (2003) is that research in change management is connected with the strive for success and to gain or sustain competitive advantage. Further Dawson (2003) also argues that one of the key issues is to understand when to change: "It is as important to recognise when not to change as it is to identify when there is a need for change." Changes are inevitable and change initiatives should not be questioned but embraced, since they are vital to the success of any organisation.

2.3.1 Managing change: Individual, Group Dynamics and Open Systems School

There are *three* central pillars on which change management theory stands:

- *The individual perspective school*
- *The group dynamics school*
- *The open systems school* (Burnes, 2004)

The individual perspective explains change management in terms of individual behaviours. Group dynamics emphasise change through groups and teams, and open systems approaches advocate whole organisation interventions (Burnes, 2004).

The Individual Perspective School
The supporters of this school are split into two camps: The Behaviourists and the Gestalt-Field Psychologists. The Behaviourists view behaviour as resulting from an individual's interaction with their environment. Gestalt-Field Psychologists on the other hand, suggests that this only is a partial explanation. In addition, they believe that an individual's behaviour is the product of the environment. Both groups of the individual perspective school have proved influential in the management of change. This combining of extrinsic and intrinsic motivators owes much to the work of the Human Relations movement, especially the work of Maslow (1943), which stresses the need for both forms of stimuli in order to influence human behaviour. (Burnes, 2004)

The Group Dynamics School
Its emphasis is on bringing about organisational change through teams or work groups rather than individuals (Bernstein, 1968). The rationale behind this is

according to Lewin (1948) that people in organisations work in groups, individual behaviour must therefore be seen, modified or changed in the light of the group. Lewin (1948) argues further that group behaviour can be seen as an intricate set of symbolic interactions and forces that not only affect group structures but also modifies individual behaviour. Individual behaviour is therefore a function of the group environment.

It is useless to concentrate on changing the behaviour of individuals when conducting change according to the Group Dynamics School. The individual on its own is constrained by group pressures, and the focus of change must be at the group level and should concentrate on influencing and changing the group's norms, roles and values. (Cummings & Huse,1989; French & Bell, 1984; Smith, Beck, Cooper, Cox, Ottaway, & Talbot, 1982)

For the dynamic school it is important to analyse the group's implicit (informal and unwritten) and explicit (formal and written) norms (Burnes, 2004). The group dynamics school has proven to be very influential in developing both the theory and practice relating to change management. This can be seen by the very fact that it is now common for organisations to view themselves as comprising groups and teams, rather than merely collections of individuals (Mullins, 1989).

The Open Systems School

The open systems school view organisations as composed of a number of interconnected sub-systems and whose primary point of reference is the organisation in its entirety. It follows that any changes to one part of the system will have an impact on other parts of the system, and in turn on its overall performance (Scott, 1987). The open systems school's approach to change is based on a method of describing and evaluating these subsystems, in order to determine how they need to be changed in order to improve the overall functioning of the organisation. (Burnes, 2004)

The open systems school is concerned with understanding organisations in their entirety and therefore attempts to take a holistic rather than particularistic perspective, which also is reflected in their approach to change. Burke (1980) displays *three factors* that are necessary to consider when conduction change according to the open systems view*:*

Factor 1: Sub-systems are independent. To be able to avoid sub-optimal outcomes, alterations need to be made in the whole organisation and not in one single department.

Factor 2: Training as a change mechanism is unlikely to succeed on its own. "Although training may lead to individual change and in some individual cases to

small group change, there is scant evidence that attempting to change the individual will in turn change the organisation"

Factor 3: In order to be successful, organisations have to tap and direct the energy and talent of their workforce. This requires removal of preventative obstacles and provision of positive reinforcements. It is also important that the approach is organisational and not focused on an individual or group, in order to change norms, reward systems and work structures that are likely to need changing.(Burke, 1980)

Shortcomings to the open systems perspective have been highlighted. Butler (1985) and Beach (1980) point out "Social systems are extremely dynamic and complex entities that often defy descriptions and analysis. Therefore, one can easily get lost in attempting to sort out all the cause-and-effect relationships". Despite the criticism, the level of support for this approach, from eminent theorists such as Burns and Stalker (1961),Lawrence and Lorsch (1967) and Woodward (1965), is formidable, which is why it has been proven so influential.

Organisational-, Group- and Individual- Level of Change

There are different levels of change, which can be analysed and identified: organisational level, group level and individual level (Cummings & Worley, 2005).

Individual-level analysis is emphasised as making an important contribution to critical understanding about change management. However, it is the most challenging and least tangible level of analysis, since it is much easier to write and think in terms of how a group or an organisation changes than in terms of the disparate individuals that make up groups and organisations. This caveat highlights the difficulty of a truly individual level of analysis, particularly in a large organisation (Hughes, 2006). Other authors that agree are for example Duck (1993). He claims that:

"For change to occur in any organisation, each individual must think, feel, or do something different".

This combined with Morrison (1994) thoughts "For organisation to change, people must change. For leaders to help people change, they do not need to understand change - they need to understand people" highlights the importance of change on an individual level.

Economic has played an important role in shaping our academic understanding of strategy. Change management is often addressed strategically and change management textbooks may directly reflect such an orientation. In terms of levels of analysis, strategy is most useful explaining organisational-level change, a potential shortcoming may be that in focusing at the organisational and sector levels, the

involvement of groups and individuals may be given low priority. There are as many perspectives on change as people in the organisation affected (Willcocks & Manson, 1987). Willcocks et al. (1987) and Burnes (1996) has emphasised that there is not one best way to manage change (Hughes, 2006).

2.3.2 Organisational Change

Planned Organisational Change

Planned change is a term first stated by Lewin (1947), and few scientists have received the level of praise as Lewin did (Ash, 1992; Bargal, Gold, & Lewin, 1992; Dent & Goldberg, 1999; Dickens & Watkins, 1999; Schein, 1988; Tobach, 1994;). Lewin (1947) defined Planned organisational change in order to distinguish change that was consciously launched and planned by an organisation, as averse to types of change that might come about by accident, by impulse or that might be forces on an organisation (Marrow, 1969).

A central theme in the work from Lewin (1947) is the view that "…the group to which an individual belongs is the ground for his perceptions, his feelings and his actions" (Allport, 1948). Lewin (1947) claims that group behaviour is an intricate set of symbolic interactions and forces that not only affect group structures, but also modify individual behaviour. Therefore, individual behaviour is a function of the group environment. Lewin (1947) stated that a field always is in a state of adaption and that "Change and constancy are relative concepts, group life is never without change, merely differences in the amount of and type of change exist". Lewin (1947) used the term "quasi-stationary equilibrium " to indicate that a the process and behaviour of a group might have a pattern to their behaviour, but that these tend to fluctuate constantly mowing to change relating to the circumstances that impinge on the group. Lewin (1947) developed a framework for change based on three different steps:

Figure 2.2: Planned Approach to Change (Lewin, 1947)

Step 1 Unfreezing: Lewin (1947) claimed that stability of human behaviour is based on a quasi-stationary equilibrium supported by a complex field of driving and restraining forces. He there for argued that in order to for new behaviours to successfully be adapted the old equilibrium needs to be destabilised (unfrozen) before old behaviour can be unlearned. In order for this unfreezing to occur there

has to be a psychological safety created, otherwise the discomforting information will be denied or in other ways defended against, no survival anxiety will be felt, and consequently no change will occur.

Step 2 Moving forward: The unfreezing is just the start, it will cause motivation to learn and according to Schein (1996)*"does not necessarily control or predict the direction".* This accords with the explanation given by Lewin (1947), that trying to predict and categorise any specific outcome from planned change is difficult since the complexity of the forces at work. Instead the tactic should be to evaluate on a trial and error basis all the different available options, and in this way try to take all the different forces in account. This iterative research and learning approach is promoted by action research, and the idea is that research, action and more research will enable groups and individuals to move towards the wanted set of behaviour, Lewin (1947) explains that without reinforcement change could be short lived.

Step 3 Refreezing: This stage attempts to stabilise the group at a new quasi-stationary equilibrium to ensure that the new behaviour are relatively safe from regression. The most important part about refreezing is to combine the new behaviour with the rest of the behaviours and environment, or it will simply lead to disconfirmation (Schein, 1996). Lewin (1947) argued in the same way and saw change as a group activity, for unless the behaviour of the group changes and transforms, the individual change of behaviour will not be sustained (Cummings & Huse, 1989).

Lewin's three-step model of change may seem unfashionable but still continues to influence, as Hendry (1996) commented: "Scratch any account of creating and managing change and the idea that change is a three-stage process which necessarily begins with a process of unfreezing will not be far below the surface".

There are many different theories concerning planned change, and the organisational developers have changed their focus from individuals and groups to organisations in their entity (Burnes, 2004), However Cumming & House (1989) points out that:" the concept of planned change implies that an organisation exists in different states at different times and that planned movement can occur from one state to another". In planned change it is therefore not sufficient just to understand the processes that bring change, but there must also be an understanding of the stages that an organisation must pass in order to reach the desired future state (Burnes, 2004).

Emergent Approach to Change

A large amount of writers, especially from the complexity perspective argue that in the turbulent and chaotic world we live in, organisational change must be viewed as

a rather continuous and open-ended process, instead of a set of discrete and self-contained events. They therefore criticise the planned approach to change. (Arndt & Bigelow, 2000; Bechtold, 1997; Black, 2000; Brown & Einsenhardt, 1997; Garvin, 1993; Kanter, Kao, & Wiersema, 1997; Peters, 1997; Stacey, 2003)

Secondly a number of authors also criticise planned change on the basis of its emphasis on incremental and isolated change, as well as its inability to incorporate radical, transformational change (Dawson, 1994; Dunphy & Stacey, 1993; Harris, 1985; Miller & Friesen, 1984; Schein, 1985; Pettigrew, 1990).

The planned approach to change dominated the theory and management practice from the 1940s to the 1980s. After and since this the emergent approach has been considered the more developed and is today the more accepted view. The emergent approach starts with the assumption that change is continuous, an open-ended and unpredictable process of steering the organisation in to its change environment. The proponents of the emergent change argues that it is important to consider the turbulent environment in which firms operates, and unlike the planned approach it recognises that adaption to "real time" is a vital aspect in changing behaviour etc. Change is also viewed as a political process whereby different groups in an organisation struggle to protect or enhance their own interests. (Burnes, 2004)

2.3.3 Cultural Change

The concept culture needs to be understood in order to understand how to change organisational culture, one definition of culture is: *"The pattern of beliefs, values and learned ways of coping with experience that have developed during the course of an organisation's history, and which tend to be manifested in its material arrangements and in the behaviours of its members"*(Brown, 1998)

Smith (2003) conducted research regarding cultural change. The research was based upon questionnaire responses from 210 North American managers who have been asked to describe a major change effort by their organisation to improve its performance. The result form showed that only 19 per cent of the culture change efforts surveyed attained breakthrough or near-breakthrough success. One key factor identified was to recognise the crucial role of the middle rank of leadership at the department, division or business unit, in order to successfully conduct a cultural change.

Cummings and Huse (1989) defined four elements to describe culture:

1. *Basic assumptions*. At the deepest level of cultural awareness are unconscious, taken-for-granted assumptions about how organisational problems should be solved. They represent non confront able and non-

debatable assumptions relating to the environment, as well as about the nature of human nature, human activity and human relationships.

2. *Values*. The next higher level of awareness includes values about what ought to be in organisations. Values tell members what is important in the organisation and what they need to pay attention to.

3. *Norms*. Just below the surface of cultural awareness are norms guiding how members should behave in particular situations. These represent unwritten values of behaviour.

4. *Artefacts*. At the highest level of cultural awareness are the artefacts and creations that are visible manifestations of the other levels of cultural elements. These include observable behaviours of members, as well as the structures, systems, procedures, rules, and physical aspects of the organisation. (Cummings & Huse,1989)

There are many different approaches of how to manage change, for example Dobson (1988) has developed *a four-step approach* to culture change:

Step 1: Change recruitment, selection and redundancy to alter the composition of the workforce, so that promotion and employment prospects are dependent on those concerned possessing or displaying believes and values that the organisation wishes to promote.

Step 2: reorganise the workforce to ensure that those employees and managers displaying the required traits occupy position of influence.

Step 3: Effectively communicate the new values. This is done using a variety of methods such as one-to-one interviews, briefing groups, quality circles, house journals, etc. However, the example of senior managers exhibiting the new beliefs and values is seen as particularly important.

Step 4: Change systems, procedures and personnel policies, especially those concerned with rewards and appraisal.(Dobson, 1988)

Another strategy is presented by Cummings & Worley (2001), they divide cultural change process into a *6 steps process:* The first step is to *Formulate a clear strategic vision*, second is to *Display top-management commitment*, third is to *Model culture change at the highest level*, followed by *Modifying the organisation to support organisational change*, the next step is to *Select and socialise newcomers and terminate deviant*, the last step is to *Develop ethical and legal sensitivity.*

The approach for how to manage cultural change can also be explained as

"First, identify the current shared values and norms of the organisation; second, state what the culture should be, third, identify the gap between the two and develop a plan to close it."(Morgan & Sturdy, 2000)

However, all these guidance's has been criticised to be too general and not useful for individual organisations. (Brown, 1995; Gordon, 1985; Hassard & Sharifi, 1989; Nord, 1985; Uttal, 1983) The authors further warn that organisations must be sure that the problems they wish to address through cultural change are actually caused by the existing culture. They claim that there is a tendency to assume that culture is the root cause of al organisational problems, when in fact they might arise from other inappropriate organisational problems, so an explanation of the theories behind these strategies should be explained before conducting a cultural change.

2.4 Network Theory

"Six degrees of separation, a term saying that everyone in the world are connected with each other by only six links between existing social contacts"(Milgram, 1967)

Networks are used by everyone to a different extent both in a private and business related context. The explanation to "six degrees of separation" is that our small local network becomes connected globally through a small numbers of links between highly connected people within our own networks, known as boundary-spanners(Allan, 1977). The role of these boundary-spanners has been widely discussed as an important part in the development and maintenance of inter-organisational links (Tushman & Scanlon, 1981). These individuals can also be important across internal interfaces, such as between project groups, functional departments and divisions (Rothwell, 1974).

2.4.1 Strong and Weak Ties

In theory the connection between individuals can be divided in to a distinction between strong and weak ties. Strong ties are trust-based and denote strong personal relationships with family, friends and close colleges (Grandovetter, 1973). Weak ties connect single individuals with much larger contact networks. Networks based on strong ties are suggested to have greater capacity in enabling the transfer of tacit forms of knowledge (Grandori & Soda, 1995; Kreiner & Schultz, 1993; Oliver & Liebeskind, 1998; Ring & Van de Ven, 1994). High levels of trust are considered important for knowledge creation and knowledge sharing (Dodgson, 1994; Newell et al., 2009; Von Kroght, Ichijo, & Nonaka, 2000). Trust can be defined as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustee, irrespective of the ability to monitor or control that other party" (Mayer, Davis, & Schoorman, 1995)

Other researchers, however, imply that strong ties not always are the more effective than weak ties for knowledge sharing. Hence strong ties take longer time to establish and studies shows that new knowledge is more likely to come out of networks based on weak ties. Further these studies show that weak ties are more efficient and effective for the transfer of explicit forms of knowledge. (Granovetter, 1973; Hansen, 1999)

2.4.2 Social Networks

Social networks are considered to play an important part in knowledge sharing, and are often important means to overcome the limitations of functional silos and hierarchies' delimiting knowledge sharing. There are many different approaches

regarding how to analysing the role of social networks, where individuals in different groups connects, and knowledge somehow flow between organisations below the radar of management(Owen-Smith & Powell, 2004)The "spill over's" from creating knowledge can be the explanation to the creation of innovative activities, one e.g. is silicon valley. Other research focuses on the individual, and highlights the importance of active networking. Research has found that successful networkers are quick to reciprocate the exchange of knowledge and information with others (Cross, Cantrell, & Davenport, 2003). Sites such as LinkedIn can be personally rewarding, but only if those involved contribute to, as well as take, from the network. (Newell et al., 2009)

Social Networks in Reality

"A typical user of LinkedIn is Trisha Colton, who leads Adobe's hunt for digital media executives. On a recent afternoon she needed to fill five positions. With a few clicks of the mouse on her ThinkPad laptop, she could tailor a project-manager search that enabled her to look at possible candidates from 21 leading ad agencies, 15 publishing outfits and a host of other suitable backgrounds. A few more tweaks of the dial and Colton had specified what current jobs these people should be holding, how many years of experience they should have and their locations."(Anders, 2012)

Several authors have demonstrated that the Internet is a powerful tool, that can be used to attract consumers, build customer loyalty, and extend a product's or service's brand (Reichheld, Markey, & Hopton, 2000). LinkedIn is an online professional network that allows users to connect with trusted contacts to exchange knowledge, ideas, and opportunities within a broader network of professionals. The site has 100 million registered users, Americans account for about one-half of the LinkedIn community (Kim, 2011). Anders (2012) argue that the main reasons to why LinkedIn started to be used are because it came at the same time as people started to get laid off, and therefore having a lot of different jobs, meaning people felt less loyal to their current workplace. Further Wagner and Newell (2004) claim that in order to make communities work, they must be easy to use and also reach the critical mass. McDermott (2004) finds that such a momentum can be maintained as long as the growth in participant numbers is matched by increases in the quality of the community dialogue and the forms of knowledge shared, which is something that LinkedIn has managed to achieve.

Social Capital Structural, Cognitive and Relational

Nahapiet and Ghoshal (1998) define social capital as "the sum of actual and potential resources, available through, and derived from the network of relationships possessed by an individual or social unit". They further define *three types* of social capital: *structural, cognitive and relational. Structural capital* refers to the actual network ties between individuals, through which knowledge potentially is shared. *Cognitive social capital* refers to the overlaps of frames and understanding

that allows sharing of knowledge between connected individuals, just because there are a network connecting people, this does not mean that knowledge sharing actually happens. *Relational social capital* refers to whether or not he individuals connected trusts each other (Newell et al., 2009). Nonaka and Takeuchi (1995) focuses a lot on the social and trusts aspects of knowledge sharing, where it is argued that it is not enough that people from different department occasionally meet. These meetings should occur over a prolonged period, in enabling contexts, so sharing of tacit knowledge becomes possible (Nonaka et al., 1995). Prolonged meetings over longer periods also allow team members to develop a shared understanding of their situation, which also affects a team's absorptive capacity. Absorptive capacity refers to the ability to recognize the value of information both new and external, and absorb it and use it productively (Cohen & Levinthal, 1990).

2.4.3 Communication, Conceptual Settings and Mapping of Networks

The importance of contextual settings have long been acknowledged in literature relating to general management (Pettigrew, 1997), innovation diffusion (Schot & Rip, 1996) and more specifically construction management innovation (Brensen & Marshall, 2001; Lu & Sextion, 2006).

The influences of an actor's unique and usually highly informal communication network, based upon trust and friendship, have been pointed out to be critical to the understanding of innovation diffusion within its contextual setting (Tichy, Tushman, & Fombrun, 1979). It is trough understanding such networks that we can gain an insight into part of an actor's contextual setting, how actors become aware of an innovation and then how their opinion is influenced (Larsen, 2011). Larsen (2011) claims further what is needed to what is required is a better understanding of the interplay between the various themes, how they impact on actors, projects, firms and even on the construction sector. It is not possible to discuss the importance of contextual settings on awareness and influence regarding innovation diffusion without considering how construction firms structure themselves (Larsen, 2011). A significant part of the challenge, noted for example in the work by Emmitt and Gorse (2007), is the realization of the difficulties when trying to in detail understand a small network, this is due to the fact that contextual settings including networks are not static but in constant state of flux and thus require a suitable theoretical perspective (Larsen, Kao, & Green, 2008). Clearly, the broader institutional forces play a role, setting the rules by which firms and the sector operate (Currie & Suhomlinova, 2006).

Different Forms of Communication

It is important to take notice that it is not only the networks that flux, communication takes different forms as well. Examples of this are that actors observe, hear, and speak which all constitute a form of communication. Other forms

include body language and physical actions (Larsen, 2011). It is also important to acknowledge the impact of other related concepts, such as peer pressure (Zenger & Lazzarini, 2004), groupthink (Janis & Mann, 1977) and power (Ibarra, 1993) which all play a role in understanding awareness and influence related to the innovation diffusion process. All of this is of course played out across the broader institutional forces (Larsen, 2011).

Communication in the Construction Industry

Gameson (1992) describes communication within a construction project as socio-emotional, whereby the fluid nature of the communication network, with actors entering and leaving, meant the high levels of trust essential for diffusing innovation would never be reached. Such arguments appear to contrast the theory of weak communication ties promoted by (Granovetter, 1973;1985).

Networks in the Construction Industry

Empirical findings, when trying to map networks within a construction company, highlights the potential differences in actor's communication networks, regarding innovation related to their contextual setting. Such networks do not only include different actors, but they are also of very differing shapes, sizes and strengths all of which affect awareness and influence. This alludes to the fact that different actors have different capabilities regarding how they become aware of innovation and even how they are influenced. Actors have different types of access to either the same or different networks; some actors are actually struggling to access their desired networks for a number of reasons. Finally, it is clear that these networks will shape the innovation diffusion within their conceptual settings. What is certain is also that these networks are far from static, they can be extremely fragile, are often centred on only a few key actors, yet the hold extremely valuable data which can potentially improve the understanding of innovation diffusion. (Larsen, 2011)

Larsen (2011) found that none of the networks in his study are symmetrical, which demonstrates the fact that the nature of such networks and actors involves varies. It would therefore be difficult to describe the networks as being constructed through a rational of logical process. This is precisely the point the research is intended to highlight: actors experience awareness and influence differently and researchers need to understand this, access it and understand its impact. The shapes of these networks immediately demonstrate the infinite number of possible permutations associated with nomination, strength of relationships and connectivity, all of which impact on awareness and influence. It is of importance to highlight that no sooner that a network has been mapped, it will have changed in numerous ways. (Larsen, 2011)

2.5 Theoretical Summary

2.5.1 Knowledge

The benefit from knowledge management is well recognized and a lot of different organisations have been trying to exploit the benefits relating to Knowledge management for decades (Grant, 2012).

The defintion and philosophies of what knolwedge is varies a lot.There are however considerd to be two differetn fundamnetal types of knowledge explicit and tacit knowledge(Polanyi, 1966). The diffferences between the two types are that rxplicit knowledge is consists to consists of facts and rules that easily can be shared without any further explanation regarding the content (Steward, 2001). Tacit knowledge on the other hand has a subjective and initiative nature and is hard to transfer to others in writing or verbal form (Polanyi, 1966;Steward, 2001). Knowledge within an organisation is made up by both explicit and tacit knowledge, and authors argue that the collective knowledge within an organisation is the most valuable asset a company has, since it can be very hard to copy or imitate and can therefore be considered to be a competitive advantage (Spencer, 1996; 1998).

2.5.2 Learning

There are many different theories regarding how individuals, groups and organisations learn related to the processes and levels of learning (Boerner et al., 2001). The learning process can be explained as the architecture built up by relationships, ties, trust and relationships (Grant, 2012). Authors agree upon the fact that the learning process for an organisation is essential for its ability to survive (Burnes, 2004).

There are three different levels of learning *Single, Double and Triple-Loop learning*, which refers to the level of learning that is happeing within the organisation. The deepest level, the tripple lopp is were individuals starts questioning the rationale for the organisation and radically transforming it, this is a state that helps the organisation to really move forward (Argyris & Schon, 1978).

The process of how an organisation learns is explained as an interaction between explicit and tacit knowledge. Nonaka & Takeuchi (1995) has explained this as an on-going circular process divided up into *4 different stages* referring to the transformation between these two fundamental types of knowledge.

Socialization- Is the process where tacit knowledge is transferred to another tacit form. This is done trough sharing of experiences and thereby creating tacit knowledge.

Combination- is the process where transfer between different explicit forms of knowledge is conducted. New knowledge can for example be created through reconfiguration of existing explicit knowledge sources such as archive.

Externalization- is the process where tacit knowledge is transferred to explicit form. These can for example take shape as metaphors.

Internalization- is the process where explicit knowledge is transferred to tacit form. This stage is depending on the completion of the other stages, and is closely related to "Learning by doing". (Nonaka& Takeuchi, 1995)

There are many boundaries identified referring to knowledge sharing and in practice a lot of organisational conditions such as time pressure, or beliefs such as that the project or assignment is unique limits the knowledge sharing process. (Newell et al., 2009)

2.5.3 Change Management

This theoretical area is of importance since it has been argued that change is a process that involves the entire organisation and can therefore not be separated from the organisations strategy (Burnes, 2004). There has to be considered that there are difference aspects effecting change on different levels, culture is such an aspect. Culture can be divided up into four different elements, Basic assumptions, Values, Norms and Artefacts; they all play an essential role in the cultural awareness. (Cummings & Huse, 1989)

Managing change processes has been described by many authors and variety of theoretical approaches has been developed, such as the one developed by Dobson (1988), he divides the approach for how to manage cultural change in to *4 steps*:

Step 1: Change recruitment, selection and redundancy to alter the composition of the workforce. This should be done in order so that promotion and employment prospects are dependent on displayed believes and values that the organisation wishes to promote.

Step 2: Reorganise the workforce to ensure that those employees and managers displaying the required traits occupy position of influence.

Step 3: Effectively communicate the new values. This is done using a variety of methods such as one-to-one interviews, briefing groups, quality circles or house journals, etc. However, the example of senior managers exhibiting the new beliefs and values is seen as particularly important.
Step 4: Change systems, procedures and personnel policies, especially those concerned with rewards and appraisal.(Dobson, 1988)

These different guides have however been criticised a lot since they are considered being too general and therefore not useful for single organisations (Brown, 1995; Gordon, 1985; Hassard & Sharifi, 1989; Nord, 1985; Uttal, 1983).

A well stated approach on how to manage change is the planned approach developed Lewin (1947). This approach is based on the statement that the group is the basis for individual perceptions, and in order to accomplice change the focus needs to be on changing the group behaviours. From this belief Lewin (1947) developed a framework consisting of *three steps* for how to perform a planned change:

1. *Unfreezing*- In order for new behaviours to be successfully adapted the old ones needs to be destabilised, unfrozen.
2. *Moving forward*- Evaluate on trial and error basis different options, and take all the different forces in account moving forward with the change.
3. *Refreezing*- Combine the new behaviours with the rest of behaviours and the environment and stabilise, “freeze”, the group according to the new equilibrium.

The planned approach on how to conduct change has been criticised and developed in to new forms or approaches, but is still consider to be the basis for these new approaches (Hendry, 1996).

2.5.4 Network Theory

Knowledge sharing can be conducted trough networks, we are all connected to different knowledge networks, and these networks are based on two different types of ties, strong or weak. (Allan, 1977; Grandovetter, 1973)

Strong ties are trust-based and developed over a long period of time. Strong ties are considered to be good when transferring tacit forms of knowledge. Weak ties on the other hand are connecting individuals to much larger networks than the once developed trough strong ties (Grandori & Soda, 1995; Kreiner & Schultz, 1993; Oliver & Liebeskind, 1998; Ring & Van de Ven, 1994). Since Strong ties are based on trust

they might not always be the most effective way to share knowledge, hence they take a long time to develop and since weak ties are considered more effective when transferring explicit form of knowledge (Granovetter, 1973; Hansen, 1999).

Social networks tend to play an important part in knowledge sharing, for example to overcome limitations such as silos or hierarchical boundaries (Owen-Smith &Powell, 2004). Internet is used as a powerful tool when it comes to build social networks and sites like LinkedIn are widely used (Reichheld, Markey, & Hopton, 2000).

Trust is an important aspect to the creation of networks, and can be related to social capital. Social capital refers to "the sum of actual and potential resources, available through, and derived from the network of relationships possessed by an individual or social unit" (Nahapiet & Ghoshal, 1998). It is important to put much focus on the social and trust aspects of knowledge sharing, according to Nonaka and Takeuchi (1995). This is also highlighted by Nahapiet & Ghoshal (1998), the authors claims that social capital can be divided up into three sub categories. One of these sub categorises refers to the fact that knowledge sharing does not actually happen, just because there are a network connecting people. Networks are considered not to be static; instead they flux (Larsen, Kao, & Green, 2008). Further according to Larsen (2011) networks varies depending on the purpose with the network, and they are therefore difficult to construct trough a rational of logical process.

2.5.5 Theoretical Focus

A decision was taken to focus this study on knowledge management combined with change management and network theory. This was done in order to improve the ability for organisations to establish functional knowledge management strategies. There has been proven to be a lot of synergies from culture and trust related areas, effecting the construction of networks and company's ability to share knowledge. One example is the definition of how an organisation learns by Grant (2012), the author claims that the learning process can be explained as: the architecture built up by relationships, ties, trust and relationships. Grant (2012) agues further that the quality of the knowledge created and exchanged by people is based on, both tacit knowledge and explicit knowledge, strategic knowledge, on the artefacts used by the organisation and communication technologies. Nonaka and Takeuchi (1995) also highlight the importance of focusing on the social and trust aspects of knowledge sharing.

With this in mind, the link between the tree different theoretical areas becomes clearer. The theoretical framework developed in this study is based on traditional theory regarding knowledge management, change management and network theory. The theories were scanned in order to find areas, concepts and barriers relating to the stated issue of the study. Several findings were made both from a

macro perspective and from single isolated factors that can only be adopted in specific circumstances. Not all of the findings from the theory where applicable to the issue of creating a functional KMS. The theoretical framework developed takes a holistic approach on knowledge management and it is based on synergy effects between different theoretical areas.
The theoretical framework is based on the findings from the theoretical studies and divided up into *4 different areas:*

- ✓ *Learning processes*
- ✓ *Knowledge sharing boundaries*
- ✓ *Change and implementation*
- ✓ *Technical boundaries*

These can in turn be divided up into sub categories that have to be full filed in order to establish a functional KMS. All these different sub factors have been considered of important for the issue of the thesis. However, they are not necessary crucial on their own, they have to be considered as part of a whole system. The whole system can function without some of the different factors, but some may be considered crucial depending on the organisational conditions that the framework is to analyse.

2.5.6 Theoretical Framework

Learning Process	• Sharing of Explicit and Tacit knowledge • Connection between individual and organisational level of learning • Learning process, Social, Combination, Externalization and Internalization • Level of learning, Single, Double or Triple Loop learning	Argyris & Schon, 1978 Boerner et al., 2001 Granovetter, 1973 Hansen, 1999 Keegan and Turner, 2001 Kotnour, 1999 Nonaka et al., 1995 Polanyi, 1966 Spencer, 1996; 1998 Von Zedtwitz, 2002
Knowledge Boundaries	• Promotion for a collective activity	Bernstein, 1968 Burnes, 2004 Lewin, 1948
Change and Implementation	• In line with company strategy and this communicated out • Purpose and benefit explained for end users • Implementation Phase • Training and education for end-users • Unfreezing phase • Lessons learned captured • Freezing phase • Clear ownership of implementation	Cummings et al., 1989 Cummings et al., 2001 Duck, 1993 Dobson, 1988 French et al., 1984 Lewin, 1947 Smith et al., 1982
Technical Boundaries	• Level of accessibility • User friendly • System up to date	Lewin, 1947

Table 2.2: Summary of Theoretical Framework

3. Methodology

This chapter describes the research approach of the thesis. The chapter starts by explaining the differences between inductive, deductive and abductive research approach and finishes by discussing the validity aspects of the research. The reason for choosing Skanska UK as a case company will also be declared.

3.1 Starting Point

The purpose for this thesis emerged from the increasing interest in the field of Knowledge Management. It is being recognised as an essential part of company-strategy with the potential to generate significant competitive advantage, and an issue in which companies have been investing a lot, but receiving quite varied results.

Theoretical studies were conducted in the areas of knowledge management, change management and network theory. The interaction between these different theories was used to get a deeper understanding relating to the purpose with the thesis, to understand how and why knowledge is shared.

The construction industry was chosen to be the case industry since the benefits of good knowledge management have long been recognized in project-based organisations. However the practical implementation is not considered well developed, particularly with regards to construction organisations. Skanska UK was chosen as case company since they are one of the world's largest construction companies and stretches out over an extensive variety of knowledge as well as geographical areas. Skanska UK is considered to be a perfect case company since they have been investing much effort and resources into knowledge sharing, but are still considered to be struggling with the task and the findings therefore seems to be relevant both for them and other large project-based organisations.

Extensive studies were made and concluded in a theoretical framework. The framework was thereafter tested and evaluated on the case company, in order to develop, generalize it and to fit it to reality. An explanation in how the theoretical findings were combined with empirics will be further explained in the following chapter.

3.2 Research Approach

Method is an essential, but not sufficient condition when performing a professional and serious research project or study. Studies in method will give the basics when performing systematic work, addressing questions of who, what, how and why regarding social problems. Method is not just a tool and does not give any answers to these questions. It is a necessary, but not sufficient condition in order to give the

result the best opportunity to reflect the reality and the conditions searched. (Holme & Solvang, 1997)

3.2.1 Inductive, Deductive and Abductive Reasoning

There are argued to be *two broad method* of reasoning, trough *inductive* or *deductive* approach.

The inductive approach is based on the assumption that a quantity of single cases with a similarity or connection observed in each will be applicable for a general case, developing new theory from empirical gathering. (Alvesson & Skjöldberg, 1994)

The deductive approach is based on an opposite assumption, where one general rule explains the condition in one single case of interest. Deductive reasoning is based on the logical explanation that if propositions A and B both are true, then this implies that C is also true, developing new theory form old ones. (Alvesson & Skjöldberg, 1994)

Another possible ways of reasoning is the more interactive *abductive approach,* which can be explained as a mixture between the two main approaches. The researcher switches between the theory and empirics to move towards a conclusion, in the abductive approach. During the process both the empirical and theoretical scope will be adjusted and refined, hence the theory and empirics will be united. The thesis is carried out in a manner that combines theoretical studies with empirical analysis in the development of the final framework answering the stated purpose, and the methodical reasoning was therefore conducted in abductive manner. (Alvesson & Skjöldberg, 1994)

3.2.2 Quality and Quantity Research Methods

In science there are usually *two methods* used to collect data*, Quality* and *Quantity* research methods. The fundamental similarity between the two methods is the common purpose, to give a better understanding of the society that we are living in(Holter, 1982). The question of which method to choose is based on the type of information that is being reviewed. The difference is depending on how accurate reality is illustrated in facts and statistics(Holme & Solvang, 1997).

A Quantitative study uses measurements, statics and mathematics. The gathering of statistics is often conducted with surveys and questioners that are fixed so that they will give a basis for the statistical study of the empirics. (Jacobsen, 2002)

The Qualitative study is based the on the opposite, non measurable characteristics, formulated verbal either spoken or whiten (Bryman, 1989). It is also possible to

combine these methods,(Jick, 1979). The thesis is carried out in a qualitative way, using interviews and observations to gain a deeper understanding of how knowledge management and transfers are carried out in the construction industry, and in the case study. Furthermore to gain depth and understanding from the study generalizations were made (Yin, 1994). Explained in section 3.3.2 Generalization.

3.3 Gathering of Empirics

There are many ways of conduction a social science research; each strategy has its advantages and disadvantages (Yin, 1994). Höst et al. (2006) states that there are four different ways of collecting and analysing empirical evidence, trough: *Surveys, action research, case studies and experiments.*

A *Survey* implicates a description and gathering regarding a current situation of a selected research object. The population that are intending to be investigated can be modified after need and the answers from the survey will be representing the general description. An *Action research* is a controlled and documented activity with the aim to solve a problem. The action research is generally conducted with firstly an observation followed by a solution that in the final stage will be evaluated. *Experiment* is a comparison between two or more alternatives to reveal different coincidence and connections. Finally a *case study* is an investigation of a selected group, the targeted group is chosen for a specific purpose. *Case study* is an investigation on a smaller distinct group and is often used when processes or change is studied. (Höst et al.,2006)

3.3.1 Case Study

The choice between survey, action research, experiment or case study can be based on three different research conditions: the type of question in the research, the amount of control an investigator possesses over the actual behavioural event and the extent which the research focuses on contemporary events (Yin, 1994). Yin (1994) argues that case studies in general are the preferred strategy when the research answers to the questions of “how” and “why”, when the investigator possesses little amount of control and when the focus is on phenomenon that are current and with real-life context. Further Yin (1994) argues that case studies allow the investigator to observe the real-life context from a holistic view, such as organisational and managerial processes. Eisenhardt (1989) claims that case studies can generate better research since the constant compiling of different realities in case studies makes us less bias.

The thesis was based on in such conditions and therefore a case study was considered the most suitable research strategy. The case study will give a deeper understanding of the construction industry, its stakeholders and the issue of study.

The case study was performed in an explanatory manor with the purpose "to pose competing explanations for the same set of events and to indicate how such explanations may apply to other situations" (Yin, 1994). Meaning that the study will generalized and be applicable for other companies conducting activities relating to the issue of study.

Single- Case Study
The thesis was preformed as a single-case study research, this choice was based upon the width and the complexity of the issue studied. A single case study can often be used when having an explanatory purpose (Yin, 1994). A single case was therefore considered sufficient for the stated purpose of the study.

Evaluating and Interpreting the Empirical Findings
The evaluation and interpreting of the findings was conducted according to a "pattern matching" approach. The approach consists of gathering several pieces of empirical information from one case, and then compares this data to the proposition. Yin (1994) states that the pattern matching approach is a useful research approach when relating data to an identified theoretical pattern. He further states that if and when a pattern coincides with the theoretical predicted outcome, it can contribute to a strong internal validity of the preformed case study (Yin, 1914). The pattern matching approach was therefore used to draw conclusions from overlaps and contradistinctions.

3.3.2 Generalisation

One important criterion when evaluating the value of a case study is in the question of how applicable the width and details of the case are to other cases and situations, how well it can be generalised (Bassey, 1981). Yin (1994) explains how a case study can be generalised by comparing an analytic generalisation with more commonly known statistical generalisation. The conclusion in a statistical generalisation is made upon a number of samples from empirical data. The statistical generalisation can often be supported by quantitative data and is considered to be the most common way to generalise, e.g. are surveys. When conducting a case study, a chosen case scan should be compared to the surveys topic of a new experiment, and not a sampling unit, since a case study influences the ability to generalise and since a case differs from a sample and the statistical generalisation logic is therefore not suitable. Instead, analytical generalisation should be used, where studied theory is used as a template to which the empirical results of the case study are compared. Analytical generalisation is considered to be a solid and valid ground for understanding of the specific case and therefore draws generalising conclusions based on the theory template. (Yin, 1994)

3.4 Work Process

The first step in the thesis was carried out in an *abductive* way, to gain understanding about the theory related to the purposed issue of study. This meant performing a literature review, which gave an understanding of how the area had been dealt with according to theory. The second phase consisted of empirical observations performed simultaneously with the theoretical study, the observations gave a deeper understanding regarding which theoretical literature was applicable to the study. These two phases gave a broad understanding of the area and the challenges regarding it. The third phase was more focused on getting a deeper understanding and consisted of narrowed literature studies, which lead up to the fourth phase where interviews was conducted. During this forth phase the development of the framework and a CV-template started to take shape. They were tested in the fifth phase and pursued by more focused and standardised interviews and surveys to strengthen the validity. The last phase consisted of a discussion between different stakeholders within the company during a final presentation for the case company. All inputs during the discussion were analysed and lead up to the developed and finalising of the framework.

3.5 Data Collection

The thesis is based on a case study, consisting of interviews, observations and surveys, complemented with studies of document and archival records. These different data sources are considered to be the most relevant in a case study, together with physical artefacts (Yin, 1994). Yin (1994) argues further that a well-preformed case study should involve as many sources as possible, in order for them to complement each other. The findings and progress from the study were tested with a pattern-matching logic against the developed theoretical framework. Other sources where meeting with advisors representing Lund University.

The collected data can be divided up and categorized two main categories: *Primary* and *secondary* data. Primary data is data that is collected by the researcher, were as secondary data has been collected by someone else and can be found in existing documents. One important thing to keep in mind is the fact that secondary data is usually collected for a different purpose than that of the study being conducted and therefore the validly, quality and usefulness of the data has to be questioned (Lekvall & Wahlbin, 1993). The thesis is based both on primary and secondary data. The collected data is divided up into both primary and secondary data, to give the thesis a valid and as correct result as possible.

3.5.1 Primary Data

The primary data can be divided in to interviews, observations and participant-observation. (Yin 1994)

Interviews
Interviews are a vital source for information in any case study. There are many different types of interviews depending on the purpose and need for information, the three most frequently used types of interviews are*: open-ended, focused* or *survey interviews.*

Open-ended interviews allow the interviewee to complement facts with own opinions and insights. This allows the questions to develop during the interview and further focus on specific subjects, and the interviewees are considered more as an informant than a respondent. *Focused interviews* are used manly when the purpose is to sustain certain known facts. The interview is often conducted following an on beforehand developed template with questions linked to a specific subject. Extensive consideration has to be taken during the development of the questions, since the questions can be considered leading and therefore undermine the corroboratory purpose. *Surveys* are structured questions often conducted on a larger population, with a more quantitative than qualitative purpose, than the two other interview approaches. (Yin 1994)

Observations
There are *two different types of observations*: *direct observations* and *participant observations* according to Yin (1994). *The direct observation* is a simple field observation, allowing conditions and routines to documented (Yin 1994). *A participating observation* on the other hand can be explained as a way to witness group actives, practices and routines conducted within an organisation in a more active manor. The observer has the possibility to take a more active role in a participating observation, than that in a direct observation (Bryman & Bell, 2005). Further the greatest advantage with observations is the ability to gain access to information that otherwise is inaccessible (Yin 1994).

3.5.2 Secondary Data

The purpose with secondary data is to corroborate and complement information provided from primary sources. Secondary data can be divided up in to: *documentation, archival records*, and *physical artefacts*. (Yin 1994)

Documentation
Documentation can be divided up into many different types of information such as reports, studies, letters etc. Sources to references are often extensive and hold a lot

of different information, it can be found on the internet, local libraries, and internal documents regarding the organisation studied. A systematically search for information is according to Yin (1994) a vital part of any case study as long as an extensive amount of consideration regarding how relevant the documentation is to the purpose is shown. Since the documentation has often been developed and established with a different purpose and target group in mind. (Yin 1994)

Archival Records and Physical Artefacts
Archival records can be divided in to organisational records, maps, service records, personal records etc. The information is often of a quantitative nature and is contrary to documentary information used more varied depending on the purpose and conditions of the case study. Physical or cultural artefacts are information such as technology devices, tools, art etc. These sources are considered unusual and are almost solely used in anthropological studies. (Yin 1994)

3.5.3 Data Collection Strategy

The chosen strategy for data collection in this thesis is done in different phases with different purposes.

Observations
First observations were made to obtain a better understanding of the knowledge sharing processes within the case company. Participating observations where preformed at Skanska UK headquarter in London, other offices and one observation where done at a project sight. This was in a practical matter done by following employees working with knowledge management in their daily work, this included department and project meetings.

Interviews
The second step were interviews and the primary data collection phase, consisting of both open-ended and focused interviews with different stakeholders. The first phase of interviews were conducted with an open ended approach in order to get as much understanding and general knowledge about the industry and the case company as possible. Further on in the second phase of the interviews a focused approach was chosen. They were conducted with employees that had specific knowledge about different subjects. The purpose was also to ensure certain known facts. All the interviews were recorded and notes were taken to ensure that correct data was collection from the interviews.

Surveys
The third step to gather primary data was conducting surveys, in order to secure that all the opinions and information regarding the study was captured. Even though

surveys are more often used to gather quantity of data this survey focused on quality instead and was only handed out to chosen employees.

Meetings
During the work process there has been frequent meetings with advisors from both the case company and with two advisors from Lund School of Economics and Management, and Lund Institute of Technology, both belonging to Lund University. These meetings have given valuable knowledge and have done impact on the direction and outcome of the project. A Final meeting with different stakeholders and sponsors from the case company was held, were the project was presented. The meeting gave a lot of valuable feedback and new insight on the work, all was taken in consideration and this helped develop the project further.

Secondary Data
All the primary data is complemented with secondary, in terms of written reports, conducted studies at both the case company and other companies within the industry, or with a similar profile. Internal documents, databases and the internal homepage have all been studied with the purpose to give a deeper understanding and more information regarding the case company, the industry and the issue of study. Also, other surveys about Knowledge Management made at Skanska UK have been studied, in order to gain as much information as possible.

3.6 Method for Analysis

A Pattern-matching approach (Yin, 1994) has been used as analysing method for the thesis. This was performed in a manner were the theoretical framework was applied on the empirical data, meaning that important factors identified in the different theoretical areas were compared to identified factors from the empirical study, all in order to find similarities and overlaps. The empirical findings were basis for development and refining of the theoretical framework.

3.6.1 Evaluation and Validity

Every method chosen to gather information has to be critically reviewed, in order to determent how trustworthy and valid they are(Holme & Solvang, 1997). Bryman & Bell (2005) argues that the terms validity needs to be redefined to fit quality studies since its definition covers measuring and therefore by nature is more applicable to quantity studies. It is therefore better determined as trustworthiness and authenticity.

Validity
The term trustworthiness is based on four sub-criterions, *credibility, transferability, dependability* and *conformability* (Bryman & Bell, 2005). The strategy to ensure

trustworthiness was mainly done by extensive comparisons between different types of information. The theory is from published articles in acknowledged journals. The trustworthiness was strengthening by continuous comparisons between different articles. To keep in mind is that the theory studied is often written from another perspective with another purpose, which impacts the trustworthiness. The Empirical findings are primarily based interviews and observations, the validity of this can be questioned since there are relation between the interviewed internally and this might affect the information revelled. A number of different approaches were chosen to complement each other and used together with secondary data in a triangulating manner, to ensure the validity. (Bryman & Bell, 2005)

Dependability

Bryman and Bell (2005) argues that reliability in the same way, as validity should be transformed into other terms to better fit a quality study research, reliability is described as dependability. To ensure dependability the entire research process is documented. The documentation has been done trough usage of recorders and continuously taking notes during interviews, to ensure that information is not missed or that the authors own values not interfere. To further ensure the dependability a final discussion with sponsors and main stakeholders was held to ensure that no misinterpretations had been done.

4. Case Study - Skanska UK

The fourth chapter gives an introduction to knowledge sharing in the construction industry, and introduce the case company Skanska UK. Further the chapter ends with a presentation of Skanska UK's current Knowledge Management systems.

4.1 Knowledge Sharing within the Construction Industry.

Knowledge Management, is regarded an area of great importance and an issue in which companies have been investing with varied results (Grant, 2012). Benefits of good knowledge management have long been recognized, especially in project driven organisations such as construction companies, and the economic benefit are shown by e.g. Greetham (2010) where companies with KMSs experience higher mean and median results.

Research from Carrillo et al. (2004) indicates that approximately three quarters of construction companies are aware of the benefits, especially large construction companies with more than 1500 employees, where the awareness of knowledge management benefits where found considerably grander compared to smaller construction companies. Carrillo et al. (2004) research further shows that 75 per cent of the construction organisations had or were planning to have a KMS in place. Skanska UK both have and believe a lot of benefits can be made with KMSs, and has therefore put a lot of money and effort into developing such systems (Skanska UK 2013-04-14).

4.2 Skanska UK

Skanska AB is a global construction company among the ten biggest in the world. Skanska AB was established in 1887 and employ 57.000 globally. In 2000 Skanska AB established a branch in the UK, Skanska UK, now employing roughly 4.000 people. Skanska UK revenue2012 was 1.166 billion GDP, approximately 12 billion Swedish crowns (2013-05-13).

Skanska AB's organisation is split in to different global Operating Units, where Skanska UK is one. An organisation chart of Skanska UK can be seen in figure 4.1, where the structure of Skanska UK's different enabling functions and Operation Units (OUs) are shown. The OUs are structured according to area of expertise, with the enabling functions are working across. One example of an enabling function responsible for tendering is submissions, a part of preconstruction, which is organized into departments related to the OUs. (Skanska UK, 2013)

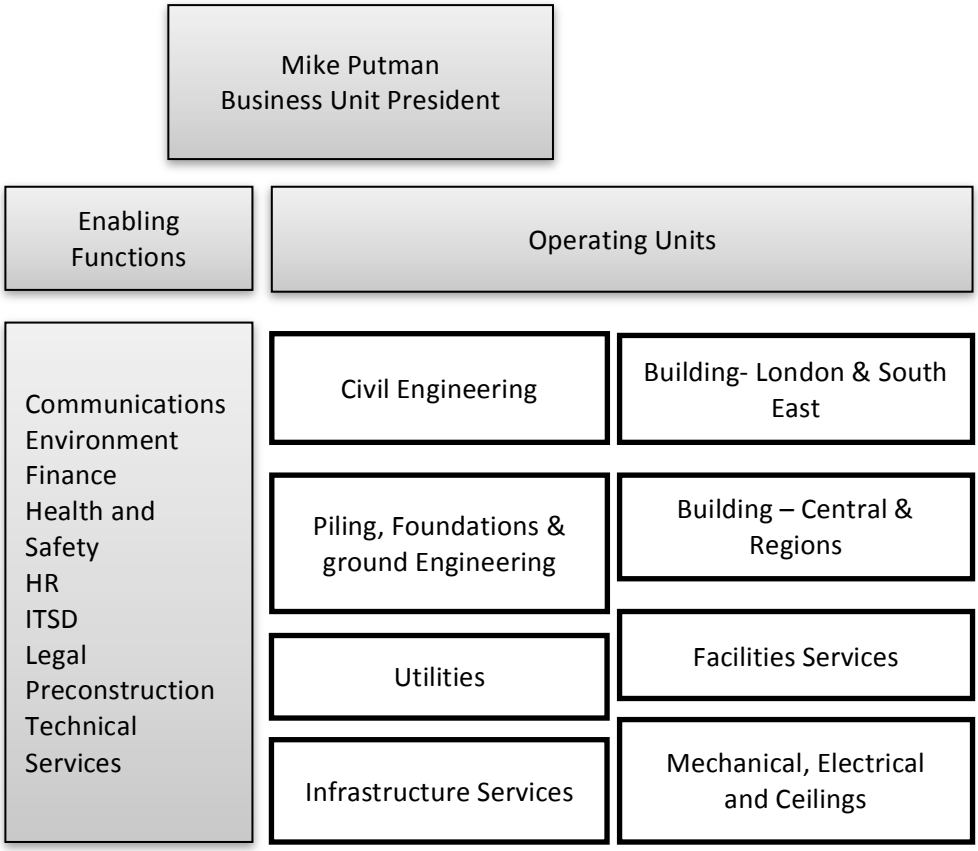

Figure 3.1: Skanska UK organisational chart

4.2.1 Skanska's Knowledge Sharing

Skanska AB has globally developed a knowledge sharing strategy, Skanska Global sharing strategy (SGSS). The main purpose of the strategy is to master both tangible assets, for example building plans, and intangible assets such knowledge. Knowledge sharing is considered an organisational support function with a primary task to secure that the right knowledge and best practices are available to the right people in the process of taking Skanska AB from its current state to its future state.

SGSS encourages a top-down approach concerning knowledge sharing. Top-down approach means that Skanska AB will use employees in the top of the hierarchy to share knowledge throughout the organisation. The opposite, bottom-up approach where people working at the lower parts of the hierarchy share information to the whole organisation, is not a focus area at Skanska AB. (Olsson Neve, 2010)

Skanska UK has many different KMS, and additional ones are being developed. Some of the systems are used throughout the whole organisation, both nationally in UK but also globally. A system is defined, in this paper, as a computer based system where it is either possible to search, add and edit for information both including document and processes. In this paper the definition of a system also include instant message program and similar systems where one can contact or/and search for other employees, with intention to share or gain information. The most common systems at Skanska UK are presented below and summarised in section 4.2.2.

One Skanska (OS)

One Skanska works as a home page for Skanska AB where different national and international news or information is spread. The entire Skanska AB uses the homepage globally. One Skanska also contains a database where you can search for basic information about Skanska's different projects, departments and employees. The information accessible to each employee varies due to departments and nationality of the employee accessing the system. One of the main purposes of One Skanska is to combine all existing documents and employees under one intranet, and one of many features is the ability to search for other employees contact information. One Skanska is the larges intranet available to the entire Skanska UK. Other intranet exists, however, e.g. IMS used by Building - Central & region. These OU specific intranets contain knowledge specific to the OUs that possesses it. (Skanska AB, 2013)

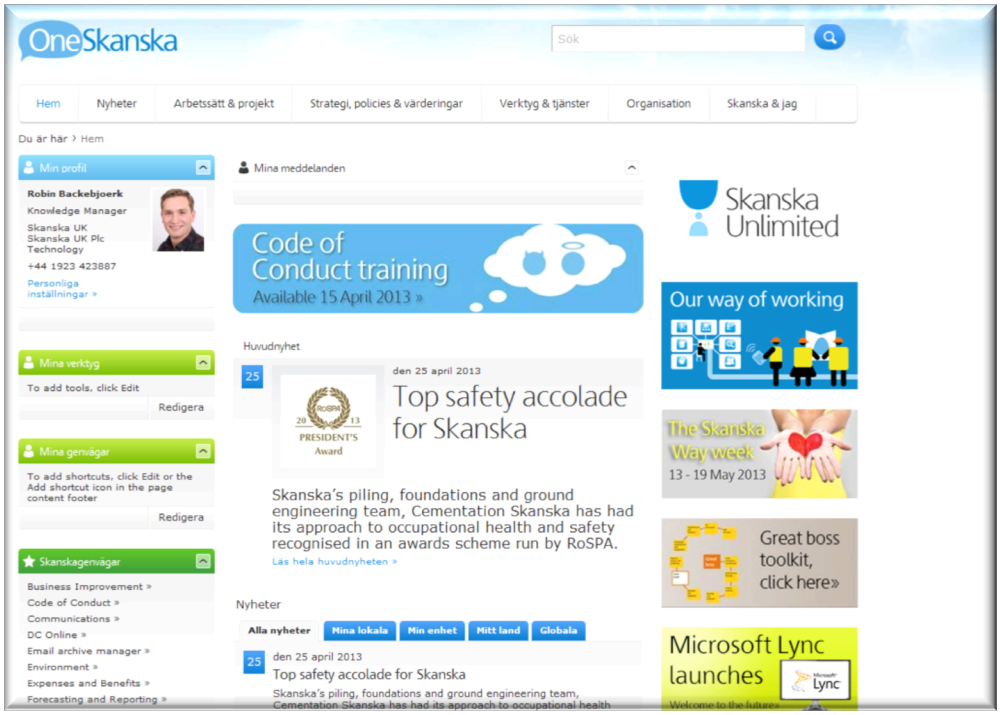

Figure 4.2: One Skanska

Our Way of Working (OW)

"Our way of working" is a database containing information about standard processes within Skanska UK. Different processes such as the bidding process is explained within, but also standard and basic processes about construction of buildings. The information is basic and main steps are explained with just a few words. "Our way of working" is possible to reach trough One Skanska, but is not searchable in the One Skanska search field.(Skanska AB, 2013)

Activity Sheets (AS) and Lessons Learned (LL)
Activity Sheets and Lessons Learned are similar systems where, and as the names reveal, lessons learned are captured with both systems. Skanska UK gathers the information using both standard sheets, filled by project managers, and visits to sites. The activity sheets are stored in Civil Engineering's own Intranet (IMS), and mostly used by this OU, while Lessons Learned are used by the entire Skanska UK. The databases can however be reach from One Skanska via links, but it is not searchable through the One Skanska search field. To access the information trough One Skanska are considered hard. (Skanska UK, 2013-03-04; Skanska AB, 2013)

Project Database (PD)
The Project Database was launched in April 2012 and lists over 5,000 Skanska AB projects from all over the world. The PD works as an internal and external database, which includes project descriptions, scope of the projects, customer information and contact details of project teams. This global database is designed to help share knowledge and 'add value' to the business by connecting people. Skanska UK occupied the system by transferring projects from an old system and the PD now includes a range of projects from every OU across Skanska UK. Approximately 18 searches are made in the project database daily. (Skanska UK, 2013-03-11)

Submissions Library (SL)
Submission Library is a database owned by the enabling function preconstruction, and is used when preparing for tenders. Other enabling functions such as Health and Safety have also access to editing information in the library, and all together approximately 200 people have access to SL. The library contains information about different awards, health and safety information and other information, often asked by clients in tenders. The database is search by using Google Search Appliance (GSA) and is searched 46 times on an average weekday. One main feature of the SL is to gather employees CVs to make the sourcing of project teams more efficient, and make presentations of the team easier in tenders. The library now contains close to 1500 CVs. (Skanska UK, 2013-03-06)

Instant Messenger Programs (IM)
Skanska AB has several different instant messenger programs: Lync, YAMMER and OUTLOOK. Yammer is social network based software, applied for business that aims to bring the power of social networking into companies(Yammer, 2013). Lync was introduced to Skanska UK in April 2013. The system enables video-conferencing, chats and instant messaging throughout the global Skanska AB. Outlook is an email program used by all employees in Skanska AB(Skanska AB, 2013).

Taleo (T)
Taleo is a Human Resources system used by the HR department within Skanska AB. Taleo enables employee search in advanced fields, such as experience and location.

The sourcing team uses Taleo to recruit people internally and externally. Taleo holds CVs of people who applied for a Skanska AB position after November 2011. The information in Taleo also includes different Human Resources information such as salary, addresses and employment date. Taleo is only accessible by the HR department where each user has signed a confidential-agreement. The confidential-agreement handles personal information liabilities regulated by UK laws. (Skanska UK, 2013-03-07)

Expert Groups (EG)

This system was created to provide a distinctive and accessible "Knowledge Sharing" portal for a number of key themes relevant to Skanska Globally. Today 12 expert groups exist; where two examples are BIM (Building Information Modeling) and Knowledge Management. Each expert group contains circa 10 people from the global organisation, who are considered to be an expert in their designated field. The knowledge exchange methodology is achieved by putting staff that requires knowledge directly in contact with staff that can provide it, via a network of these nominated experts throughout the organisation. The principles of the portal is to identify, capture and share strategically important knowledge to assist staff in winning work, planning work, delivering work and closing out work. (Skanska UK, 2013-03-12)

4.2.2 Summary of Knowledge Sharing Systems within Skanska UK

	Summary	Accessible to
One Skanska (OS)	Skanska AB intranet	Skanska AB Globally
Our way of working (OW)	Process database	Skanska AB Globally
Activity Sheets (AS)	Structured documents to spread new/better ways of doing activities.	Mostly used by Civil Engineering, accessible to Skanska UK through One Skanska
Lessons Learned (LL)	Structured documents to spread new/better ways of doing activities.	Mostly used by Central and Regions and Civil Engineering, accessible to Skanska UK through One Skanska.
Project database (PD)	Short and basic information about Skanska AB current and past projects.	Skanska AB Globally. Some information is shown externally to current and future costumers via Skanska AB homepage.
Submissions Library (SL)	Tendering information and documents. Searchable by GSA.	Submissions team
Yammer (Y)	Instant messenger program	Skanska AB Globally
Lync (L)	Instant messenger program	Skanska AB Globally
Outlook (OL)	E-mails	Skanska AB Globally
Taleo (T)	Recruitment and HR system	HR departments in Skanska AB globally
Expert groups (EG)	12 groups of experts in different selected areas	Skanska AB Globally

Table 4.1: Summary of Knowledge Sharing Systems within Skanska UK

4.3 Previous Studies at Skanska UK

Due to Skanska UK's focus upon knowledge management, studies have been made prior to this. In January 2013 Phil Taylor made a survey, where circa 200 staff within the project delivery senior management at Skanska UK where approached. The survey got 52 responses and the results are shown in table 4.2 – 4.4. The questions focus upon how individuals acquire knowledge needed in their daily work, and the results show, that the main instinct when trying to gain knowledge is by asking someone in the same place of work, Skanska UK employees does not contact other projects to solve problems on monthly basis and it is very unlikely that Skanska UK employees contact anyone from another operating unit. (Taylor, 2012)

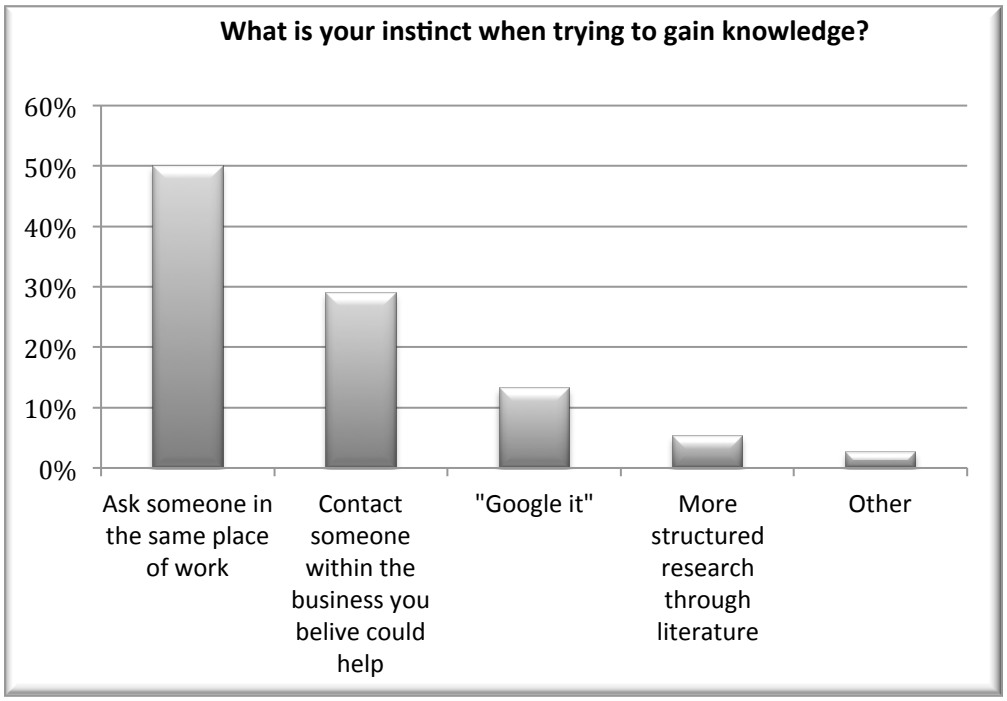

Table 3.2: What is your instinct when trying to gain knowledge? (Taylor, 2012)

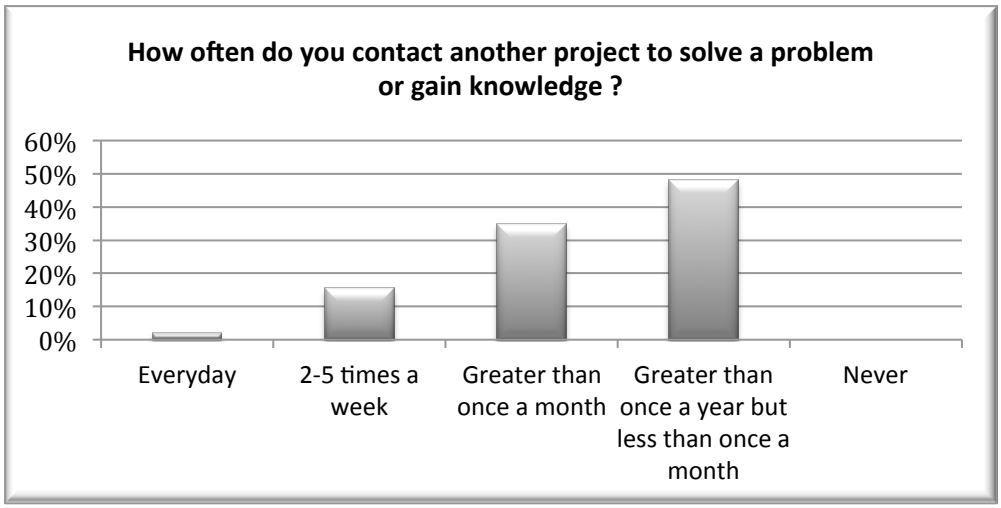

Table 4.3: How often do you contact another project to solve a problem or gain knowledge? (Taylor, 2012)

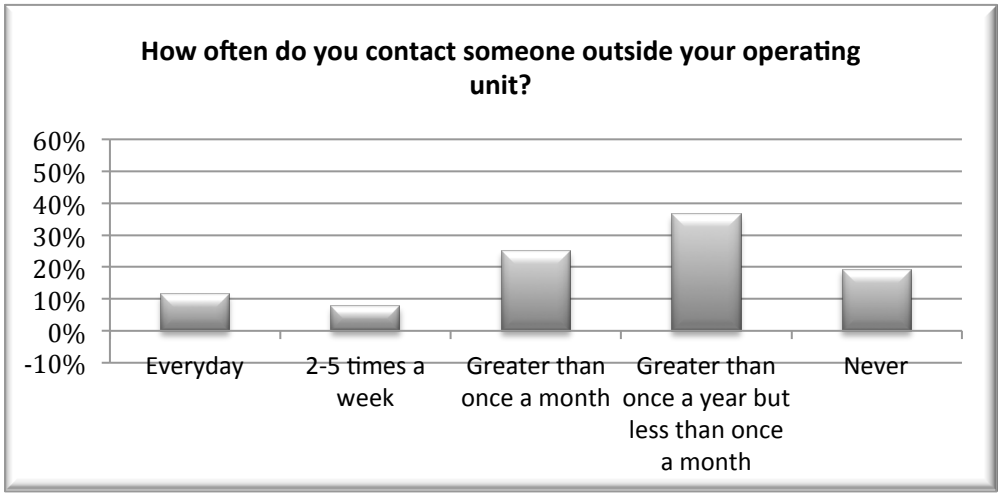

Table 4.4: How often do you contact someone outside your operating unit? (Taylor, 2012)

Another study made by Vickey Shelley in 2011 where also focused upon Skanska UK's existing KMS. Shelley interviewed employees within Civil Engineering in Skanska UK, and contacted circa 850 individuals. 189 completed answers where filled. Her findings relevant to this paper are shown in table seven and eight, and show that almost 60 % of the employees are most likely to contact someone in their own workplace when having a problem. Further the results show that only 23% had ever submitted a lessons learned card.

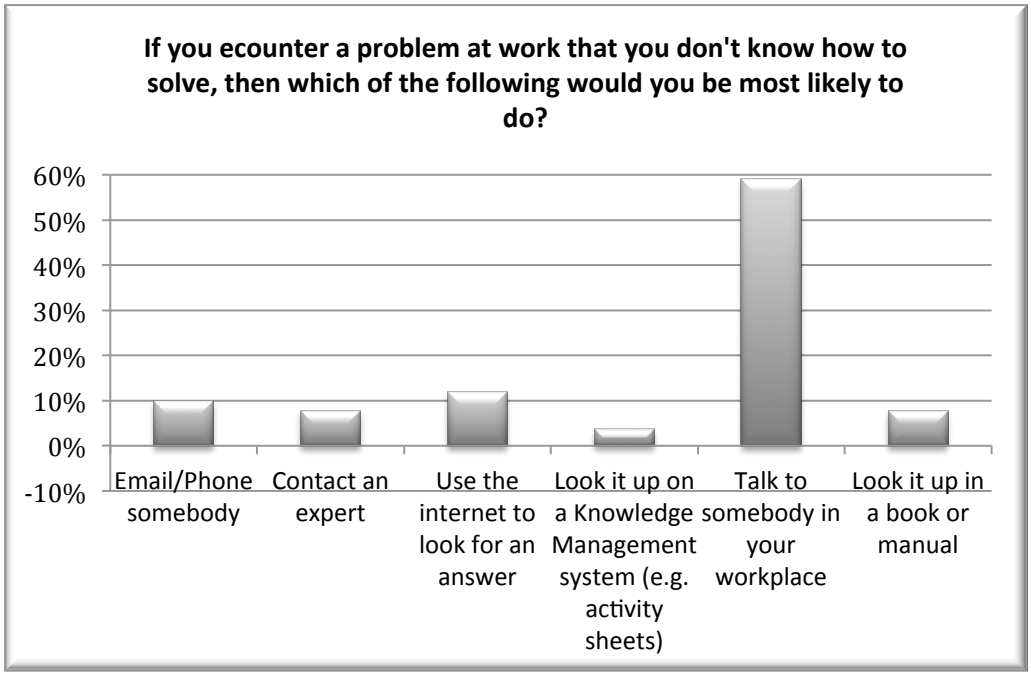

Table 4.5: If you encounter a problem. (Shelley, 2011)

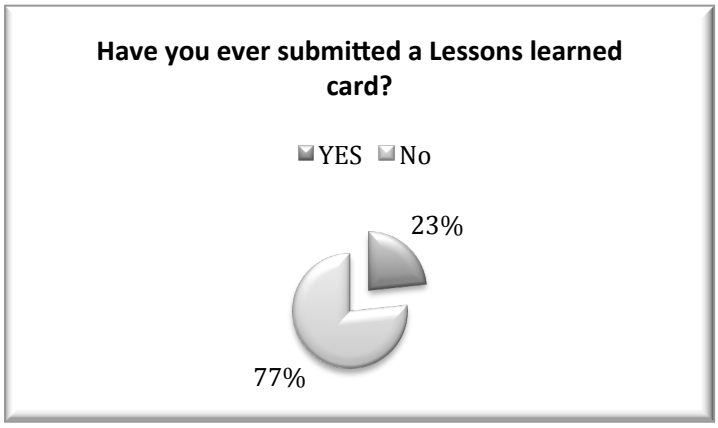

Table 4.6: Have you ever submitted a Lessons Learned card? (Shelley, 2011)

5. Empirical Findings

The following chapter contain empirical data. The Chapter is structured to make the reader understand the different demands for knowledge, the problems concerning capturing this and last the empirical findings relating to how to share this knowledge, and the chapter is structured around these fundamental questions. The last section will present findings concerning Skanska UK's current knowledge gathering and the existing culture relating to knowledge sharing.

5.1 What is Important Knowledge within Skanska?

"The real knowledge lies out in the field"(Engineer Director, Skanska UK, 2013-03-12)

"Even though there are different systems in place, for all different units, it might be more important to share knowledge within each unit, compared of sharing between units. The relevant knowledge might only exist within each own unit"(Director, Skanska UK, 2013-04-10)

Research Approach
35 semi-structured interviews have been conducted in order to gain information of Skanska UK's current systems and the employees concerns about these. The interviewees have been chosen concerning their individual relevance to knowledge management within Skanska UK, with a focus on getting a heterogeneous group. The interviewees all works within different OUs and enabling functions to ensure that all different aspects and ideas were captured. All OUs at Skanska UK are presented in the empirical findings as well as all enabling functions except from finance. A complete list of interviewees can be seen in appendix in section 10.2.

5.1.1 What is Important Knowledge for Each Unit?

"The information that are needed from business units and knowledge considered valuable for Skanska are very different to every business unit" (Director, Skanska UK, 2013-04-10)

All of the interviewed individuals found it hard to express what kind of future knowledge they demand. Knowledge needed today was easier to explained even if one of the individuals expressed the difficulty of finding and reaching this knowledge (Skanska UK, 2013).

"The difficulty is make exactly the right questions and also to make people answer the way you want" (Head of Submissions, Skanska UK, 2013-04-11)

Submissions Need Tendering Information

The process of tendering is considered a key process for Skanska UK and is given more and more focus (Director, Skanska UK, 2013-03-25). The process is compact and a non-standardized.

Tenders are most likely structured around questions, asked by possible future clients. The questions can vary between information regarding Health and Safety rewards or project manager experiences, to name a few. Some questions are quite standard, and will be repeated by many clients, while other are specific. The answers given make the difference between winning a tender or not. Answering these questions in the best possible way, is therefore of highest importance to Skanska UK, and all information made available to make tendering more efficient is of greatest interest to the submissions team.

In order to "win work"[2] and make the best possible tender, the empirical findings showed, that submissions team needs information regarding many different aspects of Skanska UK. CVs are one important aspect, since these often are considered an important part to win bids. CVs often are incomplete or not up to date, meaning that the gathering of CVs is considered time consuming and a part of tendering that needs to be improved. A structured and better CV database is considered making the tendering process more efficient. (Senior Editor, Skanska UK, 2013-03-06)

"*The submissions library are often not up to date and the CVs within are often incomplete*" (Senior Editor, Skanska UK, 2013-03-06)

At the moment employees working with tenders have different ways of collecting this information e.g. via e-mails, networking or using GSA. (Skanska UK, 2013-03-04; 2013-03-05)

Sourcing Need CVs

"The CVs within Taleo does not get updated and often information are lacking or inaccurate. This incomplete information regarding employees is making my work ineffective."(Resourcing Partner, Skanska UK, 2013-03-07)

When trying to match an opening with an applicant the sourcing team need information about individual's experience, often both work-related experience and other information. Since Taleo only contains CVs of applicants, after November 2011, there is a need to find other individuals within Skanska that might be interested in a new opportunity, even though they have not applied for that position. 50% of the submissions team were interviewed and none of them had

[2] The phrase "Win Work" is one of Skanska UKs new mantra's, and is spread trough out the business to make employees aware and focused on aspects helping Skanska to win new projects (Project Director, Skanska UK, 2013-04-16).

access to, or knowledge of, the 1500 CVs that the SL holds. (Resourcing Partner, Skanska UK, 2013-03-07)

Project Managers
"*The knowledge I demand differs both between projects and phases."* (Project Manager, Skanska UK, 2013-03-05)

"In such a big company as Skanska there are a lot of information to gain from projects which is the essence of the company. The difficulty, however, is to capture and find this knowledge."(Manager, Skanska UK, 2013-03-14)

The constructing-processes are Skanska AB's core business, and more than 50 per cent of all employees are spending all their working hours "out in the fields". It is also here, "out in the field" and within each and every live project, where the daily knowledge sharing is taken place. Sharing knowledge between projects is considered challenging, since each project is often large and time consuming (Manager, Skanska AB, 2013-04-04). Other interviewees mentioned that even if there are processes for capturing knowledge from each project; these processes are often taken place long time after the project completion, creating an unwanted time lag. (HR, Skanska UK, 2013-03-13)

"When working in a project, it is almost like working within a small company and sharing information are being made between people within that company and we do not have time to write down everything." (Project Manager, Skanska UK, 2013-03-05)

"When in a project the focus is on building and make the project move forward as smoothly as possible." (Project Director, Skanska UK, 2013-04-16)
Other issues of sharing knowledge between projects mentioned are many of co-operations Skanska UK are doing on projects with other construction companies. Co-operations are not an exception for Skanska UK, and are in fact very common in the construction industry in the UK, but can have large impact on knowledge sharing between projects and processes (Director, Skanska UK, 2013-04-10).

5.2 How Can and How is Skanska UK Reaching Knowledge?

The semi-structured interviews did not only focus upon the knowledge demanded but also discussed current KMSs within Skanska UK, with an aim to map these. Since the individuals where chosen with the intention to get a heterogeneous group, naturally not all interviewees had knowledge of, or access to every systems. The interviews were therefore constructed with this aspect in mind, and a semi-structured interview approach where taken. The questions can be seen below. The answers are presented starting in section 5.2.1, and are gathered both during the 35

above-mentioned interviews, and also during various other meetings. A description over the semi-structured interview approach can be seen in appendix, section 10.1.

1. *What kind of knowledge is shared with the KMS?*
2. *What is the purpose of the KMS?*
3. *Was the purposed benefit or problem related to the KMS explained for end users before the KMS was launched?*
4. *Was the KMS in line with the company strategy? And was this communicated before the KMS was launched?*
5. *Was training and education conducted for the end users?*
6. *Do you consider the KMS to be user friendly and appropriate to everyone?*
7. *Do you consider the KMS to be up to date?*
8. *Was there an implementation phase conducted when the KMS was launched?*
9. *Was there an unfreezing phase in the end, were the KMS was locked to the company?*
10. *Was there any lessons learned captured from the implementation of the KMS?*
11. *Is there a clear promotion regarding a connection between individual level of learning with organisational level?*
12. *Is there a clear ownership of the KMS?*

5.2.1 What Knowledge is Being Shared?

	Shared knowledge
One Skanska	**Explicit**: Documents, reports and information regarding employees **Tacit**: information, such as position that allows employees to share tacit knowledge
Project Database	**Explicit**: Documents, reports and information regarding projects
Our way of working	**Explicit**: Documents and information regarding standard processes
Activity Sheets and Lessons Learned	**Explicit**: Documents, reports and information regarding innovations etc. concerning projects.
Submissions Library	**Explicit**: Documents, reports and information regarding projects and employees
Instant messengers	**Explicit**: Information regarding projects etc. **Tacit:** Possible to ask questions and get information regarding tacit knowledge
Taleo	**Explicit**: Documented information regarding employees
Expert groups	**Explicit**: Documents, reports and information regarding innovations etc. concerning projects **Tacit**: Meetings, seminars etc.

Table 5.1: What kind of knowledge is being shared?

Even though already many existing KMS are in place, more are developed or aimed to be. Learning and development needing skills to make a structured approach to carer improvements, innovation apps and a system for "who knows what", are examples of initiative aimed to be developed in the near future (Head of Innovation, Skanska UK, 2013-03-07). Some individuals expressed their concern with these developments and see these processes are as reinventing the wheel. (HR, Skanska UK, 2013-04-15). Others mean that it only indicates that Skanska UK's is willing to put money and effort into being a learning organisation and that possible double work, only shows that big efforts are made to an innovative organisation (Director, Skanska UK, 2013-04-10). Indications from the meetings and interviews show, however, that developers of new KMS, does not take advantage of old developments and does not use of lessons learned from earlier KMS projects.

90 per cent of the interviewees say they would use and benefit from a suitable KMS. While this indicates a large willingness to share knowledge other interviews express feelings of lack between both willingness to share knowledge and the understanding of the true value of knowledge sharing across the business (Head of Innovation, Skanska UK, 2013-03-07).

5.2.2 Existing Knowledge Management System

One Skanska
All of the interviewed individuals knew about the KMS and the questions are therefore based upon everyone.

Question	Answers
Was the purposed benefit or problem explained?	More than 25 of the interviewed answered or implied that such an explanation had been carried out.
Is the KMS in line with company strategy, and is this communicated?	More than 25 of the interviewed answered or implied that such an explanation had been carried out.
Was training and education conducted?	More than 25 of the interviewed answered or implied initially that such education had been carried out, but when asked about features, such as putting up CV information, they did not know about it or used it. One of the interviewees stated, *"Can you actually do that?"*(Head of Innovation, Skanska UK, 2013-03-07)
Is the KMS considered user-friendly?	More than 25 of the interviewed answered or implied that they did **not** consider the KMS to be user friendly*, "you need to know which information exist and know how search for it. There are no obvious links.*" (Bid Writer, Skanska UK, 2013-04-02)
Is the KMS up to date?	More than 25 of the interviewed answered or implied that the KMS is **not** up to date.
Was there an implementation phase?	More than 25 of the interviewed answered or implied that an implementation had been carried out.
Was there an unfreezing phase?	More than 25 of the interviewed answered or implied that such phase had **not** been carried out. *"When launching OUs could still use their old intranets, so they did. And now they have a lot of shortcuts to reach their old systems".* (Business Improvement Coordinator, 2013-04-11).
Was there a freezing phase?	More than 25 of the interviewed

	answered or implied that such phase had **not** been carried out.
Where there any lessons learned captured from the project?	More than 20 but less than 25 of the interviewed answered or implied that such capturing had **not** been carried out. The Legal and Law department implied that they had such capturing.
Is there a clear promotion regarding an existing connection between individual- and organisational level?	More than 20 but less than 25 of the interviewed answered or implied that that such communication had been carried out, still one interviewee implied that the KMS was not consider promoting such connection more than old KMS (Project Director, Skanska UK, 2013-04-16).
Does the KMS have a clear owner?	More than 25 of the interviewed answered or implied that the KMS are owned by Skanska AB.

Table 5.2: Empirical findings One Skanska

Project Database

All of the 35 individuals interviewed knew about the KMS and the questions are therefore based upon everyone.

Question	Answers
Was the purposed benefit or problem explained?	More than 25 of the interviewed answered that such an explanation had **not** been carried out.
Is the KMS in line with company strategy, and is this communicated?	More than 25 of the interviewed answered or implied that such communication had been carried out.
Was training and education conducted?	More than 20 but less than 25 of the interviewed answered or implied that such communication had **not** been carried out.
Is the KMS considered user friendly?	More than 25 of the interviewed answered or implied that they had gotten information about the KMS, but they did not use the KMS and therefore didn't know if it was user friendly, as a Project Director (2013-04-16) put it *" I have heard about it, but I don't know how to access of use the system."*
Is the KMS up to date?	Less than 5 of the interviewees had used the KMS and according to them the information within is put there in retrospect, and is **not** considered up to date.
Was there an implementation phase?	More than 25 of the interviewed answered or implied that an implementation phase had **not** been carried out.
Was there an unfreezing phase?	More than 25 of the interviewed answered or implied that such phase had **not** been carried out.
Was there a freezing phase?	More than 25 of the interviewed answered or implied that such phase had **not** been carried out.
Where there any lessons learned captured from the project?	More than 25 of the interviewed answered or implied that such capturing had **not** been carried out.
Is there a clear promotion regarding an existing connection between individual- and organisational level?	More than 25 of the interviewed answered or implied that such connection does **not** exist.
Does the KMS have a clear owner?	More than 25 answered or implied that they did not know where the ownership recedes. As one interviewee explained it *"No one owns it and it is not up to date"*(Business Improvement Coordinator, 2013-04-11).

Table 5.3: Empirical findings Project Database

Our Way of Working

All of the interviewed individuals knew about the KMS and the questions are therefore based upon everyone.

Question	Answers
Was the purposed benefit or problem explained?	More than 25 of the interviewed answered that such explanation **not** had been carried.
Is the KMS in line with company strategy, and is this communicated?	More than 25 of the interviewed answered or implied that such communication had **not** been carried out.
Was there training and education conducted?	More than 25 of the interviewed answered or implied that that such training or education had **not** been carried out.
Is the KMS considered user-friendly?	More than 25 of the interviewed answered or implied that that the KMS was **not** user friendly. The most commonly given reason was that the information was general and therefore useless, and it was difficult to search the system and find relevant documents. *"Other operating units are not aware of where they exist and they are not easily accessible through the intranet"*(Bid Writer, Skanska UK, 2013-04-02)
Is the KMS up to date?	More than 25 of the interviewees answered or implied that that the KMS is **not** up to date.
Was there an implementation phase?	More than 25 of the interviewed answered or implied that that such phase had **not** been carried out.
Was there an unfreezing phase?	More than 25 of the interviewed answered or implied that that such phase had **not** been carried out.
Was there a freezing phase?	More than 25 of the interviewed answered or implied that that it such phase had **not** been carried out.
Where there any lessons learned captured from the project?	More than 25 of the interviewed answered or implied that that such capturing had **not** been carried out.
Is there a clear promotion regarding an existing connection between individual- and organisational level?	More than 25 of the interviewed answered or implied that that there was no clear connection. The information is not considered to be up to date and can therefore not be applied to the organisation.
Does the KMS have a clear owner?	More than 25 answered or implied that they did not know where the ownership recedes.

Table 5.4: Empirical findings our way of working

Activity Sheets and Lessons Learned

All of the interviewed individuals knew about the one or both of the KMS and the questions are therefore based upon everyone.

Question	Answers
Was the purposed benefit or problem explained?	More than 25 of the interviewed answered or implied that such explanation had **not** been carried out.
Is the KMS in line with company strategy, and is this communicated?	Less than 5 of the employees had used both or one of the KMS. These individuals answered that such communication had **not** been carried out.
Was there training and education conducted?	Less than 5 of the employees had used both or one of the KMS. These individuals answered that such education or training had **not** been carried out.
Is the KMS considered user friendly?	Less than 5 of the employees had used both or one of the KMS. These individuals answered that the KMS is **not** user friendly.
Is the KMS up to date?	Less than 5 of the employees had used both or one of the systems. These individuals answered that the KMS was up to date.
Was there an implementation phase?	More than 25 of the interviewed answered or implied that such phase had **not** been carried out.
Was there an unfreezing phase?	More than 25 of the interviewed answered or implied that such phase had **not** been carried out.
Was there a freezing phase?	Less than 5 of the employees had used both or one of the systems. These individuals answered that such information had **not** been carried out.
Where there any lessons learned captured from the project?	More than 25 of the interviewed answered or implied that that such capturing had **not** been carried out.
Is there a clear promotion regarding an existing connection between individual- and organisational level?	More than 20 but less than 25 of the interviewed answered that such communication had been carried out.
Does the KMS have a clear owner?	More than 25 answered or implied that they did **not** know where the ownership recedes.

Table 5.5: Empirical findings Activity Sheets and Lessons Learned

Submissions Library

Seven employees interview are or had been working with SL and the questions are therefore only applicable for them.

Question	Answers
Was the purposed benefit or problem explained?	All of the individuals, working with SL, answered that they had gotten such explanation.
Is the KMS in line with company strategy, and is this communicated?	The interviewed answered or implied that such communication had **not** been carried out
Was there training and education conducted?	The interviewed answered that such training exists and that it is sufficient. There are also documents and guides on how to use the system, which have been studied and considered sufficient by the authors of this study.
Is the KMS considered user-friendly?	The seven interviewees all implied that the KMS is user-friendly, which is also agreed by the authors after trying SL themself. "*If you know how to use Google, then you know how to use the GSA.* "Head of Submission, Skanska UK, 2013-04-11)
Is the KMS up to date?	All seven interviewees answered that the KMS is up to date.
Was there an implementation phase?	Not applicable for this system since it has not been launched to its full community yet.
Was there an unfreezing phase?	Not applicable for this system since it is the first of its kind.
Was there a freezing phase?	Not applicable for this system since it is the first of its kind.
Where there any lessons learned captured from the project?	Not been carried out at the moment.
Is there a clear promotion regarding an existing connection between individual- and organisational level?	The interviewees answered or implied that such promotion had **not** been carried out, and explained that they are the only ones having access to the information and when preparing for tenders.
Does the KMS have a clear owner?	The seven interviewees all implied that there is a clear owner.

Table 5.6: Empirical findings Submissions Library

Instant messengers

All of the interviewed individuals knew about instant messenger system and the questions are therefore based upon everyone.

Question	Answers
Was the purpose benefit or problem explained?	More than 25 of interviewees answered that such explanation had **not** been carried out.
Is the KMS in line with company strategy, and is this communicated?	More than 25 of the interviewed answered or implied that that such communication had **not** been carried out.
Was there training and education conducted?	More than 20 but less than 25 of the interviewed answered or implied that that such education or training had been conducted, but that it was not sufficient. "*The systems could be very good if people got more training. I think just a tutorial would improve the usage a lot. Today employees think it is just a chat program"*(Business Improvement Coordinator, 2013-04-11).
Is the KMS considered user friendly?	More than 25 of the interviewed answered or implied that that the KMS was user friendly.
Is the KMS up to date?	More than 25 of the interviewed answered or implied that the KMS is up to date.
Was there an implementation phase?	More than 20 but less than 25 of the interviewed answered or implied that education and training had **not** been conducted.
Was there an unfreezing phase?	More than 25 of the interviewed answered or implied that such phase had **not** been carried out.
Was there a freezing phase?	More than 25 of the interviewed answered or implied that that such phase had **not** been carried out.
Where there any lessons learned captured from the project?	More than 25 of the interviewed answered or implied that that such capturing had **not** been carried out.
Is there a clear promotion regarding an existing connection between individual- and organisational level?	More than 25 of the interviewed answered or implied that such communication had **not** been carried out.
Does the system have a clear owner?	**Not applicable for this system.**

Table 5.7: Empirical findings Instant Messengers

Taleo

Three employees interview were or had been working in the Human relations department and the majority of the questions were therefore only applicable for them.

Question	Answers
Was the purposed benefit or problem explained?	This question was applicable for all the interviewed and more than 20 but less than 25 of the interviewed answered or implied that such an explanation had been carried out.
Is the KMS in line with company strategy, and is this communicated?	This question was applicable for all the interviewed and more than 20 but less than 25 of the interviewed answered or implied that such communication had **not** been carried out.
Was there training and education conducted?	The three employees working with HR answered or implied that they had sufficient education concerning Taleo.
Is the KMS considered user-friendly?	The three employees working with HR answered or implied that the KMS was user friendly.
Is the KMS up to date?	The three employees working with HR answered or implied that the KMS is up to date.
Was there an implementation phase?	The three employees working with HR answered or implied that such education and training had been conducted.
Was there an unfreezing phase?	The three employees working with HR answered or implied that such phase had been carried out.
Was there a freezing phase?	The three employees working with HR answered or implied that such phase had been carried out.
Where there any lessons learned captured from the project?	The three employees working with HR answered or implied that such capturing had **not** been carried out.
Is there a clear promotion regarding an existing connection between individual- and organisational level?	**Not applicable**
Does the KMS have a clear owner?	The three employees working with HR answered or implied that the KMS has a clear owner.

Table 5.8: Empirical findings Taleo

Expert Groups

All of the interviewed knew about the Expert Groups and the questions are therefore based upon everyone.

Question	Answers
Was the purposed benefit or problem explained?	More than 25 of the interviewed answered that such explanation had been carried out.
Is the system in line with company strategy, and is this communicated?	More than 25 of the interviewed answered or implied that such communication had been carried out.
Was there training and education conducted?	More than 20 but less than 25 of the interviewed answered or implied that such education and training had **not** been conducted. The interviewed answered that they felt unsure about where and how to post a question, and also which questions were appropriate to ask. *"The system is simply not used enough, to provide the anticipated benefits of the portal"*(Director, Skanska UK, 2013-03-12).
Is the KMS considered user-friendly?	More than 25 of the interviewed answered or implied that the KMS was **not** user friendly.
Is the KMS up to date?	More than 25 of the interviewed answered or implied that the KMS is up to date.
Was there an implementation phase?	More than 25 of the interviewed answered or implied that such a phase had been conducted.
Was there an unfreezing phase?	**Not applicable, since the system is the first of its kind.**
Was there a freezing phase?	**Not applicable, since the system is the first of its kind.**
Where there any lessons learned captured from the project?	More than 25 of the interviewed answered or implied that such capturing had **not** been carried out.
Is there a clear promotion regarding an existing connection between individual- and organisational level?	More than 25 of the interviewed answered or implied that such promotion had **not** been carried out. *"To encourage true knowledge sharing a cultural shift is required. Knowledge is power and for individuals to freely give up strategically important knowledge, this kind of behaviour needs to be recognized and rewarded"*(Director, Skanska UK, 2013-03-12).
Does the KMS have a clear owner?	More than 25 of the interviewed answered or implied that the KMS had a clear owner.

Table 5.9: Empirical Findings Expert Groups

5.3 CV Template

Due to early findings concerning the behaviour of Skanska UK employees, a new research approach aroused. Since employees are more likely to ask or phone each other regarding knowledge gathering, a KMS where this behaviour was simplified could possibly benefit Skanska UK. A searchable KMS where employees different skills, expertise and project history was shown, was considered to be one way of trying to make new connections between experts and employees demanding their expertise. One-way of enable such connections were to ask employees questions about their experiences and make this data searchable. Since the submission team also demanded an improved CV database, a CV template was developed to investigate the issues and problems related to trying to gather knowledge in a structured way.

The CV template was sent to 78 employees, chosen by the submission team. In this study the results are used to analyse different aspects of how and what kind of answers employees give to structured questions about their existing experiences. The questions are developed by the authors of this study, and take its starting point in the 35 semi-structured interviews concerning OUs different demands of knowledge. However, the template is mostly focused upon the needs of Submissions, since CVs are highly demanded by them, and the submissions team had therefore a sizeable involvement in the development of the questions. The structure, and the questions asked in the template can be seen in appendix section 10.3. The individuals completing the template, were also approached with a questionnaire regarding; how long the template took to complete, which section that took the longest time to complete, if any questions were hard to understand or difficult to answer and general comments. Three individuals were also interviewed about general structure of the template.

For this study, it was chosen to only demonstrate the results concerning response rate, questions about client quotations, response time and some of the general comments about the template. It can also be mentioned that when sending out the template to employees, many individuals expressed their concerns about filling it in. The concerns were mostly relating to questions about; what the information was going to be used for, how it was going to be stored and who was going to have access to it. Some individuals also expressed their lack of trust about the template to the Law department, resulting in a meeting with this department to ensure that the right explanations and information was used when confronting employees with the template.

5.3.1 CV Template Results

As seen in table 5.10, a small amount of the total of 78 employees approached, completed the template, resulting in a response rate of 23 per cent.

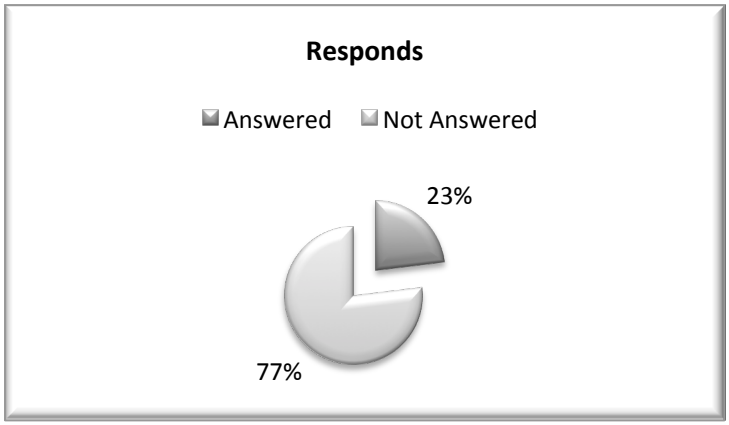

Table 5.10: Response rate CV template

The response time is seen in table 5.11, which shows the average response time of approximately one week.

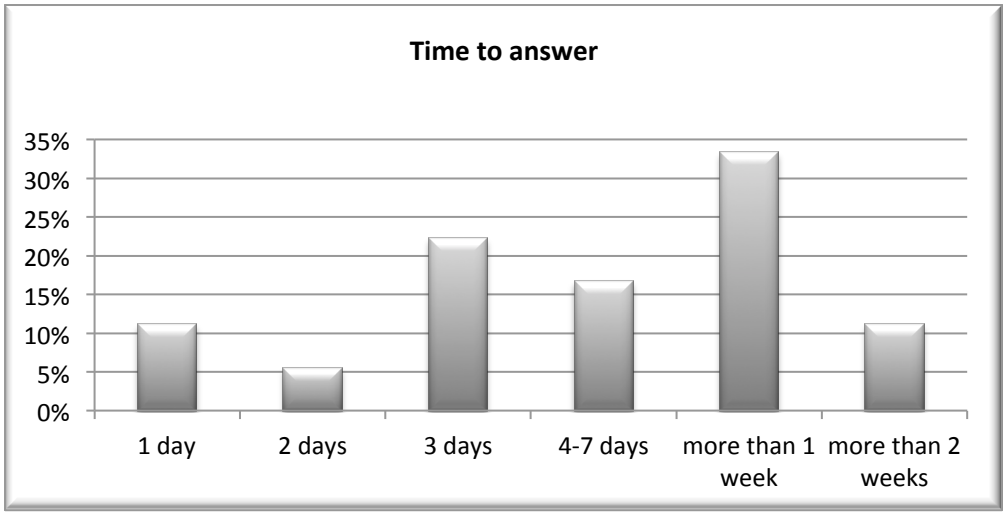

Table 5.11: Response time CV template

The 18 employees, who completed the CV template, liked the structure and it took them 1 hour on average to complete it. One question asks the employees to write a quotation from one of their clients. Quotations from clients are important to

submissions, and are often used in tenders (Senior Editor, Skanska UK, 2013-03-06). Only 33 per cent responded to this question, seen in table 5.12.

Table 5.12: Filled in Testimonial Quotes - CV Template

Only one respondent answered this question with a quote considered valid to use in tenders. The other respondents, referred to documents, where such valid quotes could be found.

5.4 Reasons for Using or Not Using Existing KMS:

When trying to gain knowledge the instinct amongst employees are to ask someone in the same place of work, both found within Shelley (2011) and Taylor (2012) and by empirical findings in this study (Project Manager, Skanska UK, 2013-04-05).

"When trying to find the answer to something I tend to phone people up…even if I don't always know straight away who to call, it usually takes a only few calls and bizarrely you end up with someone who can help you"(Project Director, Skanska UK, 2013-04-16)

Table 5.13 show the most common KMS used by the 35 interviewees.

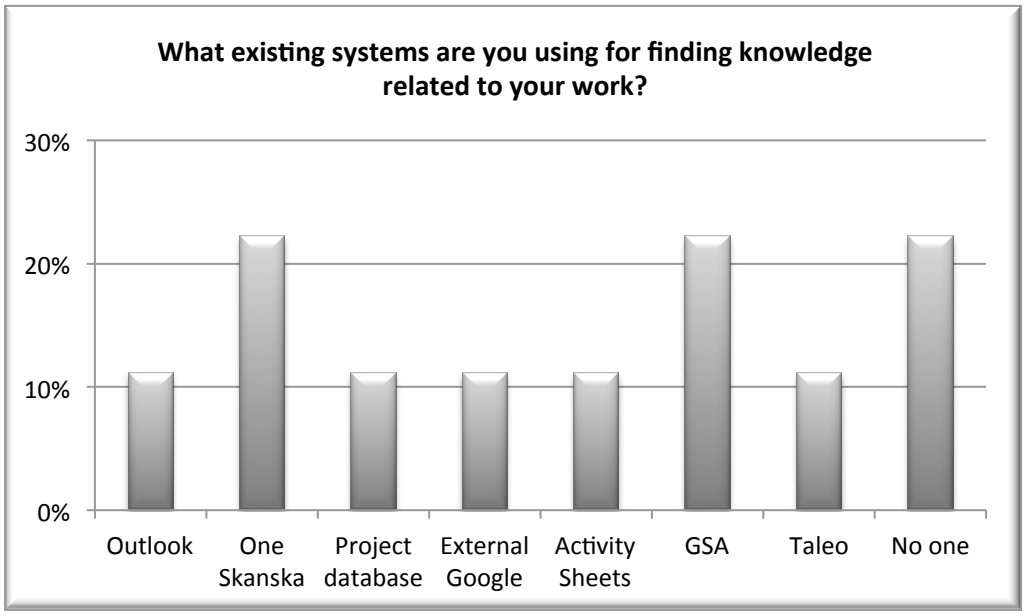

Table 5.13: What systems are you using for finding knowledge...?

Some respondents did not use any of KMS to find knowledge needed in their daily work. The reason for low usage of current KMS were discusses amongst many of the interviewees and are presented in section 5.4.1 – 5.4.3.

5.4.1 KMS is not developed for End-Users

"It is like they have not asked the people who are suppose to use the system, how the system will make their daily work easier, and I do not use any KMS in my daily work" (Project Director, Skanska UK, 2013-04-16)

One reason discussed among many interviewees, were indication of systems being far away from the employees needing them and that the KMS do not have direct links between what employees do and how the KMS is constructed (Project Director, Skanska UK, 2013-04-16).

5.4.2 Cultural Aspects

When interviewing the Skanska AB global Knowledge Sharing Manager, culture is mentioned as one possible reason for the low and diversified usage of systems. Further she puts the culture as the single most important aspect when speaking about knowledge Sharing and knowledge spreading. In Skanska AB the culture leans towards individuals wanting to solve problems by themselves, which is meant not to be specific to Skanska AB. She continues by saying that this is a natural behaviour of people. People rather solve problems on their own than asking others for help (Manager, Skanska AB, 2013-04-04)

Other interviewees also agree with above by saying that the culture within Skanska UK is bias towards sharing information (HR, Skanska UK, 2013-04-04).

"Within Skanska the ones considered "heroes" are not the ones that gain knowledge by asking others, the heroes are the ones solving problems themselves."(Manager, Skanska AB, 2013-04-04)

One VD for a Skanska AB operation unit meant, *"When a man ask someone for information it is a sign of weakness, however when a woman ask a question it is a sign of wanting to work together as a team."* (Manager, Skanska AB, 2013-04-04)

5.4.3 Time

"I'm not sure if a system which generate what everyone knows is the right thing to do. It generates too much sharing. It's a fine line between positive and negative."(HR, Skanska UK, 2013-04-04)

"I have a lot on my plate and don't have time to write down everything" (Business Developer Coordinator, Skanska UK, 2013-03-05)

Both time issues and difficulties to write down knowledge were other reasons discussed among the interviewees. As one respondent discussed, it is hard to make someone write down knowledge when not knowing exactly what kind of information you are aiming for (HR, Skanska UK, 2013-04-04). Another project manager explained it like:

"I want to see what you are aiming for, for me to give you what you want"(Senior Advisor, Skanska UK, 2013-03-05)

Other mentioned that it is easier to call someone, compared use an ineffective KMS, since the answer only might be two phone calls away. To have to go trough a system and not be sure if the right information is there seams a lot of time waste to me (Principal Consultant, Skanska UK, 2013-04-11).

"I want to share knowledge, but it has to be done efficiently. At the moment I got questions from Scotland, South America, USA and they all what the information in different format." (Project Manager, Skanska UK, 2013-03-05)

5.4.4 Technical Barriers

Other reasons are for low usage, are argued to be technical. Out of the respondents saying they are using a KMS more than 75 per cent answered that the KMS they were using, was either to difficult to search or non user-friendly.

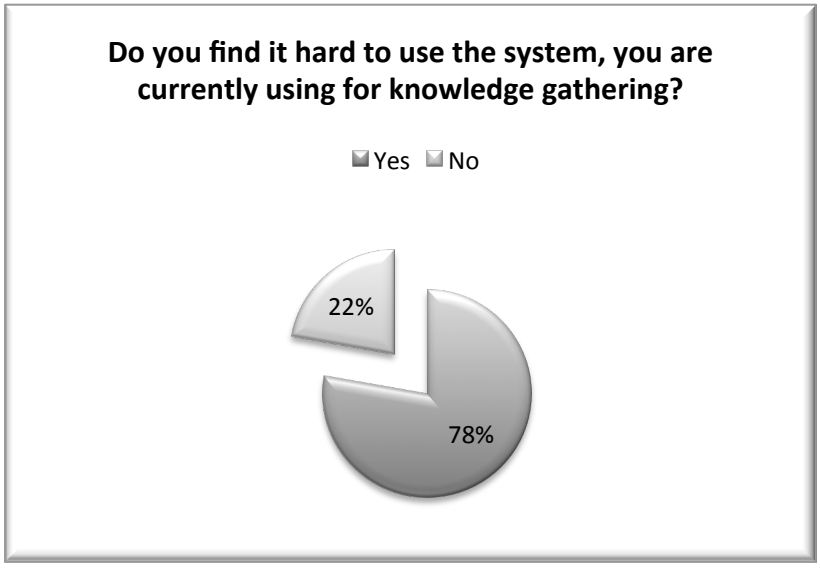

Table 5.14: Do you find it hard to use the system, you are currently using for knowledge gathering?

While most interviewed employees find the technical barriers hard to overcome, other disagree, as the ITSD manager put it:

"Technology is never the problem, the problem is to make people share information and keep it up to date" (Lead IT Business Partner, Skanska UK, 2013-03-04).

6. Analysis

The sixth chapter will provide an analysis based on the theoretical findings applied to the empirical data. The analysis will try to provide a model for efficient knowledge sharing, which is presented in the end of the chapter.

The theoretical framework presented in chapter 2.5.6 was applied to the case company. The following analysis will relate the findings from the empirical study to the presented theoretical framework, in order to develop it further in to a model.

6.1 What Kind of Knowledge does We Need?

When developing a new KMS, one of the first questions to determine is what kind of knowledge the organisation needs to share. Early findings at Skanska UK indicated the diverse demand for knowledge, both depending on which OU or employee that was questioned. However, one can say that knowledge is needed for all OUs and the many existing KMS are already trying to provide this knowledge. When trying to improve existing KMS or create new ones, it is important to try to define the kind of knowledge that really needs to be shared. Is the most important issue to share knowledge within each OU or can the organisation benefit from knowledge sharing across OUs? What kind of knowledge is important, and what knowledge is overrated and unwanted? These questions are difficult to answer, it is therefore considered important to take a holistic approach, trying to get an idea of the different needs, in order to create efficient KMS.

At Skanska UK, project specific information is demanded, but as mentioned the demand differs much, one example is preconstruction; they demand CV information in order to make decision in the tendering process, while other departments almost never uses that kind of information. It is therefore the first focus of any company trying to implement or develop a new KMS to prioritise this first aspect.

6.2 Cultural Aspects

The second aspect to reflect upon before implementing and developing KMS is the cultural aspect. The culture within Skanska UK is to ask the neighbour and not a KMS, and many of the interviewees mentioned that cultural issues are reasons to why employees rarely use existing KMSs. Some research, however, mean that it is not effective to blame all organisational problems upon culture (Brown, 1995; Gordon, 1985; Hassard & Sharifi, 1989; Nord, 1985; Uttal, 1983) and the low usage might therefore depend upon other aspects, discussed in forthcoming parts of this chapter. Culture is however not unimportant, since employees often telephone each other at Skanska UK, a KMS where this kind of behaviour is supported would probably be used more. Project managers often receive questions on email, where

questions differ both in structure and focus. If these questions were more structured, the answers would be easier to provide. Therefore before taking decisions, one also has to decide whether the culture needs to be changed or if the KMS need to be applied to the existing culture within.

6.3 Learning

This section discusses learning, where the following aspects will be analysed: explicit and implicit knowledge, connection between individual and organisational learning, type of learning and Nonaka's (1994) learning spiral. This chapter takes the starting point in the following quotation from Newell et al. (2009):

"When understanding problems associated with exploiting[1] and sharing knowledge, it is relevant to make a distinction between knowledge boundaries and learning boundaries."

6.3.1 Explicit and Tacit Knowledge

In this study the first issue was to identify and classify what type of knowledge was already being shared, and how. The empirical findings show that the majority of the knowledge shared within the most commonly used KMS turned out to be explicit, meaning knowledge that is presented in documents, reports or in information regarding employees. The employees interviewed explained that they felt a difficulty expressing and sharing knowledge, such as experiences, which is in line with Von Zedtwitx, (2002), Keegan, Turner (2001) and Kotnour's (1999) arguments that softer learning of a tacit nature often is found difficult to share and the knowledge, which is shared are therefore trapped in documents and put out for everyone to search for online. The author's further state that, in this way knowledge and learning are assume to be shared across projects (Sharp, 2003). According to the empirical studies in the thesis, this strategy is widely spread throughout Skanska UK. This kind of documentation has been reviewed not very helpful according to Von Zedtwitx (2002), Keegan and Turner (2001) and Kotnour (1999) and has also been expressed during interviews in the empirical study. The reasons why are many, time pressure is one reason, according to Keegan and Turner (2001), also expressed by project managers at Skanska UK. It is also evident that even when time and data exist, there are limits to how many soft lessons that are actually learnt (Kotnour, 1999).

Main reasons for not sharing knowledge, explicit or tacit, are presented by Newell et al. (2009) and are found to correlate a lot with the empirical findings at Skanska UK:

- ✓ *Belief in uniqueness of context:* Project managers argue that when working in a project it feels like working for a small company. Other empirical findings also implies that there is a feeling of uniqueness of context within

Skanska UK and that it might be most efficient to share knowledge only within each OU and not across them.

- ✓ *Standardisation:* While some projects are seen as unique other are considered standard. For example in a construction company where many projects are repeated, routines may work well when a project fits the normal template, which is also found in the empirical studies. Project managers demand different knowledge depending both on project and phases within projects. The fact that information only seems to be shared within OUs implies that Skanska UK does not see the benefits from sharing information between units.

- ✓ *Ability to capture and access "softer" lessons:* This ability is found difficult almost to all interviewees, which mostly explained it, as the knowledge needed is very difficult to find and capture. When developing and testing the CV template at Skanska UK, it was challenging to make individuals reply. The respond rate of 23 per cent also implies that gathering information from project managers is hard. The project managers found that time constrains are a problem, since the project-focus is to make it run as smooth as possible and that they do not have time to share and write down knowledge. All these aspects indicates that it is hard to capture "softer" lessons if the project-managers them self does not see the true value of doing so.

- ✓ *Project reviews and milestones*: Many processes within Skanska are supposed to enable knowledge sharing. These are not thought of as useful by the employees and to take one example only 23 per cent of the employees have ever submitted a "lessons learned card". Other findings indicate that existing KMS are not used, since morethan90 per cent responded that when they were to experience a problem, their first intention were not to look up the answer in a KMS. These findings mean that existing KMS and processes are not used to their full potential. Other interviewees also said that it is difficult to make employees sit down and share information while they work on projects. Knowledge capturing therefore often have to wait, even though there from the beginning existed an aim to capture these lessons in the end of the project.

- ✓ *Lack of awareness that knowledge transfer is needed:* The same problem exists within Skanska UK and is confirmed when asking the 35 interviewees to give information about what knowledge they demand. Even when realising what knowledge that is needed, it is hard to make others aware of the importance to share this information. One example is when trying to capture quotations to submissions team. Out of the 18 responses only one

submitted a quotation in a format valuable for submissions. It is important to give the exact question of what you need, and also make individuals aware of the importance for them to share it. The reason for the low number of responds can however also mean that no such quotations exist, but the fact that some answers were given in manners as "can be found in..." implies that the submitters do not understand the important of real quotations or the meaning of the question.

All of these different arguments for why knowledge is not shared correlate with the results from the empirical study. There is a widely spread perception that every project is unique within the construction industry (Newell et al. 2009), and Skanska UK is not an exception. The empirical study shows that Skanska UK is demanding tacit knowledge sharing. While some of the KMS enables sharing of tacit knowledge and others have the potential to do so, the empirical research implies that the KMS are not used in such manors. This relates to the above-mentioned reasons as well as other factors explained in the coming sections. What type of knowledge each existing KMS are sharing, are shown in below table 6.1.

	OS	**PD**	**OW**	**ASLL**	**SL**	**IM**	**T**	**EG**
Explicit or Tacit Knowledge Sharing	**E/T**	**E**	**E**	**E**	**E**	**E/T**	**E**	**E/T**

Table 6.1: Explicit or Tacit shared knowledge at Skanska UK

6.3.2 Connection Between Individual and Organisation

In theory learning must become a collective process, both enabling individuals to learn but also to help the whole organisation to learn and develop from individuals learning (Nonaka & Takeuchi, 1995). In Skanska UK, this means that it is not enough that one individual benefit from the systems, it needs to be beneficial to the whole organisation and there needs to be a fundamental shift towards a collective thinking. Even though Skanska UK are aware of the benefits with knowledge sharing, many project managers are indicating that they experience alack of both time and motivation to be able to write down their own leanings or knowledge. They also indicate that they are putting too much focus upon their current projects. This form of individual thinking can damage Skanska UK and make them oversee the benefits with triple-loop learning, which according to Argyris & Schon (1978) is where the rationality of the organisation is questioned, and can be important in the involving environment of today. Since individuals are focused upon their own projects and not thinking of the organisations best as a whole system, Skanska UK are not considered to experience connection between the individual and organisational level of learning. When individuals focus upon their own learning process and not on the

organisation as a whole, knowledge sharing that is valuable for others lack, which also the empirical findings indicates.

According to the empirical findings, the only KMS that have a clear connection between organisational level and individual level are One Skanska and Activity Sheet/Lessons Learned.

	OS	PD	OW	AS LL	SL	IM	T	EG
Connection between Individual and Organisational Level	**X**			**X**			N/A	

Table 6.2: Connection between Individual and Org. Level

6.3.3 The Knowledge Spiral

Socialization

The key to knowledge creation lies in the process of mobilizing tacit knowledge (Nonaka& Takeuchi, 1995). As Nonaka and Takeuchi (1995) argue, there is not necessarily a need to use language when acquiring knowledge and experience is one factor considered key to acquire tacit knowledge, which relates to the socialization interaction between tacit to tacit knowledge. At Skanska UK, training in the context of making people experience new knowledge, is not used as a method of spreading knowledge, and even if the "expert groups" and the members of each group have training and education, the rest of the systems is not focusing on this.

Combination

At Skanska UK the current KMS are mostly of a combination kind where explicit to explicit knowledge is shared. Since this model, according to Nonaka& Takeuchi (1995) involves the combination of different bodies of explicit knowledge new knowledge can arise from this, for example databases can be sorted and information can either be added or combined, creating new knowledge. However, since existing KMS are not widely used within Skanska UK today, combination exists but the likeliness of it to happen at the moment is low. If existing KMS where more structured and widely used the likelihood of combination would rise.

Externalization

Examples of externalization can be found in design philosophies. One Skanska could possibly been seen as one such philosophy. By naming Skanska AB's intranet "One Skanska" the name itself implies that the whole global group should work as one. As Nonaka and Tackeuchi (1995) explain, externalization is carried out when a concept or analogy is understood to be correct. The concept is therefore used to create

something tangible, which often results in gaps promoting interaction and reflection. Since Skanska UK have many separate intranets, “One Skanska” could be promoting the kind of reflection Nonaka and Tackeuchi (1995) argue are good, but “One Skanska” is not the only intranet and therefore the design philosophies can be argued not to happen. On the other hand, externalization can also happen when individuals are writing down tacit knowledge (Nonaka & Tackeuchi, 1995). The expert groups can experience these reflections and write down tacit knowledge since they are having sessions of collective dialogs and reflections on yearly basis.

Internalization

Internalization is a process closely related to ”learning by doing”, and it is enabled when experience through socialization, externalization and combination are turned into individuals tacit knowledge (Nonaka & Takeuchi, 1995). At Skanska UK neither combination nor externalization are considered to happen often and therefore internalization also becomes unlikely. The only system were internalization might happen at the moment are in the expert Groups, since members within are able to experience the social, combination and externalization learning process to some extent.

The content of the knowledge conversation created in each mode is by nature different. As argued above, each step in the knowledge spiral needs to interact with each other in the spiral of knowledge creation. Since Skanska UK is considered to not experience for example internalization processes, it is, according to Nonaka & Takeuchi (1995) difficult to reach the full strength of spiral of knowledge creation.

There are some critics to Nonaka & Takeuchi (1995) saying that knowledge instead is created from social interaction, and that norms need to be shared (Brown & Duguid, 1995; Gherardi, 2001; Lave & Wegner, 1991; Nicoli, Gherardi & Yanow, 2003; Orlikowski, 2002). Skanska UK is originally created by many individual companies. This history of separate companies with different norms can obstruct knowledge sharing according to these authors. Even though these arguments exist, it is still considered important to define in which stage a current or future KMS is or need to be concerning Nonaka & Takeuchi (1995) knowledge spiral. A map of the existing stages at Skanska UK is seen in table 6.3 below.

	OS	**PD**	**OW**	**AS LL**	**SL**	**IM**	**T**	**EG**
Social Learning Process (LP)								**X**
Combination LP	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Externalization LP								**X**
Internalization LP								**OK**

Table 6.3: Knowledge Spiral at Skanska UK

6.3.4 Single, Double and Triple-Loop Learning

In Skanska UK most of the KMS are focused on single loop learning, to detect and rectify errors in the organisations existing practises. The third type of learning, triple-loop learning, is when an organisation questioning the rationale of itself and therefore are able to transform (Argyris and Schon, 1978). This third type of learning is only found to happen in the expert groups. Since most theories suggest that organisations depend on their ability to learn in the same phase or faster than its environment, Skanska UK might suffer from their lack of ability to reach higher levels of learning loops, hence possibly inhibiting Skanska UK from being innovative and creative.

Two of the systems, instant messenger and "Activity Sheets"/"Lessons Learned" are considered to reach double loop learning. Double loop learning is when the organisation question the standard processes within the organisation (Argyris and Schon, 1978). The rest of the KMS only experience single loop learning.

	OS	PD	OW	ASLL	SL	IM	T	EG
Single Loop Learning	X	X	X	X	X	X		X
Double Loop Learning				X		X		X
Triple Loop Learning								X

Table 6.4: Type of Learning in Skanska UK

6.4 Knowledge Sharing Boundaries

The knowledge sharing boundaries contain discussions about trust, strong and weak ties and social capital. Due to the difficulties to measure current levels of trust for a KMS, instead a question regarding if the system "promotes a collective activity" or not can display the amount and level of knowledge shared. The question is considered to relate both to the type of social capital and type of tie within, which are both affected by trust. The result can be seen in table 6.5, were only instant messenger and expert groups are found to promote a collective activity.

6.4.1 Social Capital

Due to Skanska UK's large organisation, some structural social capital settings can be reasons to low knowledge sharing between OUs. The structural social capital within Skanska UK is historical where Skanska UK has arisen from many different companies now organised into one. Since structural social capital refers to the actual network ties between individuals, it is fundamental that there do exist ties that connect individuals in order to enable knowledge sharing (Napapiet and Ghoshal, 1998). One effort from Skanska UK's perspective to enables such ties, are One

Skanska, since the intention with One Skanska was to make all information available via one intranet. However, the empirical findings show that many of the OUs still are using their own "old" intranets, and therefore information sharing between the OUs can be suffering from no structural social network ties.

Skanska UK's historical mutilation of companies might also impact the cognitive social capital. Since many of Skanska's historical parts are old companies, brought up by Skanska UK, each unit might have developed their own understandings of shared norms. Knowledge sharing between units with different norms can be hard and as Newell et al. (2009) explains, *"just because there are networks connecting people, this does not mean that knowledge sharing actually happens".* Relational social capital is also relevant for knowledge sharing within a company, since individuals need to trust each other in order to share knowledge.

6.4.2 Trust, Strong Ties and Weak Ties.

Strong ties are considered to help share tacit forms of knowledge, and therefore one might argue that Skanska UK needs to focus on establishing these kinds of ties. When establishing strong ties, trust is a key ingredient (Newell et al. 2009; Dogson 1992, 1994; Von Kroght et al. 2000; Grandori & Soda, 1995; Kreiner & Schults, 1993; Oliver & Liebeskind; 1998; Rong & Van de Ven 1994). Lacking of trust can make anyone reluctant to share information, and one finding when testing the CV template, was the concerns individuals expressed concerning their personal information and where this was going to be stored. On the contrary, strong ties take a longer time to establish, and week ties are both faster to found and argued to enable new knowledge to arise (Granovetter, 1973; Hansen, 1999). In Skanska UK, it is found that most knowledge sharing is taken place within each OU, which further indicate that most connections at Skanska UK are based upon strong ties. In order to also facilitate week ties, and for Skanska UK to take advantage of these, KMS needs to be trusted. Further Nonaka and Takeuchi (1995) also putt much focus on these social and trusts aspects of knowledge sharing, they argue that strong ties are important and that interaction between people needs to be happening over a prolonged time, to enable tacit sharing.

Findings by Larsen (2011) illustrate the difficulties to map and describe networks as a logical process, which is also shown by Emmitt and Grose (2007). The contextual settings in organisations, including networks, are not static; hence these are in constant move. It is, therefore, considered very challenging to steer or influence the settings of informal networks (Larsen, 2011). In Skanska UK, expert groups are trying to make a structural network of experts; and therefore it is argued that it might be hard to control these networks over time. With more open structured networks, like LinkedIn, the settings and networks are able to fluctuate more naturally and week ties would possibly be easier to establish. Even these difficulties of steering

networks exists, it is through understanding such difficulties that insight could be gained into part of an actor's contextual setting. Understanding of how actors become aware of an innovation is critical to understanding how they impact actors, projects, firms and even the construction sector (Larsen, 2011).

In order to promote knowledge sharing it is considered important to enable different kinds of networks ties, and also work against structural, cognitive or relational barriers. The KMS needs to promote a collective activity where individuals are part of knowledge sharing networks. Skanska UK, is currently only considered to experience this enabling environment with instant messenger programs and the expert groups. All other KMS are either used specific by one OU or not used at all.

	OS	PD	OW	ASLL	SL	IM	T	EG
Promotes collective activity						X		X

Table 6.5: Promotes a collective activity.

6.5 Change

Even if a great KMS existed, the system itself is not an assurance of high degrees of knowledge sharing. One of the most crucial steps of creating a KMS is assuring that the system will be accepted when it is launched. According to authors in change management there are a lot of steps and aspects to consider when implementing a new system.

When comparing the different models of how to perform cultural changes, many similarities between the different models emerge. For example, between Dobson's (1988) four-step approach to culture change and Cummings and Worley's (2001) model to cultural change.

Step one according to Dobson (1988): Change recruitment, selection and redundancy to alter the composition of the workforce so that promotion and employment prospects are dependent on those concerned possessing or displaying believes and values that the organisation wishes to promote. According to Cummings & Worley (2001) step one is to: Formulate a clear strategic vision.

The second step is also similar, referring to top management commitment trough out the company. Step two according to Dobson (1988): reorganise the workforce to ensure that those employees and managers displaying the required traits occupy

positions of influence. According to Cummings & Worley (2001) step two is to display top-management commitment.

Hence the similarity between the two models on cultural change, a combination between these and Lewin's (1947) well-acknowledged framework for change has been made. However, as Brown (1995), Gordon (1985) and Hassard & Sharifi (1989) warn, these kinds of models are often argued to be too general since they consider change to be an open-ended process (Arndt & Bigelow, 2000) which indicate that they are not useful. Other critics also highlight the tendency within companies to assume that culture is the route to all organisational problems (Brown 1995, Gordon 1985, Hassard & Sharifi 1989). During the implementation of a new KMS, these aspects has to been taken into consideration and therefore the change and implementation part of the analysis discuss aspects which have been developed from a combination and evaluation of different respected theories. This combination and evaluation have lead to the following step, which are considered as necessary actions to take when implementing a new KMS.

6.5.1 In Line with Company Strategy

To communicate the purpose of the change, and that the change are in line with company strategy, is animportant aspect displayed by both Cummings & Worley (2001) and Dobson (1988). Both modelsclearly state this as an important step as well as Burnes (2004). When analyzing the empirical findings the only KMS where this explanation had been done in a clear way was: One Skanska, the Project Database and the expert groups. These KMSs are also the only KMSs being reviewed that are global company initiatives from Skanska AB. This could be indications that Skanska UK is not as efficient or focused when communicating out KMSs nationally compared to how Skanska AB is globally. These three KMSs are the ones that have got the most promotion and also the ones that almost all the interviewees knew about, this don't mean that they use the system though according to the empirical findings.

	OS	PD	OW	AS LL	SL	IM	T	EG
In line with company strategy and communicated	X	X						X

Table 6.6: Are the system in line with company strategy and well communicated?

6.6.2 Benefit or Problem Related to Change are Explained

The importance of a clear communication of the benefits is another essential step closely related to the above-mentioned communication. Authors like Duck (1993) explain a criterion for change to occur in an organisation, everyone within needs to start thinking and acting differently. Other authors, among these Wagner (1998), argue that humans will only become interested and motivated when change is salient to them. It is also considered useless to concentrate on changing the behaviour of individuals, according to the group dynamics school, since individuals usually are constrained by group pressure to conform. All these aspects focus upon the criterion that change must happen at group level (Cummings & Huse, 1989; French & Bell, 1984; Smith et al., 1982) and in order to make this happen individuals must understand the change.

The KMSs were it was expressed that such a communication had been carried out was One Skanska, SL, Taleo and the expert groups. Something to take in consideration regarding the SL and Taleo is that the employees, responding positively to this question, are working with the system on a daily basis, which might impact their view of how well this communication was carried out. One Skanska is clearly communicated out as well as the expert groups. These both KMSs also had a clear relation to the company strategy, as explained above. Interesting is that when the interviewees were asked further questions regarding the expert groups and the purpose of this KMS, they got increasingly unsecure of how the KMS should be used. The answers the majority of the interviewed gave about the purpose of expert groups did not correlate to the purpose given by the Global Knowledge Sharing Manager, responsible for expert groups. The purpose she gave, was that the expert should be well known within the different OUs and used as a source of knowledge on a daily basis, something that most other individuals were unaware of.

The project database was not considered sufficiently explained regarding purpose and/or benefits related to it. The majority of the interviewed implied that they knew about the KMS, but they did use it and it was also claimed that the project database was most valid for external clients. A summary of above discussion can be seen in table 6.7.

	OS	PD	OW	ASLL	SL	IM	T	EG
Purpose/benefit explained for end users	X				X		X	

Table 6.7: Is the purpose/benefit explained for end users?

6.5.3 Training and Education

Even though training, as a change mechanism is unlikely to succeed on its own (Burke, 1980), it is still considered important for a KMS to succeed. The empirical findings indicated that not much training and education about each KMS have been conducted within Skanska UK. Some KMSs have an information guide attached to the implementation phase, for example the submissions library or LYNC. Other KMSs, according to the interviewees, have not had any training at all.

One Skanska are considered inflexible and difficult to navigate and the interviewees, since these where found too difficult to use have only used some KMSs once. Other things, indicating absence of training and education, are findings showing that individuals responsible for systems found the KMS easy to use while others were unaware of all the features attached to a system. If all features were to be known, empirical indications show that processes could be made more efficient, for example having an updated version of the One Skanska CV function.

The KMSs considered to have sufficient training and education are Taleo, SL and to some extent instant messengers.

	OS	PD	OW	ASLL	SL	IM	T	EG
Training and education for end users					**X**	OK	**X**	

Table 6.8: Training and education

6.5.4 Clear Ownership

Findings from the empirical studies indicate that many KMS do not have a clear owner, especially concerning the project database. One Skanska is considered "owned" by Skanska AB, which also is the KMS used by far most employees. Submissions library was considered by the interviewees to have a clear owner, but these empirical findings might be a result from close relationships between the employees of the submissions team. Instant messenger and "Our way of working" are neither considered to have a clear owner, which might result in problems concerning updates and feature changes. If no clear owner exists, the possibility that an implementation phase or training and education will take place is low, which also correlate with the empirical findings.

	OS	PD	OW	ASLL	SL	IM	T	EG
Clear ownership to implementation	**X**				**X**	**N/A**	**X**	**X**

Table 6.9: Clear ownership

6.5.5 Unfreezing Step, Moving Forward and Freezing Step

Lewin (1947) argues about three phases that need to occur in order for a change to happen. When establishing a new KMS, the old KMS needs to be unfrozen, in order for employees to adopt the new way of doing things. At Skanska UK many different KMSs have been implemented, where one resent example is LYNC, implemented in April 2013. Even though Skanska UK had many other instant messenger systems, none of them where unfrozen.

Equally One Skanska did not have an unfreezing phase. One Skanska was supposed to be the only single intranet used by all OUs, but during the interviews it was found that each OU still used and could access other old intranets. Since Skanska UK never carried out an unfreezing phase, except concerning Taleo, the other important phase - freezing, were not occurring either. Submissions Library and Expert Groups are the first KMS of their kind and therefore the unfreezing and freezing phase is non applicable to these KMS.

	OS	**PD**	**OW**	**AS LL**	**SL**	**IM**	**T**	**EG**
Unfreezing phase					N/A		**X**	N/A
Freezing phase					N/A		**X**	N/A

Table 6.10: Lewin (1947) Steps on Skanska UK

6.5.6 Lessons Learned from Previous Implementations

Since there is a vast number of KMSs at Skanska UK, each implementing phases would, with a structured approach to lessons learnt, probably be beneficial. As well as knowledge needs to be shared within construction projects knowledge sharing between different implementations also has to be done, in order for the organisation to perform implementations more efficient. During the interviews, no such structured approach seems to have happened when implementing a new KMS. Indications of knowing which approach to change to succeed, could probably help Skanska UK in their next step towards a KMS with more users.

Other indications that lessons learned from KMS implementations are insufficient, were found when speaking to individuals who are planning to implement yet another KMS. None of these thought about or discussed the possible assistance they could possibly gain from other recent KMS implementations.

	OS	PD	OW	AS LL	SL	IM	T	EG
Lessons learned captured					N/A			

Table 6.11: Lessons learned captured when implementing systems.

6.5.7 Was There a Planned Implementation?

Even though above steps, indicate the absent of implementation phases, there was still a feeling amongst the interviewees that there had been one with some KMS, One Skanska, Taleo and Expert group, however, non of the employees were not able to name any of the steps or phases that the implementation covered. Project database, Our way of working, Activity Sheet, lessons learned or the instant messenger programs got clear indications that the interviewees did not felt that there had been any implementation phase what so ever.

Submission library, are not yet been implemented to its full potential and therefore this question was not applicable to this KMS.

	OS	PD	OW	AS LL	SL	IM	T	EG
Implementation phase	**X**				N/A		**X**	**X**

Table 6.12: Implementation phase

6.6 Technology

One of the most important aspect to make communities works, it to make them easy to use and reachable the critical mass (McDermott, 2004). There are three factors to consider when making a KMS technology feasible for the critical mass.

6.6.1 Accessibility

Any KMS that aims to be used by a whole organisation must be accessible for the employees. As Lewin (1947) states, group behaviour is an intricate set of symbolic interactions and forces that not only affect group structures, but also modify individual behaviour. Therefore, all employees need to access the KMS. The

empirical study shows that the KMS did not show any clear pattern between the accessibility and if they were used. Submissions library for example was more frequently used compared to the project database, even though the project database had more employees with access.

Other issues affecting how individuals uses a KMS is explained by three kinds of boundaries, developed by Carlile (2002: 2004). Syntactic boundary is easy to overcome, but important since individuals communicate differently (Larsen, 2011). The second boundary – Semantic, can be an issue at Skanska UK, since the vast number of employees correspond in a large variety of backgrounds. The last boundary – pragmatic, is created by different interest. Some individuals might impact others in a negative way, and also affect the likeliness for them to contact someone outside of their known network. KMS therefore, needs to take these aspects in mind and use same symbols and language in order to fit everyone regardless of role and, most importantly, be accessible to all employees.

Skanska UK, are showing good accessibility with all their current systems, except from Submissions Library and Taleo. These KMS is not accessible to reasons concerning "sensible information" and privacy laws.

	OS	PD	OW	AS LL	SL	IM	T	EG
High level of accessibility	X	X	X	X		X		X

Table 6.13: High level of accessibility at Skanska UK

6.6.2 User Friendly and Suitable to the End User

User friendly was one factor were many KMSs, except submissions library, instant messenger and Taleo, were failing according to the imperial findings. All other systems, are considered difficult to use and inaccessible. The KMS were often considered to give the wrong or no information at all, and one interviewee expressed concern relating to complicated KMS and the risk that first-time users would not use the KMS twice if the first time were too hard. Instant Messenger system, GSA and Taleo was considered user friendly due to different reasons. GSA might benefit from the high usage of "normal" Google, as GSA works in a similar way. Taleo is an advanced KMS, and the employees using it, are therefore being given a lot of training. Instant messenger systems are considered to be logical and very easy to understand.

The other KMS, indicated to be non-user friendly, were often considered so due to the difficulties finding right and valid information.

	OS	PD	OW	ASLL	SL	IM	T	EG
User friendly					**GSA**	**X**	**X**	

Table 6.14: User friendly

6.6.3 Up to Date

During the interviews, many individuals expressed their concerns related to the existing, accessible knowledge. The knowledge were often found to be inadequate, non accessible and not up to date. One example was found in the submissions library, where CVs important for tenders, was not up to date. The trail to make employees fill in a template to make these CVs up to date gave low response rate and indicated a lot of concerns regarding knowledge sharing. This indicates that there are difficulties to make individuals fill in and especially keep on filling in information so the systems always are up to date. When searching either of the KMS, the accuracy of the data is important to employees and up to date-data, are considered a necessity. Neither of the systems: One Skanska, Project database, "Our way of working" nor Submissions Library were considered to contain information that was entirely up to date.

	OS	PD	OW	ASLL	SL	IM	T	EG
Up to date				**X**		**X**	**X**	**X**

Table 6.15: Up to date information within Skanska UK

6.7 Final summary and developing of EKS Model

During the analysis, the vast theoretical areas has been evaluated and applied upon Skanska UK. The empirical findings at Skanska UK help the authors to narrow the discussed theoretical areas into a model for effective knowledge sharing (EKS). Additional areas, not pointed out as most important in theory, have been acknowledge at Skanska UK and was therefore added to the EKS model. The EKS model is completely developed by the authors of this thesis. It is supposed to support organisations to take their knowledge management further, and can be applied to organisations without existing KMS to help them develop new ones. Since the model was developed during the case study at Skanska UK, when applying the theoretical framework, a new usage area was found. The EKS model is therefore also considered to be helpful for organisation with existing KMS. For example in Skanska UK where it was used as an improvement tool, by doing a gap analysis over existing KMS as shown in chapter 7.

When analysing KMS in general, there are many aspects to keep in mind. From theory some aspects where found being essential, these are: Learning Processes, Knowledge Boundaries, Technical boundaries and Change/Implementation. However, when analysing the empirical findings at Skanska UK, other factors emerged as likewise important. First of all what kind of knowledge individual's demand must be defined. It is hard to share knowledge when the need is not defined. It is found at Skanska UK, that different knowledge is needed depending both on OU and individual employees. It is therefore considered one of the most important aspects, and the first thing to consider when developing a new or evaluating current KMS.

The second aspect, which emerged when analysing the empirical factors was culture. It is therefore, also consider important to take current culture into consideration and analyse how this affects the usage of current or new KMS. At Skanska UK the culture is found to be strong and leaning towards asking the neighbour instead of a system, and one could either build a KMS around this culture or try to change the culture itself. Even though this paper will not define what Skanska UK should do, the model, which is being developed, should reflect upon culture as one important part. The reason for having culture as one part is the findings at Skanska UK, and it is considered important to try to determine current culture and also locate which individuals are most likely to be users or not, in terms of KMS. After reflecting up on the current culture one can decide if the culture is in line with the development of the KMS, or if the culture itself should be changed.

These two first aspects, "What information is needed" and "Culture" are considered to effect the rest of the aspect much, since these are somewhat found to be the cornerstones of the whole KMS development. Therefore they should be focused

upon before taking any of the other more theoretical originated aspects into contemplation. Taking one example, Culture will affect both how the implementation is being accepted and how far along in the learning spiral, presented by Nonaka, the organisation can be considered to be. The cultural issues have been discussed as a reason for low usage of existing KMS. However there might be a lot of other aspects affecting this, for example low usage might depend upon a lack of user friendliness or not updated KMS. These aspects can also be affected by no existing ownership. Lack of ownership can affect both not updated KMS and technical issues. It is therefore important to take all different aspects in consideration. However, Culture is not unimportant, but cannot be held as responsible for all problems relating to KMS, and KMS based upon the existing culture is probably more likely to be used that KMS which are not.

The first part of the Efficient Knowledge Sharing (EKS) Model, is therefore based on the questions of "What information is needed" and "Culture" and their respective effects of the other parts are shown by an arrow, figure 6.1.

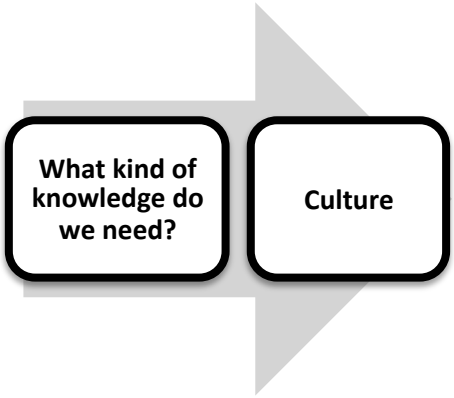

Figure 6.1: Part one of EKS Model

According to Nonaka and Takeuchi (1995), where in the knowledge Spiral an organisation is, will reflect the organisations ability to learn and innovate. It is therefore considered that these aspects are important to reflect upon. The knowledge that is being shared at Skanska UK, is mostly of an explicit nature, while the demand requests tacit knowledge. According to Nonaka and Takeuchi (1995), both tacit and explicit kind of knowledge needs to be shared in order to reach all stages in the knowledge spiral and when enabling effective knowledge sharing it is important to map what kind of knowledge is being shared and which stage of the knowledge spiral each KMS supports. Since organisational learning depends upon which stage of learning the KMS is supporting, and if the whole organisation is learning, not just one individual, these aspects are considered important. All these five aspects; What kind of knowledge is being shared, Where in the knowledge spiral

does each KMS reside, What type of learning process is supported and is the whole organization learning from the system, are all considered to be aspects of learning. Therefore Learning is one part of the EKS model, which is important to consider. It is also believed that if these different stages are considered and covered, knowledge barriers such as:

- ✓ Belief in uniqueness of context
- ✓ Standardization:
- ✓ Ability to capture and access "softer" lessons
- ✓ Project reviews and milestones
- ✓ Lack of awareness that knowledge transfer is needed

Which are all found to happen within Skanska UK, will be easier to overcome.

In Skanska UK, only some KMSs support tacit knowledge sharing. These features are however not used to a wide extent and the reason might be because employees are lacking training about the KMS. E.g. One Skanska has the abilities to upload experience and current project information, knowledge that is valuable for Submissions. But since no sufficient learning and education have been conducted regarding this, the employees are unaware of the feature and hence do not use it. Training and education are therefore also found to be important when developing new KMS. In Skanska UK, many of the system are found to be lacking in training and also in a clear implementation phase, something that might affect the usage much. Therefore another part of the EKS model should be Change/Implementation. When implementation a new system as considered in section 6.5 it is important to make sure the existing or new KMS is: in line with company strategy and this communicated out. The purpose and benefit with the KMS are explained to the end user so individuals can relate to the KMS. When implementing the system it is also considered important to have a clear implementation phase, something that Skanska UK often has been lacking to do. It is also important that Lewin´s (1947) tree different phases for how to perform an organisational change are being followed, meaning that the system has a lessons learned phase and that the system has a clear owner.

Other benefits with having a clear owner of a KMS is that the purpose can be communicated clearly, hence this enables trust for the system. Trust for a system would in turn as Nonaka (1994) claim; enable the possibility to create week ties. These ties might as Hansen (1999) explain be useful for organisations such as Skanska UK, since strong are time-consuming to establish. Other reasons why weak ties might benefit Skanska UK, relates to the findings from Larsen (2012). He concluded that individuals use different networks, depending on the questions that they need answers to, and it can therefore be argued that a wide network of week ties would suit a company like Skanska UK better than a small network with strong

ties, due to the great variation between types of questions and knowledge employees demand. Other aspect to take in consideration is the tendency employees have to change OUs. This behaviour affect the benefits of using a network of weak ties instead of strong, since the loss of one individual from a weak network is not as great as losing one from a strong, regarding time spent establish and replacing the dot in the network. The above discussion makes it clear that a KMS needs to make the whole organisation act as a collective activity so each nod in the network have the possibility to take part of the KMS and contribute to it, both affect knowledge sharing in the whole organisation.

Another part which affects both the KMS: knowledge sharing, Change/Implementation Phase and ability to Learning are the technical aspects of a KMS. It is important that a system is up to date, that the whole organisation can take part of the KMS and that the KMS fits everyone. If a system is not up to date, the implementation will fail, and if the implementation fails the KMS will not support a collective activity and in the end the organisation will not learn. Therefore all the above aspects influence each other and if one part fails, the rest will most likely also do so, and therefore it is very important not to only focus upon one part work both all four. This is illustrated by arrows pointing out of the centre of the model, showing that each part influence the other from the beginning and the affects are spread out to all different parts. The second part of the EKS model is shown in figure 6.2 and furthermore the whole EKS model and the theoretical summary applied upon Skanska UK, are presented in chapter 7, where also the EKS model is illustrated.

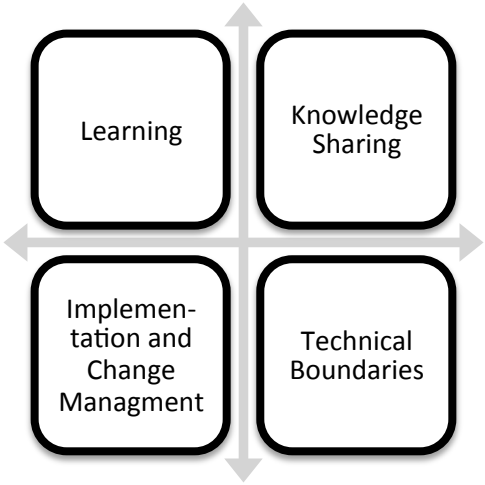

Figure 6.2: Second part of the EKS model

7. Results

This chapter presents the results and conclusions from this study. This chapter will conclude and summarize the result from the theoretical framework applied on Skanska UK, and further display and explain the EKS model.

7.1 EKS Model Applied on Skanska UK

The theoretical framework applied on Skanska UK has been discussed in the above analysis and is summarized in a gap analysis displayed the in table 7.1.

The main conclusions from the gap analysis is that Skanska UK has a variety of KMS dealing with knowledge management and that they are focusing on solutions for how to spread explicit knowledge, but are lacking in ways to share tacit knowledge. As earlier stated companies need to share both explicit and tacit knowledge and today as the empirical study indicates Skanska UK are not having a well functioning knowledge management and learning process.

Further the implementation phase, consisting of training, education and lessons learned for each system has not been carried in a sufficient way or been carried out at all. This is also an issue that is affecting the usage of the existing KMS and prohibits an effective knowledge sharing. One last issue is the above discussed cultural aspects, it is not clearly displayed in the gap analysis but as argued has a great impact on the usage and effectiveness of the KMS that Skanska UK are using.

		OS	PD	OW	ASLL	SL	IM	T	EG
Learning process	Explicit or Tacit Knowledge Sharing	ET	E	E	E	E	ET	E	ET
	Connection between Individual and Org. Level	X			X			N	
	Social Learning Process								X
	Combination LP[3]	X	X	X	X	X	X	X	X
	Externalization LP								X
	Internalization LP								OK
	Single Loop Learning	X	X	X	X	X	X		X
	Double Loop Learning				X		X		X
	Triple Loop Learning								X
KB[4]	Promote collective activity						X		X
Change and implementation	In line with company strategy and communicated	X	X						X
	Purpose/benefit explained for end users	X				X		X	
	Implementation phase	X				N[5]		X	X
	Training & education					X	OK	X	
	Unfreezing step					N		X	N
	Lessons learned captured					N			
	Freezing phase					N		X	N
	Clear ownership	X				X	N	X	X
TB[6]	High level of accessibility	X	X	X	X		X		X
	User friendly					G[7]	X	X	
	Up to date				X		X	X	X

Table 7.1: EKS model applied on Skanska UK

[3] LP= Learning Process
[4] KB= Knowledge Boundaries
[5] N= Not Applicable
[6] TB= Technical Boundaries
[7] G= Google Search Appliance

7.2 Efficient Knowledge Sharing Model

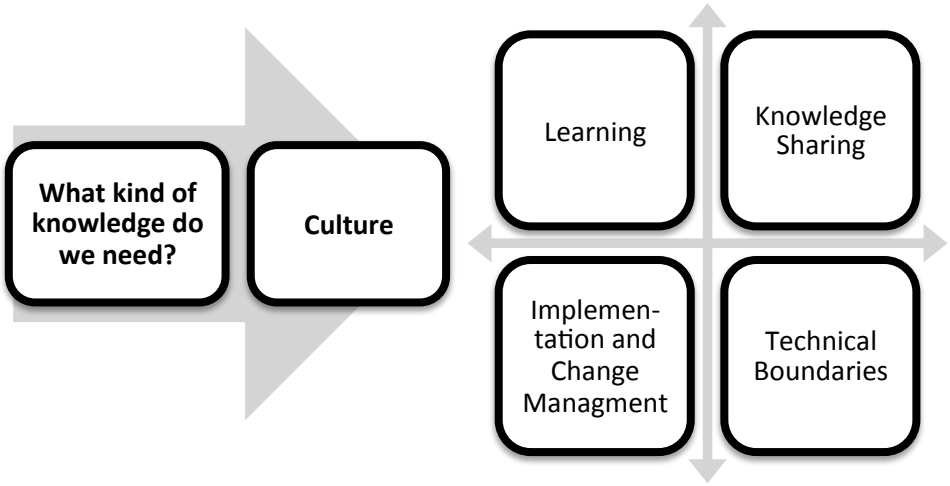

Figure 7.2: Efficient Knowledge Sharing Model

First part of the EKS model

The analysis resulted in a model called: Efficient Knowledge Sharing model (EKS model) shown in figure 7.1. The first parts of the EKS model contain; what kind of knowledge do we need? , and Culture. These two aspects are empirically found to be very important at Skanska UK. It is hard to know what kind of knowledge that is demanded but never the less it is found that there do exist different demands, and that these are important to consider. The culture are also important since, at Skanska UK the culture are found to affect the usage of the current KMS and therefore one have to consider this before implementing new or evaluation existing KMS.

This first part has a very high impact on the second part, containing; Learning, Knowledge Sharing, Implementation and Change Management and Technical Boundaries. All these four aspects have also big impact upon each other, shown with an arrow in the model. It is therefore important to take all the below described aspects in mind and make sure all of them are supported, so efficient knowledge sharing can be achieved.

Learning

Learning is considered important since a KMS need to be positioned in Nonaka´s learning spiral and which knowledge that is being shared needs to be mapped to correlate it with the existing demand. It is also important to map in which kind of learning loop the KMS are supporting in order to promote a clear connection between individual and collective learning.

Change and Implementation

In order to make the whole organisation use the KMS, and both to share and know the feature of a KMS, it is important that the KMS are implemented in an effective way. In order to change the organization, so it uses the new KMS, the system needs to be in line with company strategy and this communicated out. The purpose and benefit with the KMS needs to be explained to the end user, and there need to be training and lessons learned captured with the system. There it is a big risk that the organisation is lacking sufficient knowledge of each KMS, if these aspects are not considered, as with the case found at Skanska UK with One Skanska to name one.

Knowledge Sharing Boundaries

It is also important to considered that the new or current KMS promotes a collective activity so that the whole organisation is involved, and that the KMS enables knowledge sharing across structural barriers, as shown Skanska UK has problems with this since most knowledge sharing is made within each OUs.

Technical Boundaries

All above factors are affecting each other and the last part, technical boundaries are also to be considered when evaluation a current or implementing a new KMS. It is important to make sure that there are no technical defects affecting the usage of the system. Therefore it is important to keep the KMS up to date, that the systems have a high level of accessibility throughout the organisation and that it fits everyone regardless of role.

8. Discussion

This chapter includes a discussion about the theoretical contribution and validity of this research, as well as suggestions for improvements and further research suggestions.

8.1 Validation and Theoretical Contribution

The EKS model can be used to improve organisations knowledge management. Further the model can be used to display the current status existing KMS and display how knowledge management is being conducted. The EKS model is a develop framework, which answers and fulfills the purpose of this thesis. After applying the model on Skanska UK a final discussion was made with key stakeholders from the case company. During this discussion the model was well received and where consider having impact on Skanska UK's ongoing work with knowledge management, which further increases the validation of the EKS model.

The framework is based on and developed from a variety of theories defined in the theoretical chapter and structured in to four different areas, *Learning process, Knowledge sharing boundaries, Change and implementation, Technical boundaries.* Each of these areas is built up by a number of sub parts that together contributes to efficient and functional knowledge management. The application of the theoretical parts of the EKS model on the case company, resulted in further developments of the EKS model.

The EKS model is generalized, as mentioned in section 3.3.2 in the method chapter. The generalization has been done from a single case study, with an analytical approach. Even though the EKS model it does not have a statistical foundation it can be considered applicable for both a narrow audience such as other companies within the industry and to a broader audience of companies outside of the construction industry. This possibility arises since the theory promoting the framework is general and gathered from various different sources, which broadens the perspective and the model should therefore be applicable for other industries with the same structure and presumption.

One risk with generalization, regarding the EKS model is the section concerning change management. This section can be argued to be too general and therefore not useful for single companies. This is an issue that has been dealt with during the theoretical studies by using well-recognized models and evaluating them against each other. The framework however has not been tested on other industries and might have some limitations and a recommendation is therefore to test the framework further to evaluate these limitations.

8.2 Improvements

The empirical findings are based on stakeholders with a clear connection to knowledge management or submissions. They are from different areas within the company, but they do not represent all the identified stakeholders. The number of interviews is also limited, because of the limited time available from both the authors and the different stakeholders. The empirical study can therefore be considered a bit narrow and would benefit from input from more stakeholders within the industry. The method for data collection could have been improved, one example of improvement is to complement the empirical information gathering with a quantity approach. This could have given additional benefit to the development of the framework. Another improvement is to have the number of interviewees increased to strengthen the verification process for the research.

8.3 Further Research

The subject knowledge management is a wide and complex area, and further research should focus on evaluating the EKS model and develop the different theoretical pillars on which the model stands. This is done trough:

Apply the EKS model to other companies within the construction industry as well as from other industries.

Conduct deeper studies on how networks, as well as the implementation are effecting knowledge management.

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10 Appendix

10.1 Interview - what kind of knowledge is demanded

TIME: 30 Min

5 min *– Present who we are and our education. Explain what we are doing (focusing on a CV database where you can find people with knowledge within areas that interest you in your daily work)*

Explain that this interview will be used to highlight different areas of interest to people working at Skanska. It will be used to identify and help develop a structure of a CV template and used to put employees CV in the database. Explain that the can view the interview later if they want.

Date: _____
Name: _____
Age: >25 25-40 41<
Department and how long you have worked at Skanska: _____
Title: _____
Participants: _____

Questions of usage of searching for other Peoples knowledge within Skanska (5 min)

1. **Are you using GSA to search for peoples CV or are you using any other Skanska System to find people with knowledge in your daily work?**
1. **What do you think is good and most useful with the system?**
2. **What can be improved**
3.

System Development (10 min)

1. **If a good system for locating people's different knowledge would exist, what knowledge is important for you to know about people in your daily work?**
2. **What are the three most important areas of knowledge for you, about other people's knowledge?**
3. **Do you think it is important to know non-business related information about people? YES NO**
4. **Why?**
5. **If a good system for locating peoples different knowledge would exist, what are important features to have for you in such a system?**
6. **If such a system would exist, do you think you would use it in your**

daily work?

Other (5 min)

1. **What is your definition of an expert?**
2. **What kind of knowledge and experiences amongst your colleges do you search for most? E.g. excel experience, IT experience, Project management?**
3. **What are your 3 top knowledge areas? Do many people ask you about help concerning these areas?**
4. **Why do you think that is?**
5. **Are you often able to help other colleagues?**

Motivational factors (5 min)

1. **Have you submitted your own CV somewhere in Skanska ABs network? YES NO**
2. **Which and why?**
3. **How often do you update this CV? Once a: ___ YEAR ___MONTH WEEK DAY**
4. **Comment: Are you using any external kind of CV system for your own CV, e.g. LinkedIn at the moment? YES NO**
5. **Why? How often do you update it? Once a: ___YEAR ___MONTH WEEK DAY**
6. **What motivate you to use a CV system, please motivate.**
7. **Is there anything that we missed to ask you about?**

10.2 Interviews at Skanska AB

2013-03-04	
Technical Author	Utilities and Infrastructural Services
Lead IT Business Partner	ITSD
2013-03-05	
Business Developer Coordinator	Civil Engineering
Project Manager	Civil Engineering
Site Administration Manager	Civil Engineering
Senior Environmental Advisor	Civil Engineering
Health &Safety Advisor	Civil Engineering
2013-03-06	Civil Engineering
Senior Editor	Pre Construction
2013-03-07	
Head of Innovation	Technical Services
Knowledge Management Specialist	ITSD
Resourcing Partner	HR
Resourcing Partner	HR
2013-03-08	
Professor Reading University	Reading University
2013-03-12	
Engineering Director	Technology
2013-03-13	
HR	HR
Digital Service Manager	Communications
CV Steering Meeting	Pre Construction
2013-03-14	
Business Improvement Manager	Skanska Construction
2013-03-25	
Technical Service Director	Procurement
2013-04-02	
Bid Writer	Building – Central & Region
2013-04-03	
Commercial Manager	Skanska Construction - Education
2013-04-04	
Group Knowledge Sharing Manager	Skanska AB
HR	HR

2013-04-08	
Learning and Development Business Partner	HR (Learning & Development)
2013-04-10	
Director of Business Strategy & Improvement	Civil Engineering
2013-04-11	
Business Improvement Coordinator	Communications
Head of Submission	Procurement
Principal Consultant	Technical Services
2013-04-16	
Project Director	Building – Central & Region
Project Director	Building – Central & Region
2013-04-17	
Submissions Manager	Civil Engineering, Utilities
Submission Coordinator	Building – Central & Region
Senior Graphic Designer	Preconstruction
Submissions Technician	Building – London & South East
Submissions Manager	Building – Central & region
Submission Coordinator	Facilities Services

10.3 CV Template

The CV template contains five sections presented in section 10.3.1 – 10.3.5, Microsoft Excel was used to gather the data.

10.3.1 Basic Information

Dear colleague,
You are one of 20 project managers at Skanska we have asked to fill out this template as part of our project aiming to build a knowledge management tool for Skanska UK. It will take about 15 minutes to complete, but your answer is very important to us. Please fill in as best you can, referring to the 'Examples' sheet for guidance. We need to have all answers completed by 15 March, so thank you in advance for all your help. Please mail it to: skanskaCV@gmail.com

Navigate by using the spread sheets tabs at the bottom of the page

10.3.2 Basic background information

Questions asked in this section included:

Name:
Phone:
Email:
Title:
Operating Units you have worked in at Skanska:
Education: (what and where)
Organisations:
Professional qualifications:
Location:
Start of employment with Skanska:
Name of current project(s) you are working on:
Description of current project (max 50 words):
Your role on current project:
Completion date for current project:
Your current anticipated availability for new projects:
Exceptional contributions you feel you have made to Skanska:
Any testimonial quotes from colleagues:
Any testimonial quotes from clients:
Presentation of your self, short:
Mother tongue:
Other languages you speak:

This section also included following optional questions:

Spare time interests:
Family information:
About me:
Favourite holiday vacation:

10.3.3 Experience related to Skanska UK

Questions asked in this section included multiple sections of below questions, each referring to one project:

Project title:
Value of project:
Client:
Your role/job title in the project:
Start/end of project (month/year):
Basic facts about the project (max 50 words):
Explain your role in the project (what were your responsibilities etc.):
Your line manager:
Which of your key knowledge areas were used in this project:
List any awards won by this project:
Any testimonial quotes from clients for this project:
Form of contract:
Did we exceed client expectations (under budget, ahead of program etc.)?

10.3.4 Experience related to Skanska UK

Questions asked in this included expertise area, and the employee were to tick the box were he/her consider appropriate to each knowledge area.

	Good Knowledge	Knowledge	No Knowledge
Microsoft Excel			
People management			
Change management			
Project management			
Bridges			
Mining			
Concrete			
Cementation			
BIM			
Innovation			
Knowledge management			
Tall buildings			
Sports facilities			
Business strategy			
Apartment blocks			
Single-family houses			
Hospitals (Inc. nursing homes)			
Hotels and restaurants			
Wholesale and retail			
Entertainment			
Building integrated green technologies			
Industrial			
Defence buildings			
Logistics			
Bundled construction			
Petrochem/mining			
Law			
Sustainability			
Project planning			
Safety			
Risk management			

Product preparation
Client bonds and warrantees
IT
R&D
Customer service/public liaison
Occupational health
Design
Sourcing
Diversity
Bidding
Internal accounting
Leasing
Accounting
Business development
Marketing
Investor relations
Quality
Environment
HR
Management
Communication
Project planning
Other areas of interest to Skanska Fill in here
Other areas of interest to Skanska Fill in here
Other areas of interest to Skanska Fill in here
Other areas of interest to Skanska Fill in here
Other areas of interest to Skanska Fill in here

10.3.5 Work experience relevant to Skanska UK

Questions asked in this section included multiple sections of below questions, each referring to one experience:

Company name:
Role/job title:
Start/end years:
Description of your role:
Brief description of the company, if applicable:
Knowledge areas needed for you role: